Dynamic Containment
Service Terms

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Contents

1. Introduction

1.1 These **DC Service Terms** shall apply to each **Service Provider** and **Response Unit** the subject of a **DC Response Contract** where, in accordance with the **DC Tender Rules**, and for any **DC Service Day**, the **Service Provider's DC Tender(s)** for that **Response Unit** is/are accepted by **NGESO**.

1.2 Each **DC Response Contract** shall be governed by these **DC Service Terms**, and shall comprise a legally binding contract between **NGESO** and the **Service Provider**.

2. Changes to these DC Service Terms

2.1 Subject always to paragraph 2.2, **NGESO** may update these **DC Service Terms** from time to time by publication of an updated version on its website, and each such updated version shall be effective from the date shown on its front cover provided always that any updated version shall not apply to any **DC Response Contract** extant at the date of publication except with the consent in writing of the relevant **Service Provider**.

2.2 To the extent required by the **Electricity Balancing Guidelines** (and by reference to those provisions of the **DC Procurement Documents** constituting terms and conditions approved by the **Authority** as the terms and conditions related to balancing pursuant to Article 18 of the **Electricity Balancing Guidelines**), any variation to these **DC Service Terms** will be proposed and implemented in accordance with the applicable requirements in the **Electricity Balancing Guidelines**.

3. DC General Terms and Conditions and DC Glossary of Terms and Rules of Interpretation

3.1 These **DC Service Terms** are subject to the prevailing **DC General Terms and Conditions** published by **NGESO** alongside these **DC Service Terms**.

3.2 Unless the context otherwise requires, any capitalised term used in these **DC Service Terms** shall have the meaning given to it (if any) in the prevailing **DC Glossary of Terms and Rules of Interpretation**, and the rules of interpretation set out in that document shall also apply.

3.3 For the purposes of paragraphs 3.1 and 3.2, with respect to any **DC Response Contract**, "prevailing" shall mean the latest version of the applicable document which is in effect on the applicable **DC Market Day** in accordance with its terms.

4. DC Response Contracts

4.1 Each **DC Response Contract** shall be automatically formed in accordance with the **DC Tender Rules**.

4.2 A **DC Response Contract** shall relate to a single **Response Unit**, and shall apply only to a single **DC Service Day**.

4.3 Each **DC Response Contract** so formed shall create a legally binding obligation on the **Service Provider** to provide from the relevant **Response Unit**, and for **NGESO** to pay for, **Dynamic Containment** to be delivered during the relevant **DC Service Day** upon the terms of these **DC Service Terms**. For the avoidance of doubt, neither a **Service Provider** nor **NGESO** shall be under any obligation or commitment to provide or pay for **Dynamic Containment** except pursuant to a **DC Response Contract** formed in respect of that **Response Unit** for that **DC Service Day**.

4.4 Neither **Party** may terminate a **DC Response Contract** once formed except as provided or referred to in paragraph 14 or by agreement in writing between the **Parties**.

5. Service Availability

5.1 The **Service Provider** (or, where applicable, the **Secondary Service Provider**, and references in this paragraph 5 to "**Service Provider**" shall be construed accordingly) will procure that, with respect to each **DC Response Contract**, **Response** is made available from the **Response Unit** for delivery throughout each applicable **DC Service Day** in the manner provided in paragraph 6. It is a requirement of each **DC Response Contract** that, unless prevented by an unplanned outage or other unforeseen technical circumstances, a **Response Unit** will be available to provide **Dynamic Containment** in accordance with these **DC Service Terms** continuously throughout each **DC Service Day**, regardless of its **State of Energy** where applicable.

5.2 The **Service Provider** shall notify **NGESO** (by way of submission of **DC Operational Data** via a **Data Concentrator** or (only if directed by **NGESO**) by way of submission of **DC Performance Data**, pursuant to paragraph 15.1) promptly upon becoming aware that any **Response Unit** (including any component **Eligible**

Asset) has become unable (including, where it is **Energy Limited**, because of its **State of Energy**) to provide (in whole or part), and at any time during the relevant **DC Service Day**, the **Contracted Quantity or Response Energy Volume** or any other requirement of **Dynamic Containment** in accordance with these **DC Service Terms**.

5.3 The submission of **DC Operational Data** (or, where applicable, **DC Performance Data**) pursuant to paragraph 15.1 shall also be used by the **Service Provider** to notify **NGESO** promptly when it becomes aware that, following notification pursuant to paragraph 5.2, the ability of a **Response Unit** to meet the requirements of **Dynamic Containment** in accordance with these **DC Service Terms** has been restored.

5.4 Upon request by **NGESO**, any notification pursuant to paragraph 5.2 or 5.3 shall be followed promptly by an explanation in sufficient (but not excessive) detail to enable **NGESO** to verify that the **Service Provider**'s notification related to unplanned outage or other unforeseen technical circumstances).

5.5 Except as provided in paragraph 5.6, with effect from the start of the **Settlement Period** in which the **Response Unit** becomes unable to meet the requirements of **Dynamic Containment** (whether or not notified by the **Service Provider** pursuant to paragraph 5.2) and until expiry of the **Settlement Period** in which the ability of a **Response Unit** to meet the requirements of **Dynamic Containment** is restored (or, if later, the time when the **Service Provider** notifies **NGESO** that is has been restored), the **Response Unit** shall, for the purposes of paragraph 7, be deemed to be unavailable to deliver **Dynamic Containment**.

5.6 A **Response Unit** which would otherwise be considered unavailable due to its **State of Energy** will be deemed available if the **Service Provider** has complied with the **State of Energy** management rules in accordance with paragraph 6.11 and no further such management is possible.

5.7 Where either:-

i. in the absence of notification from the **Service Provider** pursuant to paragraph 5.2, **NGESO** nonetheless has reasonable grounds for believing that a **Response Unit** is unable to meet the requirements of the **DC Response Contract** in all or any part of a **DC Service Day**; or

ii. **NGESO** has reasonable grounds for believing that any notification from the **Service Provider** pursuant to paragraph 5.2 is for reasons other than related to an unplanned outage or other unforeseen technical circumstances and/or that the **Service Provider** has deliberately or recklessly failed to comply with the **State of Energy** management rules in accordance with paragraph 6.11,

then, notwithstanding paragraph 5.4 and for the purposes of paragraph 7, **NGESO** reserves the right to treat that **Response Unit** as deemed unavailable to deliver **Dynamic Containment** for the entirety of the **DC Service Day** in question (including any part thereof prior to the commencement of unavailability).

5.8 For the avoidance of doubt, with respect to any **Transfer Period** and for the purposes of this paragraph 5 and paragraph 7, all and any periods of unavailability of the applicable **Response Unit**(s) **Registered** to the **Secondary Service Provider** shall be treated as deemed unavailability of the **Response Unit**.

5.9 Further for the avoidance of doubt, the registration of **Eligible Assets** to a **Response Unit** may not be changed so as to be effective during the subsistence of a **DC Response Contract**.

6. Service Delivery

6.1 Throughout each **DC Service Day**, and except to the extent the **Response Unit** is deemed to be unavailable to deliver **Dynamic Containment** pursuant to paragraph 5, the **Service Provider** (or, where applicable, the **Secondary Service Provider**, and references in this paragraph 6 to "**Service Provider**" shall be construed accordingly) shall procure the delivery of **Response** in accordance with this paragraph 6.

Operational Baselines

6.2 In relation to each **Settlement Period** falling in each **DC Service Day**, the **Service Provider** shall notify **NGESO** of an intended operating profile (being a level (which may be zero) of **Output** or **Demand**) for the **Response Unit** (which, where applicable, shall be an aggregate operating profile across all **Eligible Assets**) (the "**Operational Baseline**"), together with confirmation of the technical and commercial parameters comprising each **DC Response Contract**, in accordance with either paragraph 6.3 or 6.4 (as applicable), and in relation thereto:-

i. each **Operational Baseline** shall be prepared by the **Service Provider** in accordance with **Good Industry Practice** so as to reflect for the relevant **Response Unit** the **Service Provider**'s best estimate of the operating profile of the **Response Unit** in the relevant **Settlement Period**;

ii. each **Operational Baseline** may be either an integer or a value with up to four (4) decimal places; and

iii. where the **Response Unit** is **Energy Limited** the **Service Provider** shall comply with the **State of Energy** management rules in paragraph 6.11.

6.3 Where the **Response Unit** is **BM Participating**, the **Service Provider** shall confirm its **Operational Baseline** to **NGESO** by submission of a **Physical Notification** in accordance with the **Grid Code** (where applicable, rounding up or down to the nearest integer), and shall maintain that **Physical Notification** as at **Gate Closure** (with any subsequent **Bid-Offer Acceptance** adjusting the **Operational Baseline** accordingly), and the **Service Provider** shall further maintain for each relevant **Settlement Period** (in each case as adjusted for any **Bid-Offer Acceptance**):-

i. a **Maximum Export Limit** and a **Stable Import Limit** of not less than the amount which equals the **Operational Baseline** plus the **Contracted Quantity**; and

ii. a **Stable Export Limit** and **Maximum Import Limit** of not greater than the amount which equals the **Operational Baseline** minus the **Contracted Quantity**.

6.4 Where the **Response Unit** is not **BM Participating**, the **Service Provider** shall confirm its **Operational Baseline** to **NGESO** by submission, no later than sixty (60) minutes prior to each relevant **Settlement Period**, of a **Non-BM Data Submission** (in such format as **NGESO** shall specify in the **DC Participation Guidance Document**) comprising, for that **Settlement Period**:-

i. the **Response Unit** ID;

ii. confirmation of its **Operational Baseline;**

iii. a maximum export level or minimum import level which equals the **Operational Baseline** plus the **Contracted Quantity**; and

iv. a minimum export level or maximum import level which equals the **Operational Baseline** minus the **Contracted Quantity**,

which shall be submitted by the **Service Provider** by way of **DC Operational Data** via a **Data Concentrator** or (only if directed by **NGESO**) by way of **Performance Data**, pursuant to paragraph 15.1.

6.5 Where, in respect of any **Settlement Period** in a **DC Service Day**, the **Service Provider** has failed to prepare and submit an **Operational Baseline** for the relevant **Response Unit** in accordance with paragraph 6.2 and (as applicable) paragraphs 6.3 or 6.4, then for the purposes of paragraphs 5 and 7 that **Response Unit** shall be deemed to be unavailable to deliver **Dynamic Containment** for the entirety of that **Settlement Period**.

6.6 Unless otherwise instructed by **NGESO**, for the duration of each **DC Service Day**, the **Service Provider** shall operate the **Response Unit** at the **Operational Baseline** and where applicable with a **State of Energy,** so as to provide, for any **Frequency Deviation**, at least the amount of **Response** shown in the capability data tables at Schedule 1 to these **DC Service Terms** (being expressed as a percentage of the **Contracted Quantity**) and for a continuous period not less than the **Delivery Duration.**

6.7 For the purposes of paragraph 6.6:-

i. **Response** is not required for **Frequency Deviations** +/- 0.015 Hz from **Target Frequency**, and from that dead band to +/- 0.2 Hz the required level of **Response** shall be a linear increase to a maximum of five percent (5%) of **Contracted Quantity** at 0.2 Hz, and from that point the required level of **Response** shall be a linear increase to one hundred percent (100%) of **Contracted Quantity** at +/- 0.5 Hz;

ii. the required levels of **Response** in the tables are shown as a percentage of the **Contracted Quantity**;

iii. for a **Frequency Deviation** at a given time differing from the figures shown in the tables, the required levels of **Response** shall be calculated by linear interpolation from the values derived from the table;

iv. for any **Frequency Deviation** greater than the greatest **Frequency Deviation** given in the tables (whether positive or negative), the required levels of **Response** shall be calculated by reference to the greatest **Frequency Deviation** shown (whether positive or negative); and

v. required levels of **Response** for **Frequency Deviations** lower than those specified in the tables shall be determined by deeming the tables to specify a level of zero (0) MW for a **Frequency Deviation** of zero (0).

Response Units** which are **Energy Limited

6.8 Throughout each **DC Service Day** and additionally during each **Settlement Period** falling immediately prior to and after that **DC Service Day**, for any **Response Unit** which is **Energy Limited** the **Service Provider** shall procure that its **Operational Baselines** at all times observe the **Maximum Ramp Rate**. Any failure to do so in relation to any **Settlement Period** will deem the **Response Unit** to be unavailable to deliver **Dynamic Containment** for the entirety of that **Settlement Period** for the purposes of paragraphs 5 and 7.

6.9 For the purposes of paragraph 6.8:-

i. as more particularly described in the **DC Participation Guidance Document**, the **Maximum Ramp Rate** shall be calculated by reference to whether the **Response Unit** is providing **DC-low**, **DC-high** or both, and whether its **Operational Baseline** is showing either an increase or reduction in level of **Active Power Output** or an increase or reduction in level of **Demand**;

ii. where there are two adjacent **DC Service Days** with different **Contracted Quantities**, for two (2) adjacent **Settlement Periods** on the boundary of a change in **Contracted Quantity**, the relevant **Maximum Ramp Rate** will be that which incorporates the lowest maximum rate; and

iii. for the avoidance of doubt, and as stated in paragraph 6.3, where a **Response Unit** is **BM Participating** its **Operational Baseline** shall be adjusted by a **Bid-Offer Acceptance**, and accordingly to the extent complying with any such **Bid-Offer Acceptance** the **Response Unit** shall be deemed to be observing the **Maximum Ramp Rate**.

***Energy Limited** – **State of Energy** management rules*

6.10 It shall be responsibility of each **Service Provider** to manage the **State of Energy** of any **Response Unit** which is **Energy Limited** (and constituent **Eligible Assets** if any) in order to ensure it can meet the requirements of **Dynamic Containment** and its obligations hereunder.

6.11 Without limiting paragraph 6.10, the **Service Provider** shall manage **State of Energy** so as to deliver from the **Response Unit** the **Response Energy Volume** following any activation at any point during the **DC Service Day**, and with respect thereto:

i. at the start of each **Settlement Period** within a **DC Service Day**, the **Service Provider** must assess (in accordance with **Good Industry Practice**) if the **State of Energy** is sufficient to deliver the **Response Energy Volume** as described above, and where **State of Energy** is assessed to be insufficient the **Service Provider** shall, before the end of that **Settlement Period**, calculate and submit a new **Operational Baseline** for either charging or discharging such that the **State of Energy** will become sufficient;

ii. the **Response Unit** should always be capable of recovering at least the volume of **Energy Recovery** in any single **Settlement Period**, through the resubmission of **Operational Baselines**;

iii. in the case of a **Response Unit** providing both **DC** (low frequency) and **DC** (high frequency) with an asymmetric **Contracted Quantity**, the **State of Energy** requirement will also be asymmetrical;

iv. if stored energy moves outside of this range (for example in response to a **Frequency** event), the **Service Provider** must submit at the first opportunity a revised **Operational Baseline** that will recover the stored energy back to the acceptable range;

v. at its discretion (acting reasonably), **NGESO** may determine that the **Service Provider** should not be treated as having failed to manage **State of Energy** where **System Frequency** is affected by:-

1. extended periods of high or low **System Frequency** deviation beyond 0.2 Hz above or below 50Hz; or

2. multiple concurrent frequency events; and

vi. a **Response Unit** shall not deviate from its **Operational Baseline** (whether in order to manage **State of Energy** or otherwise) whilst **System Frequency** is within the 50Hz +/- 0.015Hz "deadband".

6.12 If in the reasonable opinion of **NGESO** a **Response Unit** is operating during a **DCC Service Day** with a **State of Energy** which indicates that the **Service Provider** is not complying with the **State of Energy** management rules in paragraph 6.11, then **NGESO** reserves the right to treat that **Response Unit** as deemed unavailable to deliver **Dynamic Containment** for the purposes of paragraphs 5 and 7 until such time as **NGESO** is satisfied (acting reasonably) that the **Service Provider** is in compliance once more.

6.13 **State of Energy** may only be managed by way of the submission of, and adherence to, **Operational Baselines** in accordance with this paragraph 6 (and not, for example, through deliberate imbalance, "spilling" and over/under delivery).

7. Availability Payments

7.1 In respect of each **DC Response Contract**, **NGESO** shall, in accordance with paragraph 8, pay to the **Service Provider** an **Availability Payment** calculated in accordance with the applicable formulae in Schedule 2 to these **DC Service Terms**.

7.2 No **Availability Payment** shall be made by **NGESO** to the **Service Provider** pursuant to this paragraph 7 in respect of any period or periods of deemed unavailability pursuant to paragraphs 5 or 6.

7.3 Without prejudice to its other rights and remedies, **NGESO** reserves the right to withhold payment of any **Availability Payment** where the **Service Provider** has failed to provide relevant **DC Operational Data** and/or **DC Performance Data** pursuant to paragraph 15.

7.4 With respect to any **Transfer Period**, and for the avoidance of doubt:

i. for the purposes of this paragraph 7, the availability and provision of **Response** pursuant to the relevant **DC Response Contract** shall be assessed by reference to the **Response Units**(s) **Registered** to the **Secondary Service Provider** and not to the **Primary Service Provider's Response Unit**; and

ii. all and any **Availability Payments** accruing due pursuant to this paragraph 7 shall be payable to the **Primary Service Provider** and nothing in these **DC Service Terms** shall create any liability or obligation on the part of **NGESO** to make any such payments to the **Secondary Service Provider**.

8. Payment Procedure

8.1 In respect of each calendar month during which the **Service Provider** has been party to one or more **DC Response Contracts**, and by no later than expiry of the second calendar month which follows, **NGESO** shall send to the **Service Provider** in accordance with paragraph 4 (*Payments*) of the **DC General Terms and Conditions** a **Monthly Statement** setting out, in respect of each such **DC Response Contract**, its calculation of:-

i. the **Availability Payments** payable to the **Service Provider** pursuant to paragraph 7;

ii. any adjustments made to previous **Monthly Statements**; and

iii. the resulting net amount due to (or from, as the case may be) the **Service Provider**,

and in respect thereof the provisions of paragraph 4 (*Payments*) of the **DC General Terms and Conditions** shall apply.

9. Grid Code and Distribution Code

9.1 The provision by the **Service Provider** of **Dynamic Containment** shall not relieve it of any of its obligations or affect such obligations (where applicable) set out in the **Grid Code** (including its obligations (if any) to provide **Mode A Frequency Response** when instructed by **NGESO** pursuant to the **CUSC** and/or the **Grid**

Code) or to provide **Demand** control when instructed by **NGESO** pursuant to **Grid Code** OC6) or in the **Distribution Code** of its host **Public Distribution System Operator**.

9.2 Without limiting paragraph 9.1, each **Service Provider** that is or becomes a **DRSC Liable User** shall, for the duration of each **DC Service Day**, comply in all respects with the D**emand Response Services Code** as it refers to **Demand Response Active Power Control**.

10. Maintenance of Eligible Assets

The **Service Provider** shall maintain each **Eligible Asset** to such a standard that the **Service Provider** can meet its obligations to provide **Dynamic Containment** in accordance with each **DC Response Contract** and these **DC Service Terms**.

11. Third Party Claims

11.1 The **Service Provider** undertakes to **NGESO** that the availability and delivery of **Dynamic Containment** from any **Response Unit** pursuant to and in accordance with each **DC Response Contract** and these **DC Service Terms** (including during any **Transfer Period**) will not at any time during any **DC Service Day** cause the **Service Provider** to be in breach of or to otherwise be non-compliant with any **Connection Agreement** and/or any agreement for the supply of electricity or related services to or from any constituent **Eligible Asset** or any **Plant** and **Apparatus** associated with it.

11.2 Notwithstanding paragraph 11.1, in the event that the **Service Provider** (or, during any **Transfer Period**. any **Secondary Service Provider**) delivers **Dynamic Containment** in accordance with these **DC Service Terms** in consequence of which **NGESO** suffers or incurs any loss in respect of a claim brought by any third party related to any actual or alleged breach or non-compliance by the **Service Provider** as described in paragraph 11.1, then the **Service Provider** shall indemnify **NGESO** against all and any losses, liabilities, claims, expenses and demands suffered or incurred by **NGESO** in connection therewith. Such indemnity shall include any legal costs and expenses reasonably incurred in the contesting of such claims including the court costs and reasonable attorney's fees and other professional advisors' fees. The **Parties** agree and accept that, for the purposes of paragraph 5 (*Limitations on Liability*) of the **DC General Terms and Conditions**, all such legal costs and expenses expressed to be the subject of such indemnity shall be treated as direct losses.

11.3 In the event of any such claim referred to in paragraph 11.2 being made against **NGESO**, **NGESO** shall as soon as reasonably practicable give notice of the claim together with all relevant supporting documentation to the **Service Provider**. The **Service Provider** shall be entitled, upon written notice to **NGESO** and subject to **NGESO** receiving from the **Service Provider** such reasonable undertakings as **NGESO** shall reasonably require to protect **NGESO** against damage to its name and reputation, to assume at its own expense the sole conduct of all proceedings relating to such claim including the right to contest such claim in the name of **NGESO**. **NGESO** shall supply the **Service Provider** with all information, assistance and particulars reasonably required by the **Service Provider** in connection therewith. **NGESO** shall not accept, settle, pay or compromise any such claim without the prior written approval of the **Service Provider** (not to be unreasonably withheld or delayed). The **Service Provider** shall reimburse to **NGESO** all of its reasonable expenses incurred in connection with the provision of any such information, assistance or particulars in the contesting of any such claim.

12. Provision of Other Services

12.1 The **Service Provider** undertakes to **NGESO** that the availability and delivery of **Dynamic Containment** from any **Response Unit** pursuant to and in accordance with a **DC Response Contract** and these **DC Service Terms** will not at any time during any **DC Service Day** including during any **Transfer Period**) be impaired or otherwise prejudiced by the **Service Provider's** (or, during any **Transfer Period**, any **Secondary Service Provider's**) performance of any agreement with a third party (including another **Service Provider**) relating to any **Eligible Asset** or any associated **Plant** and **Apparatus**, including the making available and/or delivery of services to that third party by the **Service Provider** (whether by way of increases or reductions in **Generation** or **Demand** or stipulated running profiles, participation in any other services (including where part of a trial service) or otherwise, and whether to assist in the management, operation or protection of a **User System** or pursuant to the **Capacity Market Rules** or otherwise).

12.2 Notwithstanding paragraph 12.1, and without prejudice to paragraph 12.6, in the event that the **Service Provider** (or, during any **Transfer Period**, any **Secondary Service Provider**) is unable to provide **Dynamic**

Containment (to any extent) in all or any part of any **DC Service Day** for any reason described in paragraph 12.1, then the **Service Provider** shall (or shall procure that the **Secondary Service Provider** shall) give a full explanation to **NGESO** in its notification of unavailability pursuant to paragraph 5.2, and **NGESO** may in its absolute discretion (except where paragraph 12.5 applies) terminate the **DC Response Contract** in question pursuant to paragraph 14).

12.3 Subject always to paragraph 12.4, and irrespective of whether or not **NGESO** elects to terminate the **DC Contract**, the **Service Provider** hereby agrees to reimburse to **NGESO** all and any additional costs and expenses incurred by it as a result of such inability including **NGESO**'s additional costs of alternative or replacement service provision.

12.4 The amount or amounts for which the **Service Provider** may be liable to reimburse **NGESO** pursuant to paragraph 12.3 in respect of any single **DC Response Contract** shall not exceed in aggregate the greater of (1) two hundred and fifty thousand pounds sterling (£250,000), and (2) an amount equal to the aggregate **Availability Payments** in respect of that **DC Response Contract** calculated by reference to all **Settlement Periods** in the relevant **DC Service Day** (ignoring any periods of unavailability and whether or not declared by the **Service Provider**).

12.5 Where, during any one or more **Settlement Periods** in a **DC Service Day**, a **Service Provider** is required under the terms of any agreement with **NGESO** to provide from any **Eligible Asset** any other **Balancing Service** (except with respect to **Reactive Power**) the **Parties** agree and acknowledge that **Dynamic Containment** cannot be provided simultaneously with such other **Balancing Service** and to the extent that such service provision either overlaps to any extent with a **DC Service Day** and/or is otherwise inconsistent or in conflict with the delivery of **Dynamic Containment** then without prejudice to the operation of the terms for provision of and payment for such other **Balancing Services** the relevant **Response Unit** shall be deemed unavailable to provide such other **Balancing Service** pursuant to such terms, and availability of the **Response Unit** to provide **Dynamic Containment** pursuant to these **DC Service Terms** shall prevail.

12.6 Where, during any one or more **Settlement Periods** in a **DC Service Day**, a **Service Provider** (or, during any **Transfer Period**, any **Secondary Service Provider**) is making available and/or delivering services to a third party in breach of paragraph 12.1, then the relevant **Response Unit** shall be deemed unavailable for the purposes of paragraph 7.

12.7 For the purposes of this paragraph 12 and for the avoidance of doubt, where a **DC Response Contract** is formed with respect to a **Response Unit** which is not registered as a **BM Unit** and with an **Contracted Capacity** which is less than the aggregate **Registered Quantity** of each component **Eligible Asset**, then the making available and/or delivery of services by the **Service Provider** to **NGESO** or a third party from such **Eligible Assets** or any of them with respect to any or all of that excess capacity shall be deemed to impair, and be inconsistent or in conflict with, the delivery of **Dynamic Containment** pursuant to such **DC Contract** unless such excess capacity is demonstrated to **NGESO**'s reasonable satisfaction to be separately metered so as to enable the production of **Relevant Data** pursuant to paragraph 15.

13. Communications

13.1 Any communications required by these **DC Service Terms** to be given in writing shall unless otherwise provided in this paragraph 13 be made and deemed to have been received in accordance with paragraph 10 (*Notices*) of the **DC General Terms and Conditions** save as may be otherwise agreed by the **Parties**.

13.2 The **Parties** consent to the recording of all telephone conversations between them relating in whole or in part to these **DC Service Terms**, and each **Party** agrees to notify its employees of that consent and obtain their consent to that recording if required by **Law**.

13.3 All notifications to be made by the **Service Provider** with respect to any unavailability (and restoration of availability) of a **Response Unit** to provide **Dynamic Containment** pursuant to paragraph 5 shall be made by made as part of **DC Operational Data** using a **Data Concentrator** (unless otherwise provided in paragraph 15).

13.4 All **Operational Baselines** prepared by a **Service Provider** pursuant to paragraph 6.2 shall be submitted by the **Service Provider** to **NGESO** in accordance with paragraphs 6.3 or 6.4 (as applicable), which for **Response Units** which are **BM Participating** shall be via **BM Unit Data** submissions and for **Response Units** which are not **BM Participating** shall be either via a **Data Concentrator** or (for such period and upon such conditions as **NGESO** may specify) electronic transfer as part of **DC Performance Data**.

14. Termination of DC Response Contracts

14.1 In addition to any rights of termination available under the **DC Contract Documentation**, **NGESO** may in its absolute discretion terminate a **DC Response Contract** in respect of a **Response Unit** with immediate effect by notice in writing to the **Service Provider** in the following circumstances:-

i. where the **Service Provider** is in breach of a warranty or declaration given under any of the **Registration Documents**;

ii. where **NGESO** (acting reasonably) determines that the **Response Unit**, and/or one or more **Eligible Assets** comprising the **Response Unit**, is not ready for commercial operation and/or delivery of **Dynamic Containment** in one or more **DC Service Days**; or

iii. where the **Service Provider** fails to comply in any material respect with its obligations under the **Testing Guidelines**, including where **NGESO** determines (acting reasonably) that the **Service Provider's Independent Technical Expert** is failing to meet the required technical standard and/or is not sufficiently independent (each as defined in the **Testing Guidelines**).

15. Monitoring and Metering Data

Operational data

15.1 To enable **NGESO** to verify the **Operational Baseline** and facilitate calculation of **Availability Payments** in accordance with paragraph 7 and Schedule 2, and unless and to the extent otherwise directed by **NGESO**, the **Service Provider** shall procure and submit to **NGESO**, on a continuous basis and with a maximum delay of five (5) seconds, the following data ("**DC Operational Data**") all at a granularity of one (1) measurement per second (1 Hz):-

i. **Response Unit** ID;

ii. Date/time stamp;

iii. **Operational Baseline** (**Non-BM Participating** only) including date/time stamp;

iv. **Input Frequency** (for one of the relevant **Eligible Assets**);

v. whether or not the **Response Unit** is available for **Dynamic Containment** pursuant to paragraph 5, and if so whether for **DC-low** or **DC-high;**

vi. **Metered Active Power Output** or **Demand** (as the case may be); and

vii. where the **Response Unit** is **Energy Limited**, its **State of Energy** in MWh (**Active Power Output** and **Demand**).

15.2 All **DC Operational Data** shall be submitted using a **Data Concentrator** (unless and to the extent that **NGESO** may indicate otherwise) and shall cover the entirety of each **DC Service Day** together also with each **Settlement Period** which falls immediately before and after.

Performance data

15.3 In addition, and without limiting paragraph 15.1, to enable **NGESO** to monitor the delivery of **Response** pursuant to a **DC Response Contract** and to facilitate calculation of **Availability Payments** in accordance with paragraph 7 and Schedule 2, the **Service Provider** shall procure and retain (for a period of not less than three (3) months) the data specified or referred to in paragraph 15.4 ("**DC Performance Data**") and shall submit the **DC Performance Data** to **NGESO** by electronic transfer on an hourly basis throughout the **DC Service Day**.

15.4 Unless otherwise specified by **NGESO** from time to time in the **DC Participation Guidance Document**, the **DC Performance Data** shall comprise (at a granularity of twenty (20) measurements per second (20 Hz)):-

i. **Response Unit** ID;

ii. Date/time stamp;

iii. **Input Frequency** (for one of the relevant **Eligible Assets**);

iv. whether or not the **Response Unit** is available for **Dynamic Containment** pursuant to paragraph 5, and if so whether for **DC-low** or **DC-high;**

v. **Metered Active Power Output** or **Demand** (as the case may be);

vi. where the **Response Unit** is **Energy Limited**, its **State of Energy** in MWh (**Active Power Output** and **Demand**); and

vii. where applicable, the **Operational Baseline**.

15.5 All **DC Operational Data** and **DC Performance Data** to be provided by the **Service Provider** pursuant to this paragraph 15:-

i. shall be provided where applicable at an aggregate level for each **Response Unit**; and

ii. shall be to a margin of error of 0.001 Hz for **System Frequency** and one percent (1%) for **Metered Active Power Output** or **Demand**.

Publication of data

15.6 For the purposes of paragraph 8 (*Confidentiality and Announcements*) of the **DC General Terms and Conditions** the **Service Provider** consents to **NGESO** publishing all **Relevant Data**, **DC Operational Data** and **DC Performance Data** on its website in a non-anonymised format.

Delivery Failure Report

15.7 Where in relation to any one or more **Settlement Periods** in a **DC Service Period** the **Availability Payment** calculated for a **Service Provider** is affected by an active K factor (as more particularly described in Schedule 2), then no later than five (5) **Business Days** following request from **NGESO** the **Service Provider** shall provide to **NGESO** a report in writing (in such form as **NGESO** may reasonably require) setting out in reasonable detail an explanation for the underlying performance of the relevant **Response Unit(**s) attributed to such K factor.

16. ABSVD

For the purposes of the **ABSVD Methodology Statement**, the **Service Provider** hereby consents (where applicable for and on behalf of the **Lead Party** of all **relevant BM Units**) to all and any energy volumes associated with delivery of **Response** pursuant to these **DC Service Terms** not being included within the **Applicable Balancing Services Volume Data** save where the **Response Unit** is **BM Participating** in which case energy volumes will be included within the **Applicable Balancing Services Volume Data.**

17. Transfer of DC Response Contracts

17.1 At any time during the subsistence of a **DC Response Contract**, a **Service Provider** ("the **Primary Service Provider**") may nominate another **Registered DC Participant** ("the **Secondary Service Provider**") to discharge its obligations to **NGESO** with respect to the delivery of **Response** in **DC Service Day**(s) pursuant to that **DC Response Contract**.

17.2 The effect of any such nomination once validated by **NGESO** pursuant to this paragraph 17 is to treat delivery of **Response** from one or more **Response Units** registered to the **Secondary Service Provider** as if delivered by the **Primary Service Provider** from its **Response Unit** for the purposes of these **DC Service Terms**.

17.3 No nomination shall be valid unless:-

i. both entitles are **Registered DC Participants**;

ii. the **Secondary Service Provider** has **Eligible Assets** which are **Registered** to it and allocated to one or more **Response Units** pursuant to the **DC Participation Guidance Document** with sufficient aggregate **Registered Quantity** and proven capability to deliver **Dynamic Containment** to enable the **DC Response Contract** to be discharged during the applicable **DC Service Day**(s);

iii. the specified **Transfer Period** during which the nomination is to be effective is a period which comprises the entire **DC Service Day** created by a subsisting **DC Response Contract** to which the **Primary Service Provider** is a party; and

iv. the nomination is validly notified to **NGESO** pursuant to sub-paragraphs 17.4, 17.5 and 17.6 and the **Transfer Notice** validated by **NGESO**.

Transfer Notices

17.4 Each nomination shall be notified to **NGESO** by the **Primary Service Provider** by no later than one (1) hour prior to commencement of the applicable **DC Service Day**, and each such nomination is referred to in these **DC Service Terms** as a "**Transfer Notice**".

17.5 Unless otherwise stipulated in the **DC Participation Guidance Document**, each **Transfer Notice** shall comprise the entirety of a **DC Service Day**, and shall specify:-

i. the identity of the **Primary Service Provider** and **Response Unit**; and

ii. the identity of the **Secondary Service Provider** and its **Response Unit**(s) and **Eligible Assets**.

17.6 Each nomination shall comprise the entire **Contracted Quantity** associated with the **DC Response Contract** during the relevant **Transfer Period**, and for the avoidance of doubt the **Contracted Quantity** shall not be capable of being split amongst two or more **Secondary Service Providers**.

17.7 In giving a **Transfer Notice**, the **Primary Service Provider** warrants that the **Secondary Service Provider** accepts the nomination.

17.8 **NGESO** shall notify the **Primary Service Provider** as soon as reasonably practicable following receipt of the **Transfer Notice** whether or not the **Transfer Notice** has been validated. In the absence of any notification by **NGESO** of validation of the **Transfer Notice** by commencement of the relevant **DC Service Day** the **Transfer Notice** shall be deemed not to have been validated.

17.9 Where in **NGESO**'s reasonable opinion the delivery of **Response** pursuant to the **DC Response Contract** during the **Transfer Period** by the **Secondary Service Provider**'s designated **Response Unit(s)** would or might endanger operational security within the meaning of the **System Operator Guidelines**, then **NGESO** shall so notify both **Registered DC Participants** whereupon the **Transfer Notice** shall be deemed withdrawn.

17.10 A **Transfer Notice** shall be invalid if the **Secondary Service Provider'**s designated **Response Unit** or any **Eligible Asset** allocated to it is the subject of a **DC Response Contract** for the same **DC Service Day**, in which case **NGESO** shall so notify both whereupon the **Transfer Notice** shall be deemed withdrawn.

Cancellation Notice

17.11 A **Transfer Notice** may be cancelled by the **Primary Service Provider** (but not under any circumstances by the **Secondary Service Provider**) by notification to **NGESO** in writing ("**Cancellation Notice**") specifying the date and time form which the cancellation is to be effective.

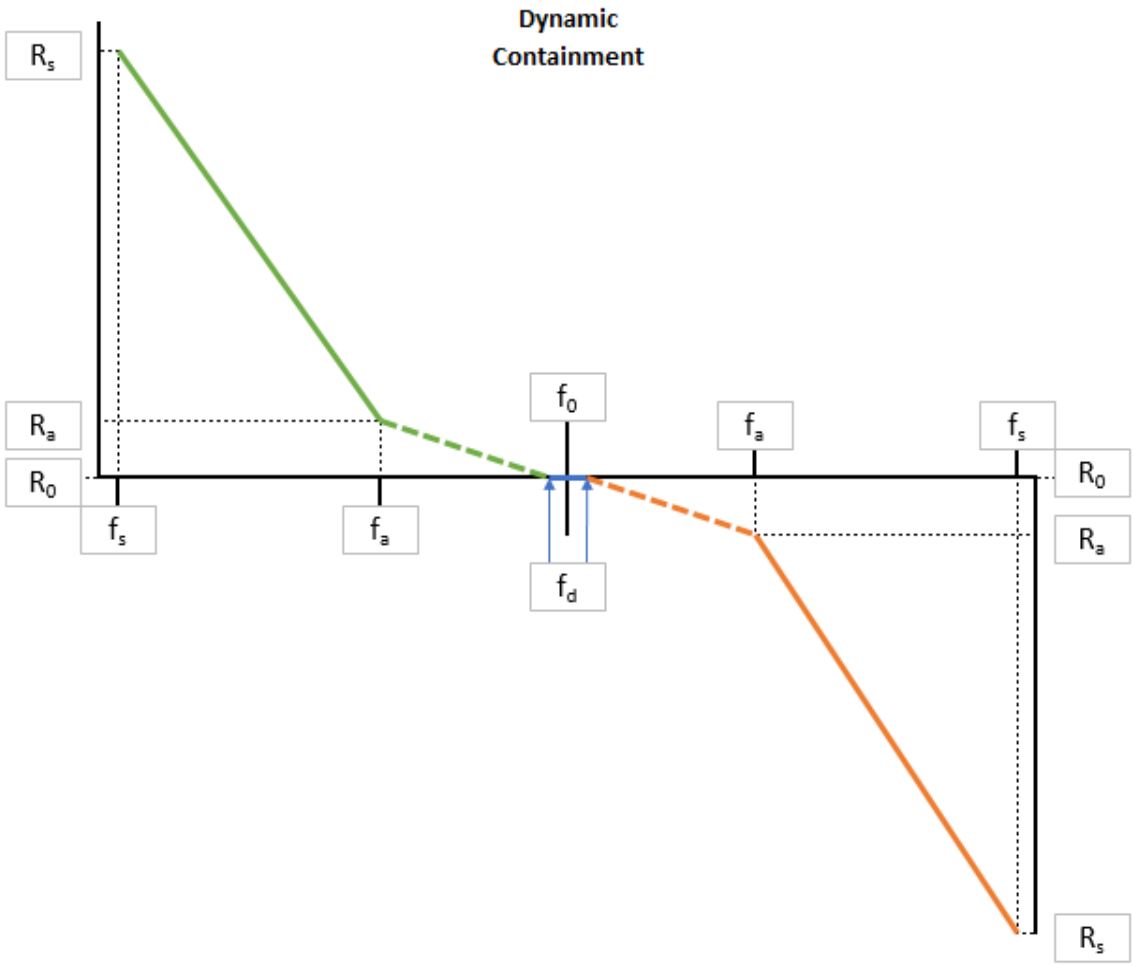
Effect of Transfer Notice

17.12 For the duration of each **Transfer Period** (or any earlier period where the **Transfer Period** comes to an end pursuant to the foregoing provisions) and subject always to paragraph 17.12, **NGESO** consents to the **Primary Service Provider**'s obligation to deliver **Response** pursuant to the relevant **DC Response Contract** being discharged on its behalf by the **Secondary Service Provider** from its **Response Unit(s)**.

Form of notifications

17.13 All **Transfer Notices** and **Cancellation Notices** and other notifications related thereto between the **Parties** referred to in this paragraph 17 shall be made using the method of communication specified from time to time by **NGESO**.

SCHEDULE 1– CAPABILITY DATA TABLES



Service parameters

The service parameters below are included solely for the interpretation and understanding of the above tables and the formulae in Schedule 2. In the event of any conflict or inconsistency between these service parameters and terminology used or defined elsewhere in the **DC Procurement Documents**, the former shall prevail.

Parameter	Description	I.D	Value (possible range)	Comment
Nominal frequency	Statutory system frequency for GB	f_n	50 Hz	

Parameter	Description	I.D	Value (possible range)	Comment
Target frequency	System frequency that NGESO aims to achieve	f_0	50 Hz	Principle is that NGESO can choose to run high/low for limited periods as part of cost vs risk operation. For example, during high-ramp periods.
Dead-band frequency range	Frequency range over which the service does not deliver	f_d	f_0 - 0.015Hz to f_0 + 0.015Hz	This has been specified to align with SOGL Article 154, Annex 5. Active power delivery will commence at f_d
Knee-point frequency	Frequency set point which defines the beginning of the delivery curve	f_a	f_n +/- 0.2 Hz	The knee point describes where delivery of the service begins.
Full delivery frequency (saturation)	Frequency set point at which the service must deliver full contracted quantity ($Q_{contract}(h,l)$)	f_s	f_n +/- 0.5 Hz	At this frequency set point the service must deliver the full contracted quantity.
Quantity at target and deadband	The percentage amount of $Q_{contract}$ to be delivered at f_0 and f_d	R_0	0 %	
Quantity at knee-point	The percentage amount of $Q_{contract}$ to be delivered at f_a	R_a	5 %	The delivery profile is linear between f_d and f_a
Quantity at saturation	The percentage amount of $Q_{contract}$ to be delivered at f_s	R_s	100 %	At the full delivery frequency the service must deliver 100 % of the contracted quantity.
Contracted quantity	The amount of service that a provider is contracted to deliver. Can be either high or low frequency, or both.	$Q_{contract}(h,l)$	Min 1MW	h refers to contracted quantity for high frequency service. l refers to contracted quantity for low service. This is the **Contracted Quantity** as defined in the **DC Glossary**.
Contracted LF quantity	The quantity of LF service that a provider is contracted to deliver	P	Min 1MW	Is equivalent to $Q_{contract}(l)$
Contracted HF quantity	The quantity of HF service that a provider is contracted to deliver	Q	Min 1MW	Is equivalent to $Q_{contract}(h)$
Delivery duration	Time that an energy limited provider must be capable of sustained delivery of $Q_{contract}(h,l)$	T_{sus}	15 minutes	Initial investigation suggests maximum event duration is ~5mins, initial value aligned with SOGL Article 127 Annex 3.
Response energy volume	The volume of stored energy required to be delivered before State of Energy management is	$V_{maxC(h,l)}$	= (T_{sus} / 60) x $Q_{contract}$ MWh	This is NOT the maximum energy volume that could be delivered over the duration of a **DC Service Day**.

Parameter	Description	I.D	Value (possible range)	Comment
	required to avoid unavailability			
Energy recovery	The minimum volume of energy recovery possible (by submission of Operational Baseline) in a single settlement period. As a percentage of $V_{maxC(h,l)}$	$V_{rec(h,l)}$	20%	Applicable only to energy limited providers. This equates to 3 minutes of energy when T_{sus} is 15 minutes.
Max initiation time	The maximum time between a change in frequency and change in the delivery of response	T_{iMAX}	0.5 s	The provider must begin their response to a change in frequency between 0.25 s and 0.5 s after the deviation occurred.
Min time to full delivery	The minimum time between frequency deviation occurring and delivery of the saturation quantity (R_s)	T_{dMIN}	0.5 s	For a change in frequency that requires a change in response from 0 to R_s, this is the minimum time it should take.
Max time to full delivery	The maximum time between frequency deviation occurring and delivery of the saturation quantity (R_s)	T_{dMAX}	1.0 s	For a change in frequency that requires a change in response from 0 to R_s, this is the maximum time it should take.
Ramp time lower bound	The lower time bound of start of delivery to delivery of full contracted quantity	tr_{min}	0.25 s	Equivalent to $(T_{dMIN} - T_{iMIN})$. If the provider initiates response at earliest possible time, this is the shortest duration that they can reach saturation quantity (R_s) output after initiation at the min initiation time.
Ramp time upper bound	The upper time bound of start of delivery to delivery of full contracted quantity	tr_{max}	0.5 s	Equivalent to $(T_{dMAX} - T_{iMAX})$. If the provider initiates response at latest possible time, this is the longest duration that a response unit can reach saturation quantity (R_s) output after initiation at the max initiation time.
Min ramp rate for Response delivery (MW)	The slowest ramp rate acceptable between change in response delivery at the max initiation time, and reaching saturation quantity (R_s)	Min_{Ramp}	R_s / tr_{max}	This can be calculated for a 100 MW saturation quantity (R_s) it is equal to: 100 MW / 0.5s or 200 MW per second.
Max ramp rate for Response delivery (MW)	The fastest ramp rate acceptable between change in response delivery at the min initiation time, and	Max_{Ramp}	R_s / tr_{min}	This can be calculated for a 100MW saturation quantity (R_s) it is equal to: 100 MW / 0.25s or 400 MW per second.

Parameter	Description	I.D	Value (possible range)	Comment
	reaching saturation quantity (R_s)			
Maximum ramp rate for Baselines	The maximum ramp rate per minute permitted at any point within a baseline submitted by an energy limited provider as a percentage of contracted quantity $Q_{contract}(h,l)$	$RR_{bp(h.l)}$	5% per minute	The ramp rate limit can be calculated from the contracted quantity. There will be a different maximum ramp rate if the volumes of high/low response are different – please see the DC Participation Guidance. Document
Error tolerance for full payment	The response error up to and including where no performance payment penalties are applied.	A	0.03	This is an error of 3% of contracted quantity. See Schedule 2.
Error limit for zero payment	The response error at and above which performance payment penalties are 100%.	B	0.07	This is an error of 7% of contracted quantity (with linear interpolation of penalties between 3% and 7%) See Schedule 2.

SCHEDULE 2 - AVAILABILITY PAYMENTS

Calculation of Settlement Value

The payment formula is:

$$Si_e = \left(\sum_{j}^{\text{Service Day}} \text{Round}\left(\text{Pij}_e \text{ x Vij}_e, 2\right) \text{ x Fij}_e \right) \text{x } K_e$$

Where

- Si_e is the settlement value for **Dynamic Containment** calculated in respect of **Response Unit** *i* for the relevant **DC Service Day** *e*
- $\sum j$ is the summation over the **Settlement Period** *j* in the relevant **DC Service Day** *e*
- Pij_e is the applicable **DC Bid Price**, in GBP/MW/h, in respect of **Response Unit** *i*, and **Settlement Period** *j,* for the relevant **DC Service Day** *e*
- Vij_e is the **Contracted Quantity** in megawatts, in respect of **Response Unit** *i* and **Settlement Period** *j,* for the relevant **DC Service Day** *e*
- Fij_e is zero where there is any period or periods of unavailability within **Settlement Period** *j* during the relevant **DC Service Day** *e*, otherwise is 1
- K_e is defined in the remainder of this Schedule 2 below.

The performance monitoring scheme for **Dynamic Containment** adjusts the value calculated for a **DC Service Day** by a factor K based on the worst of the performance scores in that **DC Service Day**. Performance scores are described below, calculated using performance bounds to represent valid response delivery. Performance bounds are a pair of time series that enclose possible valid dynamic containment delivery profiles – this accounts for different lag times and ramp rate between services.

NGESO may at its sole discretion (but shall not be obliged to) ignore a performance score when determining factor K in the calculation of the settlement value for any particular **DC Service Day**:-

(i) where the **Response Unit** in question is **Energy Limited,** and the performance monitoring error in question arose due to inadequate **State of Energy** in circumstances where the **Service Provider** was compliant in all respects with the **State of Energy** management rules in paragraph 6.11; or

(ii) where that **DC Service Day** falls in a 'grace period' to which **NGESO** has given its prior agreement in writing (which shall not exceed fourteen (14) consecutive days) to recognise on-boarding by the relevant **Service Provider** of control systems and other IS interfaces necessary for the delivery and monitoring of **Dynamic Containment**.

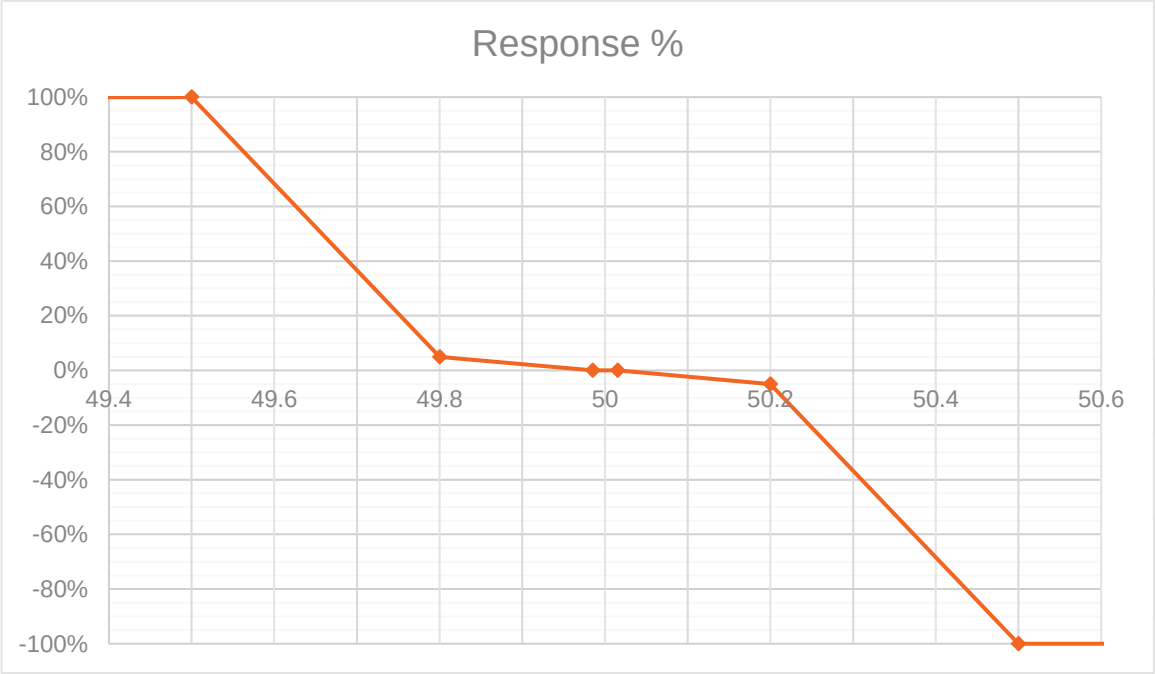
Metered response is derived from **DC Operational Data** and **DC Performance Data** for the relevant **Response Unit** obtained by **NGESO** pursuant to paragraph 15 of these **DC Service Terms**.

Determination of K factor

Response Curve

The **Dynamic Containment** response curve is defined as the linear interpolation between 6 pairs of frequency and response % delivery.

Saturation	$f_{S\pm} = f_0 \pm 0.5 \text{ Hz}$	$R_{S\pm} = \mp 100\%$
Activation	$f_{A\pm} = f_0 \pm 0.2 \text{ Hz}$	$R_{A\pm} = \mp 5\%$
Delivery/deadband	$f_{D\pm} = f_0 \pm 0.015 \text{ Hz}$	$R_{D\pm} = 0\%$



$$R_{sym}(f) = \begin{cases} R_{S-} & : f < f_{S-} \\ R_{A-} + \dfrac{R_{S-} - R_{A-}}{f_{S-} - f_{A-}} \times (f - f_{A-}) & : f_{S-} \le f < f_{A-} \\ \dfrac{R_{A-}}{f_{A-} - f_{D-}} \times (f - f_{D-}) & : f_{A-} \le f < f_{D-} \\ 0 & : f_{D-} \le f < f_{D+} \\ \dfrac{R_{A+}}{f_{A+} - f_{D+}} \times (f - f_{D+}) & : f_{D+} \le f < f_{A+} \\ R_{A+} + \dfrac{R_{S+} - R_{A+}}{f_{S+} - f_{A+}} \times (f - f_{A+}) & : f_{A+} \le f < f_{S+} \\ R_{S+} & : f_{S+} \le f \end{cases}$$

These are the equations for LF and HF only containment response curves.

$$R_{LF}(f) = \begin{cases} R_{S-} & : f < f_{S-} \\ R_{A-} + \dfrac{R_{S-} - R_{A-}}{f_{S-} - f_{A-}} \times (f - f_{A-}) & : f_{S-} \le f < f_{A-} \\ \dfrac{R_{A-}}{f_{A-} - f_{D-}} \times (f - f_{D-}) & : f_{A-} \le f < f_{D-} \\ 0 & : f_{D-} \le f \end{cases}$$

$$R_{HF}(f) = \begin{cases} 0 & : f < f_{D+} \\ \dfrac{R_{A+}}{f_{A+} - f_{D+}} \times (f - f_{D+}) & : f_{D+} \le f < f_{A+} \\ R_{A+} + \dfrac{R_{S+} - R_{A+}}{f_{S+} - f_{A+}} \times (f - f_{A+}) & : f_{A+} \le f < f_{S+} \\ R_{S+} & : f_{S+} \le f \end{cases}$$

Lags and ramp limits

Lag lower bound (minimum initiation time): $\mathrm{T_{iMIN}} = 0.25\ s$

Lag lower bound tolerance: $tol_{iMIN} = 0.05\ s$

Lag upper bound (maximum initiation time): $\mathrm{T_{iMAX}} = 0.50\ s$

Lag upper bound tolerance: $tol_{iMAX} = 0.05\ s$

Ramp time lower bound: $tr_{min} = \mathrm{T_{dMIN}} - \mathrm{T_{iMIN}} = 0.25\ s$

Ramp time upper bound: $tr_{max} = \mathrm{T_{dMAX}} - \mathrm{T_{iMAX}} = 0.50s$

Ramp rate (proportional) upper bound: $rr_{max} = \frac{1}{tr_{min}} = 4\ s^{-1}$

Ramp rate (proportional) lower bound: $rr_{min} = \frac{1}{tr_{max}} = 2\ s^{-1}$

Performance bounds definition

Frequency bounds

The frequency bounds are used in the definition of the performance bounds. The upper and lower frequency bounds describe the highest and lowest frequencies that can be found within the minimum to maximum lag window.

Upper frequency band at time t:

$$F^{upper}(t) = \max_{\mathrm{T_{iMIN}} - tol_{iMIN} \le t_{lag} \le \mathrm{T_{iMAX}} + tol_{iMAX}} f(t - t_{lag})$$

Lower frequency band at time t:

$$F^{lower}(t) = \min_{\mathrm{T_{iMIN}} - tol_{iMIN} \le t_{lag} \le \mathrm{T_{iMAX}} + tol_{iMAX}} f(t - t_{lag})$$

Where $f(t)$ is the **Input Frequency** at time *t*.

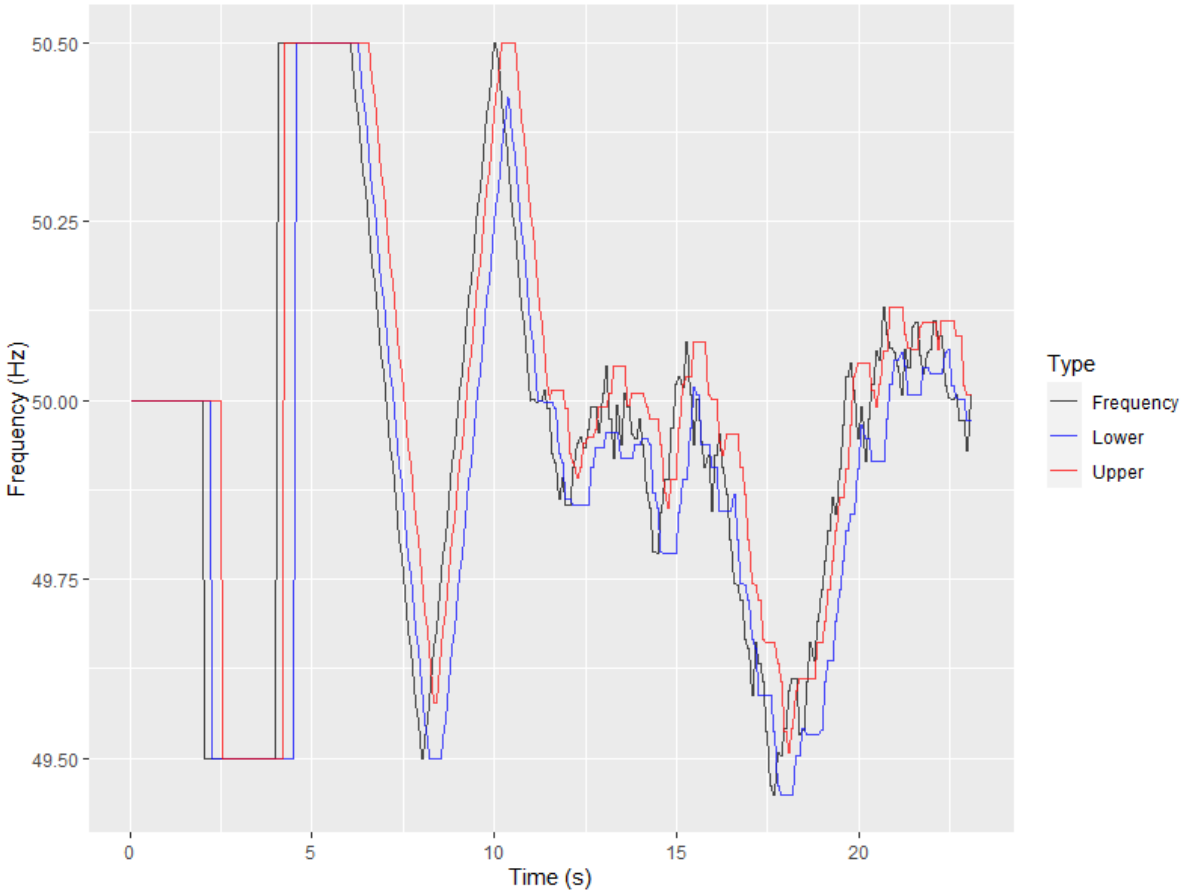


Figure 1: Example of frequency bounds calculation

Ramp limits

Ramp limits are applied to the response curves used in the calculation of the performance bounds. The ramp limits are defined as limits to the rate of change of response.

Ramp limit for function $R(t)$ with upper and lower ramp limits r_u and r_l:

$$RL(R(t), r_u, r_l) = \begin{cases} RL_{prev} - r_l \times \Delta t & R(t) < RL_{prev} - r_l \times \Delta t \\ RL_{prev} + r_u \times \Delta t & R(t) > RL_{prev} + r_u \times \Delta t \\ R(t) & \text{otherwise} \end{cases}$$

Where $RL_{prev} = RL(R(t - \Delta t), r_u, r_l)$

Performance bounds

The upper bound $UB(t)$ is the response curve applied to the lower lagged frequency, with the slow ramp limit applied when decreasing and the fast ramp limit applied when increasing.

The lower bound $LB(t)$ is the response curve applied to the upper lagged frequency, with the slow ramp limit applied when increasing and the fast ramp limit applied when decreasing.

Performance bounds for symmetric LF and HF

$$UB_{sym}(t) = RL\left(P \times R_{sym}\left(F^{lower}(t)\right), P \times rr_{max}, P \times rr_{min} \right)$$

$$LB_{sym}(t) = RL\left(P \times R_{sym}\left(F^{upper}(t)\right), P \times rr_{min}, P \times rr_{max} \right)$$

Performance bounds for LF only

$$UB_{LF}(t) = RL\left(P \times R_{LF}\left(F^{lower}(t)\right), P \times rr_{max}, P \times rr_{min} \right)$$

$$LB_{LF}(t) = RL\left(P \times R_{LF}\left(F^{upper}(t)\right), P \times rr_{min}, P \times rr_{max} \right)$$

Performance bounds for HF only

$$UB_{HF}(t) = RL\left(Q \times R_{HF}\left(F^{lower}(t)\right), Q \times rr_{max}, Q \times rr_{min} \right)$$

$$LB_{HF}(t) = RL\left(Q \times R_{HF}\left(F^{upper}(t)\right), Q \times rr_{min}, Q \times rr_{max} \right)$$

Performance bounds for asymmetric LF and HF

If P > Q:

$$UB_{asym}(t) = RL\left(M \times R_{LF}\left(F^{lower}(t)\right), M \times rr_{max}, M \times rr_{min} \right) + RL\left(Q \times R_{sym}\left(F^{lower}(t)\right), Q \times rr_{max}, Q \times rr_{min} \right)$$

$$LB_{asym}(t) = RL\left(M \times R_{LF}\left(F^{upper}(t)\right), M \times rr_{min}, M \times rr_{max} \right) + RL\left(Q \times R_{sym}\left(F^{upper}(t)\right), Q \times rr_{min}, Q \times rr_{max} \right)$$

Where M = P - Q

If Q > P:

$$UB_{asym}(t) = RL\left(P \times R_{sym}\left(F^{lower}(t)\right), P \times rr_{max}, P \times rr_{min} \right) + RL\left(N \times R_{HF}\left(F^{lower}(t)\right), N \times rr_{max}, N \times rr_{min} \right)$$

$$LB_{asym}(t) = RL\left(P \times R_{sym}\left(F^{upper}(t)\right), P \times rr_{min}, P \times rr_{max} \right) + RL\left(N \times R_{HF}\left(F^{upper}(t)\right), N \times rr_{min}, N \times rr_{max} \right)$$

Where N = Q - P

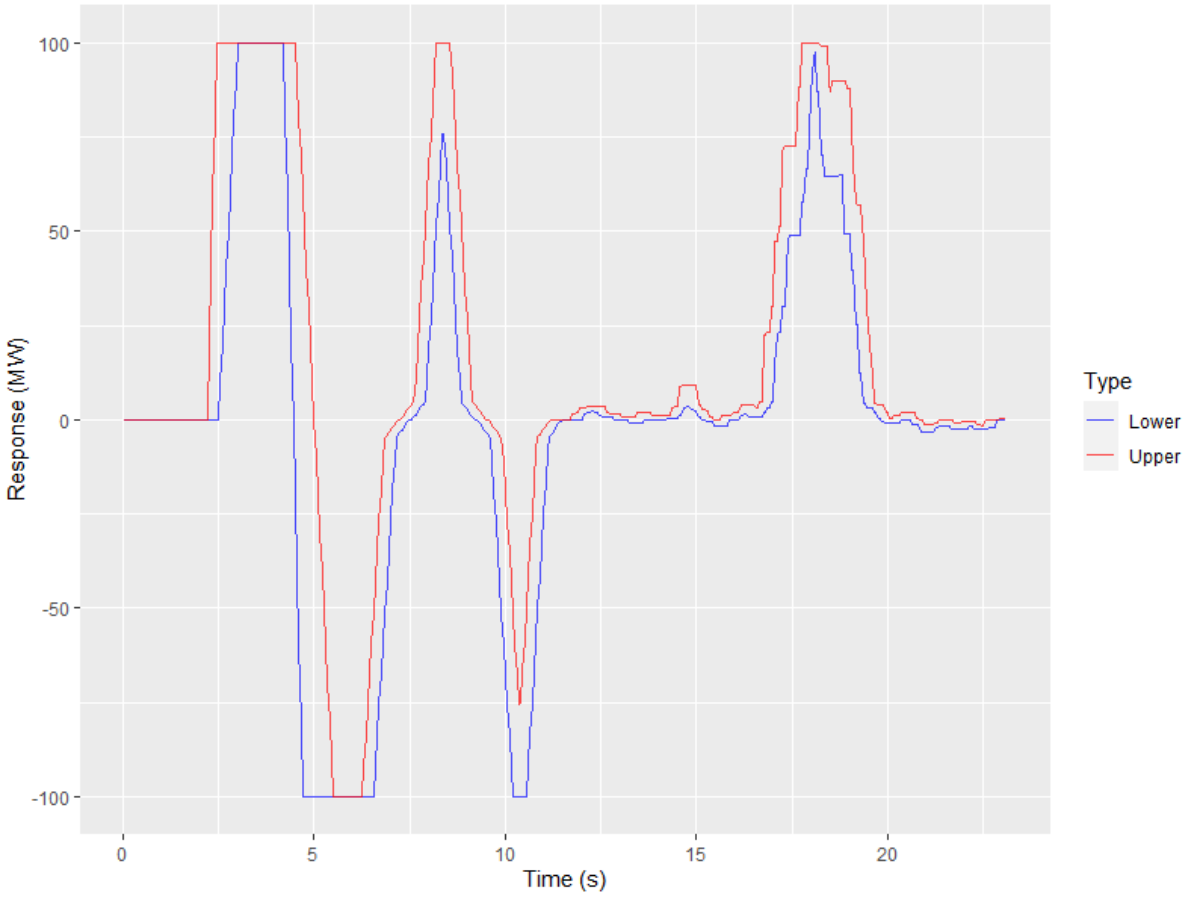


Figure 2: Example of symmetric performance bounds calculation using the frequency bounds from figure 1

Error calculation

The performance monitoring error is zero if the metered response is between the upper and lower performance bounds and is otherwise the difference between the metered response and the closer of the performance bounds.

The error e_m for one time measurement and metered response R:

$$e_m = \begin{cases} LB - R & R < LB \\ 0 & LB \leq R \leq UB \\ R - UB & R > UB \end{cases}$$

Scaled error es_m for one measurement:

For P > 0, Q = 0:

$$es_m = \frac{e_m}{P}$$

For Q > 0, P = 0:

$$es_m = \frac{e_m}{Q}$$

For P > 0, Q > 0:

$$es_m = \begin{cases} \frac{e_m}{Q} & F^{lower}{}_m > 50 \\ \frac{e_m}{P} & F^{upper}{}_m < 50 \\ \frac{e_m}{\max(P,Q)} & \text{otherwise} \end{cases}$$

The performance score for a **Settlement Period** is:

$$E = \max_m \left(\underset{\text{over 0.2 seconds}}{\text{rolling\_minimum}}\ es_m \right)$$

This is used to derive a K factor for **Settlement Period** j, being:

$$K_j = \begin{cases} 1 & E < A \\ 1 - (E - A)/(B - A) & A \le E \le B \\ 0 & E > B \end{cases}$$

Where $A = 0.03$ and $B = 0.07$

Where the K factor for the **DC Service Day** is:

$$K_e = \min_j K_j$$

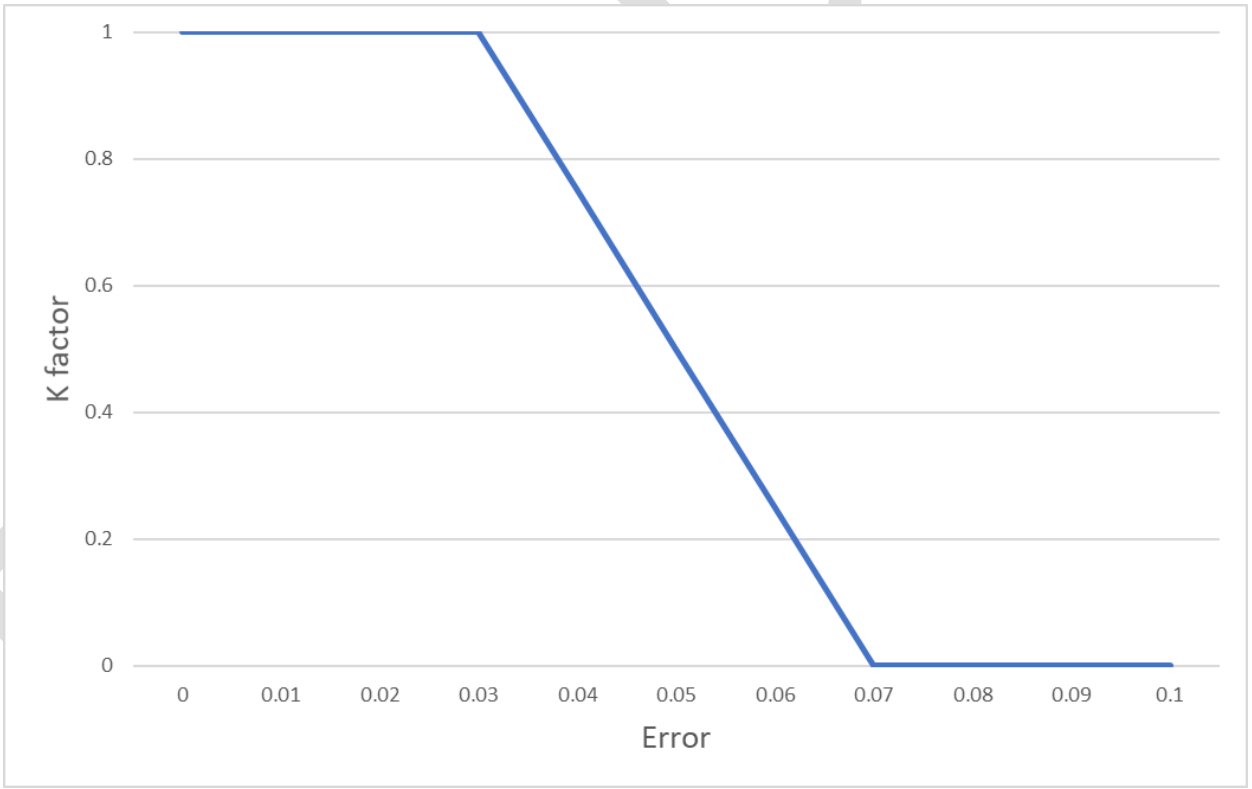


Figure 3: Payment adjustment (K factor) curve