Modification Proposal submitted by:		Date of submission of proposal:	Modification Proposal number: *(to be assigned by Review Panel Secretary)*
Tony Hearne / John Whelan		02.11.2022 07.11.2023 (modified)	# 61
Contact details for Modification Proposal originator: *(If not Distribution Code Review Panel)*			
Name	Tony Hearne	Telephone number	087 2238855
E-mail address:		tony.hearne@esb.ie	
Modification Proposal Title:		**Subsummation of content of Implementation Note for BESS V3, into the Distribution Code**	

Distribution Code section(s) affected by proposal

DCC11.3.2.2.1
DCC11.3.2.3.1
DCC11.3.2.3.2(b)
DCC11.3.2.3.3
DCC11.3.2.3.4
DCC11.3.2.3.5
DCC11.3.2.3.6
DCC11.3.2.3.7
DCC11.3.2.3.10
DCC11.3.3
DCC11.3.4.1
DCC11.3.4.2
DCC11.8
Definitions

Modification Proposal description *(clearly state the desired amendment and all text changes. Attach further information if necessary)*

Additional text to make it clear that the requirements cited do not apply to ESPS:

DCC11.3.2.2 Active Power Control

DCC11.3.2.2.1 The **PPM Control System**, with the exception of **ESPS**, shall be capable of operating each **WTG** or **SG** at a reduced level if the **Controllable PPM's Active Power** output has been restricted by the **TSO** or **DSO**. In this **Active Power Dispatch Mode**, the **PPM Control System** shall be capable of receiving an on-line **Active Power Control Set-Point** sent by the **TSO** or **DSO** and shall commence implementation of the set-point within 10 seconds of receipt of the signal from the **TSO** or **DSO** as agreed between **DSO** and **TSO**.

DCC11.3.2.3 Frequency Response

DCC11.3.2.3.1 In **Resource Following Mode**, the **Frequency Response System** for Controllable PPMs with the exception of **ESPS**s shall have the capabilities as displayed in the power-frequency response curve in Figure 13 where the power and **Frequency** ranges required for points A, B, C, D, E are defined below in Table 14 and Table 15.

DCC11.3.2.3.2 (b) When in **Active Power Control Mode**, the **Controllable PPM**, with the exception of **ESPSs**, shall always operate in **Frequency Sensitive Mode** with a **Governor Droop** as set out in **DCC**11.3.2.3.1 and with a deadband of +/-15mHz, or as otherwise agreed with the **TSO**.

DCC11.3.2.3.3 When acting to control system **Frequency**, the **Controllable PPM**, with the exception of **ESPSs**, shall provide at least 60% of its expected additional **Active Power** response within 5 seconds, and 100% of its expected additional **Active Power** response within 15 seconds of the start of the system **Frequency** excursion outside the range FB-FC, or in the case of a **Controllable PPM** in **Active Power Dispatch Mode**, when the system **Frequency** goes outside the deadband set out in **DCC**11.3.2.3.2.

DCC11.3.2.3.4 When the system **Frequency** is in the range FC-FD, the **Controllable PPM,** with the exception of **ESPSs**, shall ensure that its **Active Power** output does not increase beyond the **Active Power** value of the **Controllable PPM** when the system **Frequency** first exceeded FC, due to an increase in **Available Active Power** in that period.

DCC11.3.2.3.5 For **Controllable PPMs** with the exception of **ESPSs**, if the **Frequency** drops below FA, then the **Frequency Response System** shall act to maximise the **Active Power** output of the **Controllable PPM**, irrespective of the **Governor Droop Setting**. If the **Frequency** rises above FD, then the **Frequency Response System** shall act to reduce the **Active Power** output of the **Controllable PPM** to its **DMOL** value. If the **Frequency** rises above F_E, then the **Frequency Response System** shall act to reduce the **Active Power** output of the **Controllable PPM** to zero. Any **WTG** or **SG** which has disconnected shall be brought back on load as fast as technically feasible, provided the system **Frequency** has fallen below 50.2Hz.

DCC11.3.2.3.6 For **Controllable PPMs** with the exception of **ESPSs**, points 'A', 'B', 'C', 'D' and 'E' shall depend on a combination of the **Frequency, Active Power** and **Active Power Control Set-Point** settings. These settings may be different for each **PPM** depending on system conditions and **PPM** location. These settings are defined in Table 14.

DCC11.3.2.3.7 The table below, Table 15, shows the **Frequency** and **Active Power** ranges for **Controllable PPMs** with the exception of **ESPSs**, for F_A, F_B, F_C, F_D, F_E, P_A, P_B, P_C, P_D and P_E.

DCC11.3.3 Procedure for Setting and Changing the Power-Frequency Response Curves

Two power-frequency response curves (Curve 1 and Curve 2) shall be specified by the **TSO** at least 120 business days prior to the **Controllable PPM's, with the exception of ESPSs**, scheduled operational date. The **Controllable PPM**, with the exception of **ESPSs**, shall be responsible for implementing the appropriate settings during **Commissioning**. The **Frequency Response System** shall be required to change between the two curves within one minute from receipt of the appropriate signal from the **TSO**. The **TSO** shall give the **Controllable PPM**, **with the exception of ESPSs**, a minimum of 2 weeks' notice if changes to any of the curve's parameters (i.e. F_A, F_B, F_C, F_D, F_E, P_A, P_B, P_C, P_D or P_E) are required. The **Controllable PPM, with the exception of ESPSs**, shall formally confirm that any requested changes have been implemented within two weeks of receiving the **TSO's** formal request.

DCC11.3.4 Ramp Rates

DCC11.3.4.1 The **PPM Control System**, with the exception of **ESPSs**, shall be capable of controlling the ramp rate of its **Active Power** output. There shall be three ramp rate capabilities, designated **Resource Following Ramp Rate**, **Active Power Control Set-Point Ramp Rate**, and **Frequency Response Ramp Rate**. The **PPM Control System** shall operate the ramp rates with the following order of priority (high to low): **Frequency Response Ramp Rate; Active Power Control Set-Point Ramp Rate; Resource Following Ramp Rate. The Resource Following Ramp Rate** shall be used during Start-Up, normal **Operation**, and shutdown. The **TSO** shall specify the **Resource Following Ramp Rate** and the **Active Power Control Set-Point Ramp Rate** in percentage of **Registered Capacity** per minute. The **Frequency Response Ramp Rate** shall be the maximum possible ramp rate of the **Controllable PPM** agreed with the **TSO** and with the characteristics as set out in **PPM**1.5.2.2.2. It is acknowledged that rapid change in the resource magnitude may cause temporary deviations from the ramp rate settings of the **Controllable PPM**, but these deviations should not be allowed to exceed 3% of **Registered Capacity**.

DCC11.3.4.2 For **Controllable PPMs** with the exception of **ESPSs**, it shall be possible to vary the **Resource Following Ramp Rate** and the **Active Power Control Set-Point Ramp Rate** each independently over a range of between 1% and 100% of **Registered Capacity** per minute.

Amended to make generic rather than referring to a figure that applies to a subset of PPMs

DCC11.3.2.3.10 If the system **Frequency** rises to a level above 52 Hz, it is accepted that **Generation Units** may disconnect. Any **Generation Unit** which has disconnected shall be brought back on load as fast as technically feasible (provided the system **Frequency** has fallen below 50.2Hz).

DCC11.8 Direct and indirect control of reactive power

With the exception of:

- Topology 1 connections
- Topology 1A connections where some form of explicit agreement is in place between ESBN and EirGrid

Direct control of reactive power or the issuance other setpoints related to reactive power, or voltage control by the TSO, to distribution connected resources is not permitted.

The only means by which through which such control can be implemented is indirectly through a Nodal Controller or equivalent means by which real-time distribution voltages, currents and flows can be kept within operational limits.

New Section DCC 14 added to house the totally new content of the Implementation Note.

DCC14 ADDITIONAL REQUIREMENTS FOR ESPS

DCC14.1 Active Power Control

The PPM Control System for an **ESPS** shall be capable of operating each **Generation Unit** at a reduced level if the **Controllable PPM's Active Power** output has been restricted by the **TSO** or **DSO**. In this **Active Power Control Mode,** the **PPM Control System** shall be capable of receiving an on-line **Active Power Control Set-point** sent by the **TSO** or **DSO** and shall commence implementation of the set-point within 10 seconds of receipt of the signal from the relevant system operator. The rate of change of output to achieve the Active Power Control Set-point should be the **Active Power Control Set-Point Ramp Rate** setting of the **PPM Control System**, as advised by the **TSO** or **DSO**, as per DCC14.2. When this **Active Power Control Mod**e is turned off, the **PPM Control System** shall commence implementation of a 0 MW set-point with the rate of change of output at the **Active Power Control Set-Point Ramp Rate**, unless subsequently over-ridden by a **Dispatch** Instruction.

DCC14.2 **Ramp Rates**

The **PPM Control System** for an **ESPS** shall be capable of controlling the ramp rate of its **Active Power** output. There shall be three ramp rate capabilities, designated **Capacity Limited Ramp Rate, Active Power Control Set-Point Ramp Rate**, and **Frequency Response Ramp Rate**. The **PPM Control System** shall operate the ramp rates with the following order of priority (high to low): **Capacity Limited Ramp Rate; Frequency Response Ramp Rate; Active Power Control Set-Point Ramp Rate**. The **TSO** or **DSO** shall specify the **Capacity Limited Ramp Rate** and the **Active Power Control Set-Point Ramp Rate** in percentage of **Registered Capacity** per minute. The **Frequency Response Ramp Rate** shall be the maximum possible ramp rate of the **Controllable PPM** agreed with the **TSO** or **DSO** and with the characteristics as set out in DCC14.3. The TSO acknowledges that rapidly changing resource availability may cause temporary deviations from the ramp rate settings of the **Controllable PPM**. These deviations should not be allowed to exceed 3 % of **Registered Capacity**.

For **Controllable PPMs** consisting of **ESPSs**, it shall be possible to vary the **Capacity Limited Ramp Rate** and the **Active Power Control Set-Point Ramp Rate** each independently over a range between the following values:

a) **Capacity Limited Ramp Rate**
Minimum value shall be the lower of 10% Registered Capacity per minute or 5 MW per minute. If 5 MW is lower than 1% of Registered Capacity, then the minimum value shall be 1% of Registered Capacity per minute.Maximum value shall be 100% of Registered Capacity per minute.

b) **Active Power Control Set-Point Ramp Rate**
Minimum value shall be 1% of Registered Capacity per minute.
Maximum value shall be 100% of Registered Capacity per minute.

The ramp rate settings shall be specified by the **TSO** or **DSO** in the unit specific signal list.

DCC14.3 **Frequency Response**

The **Frequency Response System** for **Controllable PPMs** comprising of **ESPSs** shall have the capabilities as displayed in the power-frequency response curve in Figure 25A., where the characteristics and the settable parameters are defined below in Table 22A and Table 22B. **Controllable PPM** comprising of **ESPSs Frequency Response** and equivalent of **Governor Droop** shall be calculated with respect to their **Active Power** operating range.

The **Frequency Response System** shall adjust the **Active Power** output of the **Controllable PPM** according to an equivalent of **Governor Droop**, settable by the **TSO** or **DSO** in a range from 2 % to 10 %, when operating in the ranges outside the dead-band range F1-F3 in the Power-Frequency Response Curve.

Figure 25A ESPS Frequency Response Characteristic & Parameters

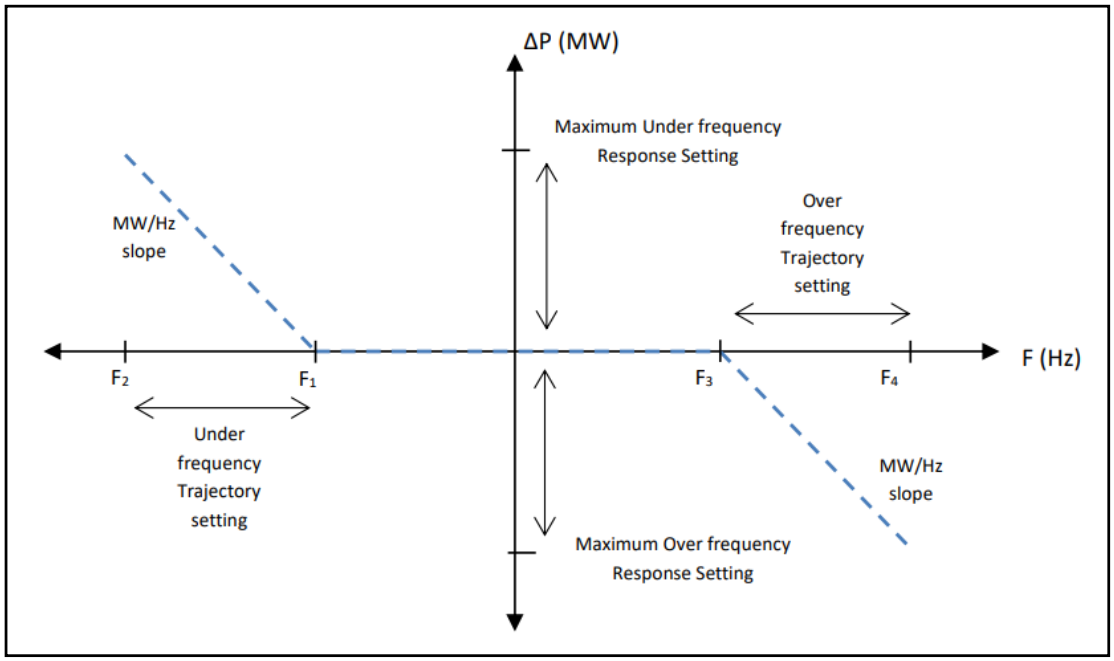


Table 22A Frequency Response Characteristics

No.	Characteristic	Description
1	F	System frequency at any given time
2	△P	Change in active power output, due to change in system frequency
3*	Under frequency trigger frequency (F1)	Frequency at which the unit begins to provide under frequency response
4	F2	Frequency at which the unit would achieve its maximum under frequency response setting (F1 - Under frequency trajectory setting)
5*	Over frequency trigger frequency (F3)	Frequency at which the unit begins to provide over frequency response
6	F4	Frequency at which the unit would achieve its maximum over frequency response setting (F3 + Over frequency trajectory setting)
7*	Under frequency trajectory	The magnitude of the change in Frequency over which the unit would deliver its Maximum Under frequency Response Setting (if it was not limited by capacity or availability)
8*	Over frequency trajectory	The magnitude of the change in Frequency over which the unit would deliver its Maximum Over frequency Response Setting (if it was not limited by capacity or availability)
9*	Maximum Under frequency Response	Maximum increase in active power which the unit will provide in response to under frequency
10*	Maximum Over frequency Response	Maximum reduction in active power which the unit will provide in response to over frequency

* Settings accompanied with an asterisk are the settable parameters which define frequency response modes 1 to 5.

The ranges for the settable frequency response parameters are shown in Table 22B.

Table 22B ESPS Minimum Operating Range for Frequency Response Parameters

Settable Parameter	Range
Under-frequency trigger frequency (F1)	49.5 Hz – 50 Hz
Under-frequency trajectory (F1 – F2)	1 Hz – 5 Hz
Maximum under frequency response	0 MW – Operating Range
Over-frequency trigger frequency (F3¬)	50 Hz – 50.5 Hz
Over-frequency trajectory (F3 – F4)	1 Hz – 5 Hz
Maximum over-frequency response	0 MW – Operating Range

DCC14.3.1 Frequency Response When Acting to Control System Frequency

When acting to control system **Frequency**, the **Controllable PPM** consisting of **ESPSs** shall provide at least 60% of its expected additional **Active Power** response within 5 seconds, and 100% of its expected additional **Active Power** response within 15 seconds of the start of the system **Frequency** excursion outside the range F1-F3, or in the case of a **Controllable PPM** in **Active Power Control Mode**, when the system **Frequency** goes outside the dead-band set out in DCC14.3.

DCC14.3.2 Procedure for Setting and Changing the Power-Frequency Response Modes

Five Power-Frequency Response Modes (Mode 1 to 5) shall be specified by the **TSO** or **DSO** at least 120 business days prior to the **Controllable PPM** consisting of **ESPSs** scheduled operational date. **The Controllable PPM** consisting of **ESPSs** shall be responsible for implementing the appropriate settings during **Commissioning**. The **Frequency Response System** shall be required to change between the five modes within one minute from receipt of the appropriate signal from the **TSO** or **DSO**. The relevant system operator shall give the **Controllable PPM** consisting of ESPSs a minimum of two weeks' notice if changes to any of the modes settable parameters are required. The **Controllable PPM** consisting of **ESPSs** shall formally confirm that any requested changes have been implemented within two weeks of receiving the system operator's formal request.

DCC14.4 Voltage Requirements

Controllable PPMs, consisting of **ESPSs**, shall remain continuously connected to the **Distribution System** at **Controlled Active Power** or **Frequency Response** output, for normal and disturbed system conditions and for step changes in system voltage of up to 10 %.

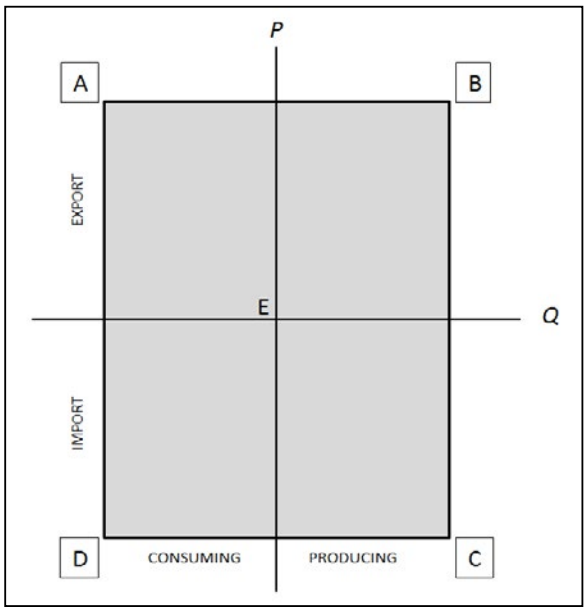
DCC14.5 Reactive Power Requirements

An **ESPS** is required to have a continuously variable and continuously acting **Voltage Regulation System**, capable of maintaining power factor and **Reactive Power** set-points at the connection point, and capable of receiving a **Voltage Regulation Set-Point** for the voltage at the connection point.

DCC14.5.1 **Controllable PPMs** consisting of **ESPSs** shall be capable of operating in **Power Factor** control mode, **Voltage Control** mode or constant **Reactive Power** mode and shall be at least capable of operating at any point within the P-Q capability ranges illustrated in Figure 27, as measured at the **Connection Point** over the **Voltage** ranges specified in Table 13.

By default, and in the absence of any other instruction to do otherwise, **Controllable PPMs** consisting of **ESPSs** shall operate in Q mode, set to Q = 0. See Table 22C below.

Figure 27 Minimum Reactive Power Capability of ESPS



Point A represents the minimum MVAr absorption capability of the **Controllable PPM** at 100 % **Registered Capacity** and is equivalent to 0.95 power factor leading [**Registered Capacity** and a Q/P ratio of -0.33 is -0.95 pf].

Point B represents the minimum MVAr production capability of the **Controllable PPM** at 100 % **Registered Capacity** and is equivalent to 0.95 power factor lagging **[Registered Capacity** and Q/P ratio of 0.33 is 0.95 pf].

Point C represents the minimum MVAr production capability of the **Controllable PPM** at **Maximum Import Capacity** and is equivalent to the same MVAr as Point B.

Point D represents the minimum MVAr absorption capability of the **Controllable PPM** at **Maximum Import Capacity** and is equivalent to the same MVAr as Point A.

Point E is the intersection of the P and Q axes and represents zero **Active Power** or **Reactive Power**.

Figure 27 represents the minimum expected **Reactive Power** capabilities of the **Controllable PPM**. The **Controllable PPM** is obliged to tell the DSO if it can exceed these capabilities, and as part of the DCC testing process, as described in WFPS Reactive Power Control & Capability Test Procedure – Type B ≥5MW, submit the actual P-Q capability diagram based upon the installed plant and **Collector Network** characteristics to the **DSO.**

Where installed, the **Grid Connected** transformer tap changing range must be capable of ensuring nominal voltage at the lower voltage side of the **Grid Connected** transformer, for any Voltage at the **Connection Point** within the ranges specified in Table 13.

DCC14.6 Reactive Power Requirements across Topologies

Table 22C: Reactive Power requirements for various Topologies

Requirement	Topology						
	1	1A	2	2A	3	4	5
Min Capability PQ Envelope per Figure 27 above	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Planners to study for Points A, B, C and D in Figure 27, to determine connection method	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Normal Operation when Nodal Controller or equivalent is not in Operation: Q mode; Q = 0	NA	NA	Yes	Yes	Yes		
Normal Operation: Q mode; Q = 0						Yes	Yes
The Battery ESPS shall be capable of operating in Power Factor, Voltage Control and Reactive Power mode at any point within the P-Q capability, as measured at the connection point, over the normal and disturbed transmission system voltage ranges as specified in the Distribution Code	Yes	Yes	Yes	Yes	Yes	Yes	Yes
The Battery ESPS shall be capable of receiving setpoints for Power Factor, Voltage Control and Reactive Power modes.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Require ESPS to supply a P-Q capability study to: - Demonstrate compliance with min. - Show expected actual capability.	Yes	Yes[19]	Yes[19]	Yes[19]	Yes[19]	>5MW[19]	Yes
Include reactive power commands in ESBN signal list	No	Yes	Yes	Yes	Yes	>5MW	No
Include reactive power commands in TSO signal list for	Yes[20]	Where agreed[21]	No[21]	No[21]	Yes	Yes	Yes
ESBN to carry out test to establish actual capability envelope.	No	Yes	Yes[19]	Yes[19]	Yes[19]	>5MW[19]	No
Testing by EirGrid	Yes[20]	Where agreed[21]	No	No	No	No	No

[19] As part of Testing Procedure: WFPS Reactive Power Control & Capability Test Procedure – Type B 5MW

[20] For Topology 1 connections, reactive power is directly dispatched by TSO.

[21] See DCC11.8.

DCC14.7 **Data Recording Requirements for Ramp Tests**

During Frequency vs MW Ramp testing carried out by the **TSO**, in addition to any requirements set out by the **TSO**, regarding on-site high speed data capture, the following requirements shall also apply.

DCC14.7.1 Measurands for recording

The **ESPS** shall arrange to capture, for the duration of the tests, the following measurands.

1. Connection Point Voltage [kV]
2. Actual active power [+/- MW]
3. Simulated Test Frequency [Hz]
4. APC set-point from NCC [MW]

DCC14.7.2 Instrumentation and Onsite Data Trending

The following trends shall be recorded by the **ESPS** during the test.

As a minimum the resolution should be as specified in Table 22D below. For some signals used to demonstrate operating reserve and FFR response time, these may be required at 20 ms resolution.

Table 22D

No.	Data Trending and Recording	Resolution
1	Connection Point Voltage (kV)	PPM to Specify (≥ 1 Hz)
2	Actual active power (MW)	PPM to specify, ≥ 10 Hz or as agreed with DSO
3	APC set-point from NCC (MW)	PPM to Specify (≥ 1 Hz)
4	Simulated Test Frequency (Hz)	PPM to specify, ≥ 10 Hz or as agreed with DSO (20 ms for FFR scalar product)

DCC14.7.3 Transfer of data to the **DSO**.

As soon as practicable but, in any event no later than 20 business days after the tests, the **ESPS** shall send following to DSOGenTesting@esb.ie

1. A graph or graphs for each file if more than one, depicting trends 1,2 and 3 [on the same graph, with secondary axes].
2. the data, including timestamps, recorded during the test, as above, in csv or excel format.

DCC14.8 **Signalling Requirements**

A unit specific signal list shall be set of Voltage related signals/measurands per connection point. There shall be one set of all other signals/ issued for each controllable **ESPS**. For multiple market units, there shall be one measurands per market unit.

DCC14.9	**Black Start Shutdown** Note there is no operational requirement for **Black Start Shutdown** scheme for **ESPS**. For hybrid sites (e.g. **WFPS** and **ESPS**), **Black Start Shutdown** will be required due to the presence of the **WFPS**. For avoidance of doubt this extends to Dispatch Fail Lamp (DFL) and Blue Alert Lamp (BAL) for distribution connected batteries. There is no operational requirement for DFL and BAL for distribution connected **ESPS**. For hybrid sites (e.g. **WFPS** and **ESPS**), DFL and BAL will be required due to the presence of the **WFPS**.
DCC14.10	**Timing of ESPS Charging** On a case-by-case basis, the DSO reserves the right to impose conditions, as reflected in the Connection Agreement, on the timing of when the **ESPS** can charge.

Amended Definitions

Available Active Power
The amount of **Active Power** that the **Controllable PPM** could produce based on current resource conditions. For **Controllable PPMs** with the exception of **ESPSs**, the **Available Active Power** shall only differ from the actual **Active Power** if the **Controllable PPM** has been curtailed, constrained or is operating in a restrictive **Frequency Response** mode.

Resource Following

Ramp Rate
The maximum rate of increase of **Active Power** output of a **Controllable PPM**, with the exception of ESPSs. in response to an increase in the resource of the **Generating Unit**.

New Definitions

Capacity Limit
The point calculated by the **PPM Control System** where there is just enough stored capacity in the **ESPS** to change the **Active Power** output to zero **MW at the Capacity Limited Ramp Rate**.

Capacity Limit Ramp Rate
The rate of increase or decrease of **Active Power** output of an **ESPS** in response to reaching the **Capacity Limit**. This is mutually inclusive with the **Frequency Response Ramp Rate** as the **ESPS** may continue to respond to Frequency once it has entered the capacity limited ramp.

ESPS
Energy Storage Power Station. A collection of one or more **ESU(s)** that can automatically act upon a remote signal from the **TSO** or **DSO** to change its **Active Power** output

Modification Proposal justification *(Clearly state the reason for the modification. Attach further information if necessary*

1. The BESS Implementation Note: This was issued by EirGrid as an expedient, in order to get the new requirements out to industry and also allow for some tweaking of content driven by experience gained. The IN has no regulatory status, so it was always intended that once the content had matured sufficiently, it would be subsumed into both the Grid and Distribution Codes.
2. Data recording of Ramp Tests. This is a new requirement by ESBN. It, and the data thus acquired, will inform future and emerging ESBN technical standards.
3. Timing of ESPS Charging. ESBN considers this to be a prudent requirement, which may be invoked in cases in existing sub-stations where capacity is limited and where future BESS connections may not otherwise be possible.

Implications of not implementing this modification

1. BESS Implementation Note: Lack of clarity of requirements for industry and mis-alignment between common Grid Code and Distribution Code content. The indeterminate and interim status of the IN could lead to enforcement issues down the road.
2. Data recording of Ramp Tests: Lack of data to inform ESBN position on such things as ramp-rates.
3. Timing of ESPS Charging: Unnecessary and sub-optimal taking up of scarce sub-station capacity. Possible stranded assets due to over reinforcement of the network.

Please submit modification proposals to the panel secretary by e-mail to: distcodepanel@esb.ie