

Dynamic Containment Participation Guidance Document

Introduction

This guidance document should be read in conjunction with the following documentation which is available on the NGESO website:

- Form A (Provider Registration)
- Form B (Dynamic Containment)
- Form C (Dynamic Containment)
- Dynamic Containment Service Terms
- Dynamic Containment General Terms and Conditions
- Dynamic Containment Glossary of Terms
- Dynamic Containment Tender Rules
- Dynamic Containment Testing Documents
 - DC Testing Guidelines
 - DC Testing Analysis Tool – user guide
 - DC Testing Analysis Tool

Version	Effective Date	Change	Page
1.0	01/10/2020	Version 1	
Consultation Draft Dec 2020	TBC	Summarised in consultation letter	

Version (February 2021 Draft)

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Overview of Dynamic Containment Requirements

This document provides an overview of the Dynamic Containment (DC) service and information designed to assist those who wish to become service providers.

Service Parameters

The parameters are described more fully in the Tender Rules and the Service Terms, but the key elements of the DC service are:

- Designed to help contain both upwards and downward frequency excursions
- Automatic activation, from either generation or demand, or energy limited (e.g. battery) assets
- Operational baselines to be notified in advance of real time
- Min 1MW of response capacity per Response Unit.
- Tenders may only be submitted in whole MWs.
- Service delivery to be across a full EFA Day, with payment for service availability (£/MW/h)
- No settlement of energy delivered
- Procured separately for low and high frequency DC
- BM or Non-BM Participating assets
- Energy limited assets to comply with “state of energy” management rules
- Aggregation possible where assets behind same GSP (transitional arrangements in place for GSP Group)
- Service providers to have the necessary data transfer capabilities to provide both operational and performance data

Transitional arrangements are in place for soft launch, which are outlined at the end of this document.

Acknowledging the complexity of describing this service via formulae and definitions we have provided a ‘plain English’ description of Dynamic Containment below.

A Response Unit should respond continuously and proportionally to frequency as it deviates from the target (50.0Hz). The requirements below describe the essential features of the DC service. They are integrated into the service description and payment formulae in the schedules to the Service Terms, and also feature in the requirements set out in the DC Testing Guidelines.

At each point of system frequency between 49.5Hz and 50.5Hz there is a target quantity of power delivery for each Response Unit (expressed as a percentage of its contracted quantity MW):-

- 100% at +/- 0.5Hz
- 5% at +/- 0.2Hz
- 0% at +/- 0.015Hz
- 0% at 50Hz
- Linear progression between all points above

At 0.5Hz deviation the full contracted quantity should be delivered within one second of the deviation occurring.

For example, NGENSO expects full contracted quantity to be delivered no later than 1 second after a step-change in frequency from 50Hz to 49.5Hz. However, in all but the most extreme events frequency does not move in step-changes like this. It could be said (when measuring at each 50ms) that frequency moves in a continuous series of small step-changes. i.e. from 50.00Hz, 49.99Hz, 49.98Hz etc

As frequency is continually moving/deviating:-

- NGENSO does not expect to see any change in response power delivery before 0.25 seconds after the deviation occurring.
- NGENSO must however see some change in response power delivery up to and including 0.5 seconds after the deviation occurring.

The acceptable rate of response delivery therefore depends on when the Response Unit begins to respond:-

- A slower rate is possible if response begins at 0.25 seconds after the deviation occurring.
- A faster rate may be required if response begins as late as 0.5 seconds after the deviation occurring.
- This is because in both cases (and any point in between) the rate must be sufficient to reach full contracted quantity within 1 second after the deviation occurring.
- Acceptable ramp rates can vary between:
 - Infinite if the response delivery both begins and ends at 0.5 seconds after the deviation occurring.
 - 133% of contracted quantity per second if the response begins at 0.25 seconds after the deviation occurring.
- The ramp rate of the response delivery is acceptable as long as the response is slower than a 0.2 seconds delay with the 400% ramp rate, and faster than a 0.55 seconds delay with the 200% ramp rate. A consistent delay and ramp rate is not required.

Registration

For a participant to register as a potential provider of DC, it must become a Registered Service Provider and accede to the DC contract documentation.

Once registration is complete, a Registered Service Provider may then submit assets under its operation or control for registration with NGENSO as Eligible Assets. Once validated, Eligible Assets may be allocated by the Registered Service Provider to Response Units, which can be tendered into the DC procurement process.

This section outlines the registration process and associated timings. Whilst it is important that participants allow sufficient time to register and prepare for participation, NGENSO will endeavor to allow participants some flexibility on timescales in relation to the soft launch period of delivery where practicable.

Submitting Forms A & B

To become a Registered Service Provider for DC, a participant must submit fully complete and correct Forms A & B to commercial.operation@nationalgrideso.com.

Forms A and B templates are published alongside this document and word versions can be requested from your account manager or contact the above email account prior to any formal submission.

For parties who wish to register on behalf of multiple SPVs (special purpose vehicles), the “related entities” sections of Forms A & B can be used.

Receiving Form C

Form C is completed by NGENSO and provides confirmation that the participant is now considered a Registered Service Provider for DC. This is not indicative of any commitment on the part of NGENSO to procure or pay for DC.

Once in receipt of Form C, a Registered Service Provider is entitled to register Eligible Assets under its operation or control, and to allocate those Eligible Assets to Response Units, in accordance with the process described below, following which Response Units may then be tendered for DC service delivery.

Timelines Forms A, B & C

Activity	Provider	NGESO
Submission Form A & B	3 business days prior to submission of first tender submission.	N/A
Form B Validation	N/A	Up to 3 business days to assess and issue Form C or request further clarifications

Registering Eligible Assets & Allocation to Response Units

Registered Service Providers must register their Eligible Assets with NGENSO using the “DC Provider Data Template”

that is published alongside this document. This template contains all the necessary information for NGENSO to validate the eligibility of assets for participation in the DC service.

The Provider Data Template must be submitted, fully complete and correct, by email to accounts outlined in the instructions page of the template.

For any new Eligible Assets, any submission must be accompanied by a testing approval report, which must be completed by an Independent Technical Expert (ITE), as described in the Testing section which follows.

Once registered, an Eligible Asset may be allocated to a Response Unit. This process is also completed through the DC Provider Data Template. Please note, a single Eligible Asset must still be allocated to a Response Unit to participate.

Every Response Unit registered onto NGENSO’s system must have at least one Eligible Asset allocated to be capable of tendering for DC. A Response Unit can only have allocated to it multiple Eligible Assets if they are all located within the same Grid Supply Point, except where transitional arrangements apply.

Initial registrations must be completed in line with the timings outlined below:

Activity	Provider	NGESO
Initial Registration of Eligible Assets	13 calendar days before any intended allocation activity, although NGENSO will endeavor to process applications submitted after this time.	If the 13 calendar days’ notice is given, deemed accepted upon submission, subject to errors and/or incomplete data Otherwise, NGENSO will notify the Registered Service Provider if it can accept the registration in time for the intended allocation activity
Allocation of Eligible Assets to Response Units	Allocation can only occur on a weekly basis and must be sent to NGENSO in the “market window” on a Tuesday via the DC Provider Data Template (see further below)	Deemed accepted upon submission, subject to errors and/or incomplete data

If Registered Service Providers wish to change the registration and/or allocation of Eligible Assets to a Response Unit, including increasing the response capacity of an existing Eligible Asset, this must be done by submitting an updated DC Provider Data Template, in line with the timelines outlined above. Any increase in capacity of an existing Eligible Asset must be accompanied by a testing approval report in the same manner as for new Eligible Assets.

All relevant asset and participant details will be captured through the DC Provider Data Template.

NGESO reserves the right to inform Registered Service Providers in writing (via email) that an Eligible Asset has been de-registered (in accordance with the Tender Rules).

DC Provider Data Template

This document is the file which should be submitted by a Registered DC Participant and contains all the relevant information regarding Eligible Assets and facilitates any allocations/re-allocations across a participant’s Response Units.

Please note that Provider Data Template submissions are only processed by NGENSO on a weekly basis, and can only therefore be submitted in the stipulated daily “market window” ending on Tuesday each week. The market window is the period from 15:00 hours on a calendar day to 10:00 hours on the next calendar day (and where this document refers to a market window for a particular calendar day, unless otherwise indicated that is a reference to the market window which ends on that day). Any submissions from Registered DC Participants received outside this market window will be rejected, and so will not be applicable, and must be resubmitted in the next following Tuesday market window. For the avoidance of doubt a Provider Data Template is not required to be sent every week. Once validly submitted this file is only required to be updated should any information change.

Note this process differs to the DC Tender Template, which may be revised on a daily basis as described below.

The DC Provider Template must be submitted to DC.Submissions@nationalgrideso.com and no other NGENSO email account. File naming format/email subject conventions must follow the guidance outlined in the Instructions page of this template. Please note that only the DC Tender template or DC Provider Data template should be submitted to this account and during the specified Market Windows. All other queries and communications shall continue through a providers account manager or commercial.operation@nationalgrideso.com

Tenders

This section outlines the process for submitting DC Tenders and associated timescales.

Tender Submissions

Once Eligible Assets are registered and allocated to Response Units via the DC Provider Data Template, a Registered Service Provider may participate in the DC tender process.

A Registered Service Provider may tender its Response Units for DC service delivery by submitting the required tender parameters to NGENSO using the separate "DC Tender Template" published alongside this document.

All tenders must be submitted in the Tuesday market window. Failure to do so will mean a party must wait until the following week to participate.

A tender can be for any of the seven service (EFA) days commencing at 23.00 hours on that Tuesday evening. Whilst a tender may be submitted in respect of any Response Unit for more than one of those service days, multiple tenders may not be submitted in respect of any Response Unit for the same service day except where mutually exclusive (ie one tender is for LF-low and the other for LF-high).

Consistent with daily procurement, NGENSO has introduced the ability for Registered Service Providers to update their weekly tendered prices, increase/reduce MW submissions and withdraw participation on a daily basis. This can only be done by revisions to the prevailing Tuesday tender submission, to be made in any subsequent market window prior to the start of the relevant service day. A Registered Service Provider may not, however, revise its Tuesday tender submission to include a new tender for a service day which was not previously included. For the avoidance of doubt daily revisions can only update prices, amend MW values (in line with tested capacity) or withdraw a tender for a Response unit for the entirety of a service day, and the updated submission must restate all other tender details.

Each Tuesday tender submission, and any revisions to it, shall reflect and be consistent with the Eligible Asset and Response Unit registration details shown on the prevailing Provider Data Template. Therefore, any increase in MW submission should not be made until the DC Provider Data Template has been updated (accompanied by a testing approval report) and accepted to record any new Eligible Assets or increased MW capacity of an existing Eligible Asset, in accordance with the weekly process described above.

Incomplete/inaccurate or modified submission structures will be rejected. Further details on the timing and content of tenders are contained in the Tender Rules. The above shall apply unless otherwise stipulated in the Transitional Arrangements outlined at the end of this document.

DC Tender Template

All DC Tender Templates must be submitted to DC.Submissions@nationalgrideso.com and no other NGENSO email account. File naming format conventions must follow the guidance outlined in the Instructions page of this document. Please note that only the DC Tender template or DC Provider Data template should be submitted to this account and during the specified windows. All other queries and communications shall continue through a parties account manager or commercial.operation@nationalgrideso.com

Testing

All assets seeking to participate in DC as Eligible Assets will be required to pass testing prior to registration via the DC Provider Data Template. Aligned with our other frequency products, testing will be the responsibility of the Registered Service Provider and subject as provided below should be undertaken/verified by an Independent Technical Expert (ITE). Registered Service Providers should refer to the accompanying document DC Testing Guidelines, DC Testing Analysis Tool User Guide & DC Testing Analysis Tool for all relevant testing information. Testing is required at 20Hz.

NGESO will require an ITE approval report as part of any Eligible Asset registration, and cannot be registered without this information. The report shall be deemed accepted by NGESO once submitted. However, should any queries be raised the Eligible Asset shall not be able to participate until any queries have been satisfied.

Testing shall also be required before the registered response capacity of an existing Eligible Asset can be increased.

Settlement

DC will be settled against an availability service fee (£/MW/h) which is submitted by the Registered Service Provider as part of its tender submission (and which may be subsequently revised daily, as described above). For further information regarding how payment is calculated, and payment terms, please refer to the Service Terms and the General Terms & Conditions.

NGESO shall apply DC energy volumes within Applicable Balancing Services Volume Data (ABSVD) for BM units only. It is the responsibility of each Registered Service Provider to ensure that the relevant BM Unit Lead Party has made the appropriate election.

In addition, where it has not already done so, each Registered Service Provider must ensure that it has completed the necessary vendor setup forms that are outlined on our Settlement webpage to be set up as a vendor on NGESO's systems. These should be submitted as soon as possible so that we make payments in a timely manner in accordance with the General Terms & Conditions.

Performance Monitoring

NGESO will conduct regular performance monitoring of the DC service. Please refer to the Service Terms regarding consequences of non-delivery and unavailability, which may impact on the level of availability service fee payments. NGESO will be seeking to increase performance transparency to industry for the DC service and publish summary reports on the quality of service delivery.

Baselines

An important component of DC service delivery is submission of operational baselines, required from all Registered Service Providers. Registered Service Providers with non-BM participating Response Units should make themselves familiar with these operational baseline rules, which have been developed to be aligned and consistent with those in place for BM Units (i.e. Physical Notifications), in the interests of fairness and transparency.

Please be aware both BM and Non-BM participants are required to submit Operational Baselines through our new Data Concentrator API. These baselines can be submitted up to 4 decimal places. NGESO recognises that this offers greater granularity than a PN does for BM units. Please refer to the relevant section in the Service Terms for further information. For participant guidance only, the processes and timings associated with PN submissions (baselines) can be found in the Grid Code at Balancing Code No.1 (BC1) Pre gate Closure Process in particular BC1.4 and BC1.A.1.1 These areas cover the timings associated with PN submissions.

See also Transitional Arrangements section and Annex 1 for further details.

State of Energy (SoE) Management

NGESO requires that delivery of DC is continuous over the service day. The state of energy rules and the baseline rules have been designed to underpin this requirement.

DC does not permit the management of SoE via delivery deviation within an 'envelope'. This 'charging in the dead band'

has been shown to be damaging to frequency quality, and whilst manageable with limited volumes of Enhanced Frequency Response, is not possible for the larger volumes of DC and subsequent response products.

The solution to SoE management for DC is to require energy limited units to:

1. Begin the service delivery day with a level of stored energy adequate for its contracted response quantity.
2. Review the level of stored energy at the start of each settlement period during that service delivery day, looking at the net energy delivery in the previous settlement period.
3. Aim to return the stored energy level to an appropriate level by the submission (and following) of operational baselines. This means charging or discharging by following a baseline.

Example:

Contracted quantity: 50MW of DC low (i.e. low frequency response only)

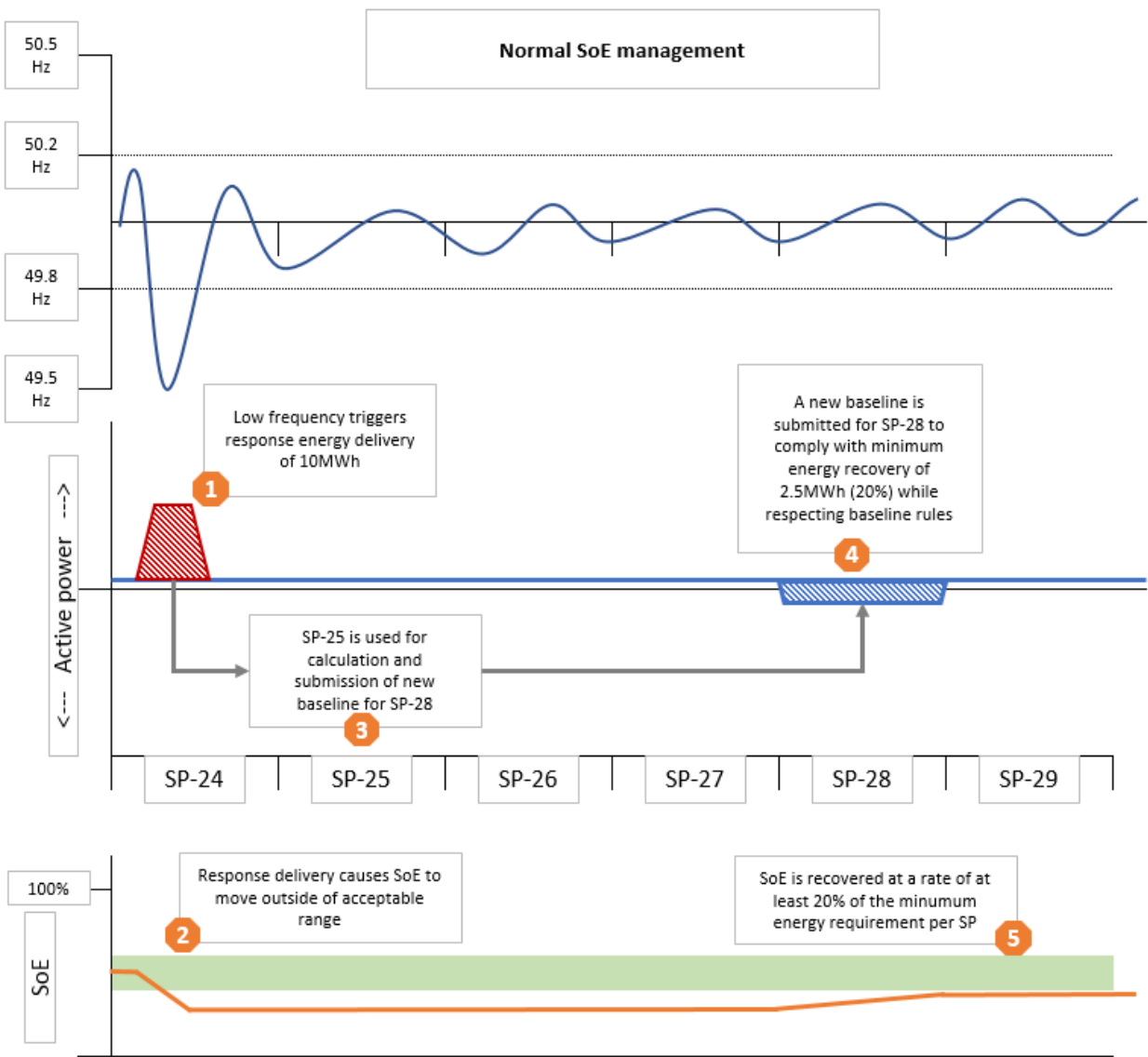
Minimum energy requirement: 12.5MWh - calculated as 15 minutes at full power: $(15/60) \times 50 = 12.5\text{MWh}$

Minimum energy recovery requirement: 2.5MWh per SP - calculated as 3 minutes at full power: $(3/60) \times 50 = 2.5\text{MWh}$

Based on the above parameters, the Registered Service Provider should therefore manage the SoE of its energy limited unit as follows:

1. Begin the service delivery day with the capability to deliver 12.5MWh of energy in the relevant direction – in this case, generation when frequency is low. Delivery might occur in a single event lasting 15 minutes at full power or any number of shorter consecutive events (see Note 1 at the end of this section). The unit should not need to recharge or pause or cease delivery at any point before delivery of 12.5MWh of energy is complete.
2. At the start of each (and every) settlement period during that service delivery day, the Registered Service Provider should calculate the net energy delivery over the preceding settlement period. For example, if in SP24 the unit delivered 10MWh of energy as it responded to frequency, at the end of SP 24 / start of SP25 the stored energy is now 2.5MWh.
3. The Registered Service Provider should submit a baseline to replenish at least 2.5MWh so that stored energy can begin to return to minimum requirement. The baseline should not exceed a level at which the unit is unable to continue to provide DC whilst following the baseline.
 - a. The Registered Service Provider should create and submit this baseline before the end of SP25 so that it can take effect from SP28. It cannot take effect any earlier because there is a 1 hour gate before baselines can apply – this is the convention applied to physical notifications in the BM and needs to be mirrored by non-BM providers to ensure fairness across all market players.
 - b. The baseline should replenish at least 2.5MWh because this is the minimum energy recovery requirement calculated as 20% of the minimum energy requirement (equal to 3 minutes at full power: $(3/60) \times 50 = 2.5\text{MWh}$).

This is illustrated below:



If there is no further response delivered in SPs 25-31 (i.e. frequency stays in the dead band 50Hz +/- 0.015) then the stored energy will be 5MWh at the end of SP28, 7.5MWh at the end of SP29, 10MWh at the end of SP30 and completely restored to 12.5MWh at the end of SP31. At the end of every Settlement Period the Registered Service Provider assesses the level of stored energy and submits an appropriate baseline to recover that energy at a rate of at least 20% per Settlement Period.

The Registered Service Provider can choose to recover the energy faster but must ensure any baseline complies with the maximum ramp-rate rule. In our example the maximum ramp rate is calculated as 5% of the contracted quantity, so 2.5MW/min. Further explanation of maximum ramp rates is provided in the Annex.

The Registered Service Provider must also ensure that DC can be delivered at all moments during the service delivery day, including when ramping to or delivering against baselines for energy recovery (See Note 2 at the end of this section). This means a unit with name-plate capacity of 50MW cannot be contracted to deliver 50MW of symmetrical DC – it must retain some headroom for energy recovery.

NGESO is not specifying how much headroom a unit must hold; that will depend on unit characteristics unknown to NGESO, e.g. cycle efficiency (See Note 3 at the end of this section). The Registered Service Provider can assess what quantity of DC a unit can provide whilst considering:

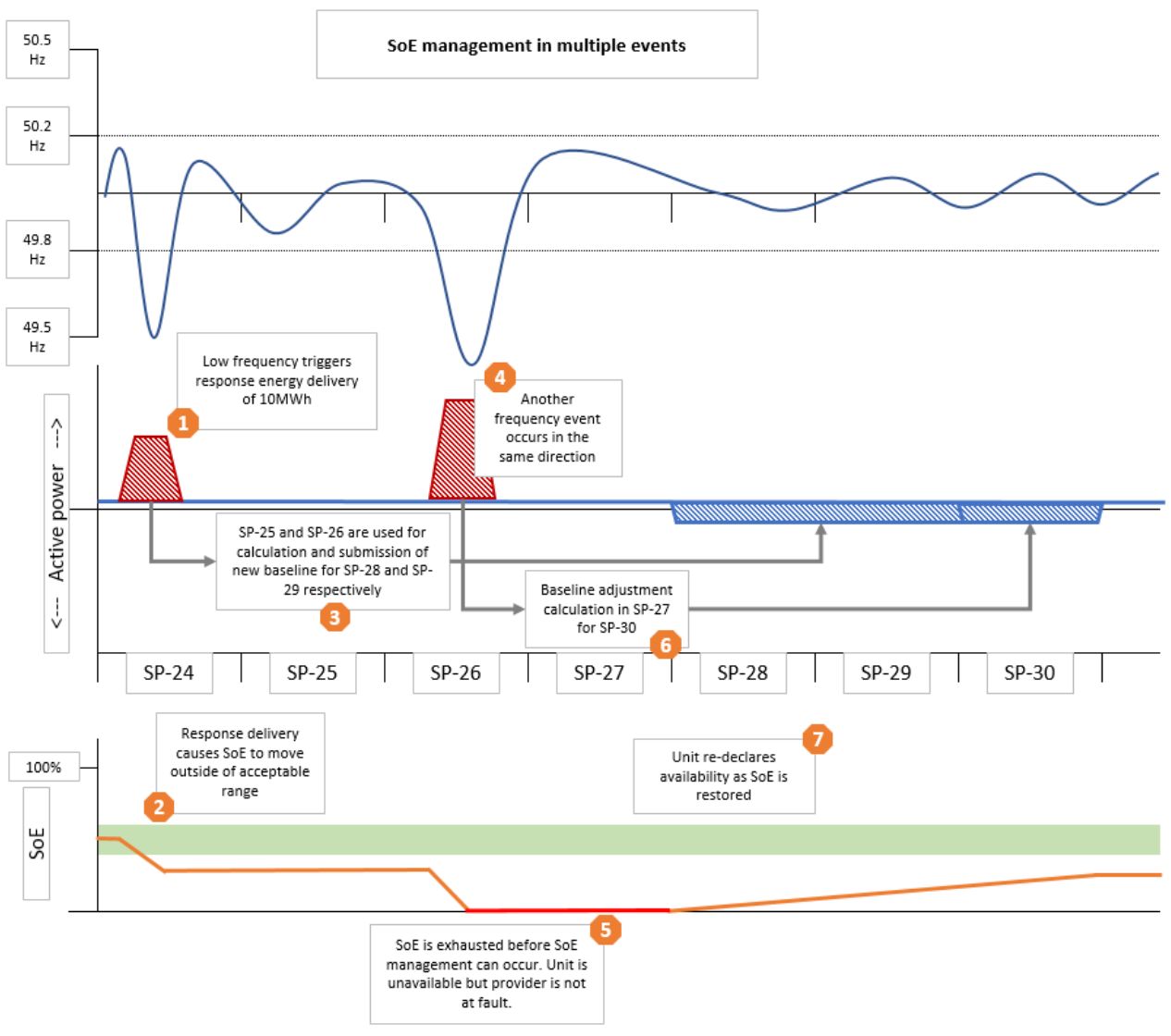
1. The requirement to recover at least 20% of the minimum energy requirement in a single Settlement Period.
2. The maximum ramp rate for all baselines submitted during the service delivery day.
3. The unit efficiency and other technical and commercial considerations.

We can continue our example by considering the more likely scenario of additional response delivery during periods 25-31. In the example below there is another significant event in SP26 which ultimately exhausts the stored energy before the unit has an opportunity to recover via a baseline.

At the start of SP25 and SP26 the Registered Service Provider calculates and submits new operational baselines for SP28 and SP29 respectively. These are each sized to replace at least 20% of the minimum energy requirement. However, during SP26 there is another event which fully depletes the stored energy:

1. The unit is now unavailable. There is no penalty or performance measurement applied to the unit because it has followed the SoE rules and always sought to recover energy at the first opportunity. The unit should re-declare as available when SoE is restored to the minimum energy requirement (12.5MWh) or the end of SP32 whichever occurs first.
2. At the start of SP27 the unit should continue the process of calculating stored energy (empty at the end of SP26) and submitting a baseline, in this case for SP30. As always, the baseline must comply with ramp-rate limits and must be sized to recover at least 20% of the energy recovery requirement.

This is illustrated below:



In the example above there will be a portion of non-delivery in SP26 when the energy is fully depleted but frequency is still in the delivery range (<49.985Hz). In cases where the SoE rules have been followed this non-delivery will not be subject to a performance penalty.

By this process of assessing the stored energy and submitting (and following) baselines the SoE can be managed to provide a high degree of certainty that energy limited units will always be able to respond adequately to frequency deviations.

Additional notes:

Note 1: For energy limited units, please take note that the energy requirement is defined in terms of MWh, not minutes. It can be calculated in terms of minutes at full power but should not be interpreted as 'maximum delivery time is 15 minutes'. Units are required to deliver at least the minimum energy requirement, this could be full power for 15 minutes but could also be 50% power for 30 minutes or 10% power for 150 minutes. There is no maximum delivery time unless/until the minimum energy requirement is fully delivered in net terms and/or the contracted MWh volume is less than 1MW (i.e. 1MW minimum contracted DC volume).

Note 2: For all Registered Service Providers, we will calculate your response delivery as a deviation from your submitted operational baseline. Therefore, the ability to accurately follow a baseline is paramount. In the dead band (+/- 0.015Hz) the unit should be operating at its baseline – this may be 0MW or any other value, particularly if the unit is following a baseline to charge/discharge for SoE management purposes. The difference between a unit's baseline at its maximum capacity should be greater than or equal to the contracted quantity of DC, otherwise it would not be able to deliver on its obligation if frequency moved to +/-0.5Hz.

Note 3: It is not possible or desirable for NGENSO to prescribe the maximum quantity of DC that an energy limited asset can provide. We do not know the cycle efficiency (or how this might change over time) so we cannot prescribe how much headroom/foot room must be maintained to allow for adequate SoE management. We can only be sure that a xMW capacity unit can offer < xMW of symmetrical DC.

Balancing Mechanism Interaction

NGESO anticipates that, as the DC service develops, Registered Service Providers and NGENSO's control room may seek to utilise additional actions for volume from assets that has been held back from DC delivery. Whilst NGENSO's control room may not seek to utilise BOAs from the infancy of the service, Registered Service Providers with BM units that are participating in the Balancing Mechanism (BM) alongside providing DC should note the following.

Where a Registered Service Provider has a BM unit participating in the BM whilst also providing DC, it is NGENSO's expectation that the BM unit's dynamic data (MEL, SEL etc.), Physical Notification (PN) data and Bid Offer Data (BOD) should be such that the unit can receive and deliver any Bid-Offer Acceptance instruction (BOA) **whilst still being available and able to fulfill any contracted DC volumes** if required.

1. In the case of an error in the submitted data, Energy limited providers of DC that are active in the BM may need to reject a BOA to manage their state of energy to maintain their contract capability to deliver DC. In this case the provider should telephone the NGENSO control room and explain why they wish to reject the BOA, specifically highlighting that the BOA will erode or compromise their ability to deliver DC.
2. NGENSO may then decide:
 - a. To accept the BMUs rejection of the BOA.
 - b. To resend an adjusted BOA that the BMU can deliver whilst maintaining DC capability.
 - c. To resend and or proxy accept the original BOA acknowledging that this will erode the available total DC volume.

NGESO would like to flag the importance of accurate data submissions in the BM when interacting with response services. Any performance penalty (e.g. from under/non delivery of DC) or imbalance charge (e.g. from under/non delivery of a BOA) incurred will be the sole responsibility of the DC providing BMU.

NGESO anticipates that BOA interaction will develop over the course of the "soft launch" as both NGENSO and industry familiarize themselves with the DC service.

Data

Registered Service Providers will be required to submit both Operational and Performance Data, as outlined in the Service Terms.

NGESO is using the Data Concentrator for Operational Data Submission and an additional Data Concentrator API development for electronic transfer of Performance Data. Details on how to connect to these platforms and further

technical detail can be found on the Dynamic Containment webpage. The published files contain high level overview and more in depth technical details are shared on a one to one basis securely. Details to access these are outlined in the documents. These are alongside other existing BM systems such as EDL/EDT and the Wider Access API for Physical Notifications and other Dynamic Data submissions required under the Grid Code for BM units.

Transparency

NGESO will seek to publish data in line with our other balancing services in the Monthly Balancing Services Summary (MBSS). NGESO will also seek to provide a service specific report covering performance of the DC service and daily tender results. NGESO website shall be used for publishing documentation on the DC service.

Capacity Market

For soft launch, Dynamic Containment will NOT be treated as a “Relevant Balancing Service” for the purpose of the Capacity Market Rules, and accordingly delivery of Dynamic Containment will not trigger any adjustment pursuant to those rules where an Eligible Asset is part of a CMU (as defined in the Electricity Capacity Market Regulations 2014 as amended).

Active Network Management Zones

Eligible Assets will not normally be registered by NGESO for participation in DC if they have a condition in their DNO connection agreement whereby they are signed up to an Active Network management (ANM) Scheme / Flexibility Connection. However, NGESO will consider this on a case by case basis and may (at its sole discretion) enable such participation if there is reasonable evidence to demonstrate that the asset has very high forecasted availability (for example as shown by Curtailment Assessment Reports from DNOs). NGESO shall continue to keep this under review and any changes to this position shall be consulted accordingly.

Transitional Arrangements

This document and the associated documentation describe a new DC service which has been “soft launched”, whilst certain underlying systems and processes are fully developed. Initially, therefore, there are several transitional arrangements currently applying which are not intended to feature as part of the DC service long term.

These transitional arrangements are described below, and they qualify and/or supplement the Tender Rules and Service Terms until further notice or as described below. Any changes as the DC service develops and evolves will be the subject of further NGESO consultation as appropriate.

All periods below apply from the first delivery date of DC.

- Subject to the tender limit below, and for a period of 6 months, NGESO will accept tenders from Registered Service Providers in respect of Response Units/Eligible Assets which:
 - do not have a live connection to the Data Concentrator for Operational Data Submission (meaning Operational Data submissions will not be required) upon condition that a connection is actively being progressed, or
 - are unable to submit 20Hz performance data, upon condition that a minimum of 10Hz performance data is provided (and in all other respects is in line with the Service Terms requirements),

provided that, for any service day, NGESO will limit its acceptance of tenders from any such Response Units to a maximum of 300MW (real time visibility).

- For a period of 6 months, NGESO will not register Eligible Assets with response capacity in excess of 100MW.
- For a period of 12 months, aggregation of Eligible Assets to a Response Unit shall be permitted at GSP Group level. Following this period, aggregation will be limited to Eligible Assets at GSP level only. NGESO will keep this under review through our regular industry communication channels and any modifications to this transitional arrangement will go through the necessary consultation.

Annex 1

Baselines for energy limited assets – additional guidance

This Annex offers further guidance on how energy limited units participating in Dynamic Containment should calculate their baseline ramp-rate limit.

All DC providers must submit **operational** baselines, and there are specific rules for energy limited providers. The operational baseline rules are outlined in paragraph 6 of the Service Terms, and at paragraphs 6.8 to 6.13 there are rules specifically addressed at energy limited providers.

For energy limited providers, these rules impose a maximum ramp-rate on any submitted operational baseline. The current limit is 5% of contracted quantity per minute (i.e. a 100MW DC contract could change its baseline by a maximum of 5MW/min). The ramp rate limit is required to smooth the impact of state of energy (SoE) management. It is plausible that battery storage may eventually be providing in excess of 500MW of DC, and therefore the ramp rate limit means that any coordinated SoE management is restricted to a rate of 25MW/min (5% of 500MW). The alternative is that all 500MW could decide to charge instantaneously (~500MW/min) at the first opportunity after a low frequency event.

To emphasise, this requirement to observe a maximum ramp-rate applies only to energy limited providers (see paragraph 6.8 of the Service Terms).

There is explanation in paragraph 6.9ii of the Service Terms as to how this maximum ramp-rate restriction must be observed where there are two adjacent service days in contract with different MW quantities, and at paragraph 6.9iii where the Response Unit is BM Participating and is the subject of a Bid-Offer Acceptance.

Furthermore, as referred to in paragraph 6.9i of the Service Terms, the maximum ramp rate will depend on whether the Response Unit is providing DC-low or 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.

Currently the DC contract documents in place for soft-launch envisage DC-low delivery only, meaning that the contract quantity of DC-high is zero. This has created some uncertainty as to how maximum ramp-rate restriction should currently be observed. For example, as there is no HF contract quantity how should 'upwards' or 'discharging' ramp rates be calculated?

Further explanation is therefore provided below as to how NGENO envisages application of paragraph 6.9i to the asymmetric DC-low and DC-high scenario. This explanation is given by reference to two scenarios:

- Unit contracted for asymmetrical quantities of HF + LF
- Unit contracted for either HF or LF only

In both these scenarios the rules are described in relation to type of baseline submitted. A baseline must have a start point and an end point, therefore there are four possible implementations of a baseline:

- Less positive (e.g. from +10MW to +5MW)
- More positive (e.g. from +60MW to +85MW)
- Less negative (e.g. from -20MW to -7MW)
- More negative (e.g. from -10MW to -50MW)

When considering these scenarios, reference should be made to the definition of maximum ramp-rate found in the DC Glossary:

“Maximum Ramp Rate”	in relation to any Response Unit which is Energy Limited and to any DC Service Day, the maximum ramp rate permitted at any point within an Operational Baseline, calculated as five percent (5%) of Contracted Quantity, as more particularly referred to in the DC Service Terms;
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How to read the scenarios below

Reading from left to right indicates the progression of the baseline over time.

All the examples use a bi-directional unit capable of generation (pink) and demand (green).

The black line indicates a baseline that is not impacted by the ramp rate limitations of the DC contract.

Red lines are used to show ramping baselines that have been calculated/limited by the ramp rate limit derived from the contract quantity of DC-HF.

Blue lines are used to show ramping baselines that have been calculated/limited by the ramp rate limit derived from the contract quantity of DC-LF.

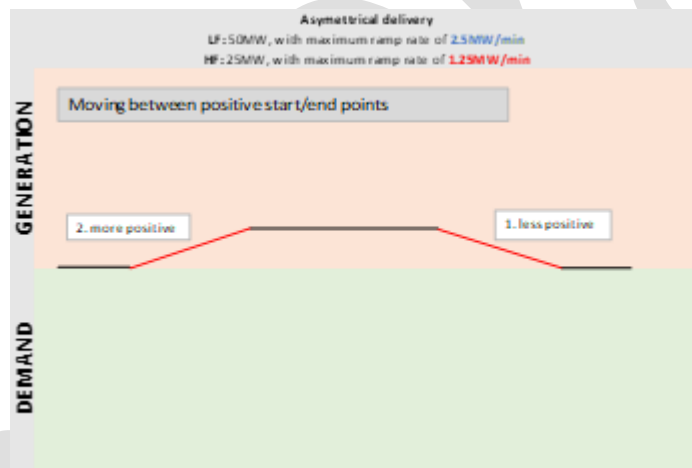
In all the examples the unit is contracted for more LF than HF, so the (blue) LF ramp rate is faster than the (red) HF ramp rate.

Each ramping baseline is labelled as one of the four possible implementations described above.

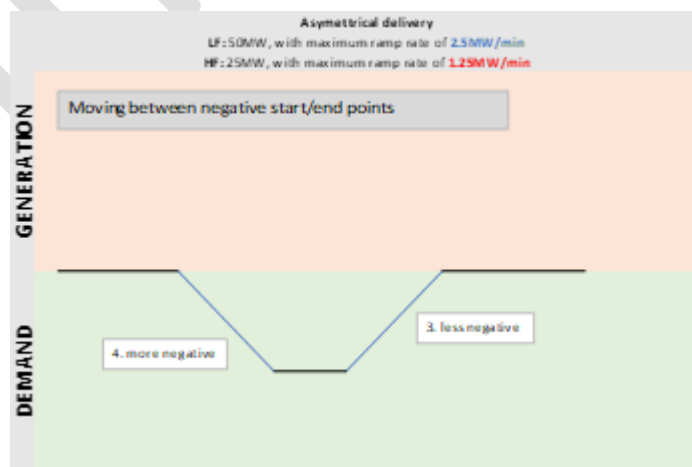
Asymmetrical delivery of HL + LF

In this scenario we have a unit providing different quantities of HF and LF, hence there are two different ramp rates to be applied (one calculated from the HF quantity and one from the LF quantity).

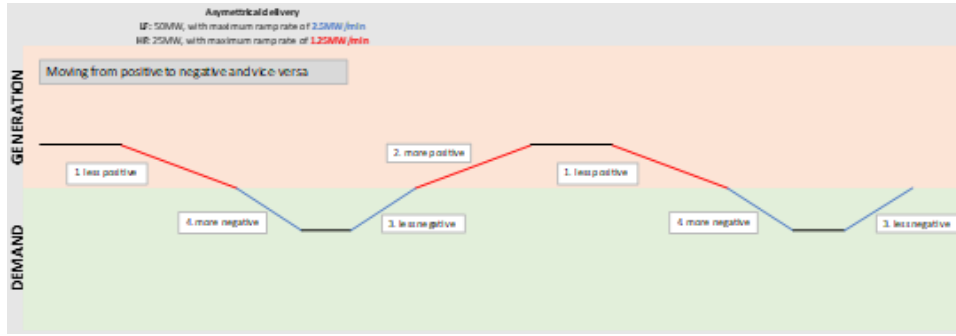
In the **first** example the ramp rates are calculated from the quantity of HF. The specific baseline change illustrated is typical of a unit managing its SoE due to delivery of HF (i.e. it needs to generate to reduce its stored energy after responding to high frequency).



In the **second** example the ramp rates are calculated from the quantity of LF. The specific baseline change illustrated is typical of a unit managing its SoE due to delivery of LF (i.e. it needs to charge/demand to increase its stored energy after responding to low frequency).



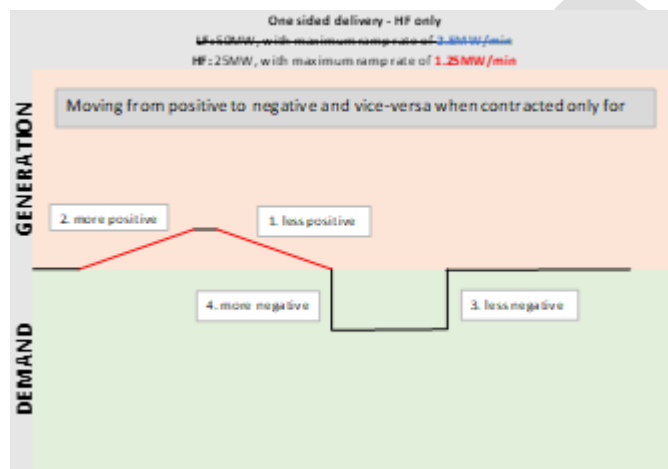
In the **third** example the ramp rates change as they go through zero, from positive to negative and vice versa. This kind of profile is not expected for normal SoE management, but the rules have been designed to allow it so as to facilitate units that wish to stack energy arbitrage on top of service provision.



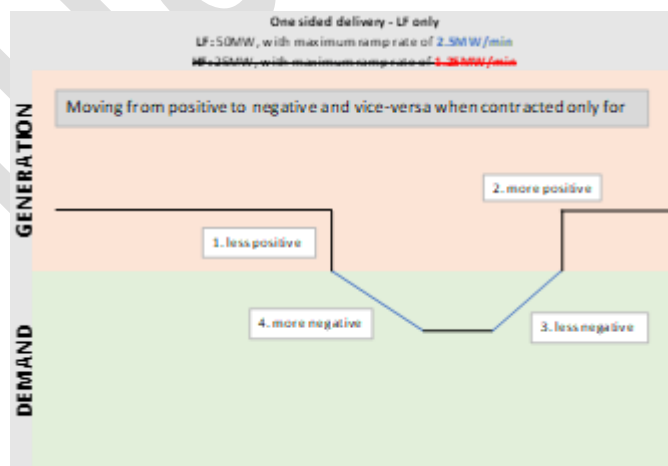
One sided delivery of HL or LF

In this scenario we have a unit providing only one of HF or LF, hence there is only one ramp rate to be applied (calculated from either the HF quantity or from the LF quantity).

In the **first** example we see how the baseline related to SoE management is limited by the quantity of HF (the red baseline). The baseline to increase demand is unrestricted by the DC ramp rate limitation (other Grid Code limits will still apply).



In the **second** example we see how the baseline related to SoE management is limited by the quantity of LF (the blue baseline). The baseline to increase generation is unrestricted by the DC ramp rate limitation (other Grid Code limits will still apply).



Why is there no ramp rate limit in the one-sided examples?

In the examples where a unit is providing only HF or LF there is no ramp rate limit (other than Grid Code) on baselines that should not be impacted by provision of the DC service. Providers doing only HF for example would not be expected to exhibit coordinated 'charging' baselines, therefore there is no need to limit their baselines in that direction.

Codifying the rules

The rules illustrated above can be written in relation to each of the four implementations of baselines:

Less positive: If no HF contract then no additional requirement, otherwise = HF contract limit

More positive: If no HF contract then no additional requirement, otherwise = HF contract limit

Less negative: If no LF contract then no additional requirement, otherwise = LF contract limit

More negative : If no LF contract then no additional requirement, otherwise = LF contract limit

Where 'no additional requirement' is used to indicate that the DC contract places no rules on baselines but other obligations may be required as per Grid Code and other service agreements.

This is further shown in the table below.

Operational State	DC-low only		DC-high only		DC-low and DC-high	
	Active Power Output	Demand	Active Power Output	Demand	Active Power Output	Demand
Baseline showing reduced Output	No additional requirement		Ramp rate defined by the HF contract quantity		Ramp rate defined by the HF contract quantity	
Baseline showing increased Output	No additional requirement		Ramp rate defined by the HF contract quantity		Ramp rate defined by the HF contract quantity	
Baseline showing increased Demand		Ramp rate defined by the LF contract quantity		No additional requirement		Ramp rate defined by the LF contract quantity
Baseline showing reduced Demand		Ramp rate defined by the LF contract quantity		No additional requirement		Ramp rate defined by the LF contract quantity