Public

Workgroup Consultation

CM097: Electromagnetic Transient (EMT) and Root Mean Square (RMS) Model Submission for Transmission Owners (TOs)

Overview: As Great Britain's (GB) power system moves towards a net zero carbon operation; the number of Inverter-Based Resources (IBR) is expected to increase, with the amount of synchronous generation in the grid to decline which will significantly change the characteristics of the GB network. These changes give rise to the need for more accurate dynamic modelling and the need for analysing the effect of potential control interactions between the devices across the network leading to risks of oscillations and inverter stability.

Modification process & timetable

1. **Proposal Form** 29/05/2024
2. **Workgroup Consultation** 28/03/2025 to 22/04/2025
3. **Workgroup Report** 20/08/2025
4. **Code Administrator Consultation** 01/09/25 to 22/09/2025
5. **Draft Final Modification Report** 22/10/2025
6. **Final Modification Report** 07/11/2025
7. **Implementation** 10 Business Days after Authority Decision

Have 5 minutes? Read our Executive summary
Have 45 minutes? Read the full Workgroup Consultation
Have 120 minutes? Read the full Workgroup Consultation and Annexes.

Status summary: The Workgroup are seeking your views on the work completed to date to form the final solution to the issue raised.

This modification is expected to have a: High impact for Transmission System Operators, Transmission System Owners (onshore & offshore)

Governance route	Standard Governance modification with assessment by a Workgroup	
Who can I talk to about the change?	**Proposer:** Frank Kasibante Frank.kasibante1@nationalenergyso.com 07812774066	**Code Administrator Chair**: Deb Spencer Deborah.Spencer@nationalenergyso.com 07752466421
How do I respond?	Send your response proforma to stcteam@nationalenergyso.com by **5pm** on **22 April 2025**	

Public

Contents

Executive Summary

This modification seeks to require Transmission Owners (TOs) to provide NESO with Root Mean Square (RMS) and Electromagnetic Transient (EMT) models to enable analysis of issues such as system oscillations, inverter stability and Transient over Voltage (ToV) on the Transmission System.

What is the issue?

As Great Britain's power system moves towards net zero carbon operation, the network is transitioning from large synchronous Generators to a large number of smaller Inverter-Based Resources (IBR) which are causing new and varying challenges to the power system, for example control interactions, low fault level, inverter instability and ToV. NESO requires RMS and EMT models from TOs so that it can analyse and understand how these interactions affect the network under different system conditions. There are currently no requirements in the System Owner Transmission Owner Code (STC) for TOs to submit EMT and RMS models of their assets to NESO and for NESO to share these models with relevant Users as well as enabling NESO to share Users' EMT and RMS models to TOs. This restricts the ability for NESO to perform system studies, modelling and post fault analysis.

What is the solution and when will it come into effect?

Proposer's solution:

The proposed solution is to:

1. Mandate the collection of EMT and RMS models from TOs. Enable the sharing of these TO models with relevant Users and allow NESO to share Users' EMT and RMS models with TOs for conducting studies. These models will contribute to a comprehensive Great Britain (GB) Model, facilitating investigations, post-fault analyses, and planning studies.
2. Create a new STCP (12-2) to specify the model exchange process between TOs and NESO.

Implementation date: 10 Business Days after Authority decision

Interactions

GC0168 Submission of Electro Magnetic Transient (EMT) Models

A separate modification will be established to introduce a new STCP.

What is the issue?

As Great Britain's power system moves towards net zero carbon operation, the network is transitioning from large synchronous generators to a large number of smaller IBR which are causing new and varying challenges to the power system, for example control interactions, low fault level, inverter instability and ToV. To address these challenges, NESO requires RMS and EMT models from TOs. These models can help NESO to analyse and understand the impact on the network under various system conditions. There are currently no requirements in the STC for TOs to submit EMT and RMS models of their assets to NESO and for NESO to share these models with relevant Users as well as enabling NESO to share Users' EMT and RMS models to TOs. This restricts the ability for NESO to perform system studies, modelling and post fault analysis.

Why change?

For an evolving system with a high penetration of IBR and thus due to a high penetration of asynchronous generation, EMT and RMS models are required to perform more detailed analysis. This will provide more certainty in the studies and analyses outcomes which will benefit NESO in meeting its legal obligations.

What is the solution?

Proposer's solution

The proposed solution is to:

1. Mandate the collection of EMT and RMS models from TOs. Enable the sharing of these TO models with relevant Users and allow NESO to share Users' EMT and RMS models with TOs for conducting studies. These models will contribute to a comprehensive Great Britain (GB) Model, facilitating investigations, post-fault analyses, and planning studies.
2. Create a new STCP (12-2) to specify the model exchange process between TOs and NESO.

Workgroup considerations

The Workgroup convened 3 times to discuss the identified issue within the scope of the defect, develop potential solutions, and evaluate the proposal in relation to the Applicable Code Objectives.

Consideration of the Proposer's solution

During the first Workgroup the Proposer advised Workgroup members CM097 Modification was closely aligned with GC0168 and was looking to achieve the same goal but in a different code.

Legal Text Discussions

The legal text for CM097 was reviewed, and suggested amendments were agreed by the Workgroup members.

During discussions, Workgroup members expressed concerns regarding the definitions of EMT Models. Specifically, issues were raised about the accuracy and comprehensiveness of the current definition, emphasising the need for precise wording to avoid ambiguity. One Workgroup member remarked that the existing definition might be too detailed and may not accurately represent all EMT Models. It was decided that an offline discussion would be conducted to address these concerns comprehensively, details are to be shared with Workgroup members in Workgroup 4 which will be after the Workgroup consultation.

Cost Recovery Mechanism

Workgroup members discussed cost recovery mechanisms for both TOs and Offshore Transmission Owners (OFTOs). It was identified that NESO needed to consult with their legal team and the Authority would review existing arrangements and address potential issues, particularly for OFTOs who lack a formal price control mechanism. A Workgroup member advised that incumbent Transmission Owners do not have price control mechanisms in place for cost recovery.

A Workgroup member highlighted that the current income adjustment clauses within the transmission licenses only allow cost recovery between £500k and £4 million, which is deemed insufficient for the anticipated expenses. It was suggested that this mechanism does not adequately support TOs and proposed introducing a contingent event clause within the license as a potential solution for cost recovery. This clause would enable TOs to recover costs in specific contingent events, providing a more satisfactory mechanism. The Proposer agreed to discuss this further with NESO colleagues and Ofgem.

Draft STCP

Workgroup members reviewed and made comments on a draft STCP modification that was shared by the Proposer, it was agreed that amendments were to be made before the STCP proposal was submitted to STC Panel.

The Workgroup members deliberated on the necessity for User manuals, DPS (Dynamic Performance Studies) reports, and validation reports. The Proposer agreed to address these concerns separately and to conduct a detailed review of the model validation and documentation requirements. A discussion with the modelling team will be initiated to provide clearer guidance in the updated document. The STCP will follow the normal governance route.

Guidance Notes/Electrical Standards

Further discussions were held regarding the distinction between guidance notes and electrical standards. Workgroup members emphasised the need for clarity in the documentation as

current references could lead to confusion. The Proposer agreed to collaborate with NESO colleagues to make the necessary updates to ensure clarity and accuracy.

Consideration of other options

No other options were considered.

Draft legal text

The draft Legal Text for this change can be found in **Annex 3**.

What is the impact of this change?

Proposer's assessment against STC Objectives	
Relevant Objective	**Identified impact**
(a) efficient discharge of the obligations imposed upon Transmission Licensees by Transmission Licences and the Electricity Act 1989;	**Positive** NESO and TOs will have the ability to meet their licence obligations relating to operating the system securely.Please provide your rationale
(b) efficient discharge of the obligations imposed upon the licensee by the Electricity System Operator licence, the Energy Act 2023 and Electricity Act 1989;	**Neutral**
(c) development, maintenance, and operation of an efficient, economical, and coordinated system of electricity transmission;	**Positive** EMT and RMS models for TO assets, for assets with Power Electronic Devices, will facilitate system analysis and enable to operate the evolving and future system with anticipated high penetration of IBR resources. This will enable achievement of an efficient, economical and coordinated electricity transmission system.
(d) facilitating effective competition in the generation and supply of electricity, and (so far as consistent therewith)	**Neutral**

facilitating such competition in the distribution of electricity;	
(e) protection of the security and quality of supply and safe operation of the National Electricity Transmission System insofar as it relates to interactions between Transmission Licensees and the licensee*;	**Positive** EMT and RMS models for TO assets, for assets with Power Electronic Devices, will facilitate system analysis and enable to operate the evolving and future electricity system.
(f) promotion of good industry practice and efficiency in the implementation and administration of the arrangements described in the STC;	**Positive** The availability of EMT and RMS models from TOs will help NESO to analyse the help NESO to analyse the impact of potential new connections to the system and undertake post-system incident analysis. This will identify any modifications and / or control measures required to operate the system.
(g) facilitation of access to the National Electricity Transmission System for generation not yet connected to the National Electricity Transmission System or Distribution System; and	**Neutral**
(h) compliance with the Electricity Regulation and any Relevant Legally Binding Decisions of the European Commission and/or the Agency.	**Neutral**

* See Electricity System Operator Licence

Proposer's assessment of the impact of the modification on the stakeholder / consumer benefit categories	
Stakeholder / consumer benefit categories	**Identified impact**
Improved safety and reliability of the system	**Positive** When TOs provide EMT and RMS models to NESO, NESO will be able to carry out pre-fault and post-fault analysis studies, the outputs of which will lead to accurate

	operational decisions in the interest of safety and reliability of the system.
Lower bills than would otherwise be the case	**Neutral**
Benefits for society as a whole	**Neutral**
Reduced environmental damage	**Neutral**

When will this change take place?

Implementation date

10 Business Days after Authority Decision

Date decision required by

June 2025

Implementation approach

No systems will have to change because of this modification

Interactions

☒Grid Code	☐BSC	☐CUSC	☐SQSS
☐European Network Codes	☐Other modifications	☐Other	

GC0168 Submission of Electro Magnetic Transient (EMT) Models

A separate modification will be established to introduce a new STCP.

How to respond

Standard Workgroup Consultation questions

1. Do you believe that the Original Proposal better facilitates the Applicable Objectives versus the current baseline?
2. Do you support the proposed implementation approach?

3. Do you have any other comments?
4. Do you wish to raise a Workgroup Consultation Alternative request for the Workgroup to consider?
5. Does the draft legal text satisfy the intent of the modification?

Specific Workgroup Consultation questions

6. Please could you share your rationale for a cost-recovery mechanism to be put in place supported by evidence, where available. If no cost-recovery mechanism were available, what do you believe the implications would be?
7. As part of the consequential modification for GC0168 is proposed to prepare an Electrical Standard detailing how an EMT model would be submitted in Power System Computer Aided Design (PSCAD) Version 5. Do you believe with appropriate signposting to the Grid Code from the STC, this would be an appropriate and cost effective method of providing this guidance to transmission licences. If you do not believe this to be the case, what alternatives would you suggest, and the rationale for your view.

The Workgroup is seeking the views of STC and other interested parties in relation to the issues noted in this document and specifically in response to the questions above.

Please send your response to stcteam@nationalenergyso.com using the response pro-forma which can be found on the CM097 modification page.

In accordance with Governance Rules if you wish to raise a Workgroup Consultation Alternative Request, please fill in the form which you can find at the above link.

If you wish to submit a confidential response, mark the relevant box on your consultation proforma. Confidential responses will be disclosed to the Authority in full but, unless agreed otherwise, will not be shared with the Panel, Workgroup or the industry and may therefore not influence the debate to the same extent as a non-confidential response.

Acronyms, key terms and reference material

Acronym / key term	Meaning
DPS	Dynamic Performance Studies Report
EMT	Electromagnetic Transient
GB	Great Britain
GC	Grid Code
IBR	Inverter Based Resources
NESO	National Energy System Operator
OFTO	Offshore Transmission Owner
PSCAD	Power System Computer Aided Design
RMS	Root Mean Square
STC	System Operator Transmission Owner Code
STCP	System Operator Transmission Owner Code Procedure
SQSS	Security and Quality of Supply Standards
TO	Transmission Owner
ToV	Transient over Voltage
T&Cs	Terms and Conditions

Annexes

Annex	Information
Annex 01	CM097 Proposal form
Annex 02	CM097 Terms of Reference
Annex 03	CM097 Draft legal text