

### GC0127/GC0128 WORKGROUP ALTERNATIVE 3

Please note all red text indicates new additions/amendments as part of the legal text to facilitate WAGCM3 (which is a combination of WAGCM1 and WAGCM2). This WAGCM includes the amendments below plus the Original Proposal legal text.

Extract from Glossary and Definitions

.....

<b>Closed Distribution System</b>	As defined as a <b>Closed Distribution System</b> in <b>European Regulation (EU) 2016/1388</b> .
<b>Defence Service Provider</b>	As defined as a <b>Defence Service Provider</b> in <b>European Regulation (EU) 2017/2196</b> .
<b>European Regulation (EU) 2017/2196</b>	<b>Commission Regulation (EU) 2017/2196</b> of 24 November 2017 establishing a network code on electricity emergency and restoration.
<b>GB Emergency and Restoration Code (GERC)</b>	That portion of the Grid Code which is identified as the <b>GB Emergency Restoration Code</b> being applicable to <b>GB Emergency Restoration Code Providers</b> .
<b>GB Emergency Restoration Code Provider</b>	A party who is not a <b>CUSC Party</b> as defined in GERC.3.2 of the <b>GB Emergency and Restoration Code (GERC)</b> .
<b>Interim Demand Loading Point</b>	The loading point in MW of an <b>Electricity Storage Module</b> between zero and <b>Maximum Capacity</b> (import).
<b>Limited Frequency Sensitive Mode – Underfrequency (LFSM-U)</b>	An operating mode which is either Limited Frequency Sensitive Mode – Underfrequency Exporting (LFSM-UE); or Limited Frequency Sensitive Mode – Underfrequency Importing (LFSM-UI)
<b>Limited Frequency Sensitive Mode – Underfrequency Exporting (LFSM-UE)</b>	A <b>Power Generating Module</b> (including a <b>DC Connected Power Park Module</b> ) or <b>HVDC System</b> or operating in a mode which is exporting energy to the <b>Total System</b> which increases its <b>Active Power</b> output in response to a fall in <b>System Frequency</b> below a certain value.
<b>Limited Frequency Sensitive Mode – Underfrequency Importing (LFSM-UI)</b>	An <b>Electricity Storage Module</b> operating mode which is importing energy from the <b>Total System</b> which decreases <b>Active Power</b> import in response to a change in <b>System Frequency</b> below a certain value.

<b>Restoration Service Provider</b>	As defined as a <b>Restoration Service Provider</b> in <b>European Regulation (EU) 2017/2196</b> .
<b>Significant Grid User (SGU)</b>	As defined as an SGU in Article 2 of <b>European Regulation (EU) 2017/2196</b> .
<b>System Defence Plan</b>	A document prepared by <b>The Company</b> and approved by <b>The Authority</b> , as published on its <b>Website</b> , outlining how the requirements of the “defence plan” (as provided for in <b>European Regulation (EU) 2017/2196</b> ) has be implemented within the <b>GB Synchronous Area</b> .
<b>System Restoration Plan</b>	A document prepared by <b>The Company</b> and approved by <b>The Authority</b> , as published on its <b>Website</b> , outlining how the requirements of the “restoration plan” (as defined in <b>European Regulation (EU) 2017/2196</b> ) has be implemented within the <b>GB Synchronous Area</b> .

#### Extract from Planning Code

.....

PC.A.5.5.4 Each **Electricity Storage Module Owner** and **GB Emergency and Restoration Code Provider** who owns or operates an **Energy Storage Unit** shall provide **Frequency** response curves demonstrating the ability of their **Energy Storage Units** to transition from a mode analogous to **Demand** to a mode analogous to generation within 20 seconds in accordance with the requirements of ECC.6.3.7.2.2.

#### Extract from the CC's

.....

CC.3 SCOPE

CC.3.1 The **CC** applies to **The Company** and to **GB Code Users**, which in the **CC** means:

- (a) **GB Generators** (other than those which only have **Embedded Small Power Stations**), including those undertaking **OTSDUW**;
- (b) **Network Operators**;
- (c) **Non-Embedded Customers**;
- (d) **DC Converter Station** owners; (e) **BM Participants** and **Externally Interconnected System Operators** in respect of CC.6.5 only; and
- (f) **GB Generators** who own and operate **Electricity Storage Modules** for whom only the requirements of CC.6.3.7(g) apply.

.....

CC.6.3.7(g) Limited Frequency Sensitive Mode – Underfrequency importing (LFSM-UI)

- (i) **Limited Frequency Sensitive Mode - Underfrequency Importing (LFSM - UI)** only applies to **Electricity Storage Modules** which are operating in a mode analogous to **Demand**.
- (ii) In the event that the **System Frequency** falls below 49.5Hz, each **Electricity Storage Module**, which is operating in a mode analogous to **Demand**, and which is also capable of reversing operation from an **Interim Demand Loading Point** (including its **Maximum Capacity** (Pmax Import)) to an exporting mode of operation shall be capable of reversing its mode of operation within 20 seconds. The transition from import mode of operation to export mode of operation shall commence linearly and proportionally as soon as practicable and at the very least within at least 500ms from when the **System Frequency** falls below 49.5Hz. During this transition period, the **Electricity Storage Module** is required to remain stable over the entire operating range of the **Electricity Storage Module**.

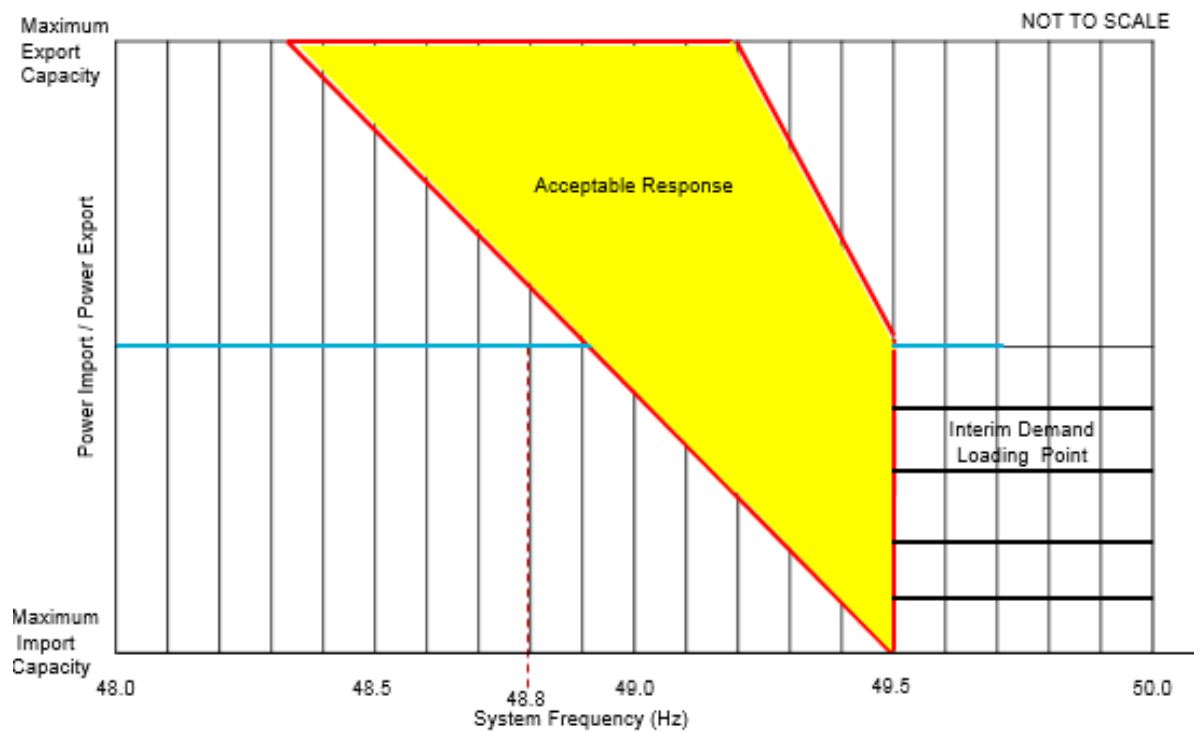


Figure 4a – Required capability of an **Electricity Storage Module** when operating in a mode analogous to **Demand** subject to a **Frequency** deviation of below 49.5Hz.

- (iii) Each **Electricity Storage Module** which is capable of meeting the requirements of CC.6.3.7(g), shall also be capable of achieving a frequency response characteristic within the shaded area shown in Figure 4a
- (iv) In the event of an **Electricity Storage Module** remaining in a demand mode at or below a **System Frequency** of 48.9Hz or below, each **Electricity Storage Module** shall be expected to trip through the operation of automatic low frequency relays in accordance with the requirements of OC6.6.6.
- (v) All **Electricity Storage Modules** which are not capable of reversing their power flow in less than 20 seconds as described in ECC.6.3.7(g)(ii); shall be required to trip when operating in a **Demand** mode and the **System Frequency** is at or below 49.2Hz in accordance with the requirements of OC6.6.6.
- (vi) For the avoidance of doubt, the provision of **LFSM - UI** for **Electricity Storage Modules** is not an **Ancillary Service** and would only be required under abnormal **System Frequency** conditions and when the **Electricity Storage Module** is in an operating in a mode analogous to **Demand**.

## Extract from ECC's

.....

### ECC.6.3.7.2 Limited Frequency Sensitive Mode – Underfrequency (LFSM-U)

**Limited Frequency Sensitive Mode – Underfrequency (LFSM-U)** consists of two operating modes which are **Limited Frequency Sensitive Mode – Underfrequency exporting (LFSM-UE)** whilst they are exporting power into the **Total System**: and **Limited Frequency Sensitive Mode – Underfrequency importing (LFSM-UI)** which applies to **Electricity Storage Modules** whilst they are importing energy from the **Total System**.

#### ECC.6.3.7.2.1 Limited Frequency Sensitive Mode – Underfrequency Exporting (LFSM-UE)

ECC.6.3.7.2.1.1 Each **Type C Power Generating Module** and **Type D Power Generating Module** (including **DC Connected Power Park Modules**) or **HVDC Systems** operating in **Limited Frequency Sensitive Mode** shall be capable of increasing **Active Power** output in response to **System Frequency** when this falls below 49.5Hz. For the avoidance of doubt, the provision of this increase in **Active Power** output is not a mandatory **Ancillary Service** and it is not anticipated **Power Generating Modules** (including **DC Connected Power Park Modules**) or **HVDC Systems** are operated in an inefficient mode to facilitate delivery of **LFSM-UE** response, but any inherent capability (where available) should be made without undue delay. The **Power Generating Module** (including **DC Connected Power Park Modules**) or **HVDC Systems** shall be capable of stable operation during **LFSM-UE** Mode. For example, an **EU Generator** which is operating with no headroom (eg it is operating at maximum output or is de-loading as part of a run down sequence and has no headroom) would not be required to provide **LFSM-UE**.

ECC.6.3.7.2.1.2 (i) The rate of change of **Active Power** output must be at a minimum a rate of 2 percent of output per 0.1 Hz deviation of **System Frequency** below 49.5Hz (ie a **Droop** of 10%) as shown in Figure ECC.6.3.7.2.1.2 below. This requirement only

applies if the **Power Generating Module** has headroom and the ability to increase **Active Power** output. In the case of a **Power Park Module** or **DC Connected Power Park Module** the requirements of Figure ECC.6.3.7.2.1.2 shall be reduced pro-rata to the amount of **Power Park Units** in service and available to generate. For the avoidance of doubt, this would not preclude an **EU Generator** or **HVDC System Owner** from designing their **Power Generating Module** with a lower **Droop** setting, for example between 3 – 5%.

(ii) As much as possible of the proportional increase in **Active Power** output must result from the **Frequency** control device (or speed governor) action and must be achieved for **Frequencies** below 49.5 Hz. The **Power Generating Module** (including **DC Connected Power Park Modules**) or **HVDC Systems** shall be capable of initiating a power **Frequency** response with minimal delay. If the delay exceeds 2 seconds the **EU Generator** or **HVDC System Owner** shall justify the delay, providing technical evidence to **The Company**).

(iii) The actual delivery of **Active Power Frequency Response** in **LFSM-UE** mode shall take into account

The ambient conditions when the response is to be triggered

The operating conditions of the **Power Generating Module** (including **DC Connected Power Park Modules**) or **HVDC Systems** in particular limitations on operation near **Maximum Capacity** or **Maximum HVDC Active Power Transmission Capacity** at low **Frequencies** and the respective impact of ambient conditions as detailed in ECC.6.3.3.

The availability of primary energy sources.

(iv) In **LFSM-UE** Mode, the **Power Generating Module** (including **DC Connected Power Park Modules**) and **HVDC Systems**, shall be capable of providing a power increase up to its **Maximum Capacity** or **Maximum HVDC Active Power Transmission Capacity** (as applicable).

### Active Power Frequency response capability of when operating in LFSM-U

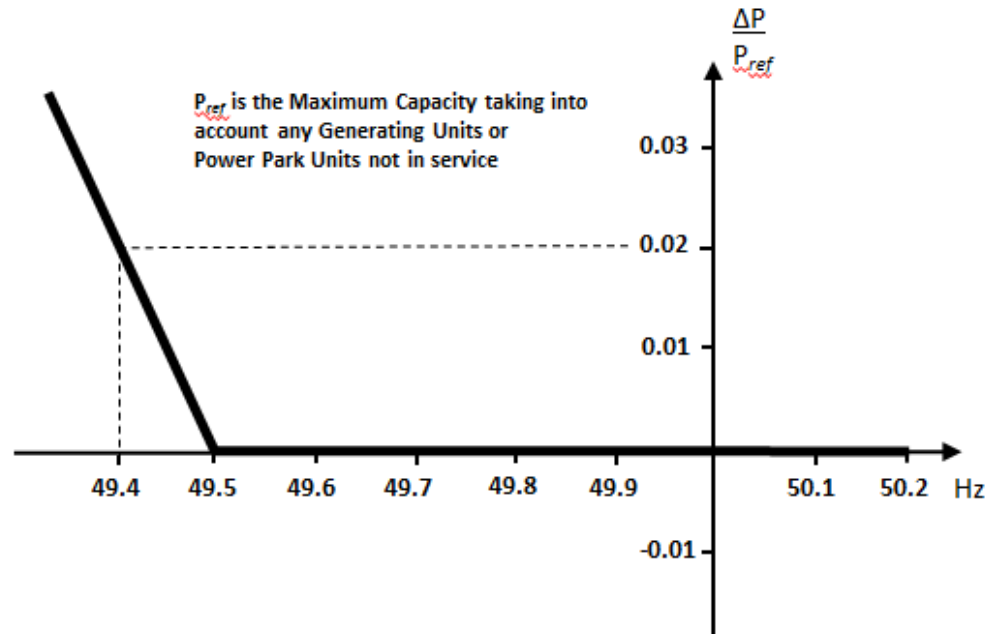


Figure ECC.6.3.7.2.1.2 –  $P_{ref}$  is the reference **Active Power** to which  $\Delta P$  is related and  $\Delta P$  is the change in **Active Power** output from the **Power Generating Module** (including **DC Connected Power Park Modules**) or **HVDC System**. The **Power Generating Module** (including **DC Connected Power Park Modules** or **HVDC Systems**) has to provide a positive **Active Power** output change with a droop of 10% or less based on  $P_{ref}$ .

### ECC.6.3.7.2.2 Limited Frequency Sensitive Mode – Underfrequency importing (LFSM-UI)

ECC.6.3.7.2.2.1 **Limited Frequency Sensitive Mode - Underfrequency Importing (LFSM - UI)** only applies to **Electricity Storage Modules** and **GB Emergency and Restoration Code Providers** who own and operate energy storage units which are operating in a mode analogous to **Demand**.

ECC.6.3.7.2.2.2 In the event that the **System Frequency** falls below 49.5Hz, each **Electricity Storage Module** and energy storage unit (belonging to a **GB Emergency and Restoration Code Provider**), which is operating in a mode analogous to **Demand** and which is also capable of reversing operation from an **Interim Demand Loading Point** (including its **Maximum Capacity** (Pmax Import)) to an exporting mode of operation shall be capable of reversing its mode of operation within 20 seconds. The transition from import mode of operation to export mode of operation shall commence linearly and proportionally as soon as practicable and at the very least within at least within 500ms from when the **System Frequency** falls below 49.5Hz. During this transition period, the **Electricity Storage Module** or energy storage unit (belonging to a **GB Emergency and Restoration Code Provider**) is required to remain stable over the entire operating range of the **Electricity Storage Module** or energy storage unit.

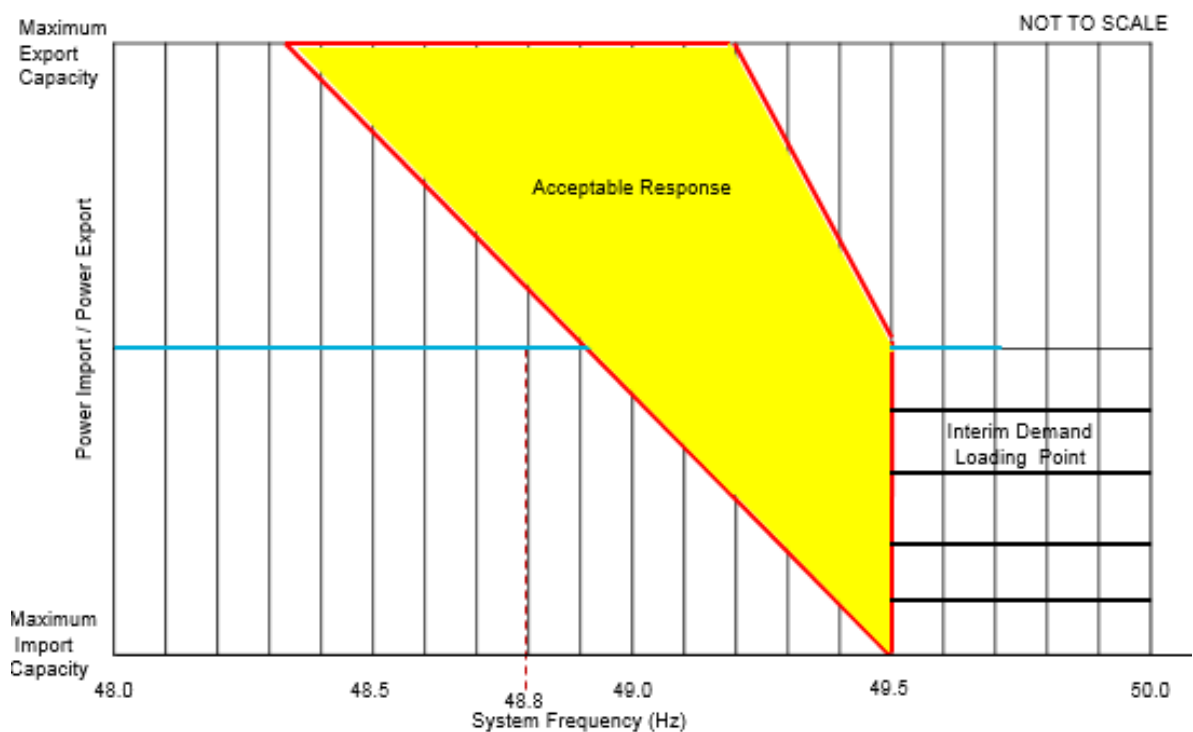


Figure ECC.6.3.7.2.2.2 – Required capability of an **Electricity Storage Module** and/or energy storage unit belonging to a **GB Emergency and Restoration Code Provider** when operating in a mode analogous to **Demand** subject to a **Frequency** deviation of below 49.5Hz.

ECC.6.3.7.2.2.3 Each **Electricity Storage Module** and/or energy storage unit belonging to a **GB Emergency and Restoration Code Provider** which is capable of meeting the requirements of ECC.6.3.7.2.2, shall also be capable of achieving a frequency response characteristic within the shaded area shown in Figure ECC.6.3.7.2.2.2.

- ECC.6.3.7.2.2.4 In the event of an **Electricity Storage Module** or energy storage unit belonging to a GB Emergency and Restoration Code Provider remains in a **Demand** mode at or below a **System Frequency** of 48.9Hz or below, each **Electricity Storage Module** or energy storage unit belonging to a **GB Emergency and Restoration Code Provider** shall be expected to trip through the operation of automatic low frequency relays in accordance with the requirements of OC6.6.6.
- ECC.6.3.7.2.2.7 All **Electricity Storage Modules** or energy storage units belonging to a **GB Emergency and Restoration Code Provider** which are not capable of reversing their power flow in less than 20 seconds as described in ECC.6.3.7.2.2.1 shall be required to trip when operating in a **Demand** mode and the **System Frequency** is at or below 49.2Hz in accordance with the requirements of OC6.6.6.
- ECC.6.3.7.2.2.8 For the avoidance of doubt, the provision of **LFSM - UI** for **Electricity Storage Modules** or energy storage units owned by a **GB Emergency and Restoration Code Provider** is not an **Ancillary Service** and would only be required under abnormal **System Frequency** conditions and when the **Electricity Storage Module** or energy storage unit owned by a **GB Emergency and Restoration Code Provider** is operating in a mode analogous to **Demand**.

### Extracts from Balancing Code 3

.....

#### BC3.7.2 Plant In Limited Frequency Sensitive Mode

##### BC.3.7.2.1 Plant in Limited Frequency Sensitive Mode applicable to GB Code Users

The following requirements are applicable to **GB Code Users** in respect of **Plant** operating in **Limited Frequency Sensitive Mode**. For the avoidance of doubt, these requirements do not apply to **EU Generators** and **HVDC System Owners** for whom the requirements of BC.3.7.2.2 apply.

- (a) Each **Synchronised Genset** (or **DC Converter** at a **DC Converter Station**) operating in a **Limited Frequency Sensitive Mode** which is producing **Active Power** is also required to reduce **Active Power** output in response to **System Frequency** when this rises above 50.4 Hz. In the case of **DC Converters** at **DC Converter Stations**, the provisions of BC3.7.7 are also applicable. For the avoidance of doubt, the provision of this reduction in **Active Power** output is not an **Ancillary Service**. Such provision is known as "**Limited High Frequency Response**".
- (b)
- (i) The rate of change of **Active Power** output must be at a minimum rate of 2 per cent of output per 0.1 Hz deviation of **System Frequency** above 50.4 Hz.
- (ii) The reduction in **Active Power** output must be continuously and linearly proportional, as far as is practicable, to the excess of **Frequency** above 50.4 Hz and must be provided increasingly with time over the period specified in (iii) below.
- (iii) As much as possible of the proportional reduction in **Active Power** output must result from the frequency control device (or speed governor) action and must be achieved within 10 seconds of the time of the **Frequency** increase above 50.4 Hz.
- (iv) The residue of the proportional reduction in **Active Power** output which results from automatic action of the **Genset** (or **DC Converter** at a **DC Converter Station**) output



control devices other than the frequency control devices (or speed governors) must be achieved within 3 minutes from the time of the Frequency increase above 50.4 Hz.

- (v) Any further residue of the proportional reduction which results from non-automatic action initiated by the Generator or DC Converter Station owner shall be initiated within 2 minutes, and achieved within 5 minutes, of the time of the Frequency increase above 50.4 Hz.
- (c) Each **GB Code User** in respect of a **Genset** (or **DC Converter** at a **DC Converter Station**) which is providing **Limited High Frequency Response** in accordance with this BC3.7.2 must continue to provide it until the **Frequency** has returned to or below 50.4 Hz or until otherwise instructed by **The Company**.
- (d) Each **GB Code User** in respect of an **Electricity Storage Module** is also required to meet the requirements of CC.6.3.7(g)

BC.3.7.2.2 Plant in Limited Frequency Sensitive Mode applicable to EU Code Users

**EU Code Users** in respect of **Gensets** and **HVDC Systems** are required to operate in **Limited Frequency Sensitive Mode** at all times unless instructed by **The Company** to operate in **Frequency Sensitive Mode**. Where **EU Code Users Gensets** and **HVDC Systems** are required to operate in **Limited Frequency Sensitive Mode** then the requirements of ECC.6.3.7.1 and ECC.6.3.7.2 shall apply. For the avoidance of doubt, the requirements defined in BC.3.7.2.1 do not apply to **New Generators** and **HVDC System Owners**. Each **EU Code User** in respect of an **Electricity Storage Module** and energy storage unit owned by a **GB Emergency and Restoration Code Provider** is also required to meet the requirements of ECC.6.3.7.2.2.

#### Extracts from GERC – New section

### GB EMERGENCY AND RESTORATION CODE (GERC)

#### CONTENTS

(This contents page does not form part of the Grid Code)

<u>Paragraph No/Title</u>	<u>Page Number</u>
GERC.1 INTRODUCTION	1
GERC.2 OBJECTIVE	1
GERC.3 SCOPE	1

GERC.1      INTRODUCTION

GERC.1.1      The **GB Emergency and Restoration Code (GERC)** is concerned with **GB Emergency and Restoration Code Providers**.

GERC.2      OBJECTIVE

The objectives of the **GERC** are to

GERC.2.1      Ensure the obligations of **European Regulation (EU) 2017/2196** have been discharged; and;

GERC.2.2      Define the minimum requirements **GB Emergency and Restoration Code Providers** are required to satisfy.

GERC.3      SCOPE

GERC.3.1      The **GERC** applies to **GB Emergency and Restoration Code Providers**.

GERC.3.2      A **GB Emergency and Restoration Code Provider** is defined as any one of the following parties who is not a **CUSC Party**:-

- (i) Existing and new **Type C** and **Type D Power Generating Modules** as defined in accordance with the criteria set out in Article 5 of **European Regulation (EU) 2016/631**.
- (ii) Existing and new **Type B Power Generating Modules** classified as defined in accordance with the criteria set out in Article 5 of **European Regulation (EU) 2016/631**, where they are identified as SGU's in accordance with Article 11(4) of **European Regulation (EU) 2017/2196**.
- (iii) Providers of redispatching of **Power Generating Modules** or of a **Demand Facility** by means of aggregation and providers of **Active Power** reserve in accordance with Title 8 of **European Regulation (EU) 2017/1485**.
- (iv) Existing and new high voltage direct current (HVDC) Systems and direct current connected **Power Park Modules** in accordance with the criteria set out in Article 4(1) of **European Regulation (EU) 2016/1447**.
- (v) Existing and new **Type A Power Generating Modules** as defined in accordance with the criteria set out in Article 5 of **European Regulation (EU) 2016/631**, to existing and new **Type B Power Generating Modules** other than those referred to in paragraph 2(b) of **European Regulation (EU) 2017/2196**, as well as to existing and new **Demand Facility's**, closed distribution systems and third parties providing demand response where they qualify as **Defence Service Providers** pursuant to Article 4(4) of **European Regulation (EU) 2017/2196**.

- (vi) **Type A and Type B Power Generating Modules** defined in GERC3.2(viii), **Demand Facility's** and **Closed Distribution Systems** providing a **Demand Response Service** may fulfil the requirements of **European Regulation (EU) 2017/2196** either directly or indirectly through a third party under the terms and conditions set out in accordance with Article 4(4) of **European Regulation (EU) 2017/2196**.
- (vii) Energy storage units of an **SGU**, a **Defence Service Provider** or **Restoration Service Provider** which can be used to balance the **System**, provided that they are identified as such in the **System Defence Plan**, **System Restoration Plan** or relevant service contract (including an **Ancillary Services** agreement, if applicable).

GERC.3.2 For the avoidance of doubt the requirements of the **GB Emergency and Restoration Code** do not apply to **CUSC Parties** as they already satisfy the requirements of **European Regulation (EU) 2017/2196** by virtue of their obligation to satisfy the other sections of the **Grid Code**.

#### GERC.4 REQUIREMENTS

GERC.4.1 All **GB Emergency and Restoration Code Providers** are required to satisfy the relevant requirements of **European Regulation (EU) 2017/2196** in addition to the requirements of ECC.6.3.7.2.2.as applicable to energy storage units.

GERC.4.2 In the case of (GB) **Defence Service Providers** this includes what is set out in the (GB) **System Defence Plan** and the terms and conditions to act as a **Defence Service Provider** proposed by **The Company** and approved by **The Authority**, from time to time, which shall define at least:

- (a) the characteristics of the service to be provided and
- (b) the possibility of and conditions for aggregation.

GERC.4.3 In the case of (GB) **Restoration Service Providers** this includes what is set out in the (GB) **System Restoration Plan** and the terms and conditions to act as a **Restoration Service Provider** proposed by **The Company** and approved by **The Authority**, from time to time, which shall define at least:

- (a) the characteristics of the service to be provided;
- (b) the possibility of and conditions for aggregation and
- (c) the target geographical distribution of power sources with black start and island operation capabilities.