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## Workgroup Report

# GC0168: Submission of Electromagnetic Transient (EMT) Models

**Overview:** This modification seeks to require certain Users to provide National Energy System Operator (NESO) with EMT models to enable the analysis of issues such as system oscillations, inverter instability and transient overvoltage (ToV).

### Modification process & timetable



**Have 5 minutes?** Read our [Executive summary](#)

**Have 60 minutes?** Read the full [Workgroup Report](#)

**Have 120 minutes?** Read the full Workgroup Report and Annexes.

**Status summary:** The Workgroup have finalised the proposer's solution. They are now seeking approval from the Panel that the Workgroup have met their Terms of Reference and can proceed to Code Administrator Consultation.

**This modification is expected to have a: High impact** on Generators (including both GB Generators and EU Generators), National Energy System Operator, Distribution Network Operators, Interconnector Owners, Transmission Owners and Non-Embedded Customers.

**Modification drivers:** Efficiency, GB Compliance, Harmonisation, New Technologies, System Operability, System Planning, System Security, Transparency

**Governance route** Standard Governance modification with assessment by a Workgroup

**Who can I talk to about the change?**

**Proposer:**  
Frank Kasibante (NESO)  
[frank.kasibante1@neso.energy](mailto:frank.kasibante1@neso.energy)

**Code Administrator Chair:**  
Kat Higby (NESO)  
[Katharine.Higby@neso.energy](mailto:Katharine.Higby@neso.energy)

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## Executive Summary

This modification seeks to require certain Users to provide NESO with electromagnetic transient (EMT) models to enable analysis of issues such as system oscillations, inverter instability and transient overvoltage (ToV) on the Transmission System.

### What is the issue?

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

The network transition from large synchronous generation to a large number of smaller Electronic Power Converters (EPCs) is causing new and varying challenges to the power system, especially in view of the different operating and performance characteristics of EPCs whose power electronics interact with the network in a different way to the older Generators. Examples of these challenges include control interactions, low fault level, inverter instability and ToV.

NESO requires EMT models from certain Users in order to analyse and understand how these interactions affect the network under different system conditions.

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

**Proposer's solution:** The proposed solution is to mandate the collection of the EMT models from certain legacy CUSC Bilateral Connection Agreements. A list of Users who will be affected by this obligation can be found in **Annex 04**. This will require updates to Grid Code Planning Code sections PC.3.3, PC.A.5, PC.A.6 and PC.A.9 as an amendment to the Annex of the General Conditions (referenced in GC11) to introduce a new Electrical Standard which will indicate a step-by-step approach of collecting EMT from Users connected before 1 September 2022. These models will feed into a wider GB model enabling investigations, post fault studies and planning studies. This will help to enable safe, reliable and economic operation of the System and enhance the security of GB electricity supply.

**Implementation Date:** In line with modifications CM097 and future CUSC modification relating to cost recovery.

**What is the impact if this change is made?** **High impact** on Generators (including both GB Generators and EU Generators), National Energy System Operator, Distribution Network Operators, Interconnector Owners, Transmission Owners and Non-Embedded Customers.

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**Workgroup conclusions:** The Workgroup concluded by majority that the Original better facilitated the Applicable Objectives than the Baseline.

### **Interactions**

A CUSC modification will be raised relating to a cost recovery mechanism.

Corresponding STC modification CM097 – Electromagnetic Transient (EMT) and Root Mean Square (RMS) Model Submission for Transmission Owners (TOs).

A separate modification will be established to introduce a new System Operator-Transmission Owner Code Procedure (STCP) 12-2.

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## What is the issue?

As Great Britain's power System moves towards net zero carbon operation, the network is transitioning from large synchronous generation to a larger number of smaller EPCs. This is causing new and varying challenges to the power System, especially in view of the different operating and performance characteristics of EPCs, whose power electronics interact with the network in a different way to older generation. Examples of these challenges include control interactions, low fault level, inverter instability and ToV.

NESO requires EMT models from Users so that it can analyse and understand how these interactions affect the network under different System conditions.

For some European Code Users, the demonstration of compliance requires EMT models to be provided and assessed through the Compliance Process. For users subject to modification GC0141 'Compliance Processes and Modelling amendments following 9th August Power Disruption', the requirements for EMT model provision and the processes surrounding their provision have been clearly articulated. However, for GB Code Users (prior to the implementation of GC0141) there is currently no clarity over how these models should be made available. Equally for early EU Code User's, the Grid Code does enable the NESO to request EMT simulation where required (PC.A.6.1.3) however as with GB Code Users which have not been subject to the GC0141 process, there is no clarity over how these models should be made available. The requirements in the current Grid Code for these relevant Users require RMS models which are inadequate to accurately model the Transmission System with high proportions of EPCs. This situation arises through the complex switching sequences that EPCs introduce, therefore requiring a detailed three-phase representation through an EMT model. Therefore, to accurately represent the behavioural characteristics of the Transmission System, detailed EMT models will be required from Users.

Grid Code modification GC0141 (as approved by The Authority on 12 December 2022) already requires Users which either connected to the System on or after 01 September 2022 or were subject to a control system change or a modification to already supply an EMT model. In addition, Grid Code modification GC0102 'EU Connection Codes GB Implementation Mod 3' also enabled NESO (formerly ESO) to request an EMT Model from EU Code Users where required. However, this modification (GC0168) is now seeking NESO to require relevant Users (which do not fall under the requirements of GC0141 or GC0102) to provide an EMT model on a retrospective basis where such a model is required.

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## Why change?

Unlike a System with a previously high penetration of synchronous generation which could be adequately analysed and studied with RMS models, an evolving System with a high penetration of EPCs requires more detailed EMT models to perform investigations and analysis. This is largely as a result of the complex switching arrangements that take place in EPCs unlike their synchronous counterparts.

The current requirements in the Grid Code are insufficient to cover the User data that NESO requires. As noted above, EMT models from Users are becoming essential to ensure that NESO can accurately model the Transmission System. Without these models, it restricts the ability of NESO to perform accurate System studies, modelling and post-fault analysis.

## What is the solution?

### Proposer's solution

The proposed solution is to mandate the collection of the EMT models from all relevant Users where this data is required. This will require updates to clauses in the Grid Code Planning Code (PC.3.3, PC.A.5, PC.A.6 and PC.A.9) and the Grid Code General Conditions (Annex to the General Conditions (referenced in GC11)). As part of this modification, it is also proposed to develop a Relevant Electrical Standard which will provide Guidance on Modelling Requirements including the collection of Retrospective EMT models.

These models will feed into a wider GB model enabling investigations in the near term, in addition to post-fault studies and planning studies. This will enable safe and reliable operation of the Transmission System and enhanced security.

## Workgroup considerations

The Workgroup convened 8 times to discuss the identified issue within the scope of the defect, develop potential solutions, and evaluate the proposal in relation to the Applicable Grid Code Objectives.

### Consideration of the Proposer's solution

#### Legal text identified to be amended (Grid Code Planning Code, sections PC.3.3, PC.A.5, PC.A.6 and PC.A.9)

During Workgroup discussions, members highlighted areas of the legal text that either needed clarification or to be changed.

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Workgroup members agreed that a table should be included within the legal text to provide clear and structured information regarding the requirements for model provision, with the aim to:

- Distinguish between different types of connections and the specific dates and conditions under which models are required;
- Make it easy for readers to understand their obligations by presenting the information in a tabular format rather than in dense legal text; and
- Align the legal text with practical implementation details, such as the distinction between pre and post-September 2022 connections and the conditions for model updates after modifications.

This table has been included within Grid Code Planning Code, section PC.A.9.2.2.

Workgroup members discussed the use of the term mathematical models, emphasising the need to distinguish RMS and EMT models. They discussed the challenges of converting models between different software versions and the importance of validation. This has been clarified within the legal text.

The Proposer amended the legal text, which included technical clarifications and changes to specific sections of the Grid Code and shared this with Workgroup members for review.

### **Model collection timescales (Grid Code Planning Code, section PC.A.9.7.3)**

Workgroup members raised concerns regarding the three-month timescale for sending validation reports to NESO in relation to model simulation results against measurements, members agreed that more time was needed. The Proposer agreed to amend the text to state the 3 months would start after compliance testing had been completed.

### **Cost of model development and cost recovery**

The Proposer noted that the Grid Code Review Panel (GCRP) had advised GC0168 Workgroup members to discuss and consider if a cost recovery mechanism was needed. Workgroup members agreed that there should be a cost recovery mechanism, but it was difficult to quantify as it would depend on the size of the unit, its age, type and if the manufacturer was still supplying equipment.

A NESO representative highlighted that cost recovery would apply to historical sites only and going forward this would be less of an issue, as new sites would not be eligible to claim.

Workgroup members agreed that a modification to the CUSC is required to introduce a cost recovery mechanism.

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## Additional Term of Reference (ToR)

It was suggested by a NESO representative that an additional item was added to the ToR relating to the need to reflect international best practice. They suggested that the recent consultations relating to EU Requirements for Generators 2.0 (RfG 2.0) and High Voltage Direct Current 2.0 (HVDC 2.0) would provide an appropriate benchmark which was agreed by the Workgroup. ToR (I) was approved by the October Grid Code Review Panel. The ToR was amended to show the new reference.

## Terms of Reference discussion

The Terms of Reference have been reviewed by the Workgroup to confirm that they have been met. The view of the Workgroup regarding the Terms of Reference is summarised as follows:

### a) Implementation and costs

A Workgroup member noted that when Panel members agreed the ToR for the Workgroup, they were not aware of what the outcome would be.

Discussions have taken place, and members agreed that there is a need for a cost recovery mechanism. As funding is a commercial issue that technically falls outside the Grid Code, the issue would need to be addressed through a CUSC modification. The CUSC Panel and a CUSC Workgroup will consider the most appropriate cost recovery mechanism, especially noting that some parties affected by this change, for example Licence Exempt Embedded Medium Power Stations (LEEMPS) are not CUSC Parties.

### b) Review draft legal text

The legal text has been discussed thoroughly by Workgroup members and all comments and amendments have been considered by the Proposer. The amended legal text, which includes technical clarifications and changes to specific sections of the Grid Code, has been reviewed and agreed by Workgroup members.

### 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

Two sets of nomination requests were issued to industry to encourage stakeholders to register for GC0168 Workgroups. Individual emails were also issued to equipment manufacturers to encourage their participation to Workgroups, this was done early in the process at the request of current Workgroup members.



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The Proposer has engaged with owners of large combined cycle gas turbines (CCGTs) Units and/or Modules, who have been given the opportunity to review and contribute to this modification.

### **d) Consider Electricity Balancing Guideline (EBR) implications**

It was agreed that there are no EBR changes, as there is no impact on the Balancing code.

### **e) Consider a cost recovery mechanism to receive the model data required to share with a CUSC Workgroup**

Discussions have taken place in relation to the cost recovery mechanism, Workgroup members felt that the cost recovery mechanism was difficult to quantify as it would depend on the size of the unit, its age, type and if the manufacturer was still supplying equipment.

Workgroup members agreed that a CUSC modification will be required to implement a cost recovery mechanism.

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

The use of User types was discussed in Workgroups, the Proposer felt that the use of a list would be easier for users and more transparent. As currently drafted the legal text refers to Large, Medium and Small Power Stations as the contractual requirements are based on these terms. Following the implementation of the EU Requirements for Generators (RfG) in the GB Grid Code in 2018, technical requirements were specified based on Type A, B, C, and D Power Generating Modules as defined in the Grid Code. Although a Large, Medium or Small Power Station could comprise of any combination of Type, A, B, C, or D Power Generating Modules, the actual contractual obligation on the Generator under CUSC is with respect to the Power Station not the Power Generating Module, although it is true to say that under RfG the technical obligations are with respect to the Power Generating Module.

Noting that this GC0168 modification applies to all Generators, including GB Generators who are not caught by the requirements of RfG, the legal drafting (PC.A.9.2.2) has therefore been based on Power Station size (i.e. Large, Medium and Small) rather than Type A, B, C, and D Power Generating Modules.

### **g) Consider approach on collecting models and where that guidance would sit**

This issue was discussed at the Workgroup, members agreed that additional guidance and the approach used could either be included as an appendix to the Planning Code in the Grid Code, under the relevant Electrical Standards, or as a standalone guidance note.

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The Proposer suggested that including the guidance as an Electrical Standard would be the best approach as this does introduce a governance process (Grid Code GC11) around the document in a simple way. It was noted that if a bespoke Appendix was added to the Planning Code, a full Grid Code modification would be required each time the document needed to be updated which would be demanding in terms of resource and time. It was also noted that a pure guidance note published on the NESO's website would be subject to no governance arrangements. Workgroup members agreed that neither of these options would be desirable from an Industry perspective, and therefore the best approach would be to consider including the appropriate guidance as an Electrical Standard.

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

Workgroup members agreed this was considered and has been included in the proposed legal text under PC.A.9.2.2. which lists the Users who are required to submit an EMT model. See **Annex 04**.

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

This issue was discussed and the proposed legal text updated in PC.A.9.2.2.1 stating that where an EMT model is requested, this is required to be provided within 9 months of a request from NESO unless otherwise agreed in the case of a GB Code User, and 3 months of a request from NESO unless otherwise agreed in the case of an EU Code User. This wording also accounts for potential problems in preparing old plant EMT models that cannot meet all the requirements in PC.A.9. It should also be noted that for GB Code Users and early EU Code Users, a cost recovery mechanism is being introduced to provide a mechanism of compensating Users for the ability to supply a model when requested by NESO.

The difference in model submission timeframes between EU Code Users and GB Code Users arises though differences in treatment between EU Code Users and GB Code Users as introduced through the EU Connection Network Codes (RfG, Demand Connection Code (DCC) and HVDC Codes). Under the EU Connection Network Codes, there is a requirement for Users to provide an EMT Model when requested from the System Operator, however this is not the case for GB Code Users which accounts for the difference in approach between EU Code Users and GB Code Users.

### **j) Consider whether there is a need for any consequential changes to the DCode and / or Distribution Connection and Use of System Agreement (DCUSA)**

A member noted that it appears that a Distribution Code modification is unlikely to be required for the technical requirements, but there may be a need for a DCUSA modification to deal appropriately with LEEMPS in relation to any compensation mechanism that might arise from a possible CUSC modification.

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It was agreed that the DCUSA administrator should be contacted and informed about this modification and Workgroup discussions.

- 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 Distribution Network Operator (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**

This was discussed at Workgroup 4, and it was noted this was a particular concern as LEEMPS are not CUSC signatories but are bound by some of the requirements of the Grid Code Planning Code through obligations in the Distribution Code. The obligation for LEEMPS to comply with these requirements falls on the DNO, which the DNO would pass on to their LEEMPS customers through the connection agreement. However, as the LEEMPS would have no funding for the provision of the model under CUSC, this would be unfair if generators with a CUSC contract were compensated.

- l) Consider if we are reflecting international practice including observation of the modelling developments proposed for RfG 2.0 and HVDC 2.0**

NESO advised that some additional requirements had been included in the proposed EU Connection Network Codes (e.g. RfG 2.0, DCC 2.0 and HVDC 2.0) relating to EMT models. It was suggested by NESO that these documents were reviewed with respect to their requirements on modelling to reflect international best practice. NESO has reviewed these documents, and the Workgroup has considered the impacts of these proposals.

## Workgroup Consultation Summary

The Workgroup held their Workgroup Consultation between 23 January and 21 February 2025 and received 7 non-confidential responses and 2 confidential responses. The full non-confidential responses and a summary of the non-confidential responses can be found in **Annexes 05 and 06**.

### **Support for the requirement for users providing EMT models to NESO when requested:**

Six respondents supported the implementation approach, including the requirement for Users to provide EMT models to NESO when requested, noting the importance of accurate power system modelling, including planning, operation, and post-event analysis.

- Most respondents noted that this support is conditional on a sufficient cost recovery mechanism being in place to allow for compensation for older Plants in particular, due to the significant cost of obtaining models.

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- One respondent noted that it is reasonable to require Users to provide an EMT model, but the approach must consider the difficulties in obtaining models from legacy Plants.
- Two respondents noted that it is reasonable to require EMT models from Users identified in the draft legal text, but clarity is needed on which Users need to provide models by default, and which need to provide them when requested by NESO.

*Workgroup feedback:* Workgroup members agreed that the legal text must be clear on the process and obligations around model provision.

## Non-support of the solution:

One respondent did not support the solution, noting that NESO needs to appreciate the significant cost involved in doing this for legacy Plants and the impacts of this cost, with the worst-case being closure of Plant.

*Workgroup feedback:* Workgroup members consider that providing Users with flexibility to make use of their existing RMS data will alleviate concerns around the implementation of this modification. It was noted that there is flexibility in the legal text to address practical challenges and timelines on a case-by-case basis. This will also be clarified within the Electrical Standard.

## Cost recovery:

All of the respondents noted the need for a cost recovery mechanism, noting the following key points:

- Not having a cost recovery mechanism could lead to premature closure of older Plants.
- Having a cost-recovery mechanism in place before GC0168 is implemented is necessary to compensate parties who incur unexpected and significant costs as a result of providing models.
- A cost recovery mechanism is necessary to avoid discrimination against older Plants and potential non-compliance issues, including the need to apply for derogations.
- CUSC modification CMP398 'GC0156 Cost Recovery mechanism for CUSC Parties' was noted as a relevant example of cost recovery.
- Sites connected before September 2022 were not required to develop an EMT model by the Connection Agreement or Grid Code. A cost recovery mechanism is

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required because Users should not necessarily bear the cost of requirements introduced retrospectively by NESO.

*Workgroup feedback:* Workgroup members clarified that EU Code Users connected before September 2022 may still be required to provide EMT models if requested, as per the requirements of the EU connection network codes (RfG, HVDC).

## Governance

Six respondents agreed it is appropriate to define the detail of the model submission in an Electrical Standard rather than in a specific part of the Grid Code, or as a separate guidance note.

- Respondents that preferred the model submission to be defined in an Electrical Standard noted its appropriate flexibility and that it would strike the correct balance between administrative burden and governance.
- Some respondents noted that ideally, everything should be in the Grid Code as a one-stop-shop for Code Users, however respondents acknowledge that they would support the use of Electrical Standards over guidance notes.

*Workgroup feedback:* Workgroup members agreed that the Electrical Standard will detail the process for model collection and submission, ensuring clarity and consistency.

## Model submission method

Five respondents noted that it is appropriate for EMT models to be submitted in Power Systems Computer Aided Design (PSCAD) Version 5, however one raised concerns about future compatibility with newer software versions. One respondent noted that NESO should not define specific software, as it adds expense and complication.

*Workgroup feedback:* Workgroup members agreed that EMT models should be submitted in PSCAD Version 5, with considerations for future compatibility and flexibility in software choice.

**Dealing with LEEMPS:** There were mixed views around whether LEEMPS had been adequately dealt with within the Proposal:

- Two respondents noted that the Proposal does deal with LEEMPS adequately, requiring them to provide an EMT model where requested. However, both

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responses question how cost recovery will work, considering LEEMPS are not CUSC Parties. Another response also questioned this.

- Two respondents note that further clarification is required, as within the draft legal text, the arrangements for obtaining EMT models from a LEEMPS owner / operator is not clear.
- One respondent does not believe the proposal deals adequately with LEEMPS, stating that pre-September 2022 LEEMPS Generators should receive the same compensation as other Users.

*Workgroup feedback:* Workgroup members agreed that dealing with LEEMPS in terms of cost recovery is out of scope for the Workgroup and should be discussed within the CUSC modification which is to follow.

## Target Implementation Date

Six respondents agreed with the proposed Implementation Date. However, the following concerns were raised:

- Consideration is needed for the timeline of associated CUSC, STC and potentially DCUSA modifications.
- One respondent does not believe the proposed timeline for Workgroup meetings and target date of September 2025 are reasonable, suggesting cost recovery mechanisms should be decided and implemented first.

*Workgroup feedback:* Workgroup members agreed that the implementation of this modification should be in line with the future CUSC modification relating to cost recovery and the implementation of modification CM097.

## Legal text

The legal text for this change can be found in **Annex 03**.

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## What is the impact of this change?

Proposer's assessment against Grid Code Objectives	
Relevant Objective	Identified impact
(i) To permit the development, maintenance and operation of an efficient, coordinated and economical system for the transmission of electricity	<p><b>Positive</b></p> <p>EMT models will be required to carry out analysis such as system oscillation, inverter stability, ToV analyses, especially noting that EPCs require a more detailed model than that available from a current RMS representation.</p> <p>Without being able to conduct this type of analysis using EMT models, it could lead to unnecessary investment by Users or TOs, significant increase in constraint costs, single events leading to tripping of a number of generators and could ultimately lead to loss of supply.</p>
(ii) Facilitating effective competition in the generation and supply of electricity (and without limiting the foregoing, to facilitate the national electricity transmission system being made available to persons authorised to supply or generate electricity on terms which neither prevent nor restrict competition in the supply or generation of electricity);	<p><b>Positive</b></p> <p>As new generation technologies connect to the network, most of which will rely on power electronic converters, more detailed models will be required not only in respect of the new generation itself but also the impact they have on existing</p>

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	generation. This will drive greater impact on competition.
(iii) Subject to sub-paragraphs (i) and (ii), to promote the security and efficiency of the electricity generation, transmission and distribution systems in the national electricity transmission system operator area taken as a whole;	<b>Positive</b>  Due to the increase in EPCs connecting to the grid which is in line with the UK government's Net Zero ambition, this modification will enable a greater volume of EPCs to connect whilst ensuring a more thorough evaluation of the source of oscillations or disturbances and to plan mitigating actions.
(iv) To efficiently discharge the obligations imposed upon the licensee by this licence* and to comply with the Electricity Regulation and any relevant legally binding decisions of the European Commission and/or the Agency; and	<b>Positive</b>  EMT analysis is important for investigating the dynamics of converters and control interactions with the System, which enables the NESO to meet its licence obligations.
(v) To promote efficiency in the implementation and administration of the Grid Code arrangements	<b>Positive</b>  At the moment, NESO has a need for analysis to be done, and in many cases the obligations for that analysis are on new entrants in the first instance, without the data to support the analysis. Then beyond that we have requirements to support the planning and operation of the system which are



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	lacking these same models. This modification will give NESO access to models of already connected Plants.
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\*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	<b>Positive</b> When generators provide EMT models to the NESO, it 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 which could ultimately lead to lower operational costs for the benefit of the end consumer.
Lower bills than would otherwise be the case	<b>Positive</b> More accurate models will enable greater Transmission System optimisation which would have the benefit of reducing consumer bills.
Benefits for society as a whole	<b>Positive</b> More accurate models will enable greater Transmission System optimisation and reduce the need to run other Plant to compensate for inaccurate models.
Reduced environmental damage	<b>Positive</b> More accurate models will enable greater Transmission System optimisation and a reduced need to run other Plant, some of which could be carbon based which will have a positive environmental impact.

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Improved quality of service	<b>Positive</b>  More accurate models provide greater optimisation resulting in lower bills and therefore improving quality of service.
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## Workgroup Vote

The Workgroup met on 09 May 2025 to carry out their Workgroup Vote. The full Workgroup Vote can be found in **Annex 07**. The table below provides a summary of the Workgroup Members view on the best option to implement this change.

For reference the Applicable Grid Code Objectives are:

- i. *To permit the development, maintenance and operation of an efficient, coordinated and economical system for the transmission of electricity;*
- ii. *Facilitating effective competition in the generation and supply of electricity (and without limiting the foregoing, to facilitate the national electricity transmission system being made available to persons authorised to supply or generate electricity on terms which neither prevent nor restrict competition in the supply or generation of electricity);*
- iii. *Subject to sub-paragraphs (i) and (ii), to promote the security and efficiency of the electricity generation, transmission and distribution systems in the national electricity transmission system operator area taken as a whole;*
- iv. *To efficiently discharge the obligations imposed upon the licensee by this license\* and to comply with the Electricity Regulation and any relevant legally binding decisions of the European Commission and/or the Agency; and*
- v. *To promote efficiency in the implementation and administration of the Grid Code arrangements.*

\* See Electricity System Operator Licence

The Workgroup concluded by majority that the Original better facilitated the Applicable Objectives than the Baseline.

Option	Number of voters that voted this option as better than the Baseline
Original	5

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## When will this change take place?

### Implementation Date

In line with CUSC modifications [CM097](#) and future CUSC modification relating to cost recovery.

### Date decision required by

In line with CUSC modifications [CM097](#) and future CUSC modification relating to cost recovery.

### Implementation approach

No systems will have to change as a result of this modification.

## Interactions

<input checked="" type="checkbox"/> CUSC	<input type="checkbox"/> BSC	<input checked="" type="checkbox"/> STC	<input type="checkbox"/> SQSS
<input type="checkbox"/> European Network Codes	<input type="checkbox"/> EBR Article 18 T&Cs <sup>1</sup>	<input type="checkbox"/> Other modifications	<input type="checkbox"/> Other
<input type="checkbox"/> DCODE	<input checked="" type="checkbox"/> DCUSA		

A CUSC modification will be raised relating to a cost recovery mechanism, which may result in the need for a DCUSA modification.

Corresponding STC modification [CM097 – Electromagnetic Transient \(EMT\) and Root Mean Square \(RMS\) Model Submission for Transmission Owners \(TOs\)](#).

A separate modification will be established to introduce a new System Operator–Transmission Owner Code Procedure (STCP) 12-2.

The new Electrical Standard will go through the governance process in the General Conditions (GC11) following an Authority decision.

<sup>1</sup> If the modification amends any of the clauses mapped out in Annex GR.B of the Governance Rules section of the Grid Code, it will change the Terms & Conditions relating to Balancing Service Providers. The modification will need to follow the process set out in Article 18 of the Electricity Balancing Regulation (EBR – EU Regulation 2017/2195). All Grid Code modifications must be consulted on for 1 month in the Code Administrator Consultation phase, unless they are Urgent modifications which have no impact on EBR Article 18 T&Cs. N.B. This will also satisfy the requirements of the NCER process.

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## Acronyms, key terms and reference material

Acronym / key term	Meaning
BSC	Balancing and Settlement Code
CCGT	Combined Cycle Gas Turbine
CMP	CUSC Modification Proposal
CUSC	Connection and Use of System Code
DCC	Demand Connection Code
DCUSA	Distribution Connection and Use of System Agreement
DNO	Distribution Network Operator
EBR	Electricity Balancing Regulation
EMT	Electromagnetic Transient
EPC	Electronic Power Converter
GCRP	Grid Code Review Panel
HVDC	High Voltage Direct Current
LEEMPS	Licence Exempt Embedded Medium Power Stations
NESO	National Energy System Operator
PSCAD	Power Systems Computer Aided Design
RfG	Requirements for Generators
RMS	Root Mean Square
STC	System Operator Transmission Owner Code
TO	Transmission Owner
SQSS	Security and Quality of Supply Standards
STCP	System Operator-Transmission Owner Code Procedure
ToR	Terms of Reference
ToV	Transient Overvoltage

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T&Cs	Terms and Conditions
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## Annexes

Annex	Information
Annex 01	GC0168 Proposal Form
Annex 02	GC0168 Terms of Reference
Annex 03	GC0168 Legal Text
Annex 04	GC0168 List of types of Users required to provide EMT models
Annex 05	GC0168 Workgroup Consultation Summary
Annex 06	GC0168 Workgroup Consultation Responses
Annex 07	GC0168 Workgroup Vote
Annex 08	GC0168 Workgroup Attendance Record
Annex 09	GC0168 Workgroup Action Log