

GC0168

23 September 2024

Online Meeting via Teams

WELCOME



Objectives

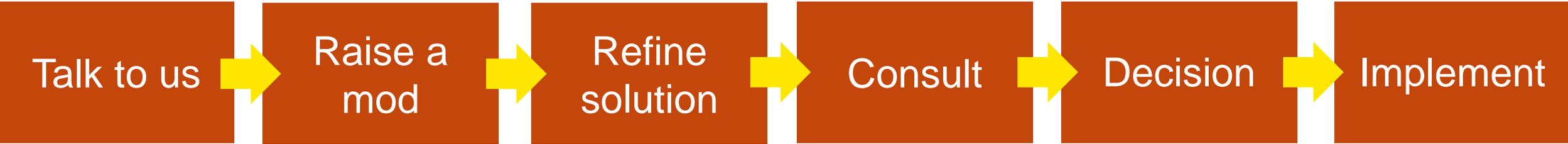
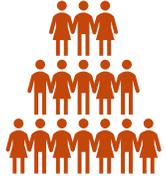
- **Introductions**
- **Modification Process**
- **Workgroup Responsibilities**
- **Workgroup Alternatives and Workgroup Vote**
- **Timeline**
- **Proposer's Solution**
- **Terms of Reference**
- **Any Other Business**
- **Next steps**



Modification Process

Sarah Williams – 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

Sarah Williams – 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

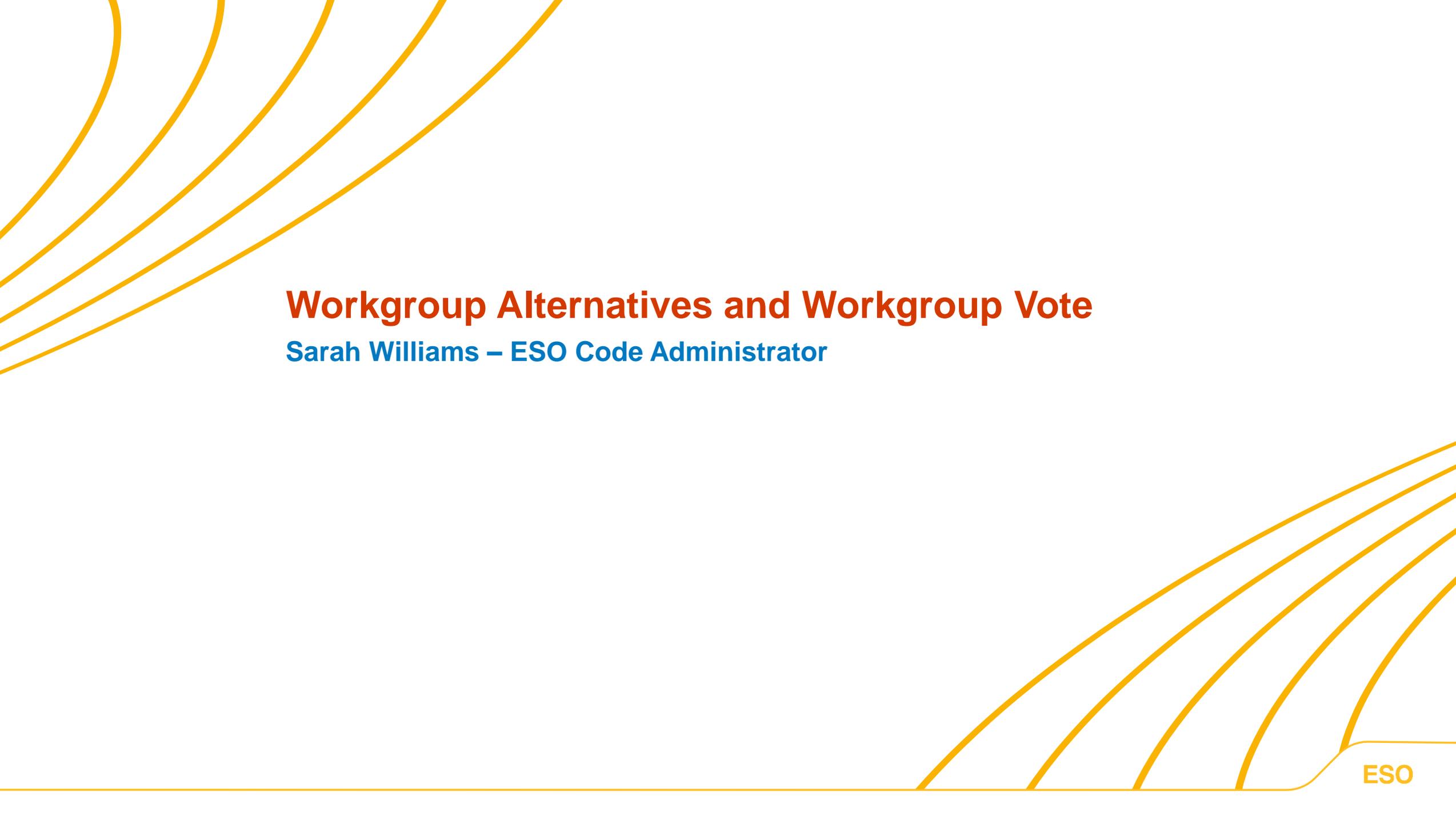
Your Roles

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

Sarah Williams – 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

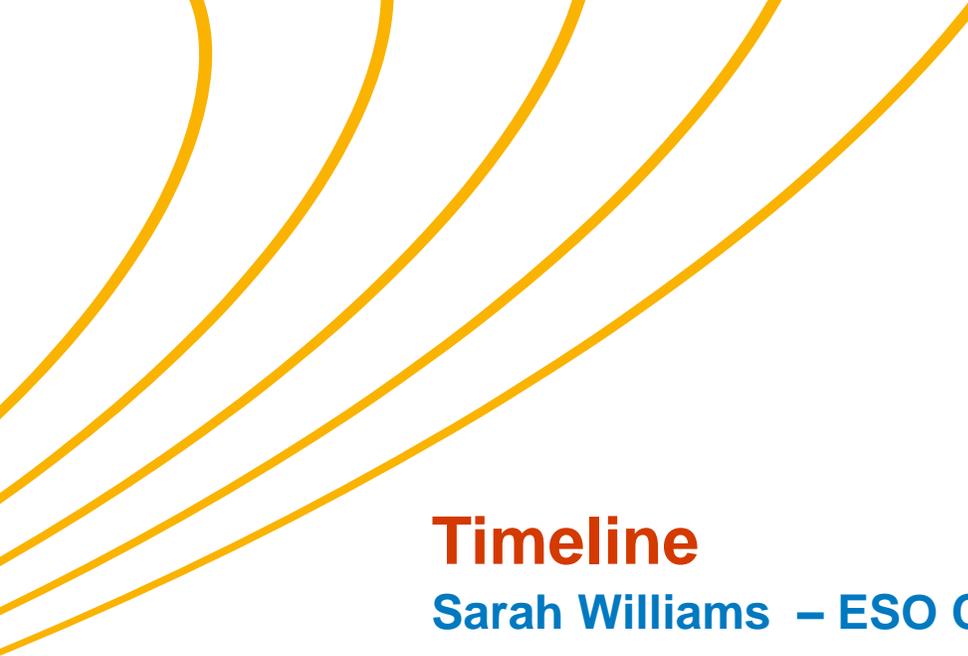
- Vote on whether Workgroup Alternative Requests should become Workgroup Alternative Grid Code Modifications.
- The Alternative vote is carried out to identify the level of Workgroup support there is for any potential alternative options that have been brought forward by either any member of the Workgroup 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 Grid Code objectives than the Original then the potential alternative will be fully developed by the Workgroup with legal text to form a Workgroup Alternative Grid Code modification (WAGCM) 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.



Timeline

Sarah Williams – ESO Code Administrator

Draft Timeline for GC0168

Milestone	Date	Milestone	Date
Modification presented to Panel	21 March 2024	Code Administrator Consultation (1 calendar month)	04 June 2025 – 04 July 2025
Workgroup Nominations (15 Working Days) <i>NOTE: Workgroup Nomination have been extended 5 working days</i>	03 May 2024 to 28 May 2024	Draft Final Modification Report issued to Panel (5 working days)	16 July 2025
Workgroup 1 and 2 <i>Agree timeline, Terms of Reference, discuss solution and legal text</i>	23 September 2024 14 October 2024	Panel undertake DFMR Recommendation vote	24 July 2025
Workgroup 3 and 4 <i>Legal text review and draft Workgroup Consultation. Approve Workgroup Consultation</i>	04 November 2024 17 December 2024		
Workgroup Consultation (1 Month)	06 January 2025 to 03 February 2025	Final Modification Report issued to Panel to check votes recorded correctly	29 July 2025 – 05 August 2025
Workgroup 5 <i>Review Workgroup Consultation responses and any alternatives.</i>	17 February 2025	Final Modification Report issued to the Authority	07 August 2025
Workgroup 6 <i>TBC</i>	10 March 2025		
Workgroup 7 <i>TBC</i>	31 March 2025		
<i>Workgroup 8</i> <i>TBC</i>	21 April 2025		
Workgroup report issued to Panel (5 working days)	22 May 2025	Implementation Date	TBC
Panel sign off that Workgroup Report has met its Terms of Reference	29 May 2025		



Proposer's Solution
Frank Kasibante - ESO



GC0168 - Submission of Electromagnetic Transient Models
Workgroup 1 – September 2024

GC0168 | Submission of Electromagnetic Transient (EMT) Models

What's the issue?

Great Britain's power system is moving towards net zero carbon operation.

This network transition from large synchronous generators to a large number of smaller Inverter-Based Resources (IBR) is causing new and varying challenges to the power system. Examples of these challenges include, control interactions, low fault level, inverter instability, Transient Overvoltage, etc, whose power electronics interact with the network in a different way to the older generators.

The Electricity System Operator (ESO) requires EMT models for Users so that it can analyse and understand how these interactions affect the network under different system conditions.

Why Change?

Unlike for a system with a previously high penetration of synchronous generation which could be adequately analysed and studied with Root Mean Square (RMS) models, an evolving system with a high penetration of IBR requires EMT models to perform more detailed investigations and analyses.

The current requirements in the Grid Code are not sufficient to cover all Users that the ESO requires EMT models from (including generation connected to the transmission network). This restricts the ability for the ESO to perform system studies, modelling and post fault analysis.

What is the proposed solution?

The proposed solution is to mandate the collection of the EMT models from all relevant Users. This will require updates to clauses in PC.A.6 and PC.A.9.

These models will feed into a wider GB Model enabling investigations at the near term and post fault studies and planning studies. This will enable safe and reliable operation of the system and enhance the security of GB electricity supply.

GC0168 | Submission of Electromagnetic Transient (EMT) Models

1. Legal Text

PC.A.6.1.3 PC.A.6.2, and PC.A.6.4 to PC.A.6.7 consist of data which is only to be supplied to **The Company** at **The Company's** reasonable request. In the event that **The Company** identifies a reason for requiring this data, **The Company** shall write to the relevant **User(s)**, requesting the data, and explaining the reasons for the request. If the **User(s)** wishes, **The Company** shall also arrange a meeting at which the request for data can be discussed, with the objective of identifying the best way in which **The Company's** requirements can be met. ~~In respect of EU Code User(s) only, The Company may shall request the need for electromagnetic transient simulations and models from all Generators, DC Converter Station Owners, HVDC System Owners, Network Operators and Non-Embedded Customers with Grid Supply Points as necessary. Where required, Users shall provide electromagnetic transient models within 3 months after a request is made by The Company. For GB Code Users, where EMT data is not readily available these timelines can be extended to 6 months. All Users shall acknowledge to The Company's request within 30 days. Further guidance on a step by step approach of collecting the models from Users shall be published on The Company's website, at The Company's reasonable request. Users with EU Grid Supply Points may be required to provide electromagnetic transient simulations in relation to these EU Grid Supply Points at The Company's reasonable request.~~

Where **The Company** makes a request to a **User** for dynamic models (RMS and EMT) under PC.A.6.7, each relevant **User** shall ensure that the models supplied in respect of their **Plant** and **Apparatus** reflect the true and accurate behaviour of the **Plant** and **Apparatus** as built and verified through the **Compliance Processes** (CP's) or **European Compliance Processes** (ECP).

Where The Company makes a request to a User for dynamic models (RMS and EMT), each relevant User shall ensure that the models supplied are in accordance with the requirements of PC.A.9.

PCA.6.1.4 Where there is a requirement for GB Code Users to provide an EMT models as a result of an Event on the Total System or or stability investigation, such data and/or models shall be provided in accordance with the time scales and compensation arrangements pursuant to the requirements of section XXX of the CUSC.

GC0168 | Submission of Electromagnetic Transient (EMT) Models

1. Legal Text

- PC.A.9.2. SCOPE
- PC.A.9.2.1 All Users shall provide root mean-square (RMS) models which represent the **Users Plant and Apparatus** and controllers in balanced, RMS, positive phase-sequence, time domain studies.
- PC.A.9.2.2 In addition, and where required The Company, the following User's
1. All Generators (including those in respect of OTSDUW) or
 2. HVDC Converter Station Owners, or HVDC System Owners or
 3. DC Converter Station Owners
 4. Network Operators Operators with EU Grid Supply Points or
 5. Non- Embedded Customers with EU Grid Supply Points
- to provide Electro-Magnetic Transient (EMT) models which represent the User's Plant and Apparatus. The Company shall use these model in electromagnetic transient studies on the transmission and distribution system. All Generators, HVDC Converter Station Owners, or HVDC System Owners directly connected to the Transmission System or Generators with Large Power Stations and HVDC Converter Station Owners or HVDC System Owners with DC Converter Stations or HVDC Systems embedded within a User system which employ converters/inverters to import or export power to or from the System shall provide Electro-Magnetic Transient (EMT) models which represent the Users Plant and Apparatus in electromagnetic transient studies on the transmission and distribution system. For the avoidance of doubt this includes Generators who own and operate a Power Park Module comprising doubly fed induction generators and may include the excitation and governor control systems associated with Synchronous Generating Units if these impact on the types of study described on The Company website.
- PC.A.9.2.3 **The Company** may specify requirements for other models in the **Bilateral Agreement** if required for specific connections in accordance with good industry practice. For example Real Time Dynamic Simulator (RTDS) Models may be required for protection co-ordination.
- PC.A.9.3 Balanced Root Mean Squared (RMS) Control System Model
- PC.A.9.3.1 The balanced, root mean-square positive sequence time-domain models shall be able to calculate how aspects, (including but not limited to; **Active Power** and **Reactive Power**) of the **User's Plant and Apparatus** vary due to changes in **System Frequency** and voltage at the **Connection Point**.

GC0168 | Submission of Electromagnetic Transient (EMT) Models

1. Legal Text

- PC.A.9.7.3 After final compliance testing as required under the CP or ECP, the **User** shall carry out validation of the model simulation results against measurements from final compliance testing in accordance with CP.A.3 or ECP.A.3, to ensure the model responses are representative of the **Users Plant and Apparatus** within 3 months after final compliance testing.
- PC.A.9.7.4 If these tests show the models are not representative of the **User's Plant and Apparatus**, the **User** shall provide updated models, supporting documentation and associated data to ensure the responses shown by the model is representative of the responses shown by **User's Plant and Apparatus** during testing.

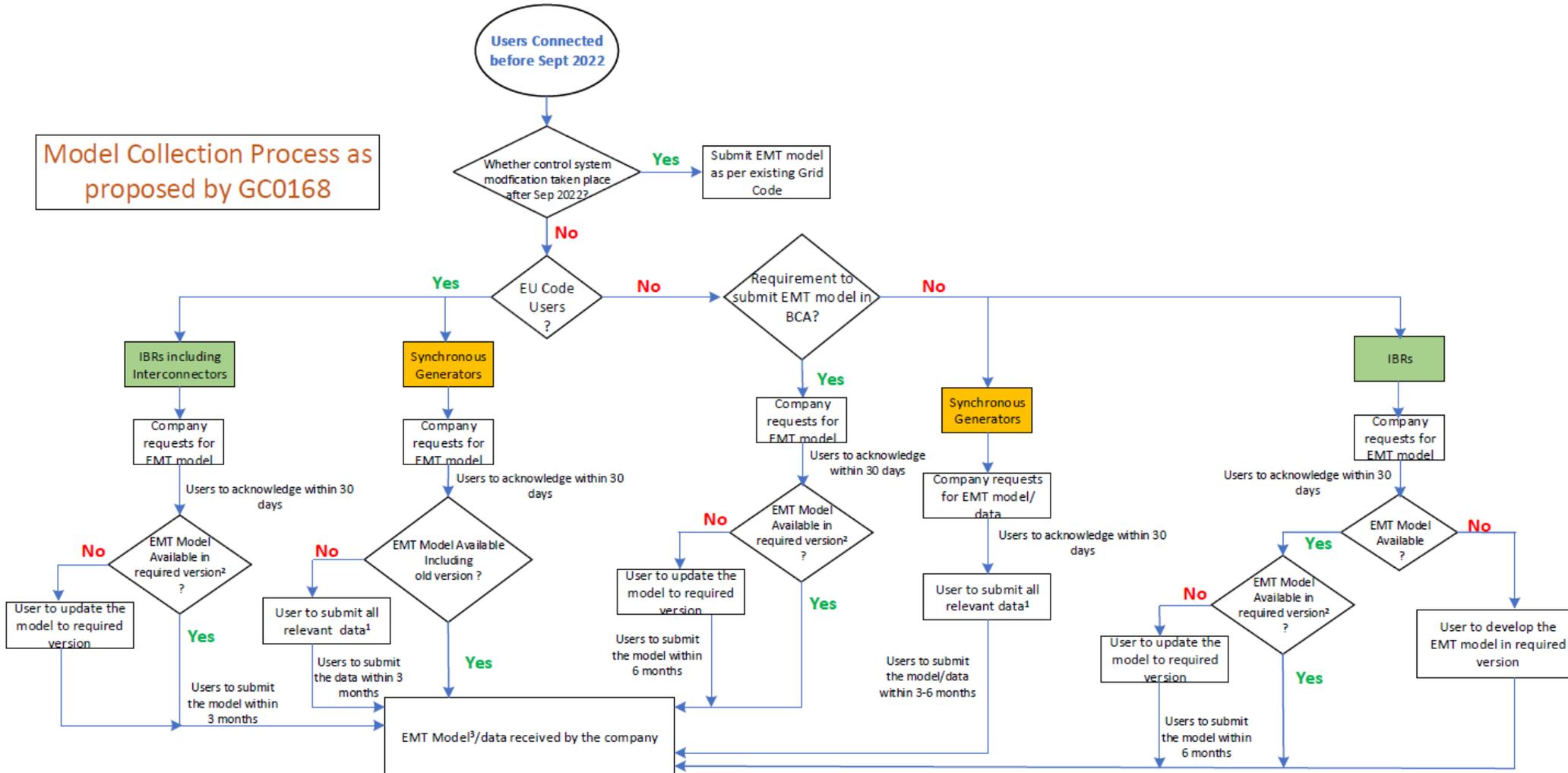
GC0168 | Submission of Electromagnetic Transient Models

2. List of Users by Technology Type who will be required to provide EMT models

User Connection Type	Technology	EMT model requirements on Users connected after 1st of Sep 2022 under current Grid Code	EMT model request under GC0168 from Users connected before and after 1st of Sep 2022
<i>Directly Connected</i>	<i>Non- Synchronous Generator</i>	Yes	Yes
	<i>Synchronous Generator</i>	Yes	Yes
<i>Bilateral Embedded Generator Agreement (BEGA) - Large</i>	<i>Non- Synchronous Generator</i>	Yes	Yes
	<i>Synchronous Generator</i>	Yes	Yes
<i>Bilateral Embedded Generator Agreement (BEGA) - Medium</i>	<i>Non-Synchronous Generator</i>	No	Yes
	<i>Synchronous Generator</i>	No	Yes
<i>Bilateral Embedded Generator Agreement (BEGA) - Small</i>	<i>Non-Synchronous Generator</i>	No	No
	<i>Synchronous Generator</i>	No	No
<i>Bilateral Embedded Licence Exemptible Large Power Station Agreement (BELLA)</i>	<i>Non - Synchronous Generator</i>	Yes	Yes
	<i>Synchronous Generator</i>	Yes	Yes

GC0168 | Submission of Electromagnetic Transient (EMT) Models

3. Proposed Model Collection Process



Notes:

- List of relevant synchronous machine plant parameters (data) can be found in the model collection guidance document. Synchronous machine plant elements include generator, excitor, AVR, PSS (if any) and shaft data
- PSCAD/EMTDC version 5 or the version specified by company.
- The Final EMT model submission from Users should be in accordance with the grid code P.C.A.9



Thanks



Terms of Reference

Sarah Williams – ESO Code Administrator

GC0168 - Terms of Reference

Workgroup Term of Reference

a) Implementation and costs;

b) Review draft 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 a cost recovery mechanism to receive the model data required to share with a CUSC Workgroup

f) Consider the use/introduction into the Legal Text of generator classifications types C, D as opposed to Medium and Large.

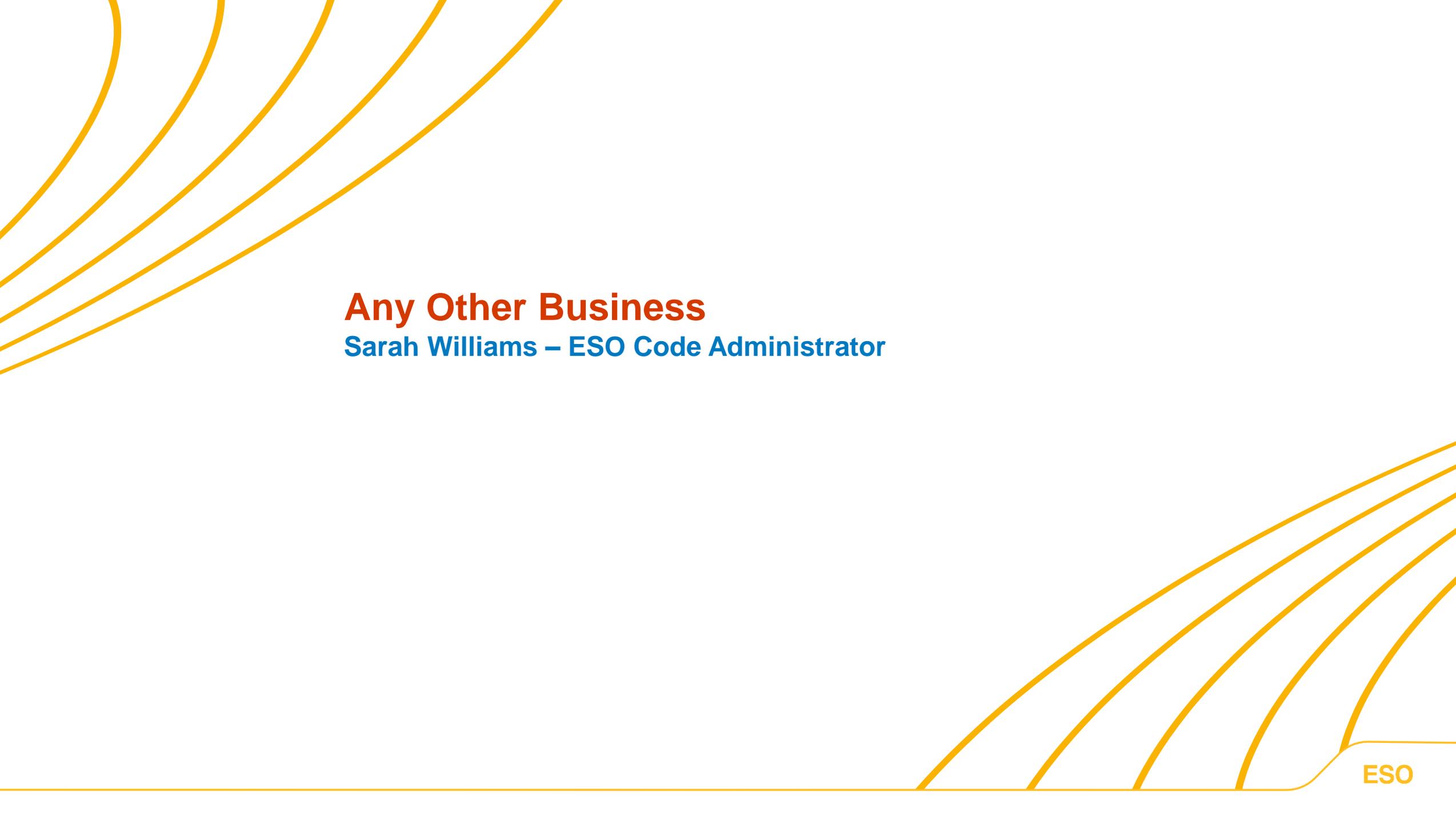
g) Consider approach on collecting models and reference to published guidance/phased application of approach.

h) Consider codifying the list of Users who are required to submit EMT models.

i) Consider the scenario where a User is unable to provide an EMT model.

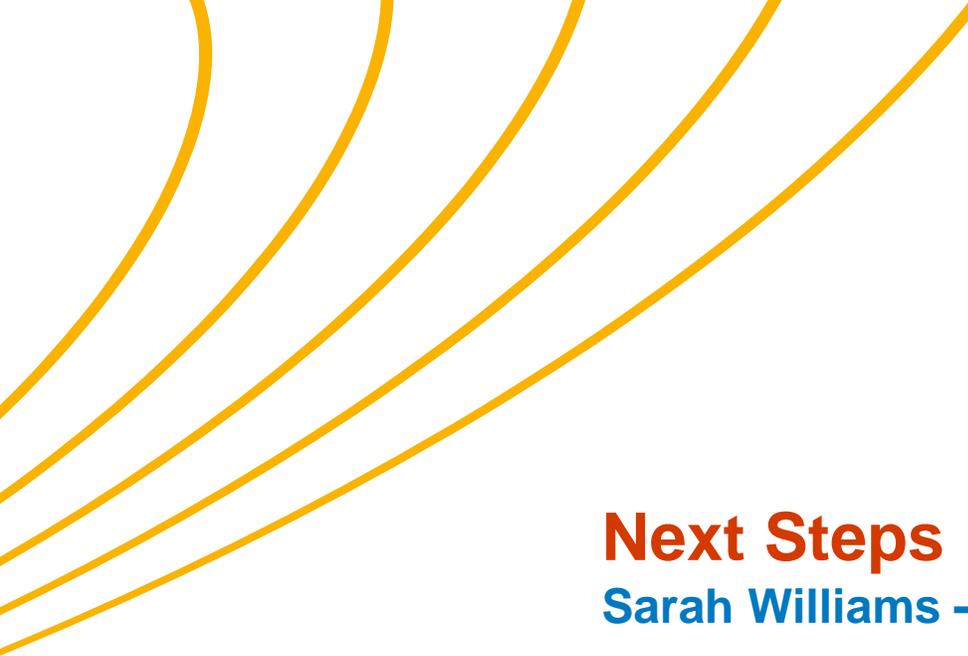
j) Consider whether there is a need for any consequential changes to the DCode and / or DCUSA.

k) Consider whether there is a need to obtain EMT models from medium power stations embedded in distribution networks and, if so, the mechanism for engaging with the host DNO and the Generator and the process to be followed in the event that the Generator is unable to provide the EMT models or would incur significant costs in doing so.



Any Other Business

Sarah Williams – ESO Code Administrator



Next Steps

Sarah Williams – ESO Code Administrator