

Grid Code Alternative and Workgroup Vote

GC0137: Minimum Specification Required for Provision of GB Grid Forming GBGF Capability formerly Virtual Synchronous Machine VSM Capability

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

Stage 1 - Alternative Vote

If Workgroup Alternative Requests have been made, vote on whether they should become Workgroup Alternative Grid Code Modifications (WAGCMs).

Stage 2 - Workgroup Vote

2a) Assess the Original and WAGCMs (if there are any) against the Grid Code objectives compared to the baseline (the current Grid Code).

2b) If WAGCMs exist, vote on whether each WAGCM better facilitates the Applicable Grid Code Objectives better than the Original Modification Proposal.

2c) Vote on which of the options is best.

Terms used in this document

Term	Meaning
Baseline	The current Grid Code (if voting for the Baseline, you believe no modification should be made)
Original	The solution which was firstly proposed by the Proposer of the modification
WAGCM	Workgroup Alternative Grid Code Modification (an Alternative Solution which has been developed by the Workgroup)

The Applicable Grid Code Objectives:

- a) To permit the development, maintenance and operation of an efficient, coordinated and economical system for the transmission of electricity
- 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);
- c) 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;
- 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

- e) To promote efficiency in the implementation and administration of the Grid Code arrangements

Workgroup Vote

Assessment against objectives

To assess the Original and WAGCMs against the Grid Code objectives compared to the baseline (the current Grid Code).

You will also be asked to provide a statement to be added to the Workgroup Report alongside your vote to assist the reader in understanding the rationale for your vote.

AGCO = Applicable Grid Code Objective

Workgroup Member	Better facilitates AGCO (a)	Better facilitates AGCO (b)	Better facilitates AGCO (c)	Better facilitates AGCO (d)	Better facilitates AGCO (e)	Overall (Y/N)
Andrew Roscoe – Siemens Gamesa Renewable Energy						
Original	Yes	Yes	Yes	Neutral	Neutral	Yes
Voting Statement:						

Workgroup Member	Better facilitates AGCO (a)	Better facilitates AGCO (b)	Better facilitates AGCO (c)	Better facilitates AGCO (d)	Better facilitates AGCO (e)	Overall (Y/N)
Andrzej Adamczyk – GE HVDC Power						
Original	Yes	Yes	Yes	Neutral	Neutral	Yes
<p>Voting Statement: We recognize the challenges to the future electricity market posed by the changing nature of energy generation and agree that the proposed grid code modification will be instrumental in mitigating these challenges.</p> <p>Given the fundamental impact of the proposed changes on the underlying technology, we appreciate that GB Grid Forming is specified on a non-mandatory commercial basis. We are hoping that market mechanisms that will be defined following this specification will value the services that generators, HVDC and FACTS devices can provide under the GB Grid Forming umbrella, so as to allow different technologies to stay cost effective by playing to their natural strengths.</p> <p>We also appreciate the high-level, technology neutral formulation of the GB Grid Forming requirements in this grid code modification. However, to allow vendors to be able to fully assess the impact on their particular technology and design appropriate solutions, it is crucial to further clarify the technical details of the specification via a best practice working group.</p>						

Workgroup Member	Better facilitates AGCO (a)	Better facilitates AGCO (b)	Better facilitates AGCO (c)	Better facilitates AGCO (d)	Better facilitates AGCO (e)	Overall (Y/N)
Andy Vaudin – EDF						

Original	Yes	Yes	Yes	Neutral	Neutral	Yes
Voting Statement: This original proposal will provide technology developers with a measure of guidance and confidence going forward. It is very important that Grid Forming market arrangements are swiftly put in place and that these arrangements are completely open and non-discriminatory for all existing and new plant and technologies that comply with the technical requirements.						

Workgroup Member	Better facilitates AGCO (a)	Better facilitates AGCO (b)	Better facilitates AGCO (c)	Better facilitates AGCO (d)	Better facilitates AGCO (e)	Overall (Y/N)
------------------	-----------------------------	-----------------------------	-----------------------------	-----------------------------	-----------------------------	---------------

Alastair Frew - Drax Generation Enterprise Ltd

Original	Yes	Yes	Yes	Yes	Neutral	Yes
----------	-----	-----	-----	-----	---------	-----

Voting Statement: This modification will standardise the requirements for the provision of auxiliary services which are generally provided by default by synchronous generators and allows other non-synchronous providers to enter into this market and provide these services as the level of synchronous generation reduces.

Workgroup Member	Better facilitates AGCO (a)	Better facilitates AGCO (b)	Better facilitates AGCO (c)	Better facilitates AGCO (d)	Better facilitates AGCO (e)	Overall (Y/N)
------------------	-----------------------------	-----------------------------	-----------------------------	-----------------------------	-----------------------------	---------------

Antony Johnson – National Grid ESO

Original	Yes	Yes	Yes	Yes	Neutral	Yes
----------	-----	-----	-----	-----	---------	-----

Voting Statement: We support this modification. In respect of Grid Code objectives (a), (b) and (c) this modification paves the way for secure zero carbon operation in a cost effective and non-discriminatory manner. We support Grid Code objective (d) in recognising the changing nature of the Transmission System and to ensure that the Grid Code is kept up to date.

We recognise that this work provides for a high level specification in the Grid Code which will facilitate a future short term stability market. We also believe it provides sufficient future flexibility.

We also recognise the substantial and important contribution of this technology and support the need for sharing best practice across the industry. We believe this is best addressed through the publication of a “Best Practice Guide” which will be prepared by a group of Industry Experts.

Workgroup Member	Better facilitates AGCO (a)	Better facilitates AGCO (b)	Better facilitates AGCO (c)	Better facilitates AGCO (d)	Better facilitates AGCO (e)	Overall (Y/N)
------------------	-----------------------------	-----------------------------	-----------------------------	-----------------------------	-----------------------------	---------------

Ben Hillman – SP Energy Networks

Original						
----------	--	--	--	--	--	--

Voting Statement:

Not present

Workgroup Member	Better facilitates AGCO (a)	Better facilitates AGCO (b)	Better facilitates AGCO (c)	Better facilitates AGCO (d)	Better facilitates AGCO (e)	Overall (Y/N)
	Ben Marshall – SHE Transmission LTD					
Original	Yes	Yes	Yes	Yes	Yes	Yes
<p>Voting Statement: Provides a clear common basis to go forward with. There remain a number of implementation questions which best practice best support - one key area can is how transitions between Grid Following and Grid forming mode selection are achieved and what is expected of network conditions to support that. There may also be value in a post implementation review of these minimum expectations based on suitable implementation experience being generated over the next 3-7 years.</p> <p>The generation of a minimum standard provides not only useful clarity over the operational behaviours to be expected but also but supports the planning and development of the networks connecting these capabilities to ensure they complement such operation. The associated processes supporting these assessments would be expected to be clarified across the developing processes of Stability Pathfinder and associated STC process surrounding that.</p>						

Workgroup Member	Better facilitates AGCO (a)	Better facilitates AGCO (b)	Better facilitates AGCO (c)	Better facilitates AGCO (d)	Better facilitates AGCO (e)	Overall (Y/N)
	Carl Barker – GE Power					
Original	Yes	Yes	Yes	Neutral	Neutral	Yes
Voting Statement:						

Workgroup Member	Better facilitates AGCO (a)	Better facilitates AGCO (b)	Better facilitates AGCO (c)	Better facilitates AGCO (d)	Better facilitates AGCO (e)	Overall (Y/N)
	Christopher Smith – National Grid Interconnectors Ltd					
Original	Yes	Yes	Yes	Neutral	Neutral	Yes
Voting Statement: This will allow new services to be offered by the market to meet future grid challenges.						

Workgroup Member	Better facilitates AGCO (a)	Better facilitates AGCO (b)	Better facilitates AGCO (c)	Better facilitates AGCO (d)	Better facilitates AGCO (e)	Overall (Y/N)
	Dr.-Ing. Thorsten Bülo – SMA Solar Technology AG					
Original	Yes	No	Yes	No	Yes	Yes
<p>a) Voting Statement: Proposal provides steps for providing new capabilities needed in grids with a high penetration of Converter Based Generation</p> <p>b) Since many details (e. g. test signals...) are still unclear and up to further discussion, it's not clear yet, which generation technologies may be able to provide</p>						

the needed capabilities. In addition, economically relevant criteria depend on further market arrangements

- c) Original is a good attempt to define gridforming requirements, which is definitely needed in the future in technology neutral way
- d) There are a lot of new requirements with extensive compliance efforts to be expected. The efficiency will have to be proven.
- e) The original provides a good entry point to formulate Grid Forming requirements in a Grid Code

However, a lot of details regarding Technology and the process are to be clarified based on this Original. Especially regarding the Pathfinder II program several points are to be clarified, since the Phase II has been started with a different specification.

Workgroup Member	Better facilitates AGCO (a)	Better facilitates AGCO (b)	Better facilitates AGCO (c)	Better facilitates AGCO (d)	Better facilitates AGCO (e)	Overall (Y/N)
	Eric Anthony Lewis – Enstore					
Original	Yes	Yes	Yes	Yes	Neutral	Yes
<p>Voting Statement: It is essential that the GB Grid Forming work is continued as soon as possible in the Best Practice Expert Group that needs to review a wide range of topics especially those relating to Network Perturbation Frequency “NFP” plots.</p> <p>One of the most important topics is to define the features of an NFP plots that are either beneficial or not beneficial to the operation of the GB Grid.</p> <p>In Enstore’s opinion this part of the Best Practice Expert Group can only be carried out by a representative in the Best Practice Expert Group from NGESO.</p>						

Workgroup Member	Better facilitates AGCO (a)	Better facilitates AGCO (b)	Better facilitates AGCO (c)	Better facilitates AGCO (d)	Better facilitates AGCO (e)	Overall (Y/N)
	Francesco Cristiano – Highview Power (Fernando Morales)					
Original	Yes	Yes	Yes	Neutral	Neutral	Yes
<p>Voting Statement: We support this grid code modification. We believe it provides a framework for technology developers to initiate work in the development of this crucial technology. We note that clear guidance notes are needed to complement the legal text and work should be started as soon as possible.</p>						

Workgroup Member	Better facilitates AGCO (a)	Better facilitates AGCO (b)	Better facilitates AGCO (c)	Better facilitates AGCO (d)	Better facilitates AGCO (e)	Overall (Y/N)
	Gert Andersen – Vestas					
Original	Yes	Yes	Yes	Neutral	Neutral	Yes
Voting Statement:						

Workgroup Member	Better facilitates AGCO (a)	Better facilitates AGCO (b)	Better facilitates AGCO (c)	Better facilitates AGCO (d)	Better facilitates AGCO (e)	Overall (Y/N)
	Hariram Subramanian – Huawei					
Original						
Voting Statement: Not present						

Workgroup Member	Better facilitates AGCO (a)	Better facilitates AGCO (b)	Better facilitates AGCO (c)	Better facilitates AGCO (d)	Better facilitates AGCO (e)	Overall (Y/N)
	Isaac Gutierrez – Scottish Power Renewables (Razvan Pabat-Store)					
Original	Yes	Yes	Yes	Neutral	Neutral	Yes
Voting Statement: The implementation of this Grid Code modification should create the basis for the development of a non-discriminatory market for the provision of Grid Forming services. We understand this is only the legal text to be inserted in the Grid Code and further technical considerations (simulation and testing) will be discussed in the expert working group and the outcome will be published separately in a guideline document.						

Workgroup Member	Better facilitates AGCO (a)	Better facilitates AGCO (b)	Better facilitates AGCO (c)	Better facilitates AGCO (d)	Better facilitates AGCO (e)	Overall (Y/N)
	Janet Lees – SSE					
Original						
Voting Statement: Not present						

Workgroup Member	Better facilitates AGCO (a)	Better facilitates AGCO (b)	Better facilitates AGCO (c)	Better facilitates AGCO (d)	Better facilitates AGCO (e)	Overall (Y/N)
	Marko Grizelj – Siemens AG					
Original	Yes	Yes	Yes	Neutral	Neutral	Yes
Voting Statement: Due to the invaluable work from the workgroup members, GC0137 provides an important and functional foundation for the grid forming market in the UK. The following steps, such as the formation of the expert group and developing the best practice guide, will be required to provide clear guidance to industry on this crucial topic.						

Workgroup Member	Better facilitates AGCO (a)	Better facilitates AGCO (b)	Better facilitates AGCO (c)	Better facilitates AGCO (d)	Better facilitates AGCO (e)	Overall (Y/N)
	Martin Aten – Uniper					
Original	Yes	Yes	Yes	Neutral	Neutral	Yes
Voting Statement: Clear guidance notes are needed to complement the legal text on how exactly to conduct and present tests and simulations, and what the pass/fail criteria are.						

Workgroup Member	Better facilitates AGCO (a)	Better facilitates AGCO (b)	Better facilitates AGCO (c)	Better facilitates AGCO (d)	Better facilitates AGCO (e)	Overall (Y/N)
	Meghdad Fazeli – Swansea University & Innoverters-Ltd					
Original						
Voting Statement: Not present						

Workgroup Member	Better facilitates AGCO (a)	Better facilitates AGCO (b)	Better facilitates AGCO (c)	Better facilitates AGCO (d)	Better facilitates AGCO (e)	Overall (Y/N)
	Mike Kay – P2Analysis					
Original						
Voting Statement: Not present						

Workgroup Member	Better facilitates AGCO (a)	Better facilitates AGCO (b)	Better facilitates AGCO (c)	Better facilitates AGCO (d)	Better facilitates AGCO (e)	Overall (Y/N)
	Robert Longden – Cornwall Insight					
Original	Yes	Neutral	Yes	Neutral	Neutral	Yes
Voting Statement: Grid forming capability will be increasingly important to the power system in the future. This specification enables a platform to take forward development of the required capability, whilst providing the required flexibility to meet the emerging system needs.						

Workgroup Member	Better facilitates AGCO (a)	Better facilitates AGCO (b)	Better facilitates AGCO (c)	Better facilitates AGCO (d)	Better facilitates AGCO (e)	Overall (Y/N)
	Roberto Rosso – ENERCON GmbH					
Original	Yes	No	Yes	No	No	No
Voting Statement: <u>Summary:</u> <i>ENERCON is voting “No” to the proposal.</i>						

We accept that the proposed legal text makes a big step towards accommodating Grid Forming capabilities on the power system, and if the vote passes, we will be keen to engage with the follow-on processes, in particular the Expert Group.

However, with our “No” vote, we wish to voice our concerns on AGCOs points (b) and (e).

We have commented in detail below regarding the Original proposal, as it relates to the AGCOs.

a) Yes:

The proposed Legal Text will promote further development of the power system by allowing Grid Forming technologies to access the grid. It is a very welcome step. However, the scope of the Legal Text is not sufficient to achieve an efficient, coordinated and economical outcome.

We understand that the follow-on processes from this Workgroup (i.e. the Expert Group and procurement systems) will be relied upon to achieve this outcome. Therefore, suitable stakeholder consultation and regulatory oversight are needed for these processes.

We are keen to attend the Expert Group and provide input as a Wind Turbine OEM.

b) No:

Facilitation of competition:

We understand that competitive procurement systems are planned for the procurement of Grid Forming capabilities. However, these have yet to be designed in detail, so we cannot say whether effective competition will be facilitated if the vote succeeds.

We would emphasise that ‘effective competition’ in today’s power system will necessarily mean accommodating a diversity of generator technologies, and sizes of generators, in the procurement systems.

This will need to be ensured through careful design of the procurement systems and the GB Grid Forming Best Practice Guide.

The proposed Legal Text may suit the most mature technologies such as BESS, synchronous condenser and power plants with rotating synchronous generators. However, for other technologies (such as wind and PV) a more precise technical specification will be essential. While these technologies are present in large numbers on the grid, their Grid Forming capabilities are still being developed..

Further, we strongly advocate for any procurement systems to be transparent, consistent, and administratively simple to access, in order to get the best possible uptake from smaller and independent generators.

c) Yes:

Security of the power system

The proposed legal text makes a big step towards accommodating Grid Forming capabilities on the power system.

But to ensure security of the power system, it is essential that the details of these requirements be worked out as soon as possible prior to commercial procurement. In particular any potential risks to system security must be identified and mitigated. (e.g. unintentional islanding)

For example, where the Grid Forming Capability definition allows exceptions during transients: the nature and extent of these exceptions must be clearly defined – and made visible in power system planning & operation. Also, as this aspect determines hardware sizing, it is key for the cost of the service. This leads back to the question: what is a reasonable cost for system security?

We understand that such matters will be addressed by the Expert Group and look forward to participating there.

d) No:

We are unable to evaluate this point, having limited knowledge of ESO license obligations. Regarding the European Regulations, we are aware only that the European Network Codes do not address Grid Forming capabilities as of today.

e) No:

Efficiency in the implementation and administration of the Grid Code arrangements

The Workgroup has done unprecedented work to develop Grid Code requirements for this new and still-emerging technology. However, much remains to be seen as to how the requirements will work in practice.

We understand the Expert Group will now begin to develop detailed technical specifications, in the form of a GB Grid Forming Best Practice Guide. This will take time to develop.

On the other hand, commercial procurement systems for Grid Forming capabilities are planned very soon and a variety of OEMs (including less mature GBGF-I technologies) will be tasked with delivering Grid Forming capabilities in time for these procurements.

This gives rise to a complicated situation, whereby requirements and OEM technologies are developing rapidly in parallel, under time pressure, on the real power system. Managing this situation safely and efficiently will be a challenge.

Finally, regarding the Baseline (current version of the Grid Code), we would note that the proposed Grid Forming requirements will form an entirely new set of requirements, which are not addressed by the Baseline in any way.

Workgroup Member	Better facilitates AGCO (a)	Better facilitates AGCO (b)	Better facilitates AGCO (c)	Better facilitates AGCO (d)	Better facilitates AGCO (e)	Overall (Y/N)
	Sigrid Bolik – ITP Energised Ltd					
Original	Yes	Yes	Neutral	Yes	Neutral	Yes

Voting Statement:

The original does not include the newly developed grid forming requirements. The new Draft gives that opportunity. Further additional clarity will be provided through a Guidance Note developed by a further expert group.

Stage 2c – Workgroup Vote

Which option is the best? (Baseline, Proposer solution (Original Proposal), WAGCM1 or WAGCM2)

Workgroup Member	Company	BEST Option?	Which objective(s) does the change better facilitate? (if baseline not applicable)
Andrew Roscoe	Siemens Gamesa Renewable Energy	Original	A B C
Andrzej Adamczyk	GE Power	Original	Better than the baseline
Alastair Frew	Drax Generation Enterprise Ltd	Original	A B C D
Andy Vaudin	EDF	Original	A B C – better than baseline
Antony Johnson	National Grid ESO	Original	Better than the baseline
Ben Hillman	SP Energy Networks		
Ben Marshall	SHE Transmission LTD	Original	
Carl Barker	GE Power	Original	Better than the baseline
Christopher Smith	National Grid Interconnectors Ltd	Original	A B C – Better than the baseline
Dr.-Ing. Thorsten Bülo	SMA Solar Technology AG	Original	A C E – better than the baseline
Eric Anthony Lewis	Enstore	Original	Better than the baseline
Francesco Cristiano	Highview Power	Original	A B C – better than the baseline
Gert Andersen	Vestas	Original	A B C – better than the baseline
Hariram Subramanian	Huawei		
Isaac Gutierrez	Scottish Power Renewables	Original	A B C – better than the baseline
Janet Lees	SSE		
Marko Grizelj	Siemens AG	Original	Better than the baseline
Martin Aten	Uniper	Original	Better than the baseline
Meghdad Fazeli	Swansea University & Innoverters-Ltd		
Mike Kay	P2Analysis		
Robert Longden	Cornwall Insight	Original	A C – better than baseline
Roberto Rosso	ENERCON GmbH	Original	A C – better than baseline

Sigrid Bolik	ITPEnergised Ltd	Original	Better than baseline
--------------	------------------	----------	----------------------

Of the X votes, how many voters said this option was better than the Baseline.

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