

Grid Code Modification Proposal Form

GC0168: Submission of Electro Magnetic Transient (EMT) Models

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 potential control interactions between the devices across the network leading to risks of oscillations and inverter stability. This modification seeks to require certain Users to provide the ESO with EMT models to enable analyses such as system oscillation, inverter stability and Transient Over Voltage (ToV).

Modification process & timetable



Status summary: The Proposer has raised a modification and is seeking a decision from the Panel on the governance route to be taken.

This modification is expected to have a: High impact

Generators, Transmission System Operators, Distribution Network Operators, Interconnector Owners, Transmission Owners

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

Proposer's recommendation of governance route

Standard Governance modification with assessment by a Workgroup

Who can I talk to about the change?

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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 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, ToV, etc. The ESO requires Electromagnetic Transient (EMT) models for Users so that it can analyse and understand how these interactions affect the network under different system conditions. 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.

Why change?

Previously, Root Mean Square (RMS) models have been adequate for system analysis and studies due to a high penetration of synchronous generation, however, these models are not accurate enough (for both system analysis and/or investigation) for an evolving system with a high penetration of IBR, with EMT models now required to perform more detailed analysis. This will provide more certainty in the studies and analyses outcomes which will benefit the ESO in meeting its legal obligations.

What is the proposer's solution?

The proposed solution is to mandate the collection of the EMT models from certain Users. A list of Users who will be affected by this obligation can be found in Annex 1. This will require updates to clauses in PC.A.6, PC.A.9 These models will feed into a wider GB Model enabling investigations, post fault studies and planning studies. This will help to enable safe and reliable operation of the system and enhance the security of GB electricity supply.

Draft legal text.

Draft Legal Text for this modification can be found in Annex 2.

What is the impact of this change?

Proposer's assessment against Grid Code Objectives

Relevant Objective	Identified impact
(a) To permit the development, maintenance and operation of an efficient, coordinated and economical system for the transmission of electricity	<p>Positive</p> <p>EMT models will be required to carry out analysis such as system oscillation, inverter stability, ToV analyses.</p> <p>Without being able to conduct these types of analysis using EMT models, it could lead to unnecessary investment by the users or the TO, significant increase in constraint cost, single</p>

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	event leading to tripping of number of generators and could ultimately lead to loss of supply.
(b) 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);	Neutral
(c) Subject to sub-paragraphs (a) and (b), 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;	Positive Due to the increase in IBRs connecting to the grid which is in line with the UK government's Net Zero ambition, this modification will enable evaluation of the source of oscillations and to plan the mitigating actions.
(d) 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	Positive Electromagnetic Transient (EMT) analysis is important for investigating the dynamics of converters and control interactions between the devices in the network which enables the ESO to meet its license obligations.
(e) To promote efficiency in the implementation and administration of the Grid Code arrangements	Neutral

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 generators provide EMT models to the ESO, 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.

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Lower bills than would otherwise be the case	Neutral
Benefits for society as a whole	Neutral
Reduced environmental damage	Neutral
Improved quality of service	Neutral

When will this change take place?**Implementation date**

10 working days after Ofgem Decision

Date decision required by

February 2025

Implementation approach

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

Proposer's justification for governance route

Governance route: Standard Governance modification with assessment by a Workgroup

The proposed change is material, and a robust solution needs to be developed through Industry participation.

Interactions

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

A CUSC Modification will be raised to explore a cost recovery mechanism for Users that would now be obligated to provide EMT models with qualifying factors to the effect that this model did not exist or could not be easily provided.

¹ If your 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.

Acronyms, key terms and reference material

Acronym / key term	Meaning
BSC	Balancing and Settlement Code
CUSC	Connection and Use of System Code
EBR	Electricity Balancing Regulation
EMT	Electromagnetic Transients
GC	Grid Code
IBR	Inverter Based Resources
RMS	Root Mean Square
STC	System Operator Transmission Owner Code
SQSS	Security and Quality of Supply Standards
ToV	Transient over Voltage
T&Cs	Terms and Conditions

Annexes

Annex	Information
Annex 1	Table of Affected Users
Annex 2	Draft Legal Text