Code Administrator Consultation Responses Summary
GC0163: GB Grid Forming (GBGF) - Removal of Virtual Impedance restriction

Consultation date: 02 April 2024 - 02 May 2024

Respondent Details				Standard Consultation Questions					Themes
Response Number	Organisation	Name	Organisation type	Please provide your assessment for the proposed solution(s) against the Applicable Objectives?	Do you have a preferred proposed solution?	Do you support the proposed implementation approach?	Do you have any other comments?	Any Legal Text issues?	Key points
1	Uniper	Martin Aten	Generator	Yes for a) and b)	Original	Yes	Yes	No	Respondent is supportive of the implemetation approach because removing the virtual impedance restriction will provide greater design flexibility for more cost-effective designs of grid forming converters Grid Code should not dictate how a requirement is achieved by a specific design method, but describe the performance clearly.
2	HDVC	Ben Marshall	TO	Yes for b) and c)	Original	Yes	Yes	No	Respondent is supportive of the implementation approach it improves upon the original conception of Grid forming by providing the OEM greater flexibility in how the objectives of grid forming performance are met without diluting that performance. Respondent feels this modification provides a foundation however there are further steps beyond it. Suggests future work on grid forming controls, such as testing, damping, inertia, switching, and coordination
3	SSEN	Pablo Briff	TO	*Yes for a) and b)*	No comment	No	Yes	No	Respondent does not support the proposed implementation in its current form, but acknowledges the benefits virtual impedances can bring Respondent provided rationale on virtual impedance, a controller function that mimics the behaviour of a physical impedance, can be difficult to characterize, implement and justify in terms of cost and performance for power converters. Respondent has identified four factors that make the controller impedance characterization more complex than the physical impedance characterization: the dependence on the operating point, the discrete-time behaviour, the fault-ride through characteristic, and the safety integrity level. By reducing the physical impedance in the power converters, especially the inductance, may require faster and more reliable protection systems to limit the fault current and prevent damage to the converter equipment. The economic benefits were questioned regarding virtual impedance, as it may introduce additional system risk, increased redundancy levels, higher switching frequency, larger cooling system requirements, and higher voltage demand for the power converters. The document suggests that a cost-benefit analysis is needed to support the CAPEX and OPEX reduction claims. It was pointed out that the method of synthesizing an impedance is likely to be proprietary and protected by the intellectual property rights of the control algorithms, which may limit the information sharing and specification, and increase the costs for the stakeholders to ensure the system-level transient response.
4	ESO	Antony Johnson	SO	Yes for a), b) and c)	Original	Yes	Yes	Yes	Respondent is supportive of modification as by removing the obligation to have a real impedance between the Internal Voltage Source of a Grid Forming Converter and the Grid Entry Point or User System Entry Point (if Embedded) we believe this provides greater flexibility and cost savings to developers and manufacturers. Respondent suggested an amendment to Legal text for the definition of Internal Voltage Source in the Glossary and Definitions
5	Scottish Power	Julie Richmond	Generator	Yes for b) and c)	Original	Yes	Yes	No	Respondent is supportive of the change as it allows greater flexibility in a cost effective way