GC0163: GB Grid Forming (GBGF) - Removal of Virtual Impedance restriction

Workgroup 1 - 12 December 2023

Online Meeting via Teams


WELCOME

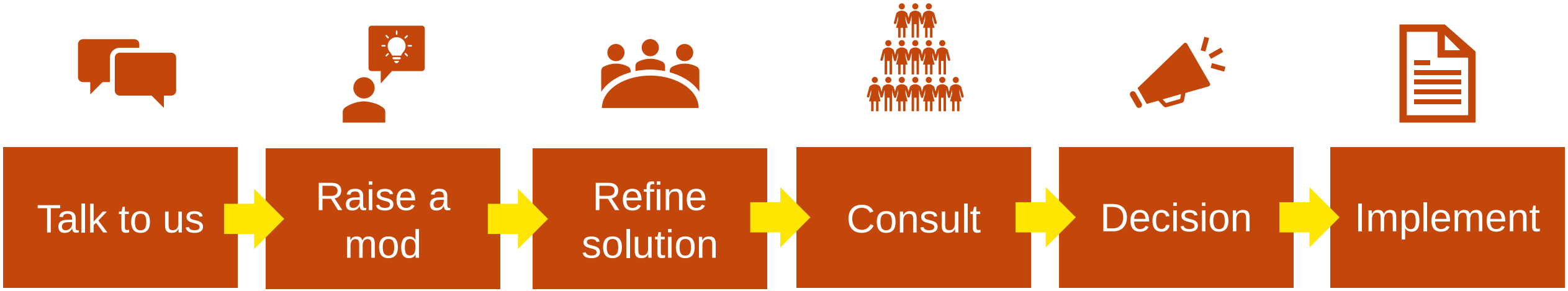
Agenda

#	Topics to be discussed	Lead
1.	Introductions	Chair
2.	Code Modification Process Overview • Workgroup Responsibilities • Workgroup Alternatives and Workgroup Vote	Chair
3.	Objectives and Timeline • Walk-through of the timeline for the modification	Chair
4.	Review and agree Terms of Reference	All
5.	Proposer Presentation and Questions	Proposer
6.	Cross Code Impacts	All
7.	Any Other Business	Chair
8.	Next Steps	Chair

Modification Process

Jonathan Whitaker – ESO Code Administrator

Code Modification Process Overview



Forums

Panels

Workgroups
(Workgroup Consultations)

Ofgem/Panel

Refine solution
Workgroups

- If the proposed solution requires further input from industry in order to develop the solution, a Workgroup will be set up.

- The Workgroup will:
  - further refine the solution, in their discussions and by holding a **Workgroup Consultation**
  - Consider other solutions, and may raise **Alternative Modifications** to be considered alongside the Original Modification
  - Have a **Workgroup Vote** so views of the Workgroup members can be expressed in the Workgroup Report which is presented to Panel

Consult

Code Administrator Consultation

- The Code Administrator runs a consultation on the **final solution(s)**, to gather final views from industry before a decision is made on the modification.

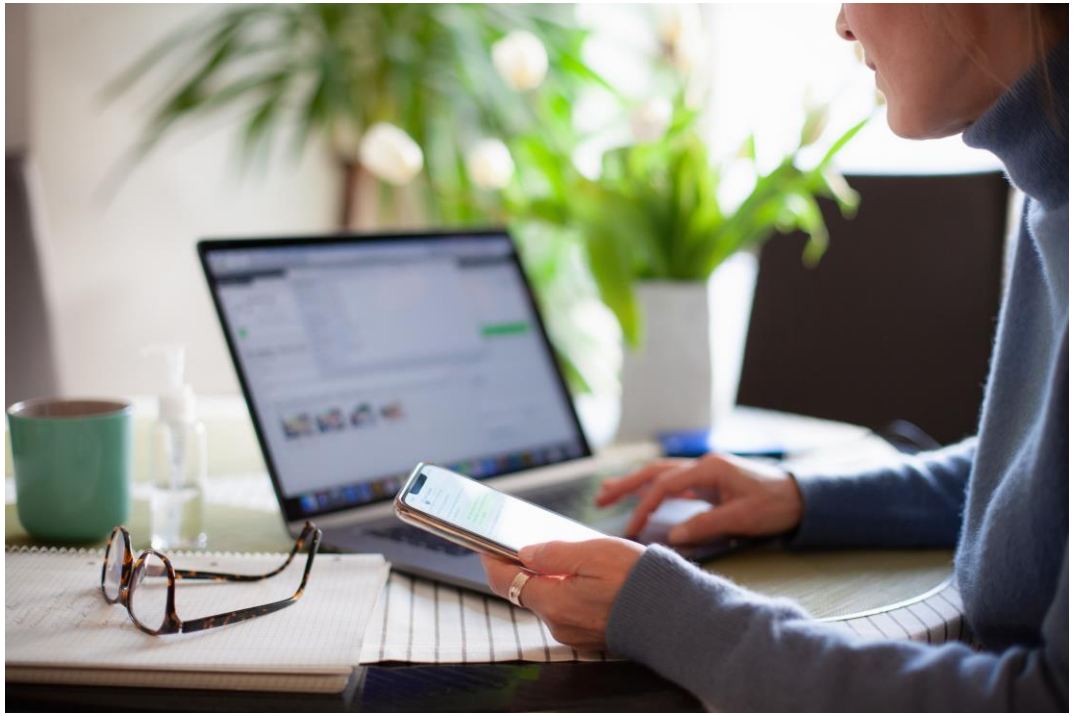
- After this, the modification report is voted on by Panel who also give their views on the solution.

Decision

- Dependent on the Governance Route that was decided by Panel when the modification was raised
- **Standard Governance:** Ofgem makes the decision on whether or not the modification is implemented
- **Self-Governance:** Panel makes the decision on whether or not the modification is implemented
  - an appeals window is opened for 15 days following the Final Self Governance Modification Report being published

Implement

- The Code Administrator implements the final change which was decided by the Panel / Ofgem on the agreed date.



Workgroup Responsibilities

Jonathan Whitaker – ESO Code Administrator

Expectations of a Workgroup Member

- Contribute to the discussion
- Be respectful of each other's opinions
- Language and Conduct to be consistent with the values of equality and diversity
- Do not share commercially sensitive information
- Be prepared - Review Papers and Reports ahead of meetings
- Complete actions in a timely manner
- Keep to agreed scope
- Email communications to/cc'ing the .box email

Your Roles

- Help refine/develop the solution(s)
- Bring forward alternatives as early as possible
- Vote on whether or not to proceed with requests for Alternatives
- Vote on whether the solution(s) better facilitate the Code Objectives

Workgroup Alternatives and Workgroup Vote

Jonathan Whitaker – ESO Code Administrator

Can I vote? and What is the Alternative Vote?

To participate in any votes, Workgroup members need to have attended at least 50% of meetings

Stage 1 – Alternative Vote

- Vote on whether Workgroup Alternative Requests should become Workgroup Alternative CUSC Modifications.
- The Alternative vote is carried out to identify the level of Workgroup support there is for any potential alternative options that have been brought forward by either any member of the Workgroup OR an Industry Participant as part of the Workgroup Consultation.
- **Should the majority of the Workgroup OR the Chair believe that the potential alternative solution may better facilitate the CUSC objectives than the Original then the potential alternative will be fully developed by the Workgroup with legal text to form a Workgroup Alternative CUSC modification (WACM)**and submitted to the Panel and Authority alongside the Original solution for the Panel Recommendation vote and the Authority decision.

Can I vote? and What is the Workgroup Vote?

To participate in any votes, Workgroup members need to have attended at least 50% of meetings

Stage 2 – Workgroup Vote

- 2a) Assess the original and Workgroup Alternative (if there are any) against the relevant Applicable Objectives compared to the baseline (the current code)
- 2b) Vote on which of the options is best.

Objectives and Timeline

Jonathan Whitaker – ESO Code Administrator

Timeline for GC0163 – Proposed Timeline - *Workgroup*

Milestone	Date	Milestone	Date
Modification presented to Panel	26 October 2023	Code Administrator Consultation (1 calendar month)	01 April 2024 – 01 May 2024
Workgroup Nominations (15 Working Days)	31 October 2023 to 21 November 2023	Draft Self Governance Modification Report issued to Panel (5 working days)	22 May 2024
Workgroup 1 Workgroup 2	12 December 2023 16 January 2024	Panel undertake Draft Self Governance Modification Report determination vote	30 May 2024
Workgroup Consultation (15 working days)	22 January 2024 to 12 February 2024	Final Self Governance Modification Report issued to Panel to check votes recorded correctly	03 June 2024 to 07 June 2024
Workgroup 3	27 February 2024	Appeals Window (15 working days)	10 June 2024 to 28 June 2024
Workgroup report issued to Panel (5 working days)	13 March 2024	Implementation Date	05 July 2024
Panel sign off that Workgroup Report has met its Terms of Reference	21 March 2024		

Terms of Reference

Jonathan Whitaker – ESO Code Administrator

GC0163 - Terms of Reference

Workgroup Terms of Reference

a) Implementation and costs;

b) Review draft legal text should it have been provided. If legal text is not submitted within the Grid Code Modification Proposal the Workgroup should be instructed to assist in the developing of the legal text;

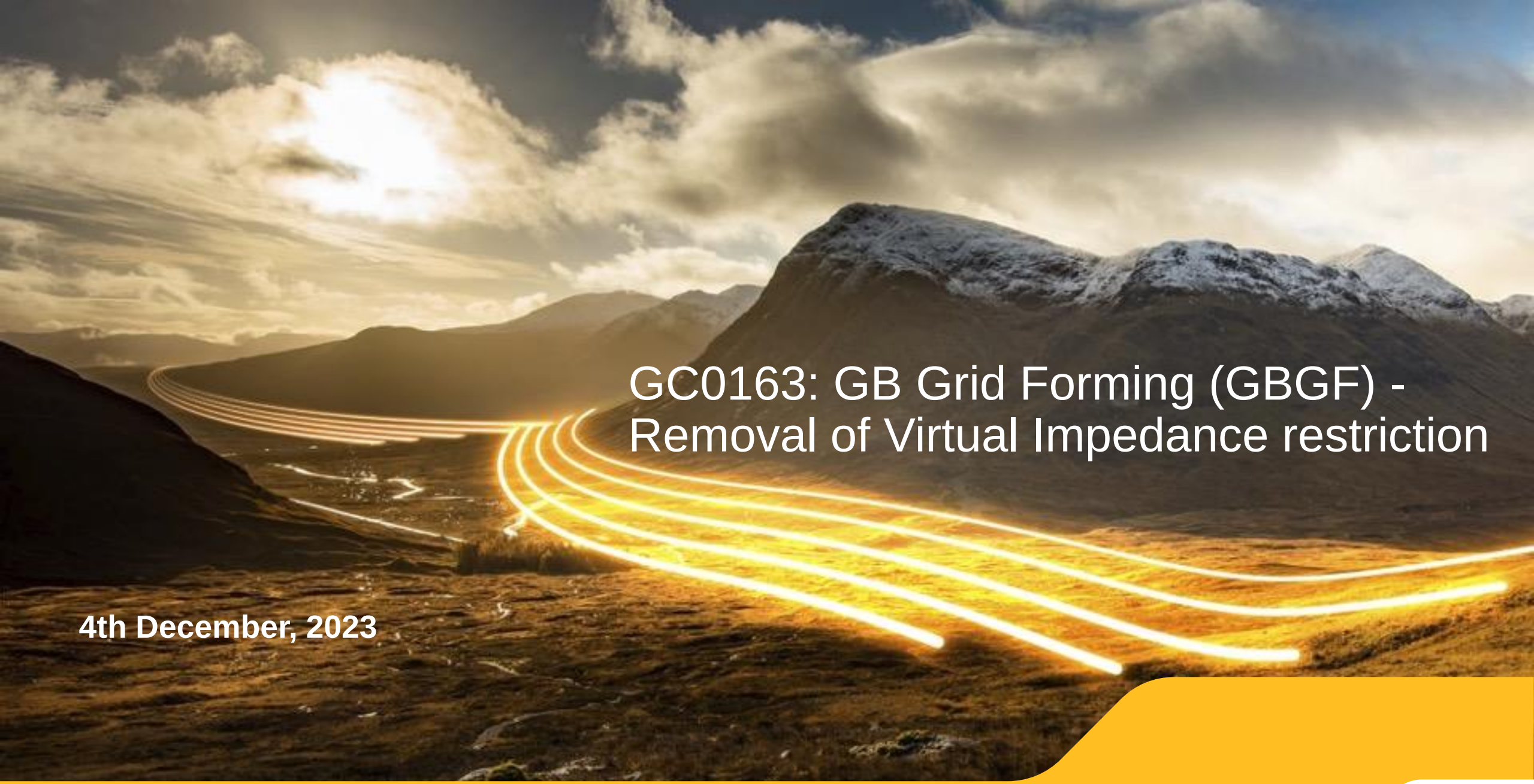
c) Consider whether any further Industry experts or stakeholders should be invited to participate within the Workgroup to ensure that all potentially affected stakeholders have the opportunity to be represented in the Workgroup. Demonstrate what has been done to cover this clearly in the report; and

d) Consider EBR implications

e) Consider whether there are any unintended consequences of removing the virtual impedance restriction which could affect system security

f) Consider whether removing the virtual impedance restriction would conflict with the specified Self Governance criteria.

Proposer’s Solution



GC0163: GB Grid Forming (GBGF) - Removal of Virtual Impedance restriction

4th December, 2023

ESO

Background

As discussed/consulted, concluded and commonly agreed within ESO's GB Grid Forming Best Practice Group including comprehensive stakeholder engagement*:

- The ESO propose, the equivalent Internal Voltage Source should be defined as a Grey Box rather than a White Box, where its functionality & performance as well as inputs/outputs should be clearly defined. The proposal of Grey Box has been widely supported by stakeholders of the Best Practice Group.
- The ESO propose the Internal Voltage Source should be defined as the Grey Box so the **definition and figures prohibiting the use of a Virtual Impedance in current Grid Code should be removed**.
- The proposed legal text has been internally reviewed.

Note*: For details, please see the reference as listed.
ESO's GB Grid Forming Best Practice Guide as issued in April, 2023
URL: https://www.nationalgrideso.com/document/278491/download

GC Changes as Proposed

Internal Voltage Source or **IVS**	For a **GBGF-S**, a real magnetic field, that rotates synchronously with the **System Frequency** under normal operating conditions, which as a consequence induces an internal voltage (which is often referred to as the Electro Motive Force (EMF)) in the stationary generator winding that has a real impedance. In a **GBGF-I**, switched power electronic devices are used to produce a voltage waveform, with harmonics, that has a fundamental rotational component called the **Internal Voltage Source (IVS)** that rotates synchronously with the **System Frequency** under normal operating conditions. For a **GBGF-I** there must be an internal impedance ~~with only real physical values,~~ between the **Internal Voltage Source** and the **Grid Entry Point** or **User System Entry Point**. ~~For the avoidance of doubt, a virtual impedance, is not permitted in GBGF-I.~~

ECC.6.3.19.3 As noted in ECC.6.3.19.2, **Grid Forming Capability** is not a mandatory requirement, however where a **User** (be they a **GB Code User** or **EU Code User**) or **Non-CUSC Party** wishes to offer a **Grid Forming Capability**, then they will be required to ensure their **Grid Forming Plant** meets the following requirements.

(i) The **Grid Forming Plant** must fully comply with the applicable requirements of the Grid Code including but not limited to the **Planning Code** (**PC**), **Connection Conditions** (**CC**'s) or **European Connection Conditions** (**ECC**'s) (as applicable), **Compliance Processes** (**CP**'s) or **European Compliance Processes** (**ECP**'s) (as applicable), **Operating Codes** (**OC**'s), **Balancing Codes** (**BC**'s) and **Data Registration Code** (**DRC**).

(ii) Each **GBGF-I** shall comprise an **Internal Voltage Source** behind an impedance ~~and reactance. For the avoidance of doubt, the reactance between the **Internal Voltage Source** and **Grid Entry Point** or **User System Entry Point** (if **Embedded**) within the **Grid Forming Plant** can only be made by a combination of several physical discrete reactances. This could include the reactance of the **Synchronous Generating Unit** or **Power Park Unit** or **HVDC System** or **Electricity Storage Unit** or **Dynamic Reactive Compensation Equipment** and the electrical **Plant** and **Apparatus** connecting the **Synchronous Generating Unit** or **Power Park Unit** or **HVDC System** or **Electricity Storage Unit** (such as a transformer) to the **Grid Entry Point** or **User System Entry Point** (if **Embedded**).~~

Thanks for your attention!

Cross Code Impacts

Jonathan Whitaker – ESO Code Administrator

Any Other Business

Jonathan Whitaker – ESO Code Administrator

Next Steps

Jonathan Whitaker – ESO Code Administrator