

# Grid Code Issue Paper

Paper Ref: Date Raised: 

[For presentation at the May 2016 meeting of the Grid Code Development Forum](#)

**Patrick Cassels on behalf of National Grid**

**Provisions for Energy Storage Devices in the Grid Code**

**If submitting to the Grid Code Review Panel, has this issue been discussed at the [Grid Code Development Forum](#)?**

Yes [Please provide details of any outcomes below]  No

## RECOMMENDATION

**What would you like the GCDF or GCRP to do?**

Note the issue for information only	<input type="checkbox"/>
Consider the issue and provide guidance	<input type="checkbox"/>
Further investigate this issue at a one-off workshop <i>[Please consider GCDF if answered 'no' for question above]</i>	<input type="checkbox"/>
Approve this issue for a workgroup for further analysis and form solutions <i>[Please consider workgroup Terms of Reference and attendance at workgroup]</i>	<input checked="" type="checkbox"/>
Progress this issue straight to Industry Consultation <i>[Please contact the code administrator before proceeding (see details at the bottom)]</i>	<input type="checkbox"/>

## DEFINE

### **Summary**

National Grid has recently received a number of connection applications for a transmission connected energy storage device which can both import and export electricity to the National Electricity Transmission System for which there is currently a lack of clear provisions in the Grid Code. Given that National Grid has received a significant degree of interest from further potential connectees it is highly likely that additional connection applications will be received in the near future.

This paper identifies a need to clearly specify Grid Code requirements for a range of energy storage devices of diverse technology type which could reasonably be considered to fall outside of the existing code provisions. Attachment 1, at the end of this paper, identifies a range of energy storage technologies for consideration and the current interpretation of Grid Code for the treatment of these varying device types which will be applied in the absence of bespoke definitions and requirements in order to progress pending connection applications. Attachment 2 identifies the additional DRC data which has been requested to proceed with these connections pending further code development.

This paper seeks approval for the creation of an industry workgroup to assess the appropriate Grid Code provisions for energy storage devices. This is particularly significant given that energy storage devices are not covered under EU codes. Furthermore, energy storage devices have the capability to act as a source of either generation or demand. It is therefore necessary

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to establish a set of requirements which is consistent with existing industry codes, gives due consideration to compatibility with developments needed in other code areas (for example: the Planning Code and the Data Registration Code) and ensures equitable treatment with other Users.

Given that energy storage devices are a growing sector, it is proposed that this paper is also circulated to the Distribution Code Review Panel as similar issues are likely to be faced at a Distribution Code level. The Grid Code Review Panel should therefore consider the potential merits of a joint workgroup under the governance of both Grid Code and Distribution Code Review Panels for the development of harmonised and consistent solutions across GB codes.

## Description

There is currently a lack of bespoke requirements in the Grid Code for a diverse range of energy storage devices (other than for pumped storage).

Parties who own energy storage devices and use the National Electricity Transmission System will be expected to meet applicable sections of the Grid Code which are consistent with the existing requirements. There is a need, therefore, to consider code developments which account for a range of technology solutions and different operational characteristics.

For example, the technical requirements for an asynchronous battery storage device connected via DC converter may be most closely aligned to those of an HVDC converter under the current code, whereas the technical requirements for a synchronous compressed air energy storage device which is directly connected may be most closely aligned to the existing treatment of a synchronous generator. Presently, the application of these requirements is subject to interpretation of the existing Grid Code and codified clarity is required.

All aspects of energy storage devices should be considered from the perspective of both bespoke energy storage installations as well as energy storage devices which are part of a hybrid power plant with a mix of technology types.

## Proposed solution

The proposed solution is to establish an industry work group to develop an appropriate set of Grid Code requirements with regards to energy storage. The panel should consider the potential merits of a joint Grid Code and Distribution Code workgroup, giving due respect to the need for swift action as imposed by pending connection applications.

Developments considered by the workgroup should be consistent with existing code requirements where possible, recognising that the capabilities of energy storage devices span conventional generator and demand definitions, whilst giving due regard to operational requirements.

The workgroup should also consider the more detailed data submissions are likely to be required under the Planning Code in addition to amendments to the Data Registration Code

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required for modelling purposes.

## Which Grid Code clause/section is relevant for this issue?

All sections of the Grid Code will require review but it is envisaged that the major elements of change will be to the Connection Conditions and Planning Code. Some general areas for consideration which relate to the Connection Conditions and Planning Code include:

- Frequency variations, frequency response, and governor behaviour
- Voltage variations, reactive power capability, voltage control capability, voltage waveform quality and response to voltage fluctuations
- Fault ride through and behaviour under fault conditions
- Modelling data

## How has this issue originated? [Please provide details in the text box below]

An affected party has identified a Grid Code defect	<input checked="" type="checkbox"/>
An affected party wishes to provide information to the Panel	<input type="checkbox"/>
An affected party has identified a Grid Code procedural inefficiency	<input type="checkbox"/>
An affected party needs clarity	<input checked="" type="checkbox"/>
As a consequence of Significant Code Review (initiated by the Regulatory Authority)	<input type="checkbox"/>
As a consequence of a licence or legislative change (including European Law)	<input type="checkbox"/>
Other (range of energy storage technologies not currently considered in Grid Code):	<input checked="" type="checkbox"/>

## ASSESSMENT AGAINST GRID CODE OBJECTIVES

### How are the Grid Code objectives better achieved by resolving this issue?

**Economic & Efficient Development:** (i) to permit the development, maintenance and operation of an efficient, coordinated and economical system for the transmission of electricity

The capability of energy storage devices to act as both a generation and demand source raises a number of unique opportunities to permit the development and maintenance of an efficient, coordinated and economic transmission system.

**Competition:** (ii) to facilitate competition in the generation and supply of electricity ... (on terms which neither prevent nor restrict competition in the supply or generation of electricity)

New developments in energy storage technologies provide an additional avenue to facilitate competition in generation and supply.

**System Security:** (iii) subject to sub-paragraphs (i) and (ii), to promote the security and

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*efficiency of the electricity generation, transmission and distribution systems in the national electricity transmission system operator area taken as a whole;*

The capability of energy storage devices to act as both a generation and demand represents opportunity for system security, however, such technologies need to be treated in an equitable manner to ensure a level playing field and ensure the maintenance of system security.

**Licence Obligations:** (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

The development of bespoke provisions for energy storage devices in the Grid Code will ensure that the Grid Code does not constitute an undue barrier to entry for the connection of energy storage devices to the National Electricity Transmission System.

## IMPACT

### To what extent are industry stakeholders affected by this issue?

Developers/Operators of Large generation units	Medium
Developers/Operators of Medium generation units	Medium
Developers/Operators of Small generation units	Medium
National Electricity Transmission System Operator (NETSO)	High
Transmission Owners (incl OFTOs & Interconnectors)	High
Distribution Network Operators	High
Suppliers	Medium
Aggregators	High
Directly-Connected Demand (including Response providers)	High
Manufacturers	High
Regulator	High
Other	N/A

### Is there a positive impact on greenhouse gas emissions by resolving this issue?

Yes	<input checked="" type="checkbox"/>	No	<input type="checkbox"/>
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### \*Is there any impact on industry codes or documents?

CUSC	<input checked="" type="checkbox"/>	BSC	<input type="checkbox"/>
STC	<input checked="" type="checkbox"/>	SQSS	<input type="checkbox"/>
Distribution Code	<input checked="" type="checkbox"/>	DCUSA	<input type="checkbox"/>
Other Industry Documents	<input checked="" type="checkbox"/>		

Whilst best efforts should be made to develop the requirements specified in the Grid Code and Distribution Code in such a way that they are consistent with existing codes and definitions, the dual characteristic of storage as both a generation and demand source could have implications for developments in other code areas.

The Grid Code sets out the minimum technical, design and operational criteria for users of the National Electricity Transmission System. Developing the code to accommodate storage devices is therefore the first in a series of potential modifications in other areas of code to

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facilitate the connection of energy storage devices.

It follows that further developments in code areas such as the CUSC, STC, Distribution Code and other code areas such as the DRC and Planning Code may also be required.

## Is there a time limitation for this issue?

Yes



No



There are currently a number of active energy storage device connection applications in progress. The workgroup should therefore consider the appropriate interpretation and application of current requirements to these connections pending Grid Code developments. Similarly, the group should consider the implications for Grid Code developments which deviate from those initially applied to the in-progress applications.

## Have you attached any supporting documentation?

No



Yes [Please provide details/attach files below]



Attachment 1 – Draft Grid Code Treatment



Attachment 1 - Draft  
Grid Code Treatment.

Attachment 2 – Draft DRC Schedules



Attachment 2 - Draft  
DRC Schedules.xlsx

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## Document Guidance

This template is used to raise an issue at the Grid Code Review Panel, as well as providing an initial assessment. An issue can be anything that a party would like to raise and does not have to result in a modification to the Grid Code or creation of a Working Group.

**Grid Code Issue Papers for consideration at the next scheduled Grid Code Panel meeting (GCRP), must be submitted THREE weeks in advance [[GCRP dates](#)]**

Guidance has been provided in square brackets within the document, but please contact National Grid, The Code Administrator, with any questions or queries about this template: [grid.code@nationalgrid.com](mailto:grid.code@nationalgrid.com)

An overview of the Grid Code modification process can be found here:  
<http://www2.nationalgrid.com/WorkArea/DownloadAsset.aspx?id=28959>