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 Auction 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	
2.0	02/03/2021	Version 2	
3.0	09/04/2021	V3 – updates for EPEX auction platform & automation	
3.1	03/09/2021	Version 3.1 – updated to include provider feedback following V3 EBGL consultation	
4.0	07/10/2021	Version 4.0 – updated following DCH Consultation and stakeholder feedback	

Version 4,0

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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.

1. Service overview

The key elements of the DC service are:

- Designed to help contain frequency within statutory limits +/- 0.5Hz from target frequency of 50 Hz
- Automatic activation, from either generation or demand, or energy limited (e.g. battery) assets
- Min 1MW and max 100MW of response capacity per Response Unit (or such other min/max as NGESO may notify from time to time)
- DC Sell Orders may only be submitted in whole MWs
- Contract delivery across 4 hour EFA Blocks
- Availability payment only; settlement of energy delivered
- Procured separately for low and high frequency DC
- Participation by both BM and 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 in section 16 of this document.

2. Service delivery

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

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 Documents.

A Response Unit should respond continuously and proportionally to frequency as it deviates from the target (50Hz). At each point of system frequency between 49.5Hz and 50.5Hz there is a target quantity of power delivery for a providing 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.

NGESO expects full contracted quantity to be delivered no later than 1 second after a step-change in frequency from 50Hz to 49.5Hz or from 50Hz to 50.5Hz. 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 or from 50.00Hz, 50.01Hz, 50.02Hz etc.

As frequency is continually moving/deviating, NGESO must see some change in response power delivery up to and including 0.5 seconds after the deviation occurring.

3. 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 NGESO as Eligible Assets. Once validated, Eligible Assets may be allocated by the Registered Service Provider to Response Units, which may then participate in the DC daily auctions.

This section outlines the registration process and associated timings. Whilst it is important that participants allow sufficient time to register and prepare for participation, NGESO 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 NGESO 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 NGESO 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 participate in the daily auctions for DC service delivery.

Timelines Forms A, B & C

Activity	Provider	NGESO
Submission Form A & B	3 business days prior to submission of first DC Sell Order 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 NGESO using the “DC Provider Data Template” that is published alongside this document. This template contains all the necessary information for NGESO 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 NGESO'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	In order to enable allocation activity, valid and complete data should be submitted 13 calendar days in advance.	Allocation activity can take place 13 calendar days after submission of validly completed data. NGESO will notify the Registered Service Provider if allocation activity can be accommodated sooner.
Allocation of Eligible Assets to Response Units	Allocation can only occur on a weekly basis and must be sent to NGESO 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 New/updated Response Units can participate in Auctions from and including that for DC Service Days commencing 23.00 hours the following Wednesday

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 Auction 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 NGESO 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.

As explained above, revisions to a Provider Data Template submitted during the Tuesday market window will not become effective until the DC Service Day commencing 23:00 hours on the following Wednesday.

The DC Provider Template must be submitted to **DC.Submissions@nationalgrideso.com** and no other NGESO

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

4. Daily Auctions

This section outlines the process for submitting DC Sell Orders in the daily auctions, and associated timescales.

Designated Auction Platform

A Registered Service Provider can only participate in the DC auction process once it is confirmed as a Registered Service Provider for DC (through receipt of Form C), and only in respect of assets under its operation or control which have been validated by NGESO as Eligible Assets and allocated by the Registered Service Provider to Response Units.

The DC auction process is hosted by EPEX, and participation is more particularly described in the Trader User Guide at the EPEX user guide below (as updated from time to time):

CTS++ Trader User Guide (nationalgrideso.com)

DC Buy Orders

NGESO will confirm to EPEX its DC requirement (MW) for each product type by no later than 14.30 hours on D-1, for each EFA Block in the following EFA Day. Each EFA Day for which NGESO has indicated a requirement in one or more EFA Blocks is a "DC Service Day".

DC Sell Orders

Each DC Sell Order is required to cover a single EFA Block in any DC Service Day, and must be submitted during the 13 day period between the Auction Opening and Auction Closing Times.

Each DC Sell Order must relate to a single Response Unit, DC product type and EFA Block, and must indicate a single availability price (£/MW/h) and offered contracted quantity (not exceeding the registered quantity of the aggregate registered quantity of each of the component eligible assets).

Multiple DC Sell Orders may be submitted for the same Response Unit, the same EFA block and the same DC Product if Parent-Child blocks are used.All DC Sell Orders shall reflect and be consistent with the Eligible Asset and Response Unit registration details.

After the Auction Closing Time, the auction algorithm will match all valid DC Sell Orders to the DC Buy Order for the relevant EFA Block and product type, through the acceptance (or partial acceptance) of DC Sell Orders in accordance with the DC Auction Rules. This will produce a Market Clearing Price for that EFA Block and product type. NGESO may publish further guidance from time to time on the operation of the DC auction process.

The auction timescales are as follows:

- Daily auction open on a rolling 13-day basis at 08:00 on D-14
- Ability to withdraw and re-submit DC Sell Orders up to daily auction close
- Daily auction close is at 14.30 on D-1
- The result of each auction will be communicated or otherwise published by EPEX each day no later than 15.00 on D-1 and will confirm the (Pay as Cleared) Availability Price.

The DC Response Contract for the relevant Response Unit will be formed at the time of communication or publication by EPEX of the auction outcome.

- In addition, NGESO will aim to publish all auction results in full (via its Daily Auction Report) on our website/data portal each working day at approximately 16.30 on D-1

This is illustrated below:

D-14	D-1	D-1	D
08.00 Order book opens for DC Sell Orders	14.30 Auction Closure Time (Order book closes) Deadline for submission/update of NGESO's Buy Order	15.00 Auction results published by EPEX	23.00 Delivery starts for EFA block one on service delivery day D (which is the same calendar day as D-1)
NOTE: Processing of Provider Data Templates during Tuesday market window (ie 15:00 hours Monday to 10:00 hours Tuesday) will be effective (so as to enable participation in the Auctions by the relevant Response Unit) from service delivery day beginning 23:00 Wednesday			

5. 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 an Independent Technical Expert (ITE). Registered Service Providers should refer to the accompanying document DC Testing Documents, 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.

6. Settlement

For each EFA Block the subject of a DC Response Contract, the applicable DC product will be settled against the market clearing price (£/MW/h) for that EFA Block and DC product established pursuant to the DC Auction Rules. 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.

7. 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.

8. Operational and Performance Baselines

An important component of DC service delivery is submission of baselines, required from all Registered Service Providers.

Operational
Response Units that are also registered in the BM are required to submit an operational baseline in the form of a physical notification (the processes and timings associated with PN submissions 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

Response Units that are not registered in the BM ('non-BM') will only be required to submit an operational baseline that conforms with the rules referenced above as and when NGESO implements a communications channel that can receive these submissions.

Performance
In respect of both BM and Non-BM Response Units, Registered Service Providers with DC Response Contracts are required to submit Performance Baselines for their assets through the Data Concentrator API. These baselines can be submitted up to 4 decimal places. The timescales and other requirements for these baselines are set out in the Service Terms.

Operational vs Performance baselines
As the name suggests the Performance baseline will be used by NGESO to measure the performance of a Response Unit. The difference between the active power and the performance baseline is the quantity of response delivered.

The Operational baseline is a type of nomination baseline, it must be submitted in advance and covering the period up to 90 minutes in the future. The Response Unit is committed to follow its Operational baseline giving NGESO the benefit of visibility of planned output (a feature upon which the Balancing Mechanism and NGESO balancing strategy relies). In addition the Operational baseline serves to protect NGESO against provider 'gaming' of the service.

Physical Notifications (PNs) as used in the Balancing Mechanism are the model for Operational Baselines, a PN is an acceptable Operational Baseline. A PN does not need to be at a static value for the duration of a settlement period, it can change on a minute-by-minute basis.

NGESO will be checking that the Operational and Performance baselines are equivalent. Ideally there would only be one form of baseline but system limitations mean that Operational baselines submitted via BM systems cannot accommodate the required level of detail for this high specification service, thus Performance baselines have been introduced to allow Response Units to submit up to 4 decimal places at a frequency of 20Hz or greater.

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

9. Energy Requirement and Duration

Energy limited as an asset type is defined in the Glossary as:

> a classification given for the purposes of **Dynamic Containment** to any **Response Unit** comprised of one or more **Eligible Assets**:-
> (a) which creates its store of energy by using power ultimately drawn from the **National Electricity Transmission System**; and/or
> (b) whose **State of Energy** at the start of a relevant **EFA Block** is insufficient to provide full delivery of the **Contracted Quantity** for the duration of that **EFA Block**;

These assets are subject to a number of additional rules detailed in section 6 of the Service Terms. One area of additional rules relates to; delivery duration, response energy and energy recovery.

The rules are required to give ESO assurance that energy limited assets can reliably provide the full contracted quantity of dynamic containment. The duration and volume requirements have been sized based on analysis of frequency events and a risk-based assessment.

The terms below are fully defined in the Glossary. Below a plain English explanation is offered.

1. Contracted Quantity
    a. the amount of Response (MW) which a Service Provider has agreed to provide.

2. Delivery Duration
    a. fifteen (15) minutes
3. Response Energy Volume
    a. the amount of stored energy (or capability to store energy) that a Response Unit should be capable of delivering before becoming unavailable due to exhaustion. Calculated as the Contracted Quantity multiplied by the Delivery Duration.
4. Energy Recovery
    a. the minimum volume of stored energy (or capability to store energy) capable of being recovered by way of State of Energy management in a single Settlement Period. Calculated as twenty percent (20%) of Response Energy Volume.

Example for DC-LF
Consider a battery asset with capabilities of 50MW and 50MWh.

This asset may choose to offer a DC-LF contract of 50MW in a single 4 hour EFA block. The parameters above would be computed as:

1. Contracted Quantity
    a. 50MW of DC-LF
2. Delivery Duration
    a. 15 minutes
3. Response Energy Volume
    a. 12.5MWh
4. Energy Recovery
    a. 2.5MWh

Example for DC-HF
Consider a battery asset with capabilities of 50MW and 50MWh.

This asset may choose to offer a DC-HF contract of 50MW in a single 4 hour EFA block. The parameters above would be computed as:

5. Contracted Quantity
    a. 50MW of DC-HF
6. Delivery Duration
    a. 15 minutes
7. Response Energy Volume
    a. 12.5MWh
8. Energy Recovery
    a. 2.5MWh

10. State of Energy (SoE) Management

NGESO requires that delivery of DC is continuous over the EFA Block. 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 EFA Block 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 EFA Block, 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) x 50 = 12.5MWh
Minimum energy recovery requirement: 2.5MWh per SP - calculated as 3 minutes at full power: (3/60) x 50 = 2.5MWh

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

1. Begin the EFA Block 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.

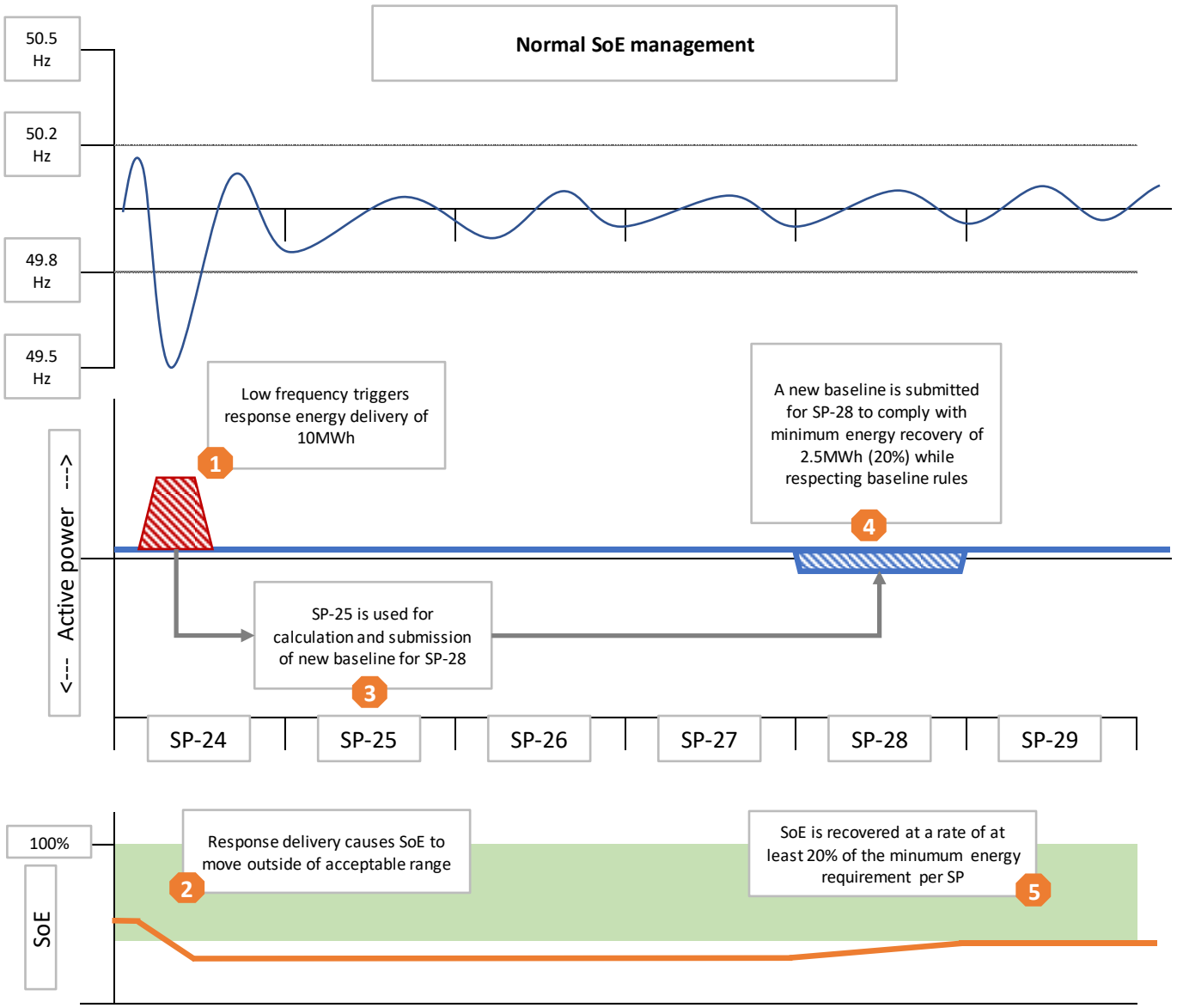
2. At the start of each (and every) settlement period during that EFA Block, the Registered Service Provider should calculate the net energy delivery over the preceding settlement period. For example, if in SP24 the unit delivered 10MWh of energy as it responded to frequency, at the end of SP 24 / start 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) x 50 = 2.5MWh).

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 be capable of recovering at least 20% of the minimum energy requirement in a single Settlement Period.
2. The maximum ramp rate limits for all baselines submitted during the EFA Block.

3. The unit efficiency and other technical and commercial considerations.

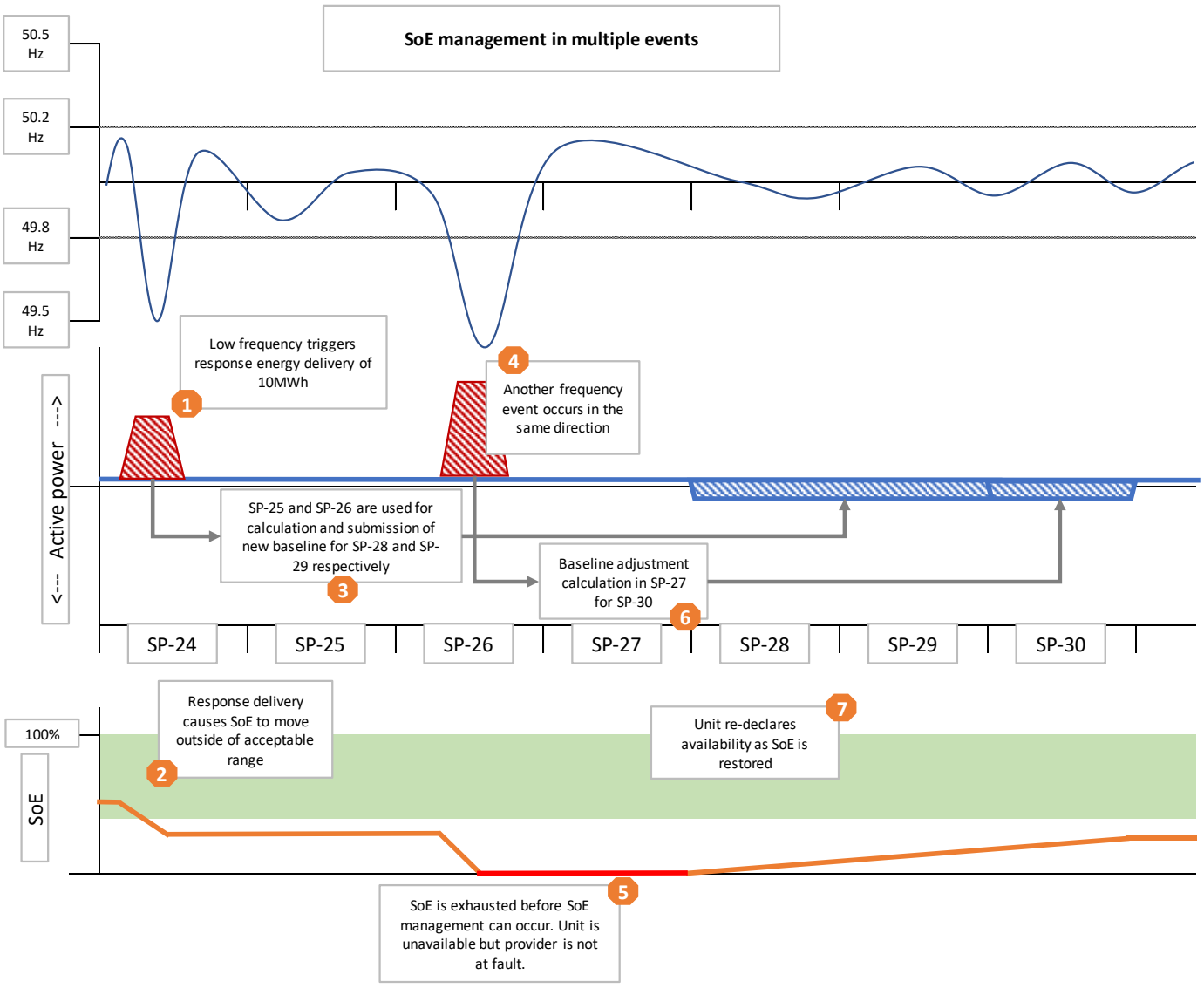
We can continue our example by considering the more likely scenario of additional response delivery during periods 25-31. In the example below there is another significant event in SP26 which ultimately exhausts the stored energy before the unit has an opportunity to recover via a baseline.

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:

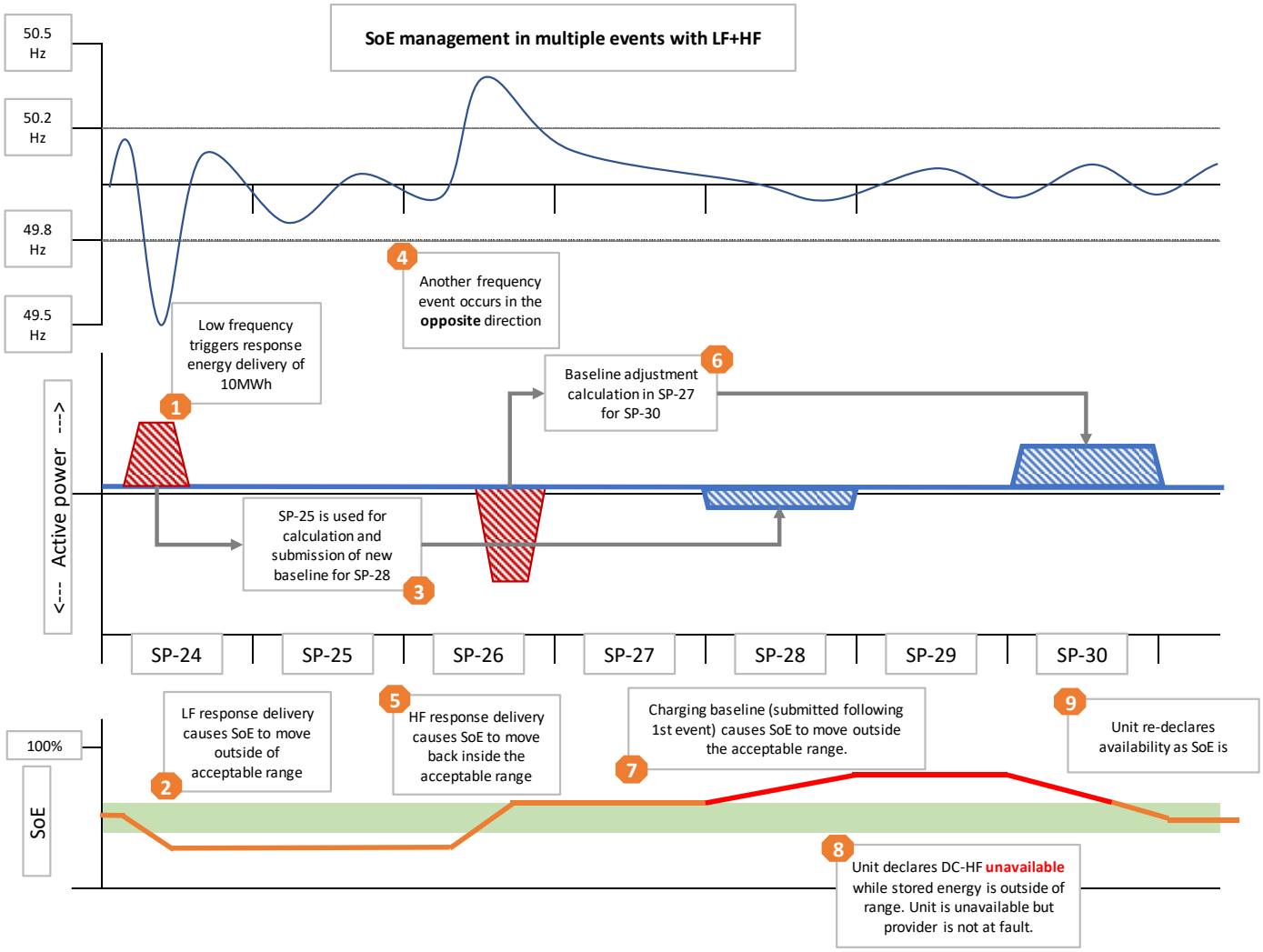


In the example above there will be a portion of non-delivery in SP26 when the energy is fully depleted but frequency is still in the delivery range (<49.985Hz). In cases where the SoE rules have been followed this non-delivery will not be subject to a performance penalty.

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.

The example below looks at how SoE management might occur for an unit holding contracts for DC-LF and DC-HF at the same time. Exactly the same principles and process apply:

1. Begin the EFA Block with a level of stored energy adequate for its contracted response quantity – **in this case a stored energy level that can meet both the DC-LF and DC-HF requirements**
2. Review the level of stored energy at the start of each settlement period during that EFA Block, 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.



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, and so on. 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 performance 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 and 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 NGESO 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.

11. Balancing Mechanism Interaction

NGESO anticipates that, as the DC service develops, Registered Service Providers and NGESO's control room may seek to utilise additional actions for volume from assets that has been held back from DC delivery. Whilst NGESO'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 read the separate NGESO document entitled "Unlocking Stacking of BOAs in DC" as updated or replaced from time to time.

12. Data

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

All performance data is to be submitted via the Data Concentrator. Operational data should be submitted via BM systems (e.g. EDT/EDL) and for non-BM by any method made available by NGESO.

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.

13. 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 auction results. NGESO website shall be used for publishing documentation on the DC service.

14. Capacity Market

In line with changes to the Capacity Market Rules approved by Ofgem on 5 July 2021, and effective from the 2021 Capacity Market Participation round, Dynamic Containment will be treated as a "Relevant Balancing Service" for the purpose of the Capacity Market Rules, and accordingly delivery of Dynamic Containment will trigger an 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).

15. 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.

16. 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, transitional arrangements currently apply 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 Auction Rules and Service Terms until further notice or as described below:

- 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.

Any changes as the DC service develops and evolves will be the subject of further NGESO consultation as appropriate. The 12 month period above applies from the first delivery date of DC.

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. These rules apply to both operational and performance baselines.

All DC providers must submit baselines**,** and there are specific rules for energy limited providers. The 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 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 EFA Blocks 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 Baseline is showing either an increase or reduction in level of Active Power Output or an increase or reduction in level of Demand.

Initially the DC contract documents in place for soft-launch envisage DC-low delivery only, meaning that the contract quantity of DC-high can be 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 NGESO 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:

> in relation to any **Response Unit** which is **Energy Limited** and to any **EFA Block**, the maximum ramp rate permitted at any point within an **Operational Baseline** and **Performance Baseline**, calculated as five percent (5%) of **Contracted Quantity**, as more particularly referred to in the **DC Service Terms**;

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

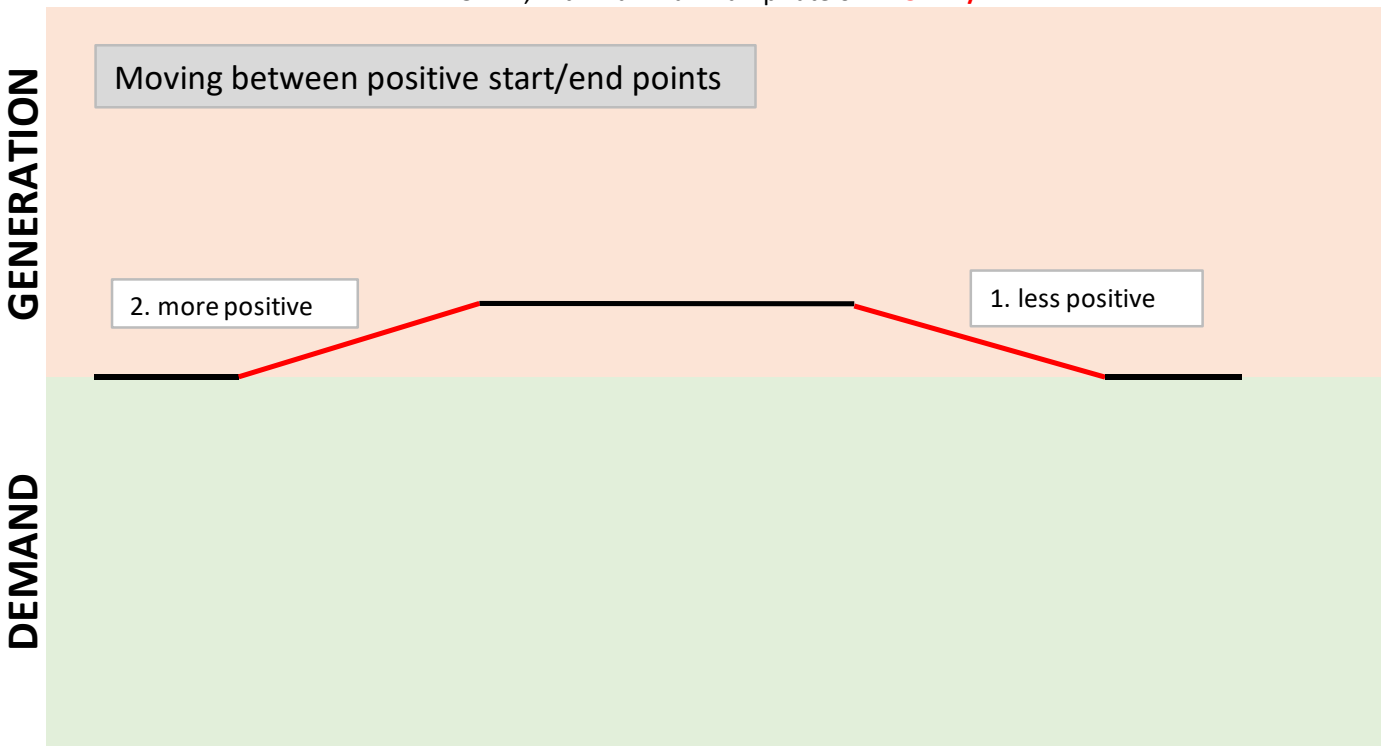
In this scenario we have a unit providing different quantities of HF and LF, hence there are two different ramp rates to be applied (one calculated from the HF quantity and one from the LF quantity).

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).

Asymettrical delivery

LF: 50MW, with maximum ramp rate of **2.5MW/min**

HF: 25MW, with maximum ramp rate of **1.25MW/min**

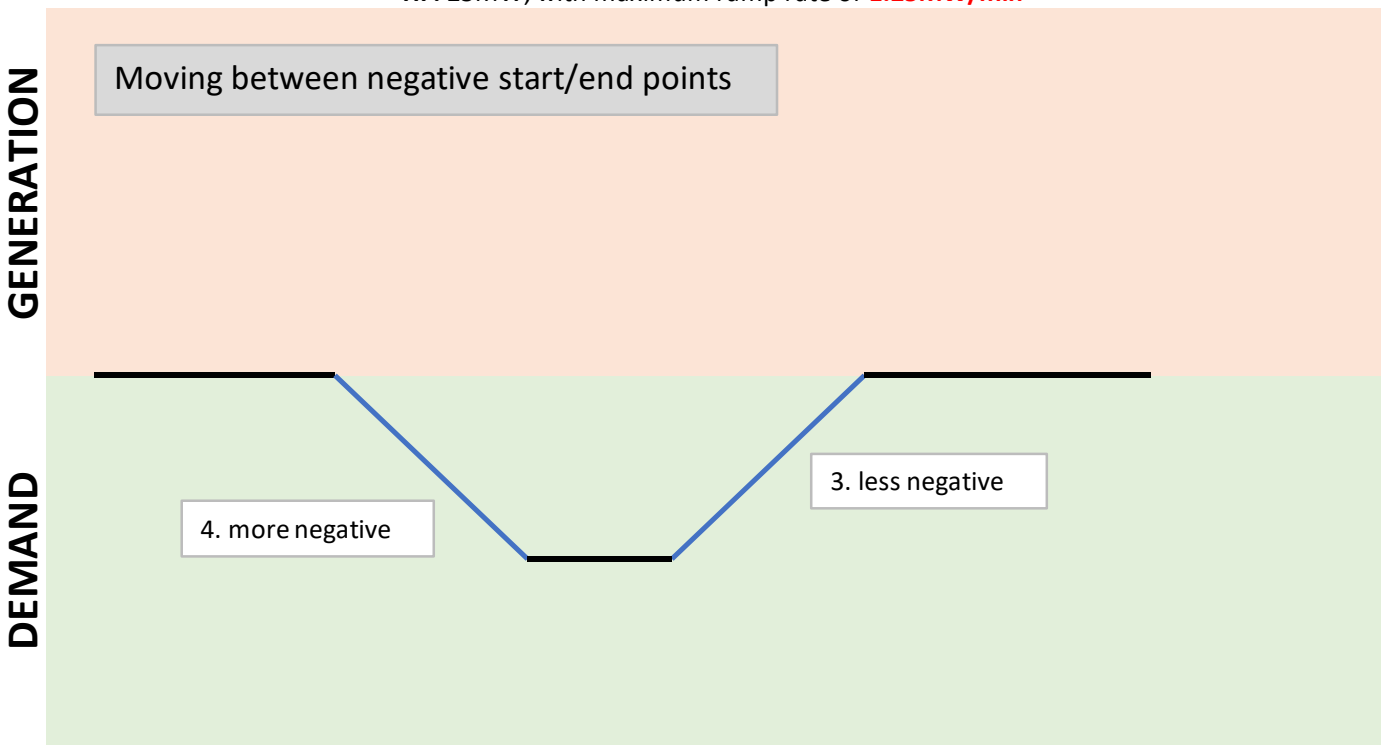


In the **second** example the ramp rates are calculated from the quantity of LF. The specific baseline change illustrated is typical of a unit managing its SoE due to delivery of LF (i.e. it needs to charge/demand to increase its stored energy after responding to low frequency).

Asymettrical delivery

LF: 50MW, with maximum ramp rate of **2.5MW/min**

HF: 25MW, with maximum ramp rate of **1.25MW/min**

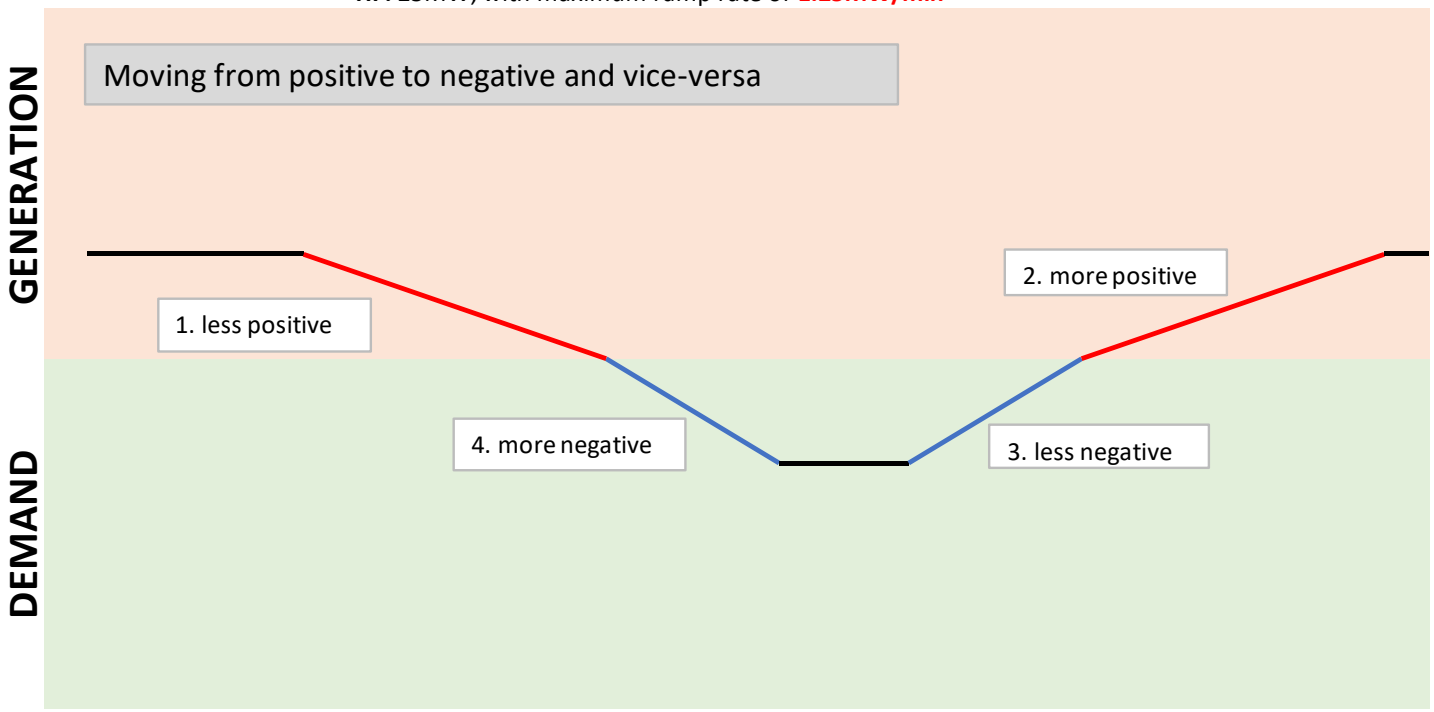


In the **third** example the ramp rates change as they go through zero, from positive to negative and vice versa. This kind of profile is not expected for normal SoE management, but the rules have been designed to allow it so as to facilitate units that wish to stack energy arbitrage on top of service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

Asymettrical delivery

LF: 50MW, with maximum ramp rate of **2.5MW/min**

HF: 25MW, with maximum ramp rate of **1.25MW/min**



One sided delivery of HL or LF

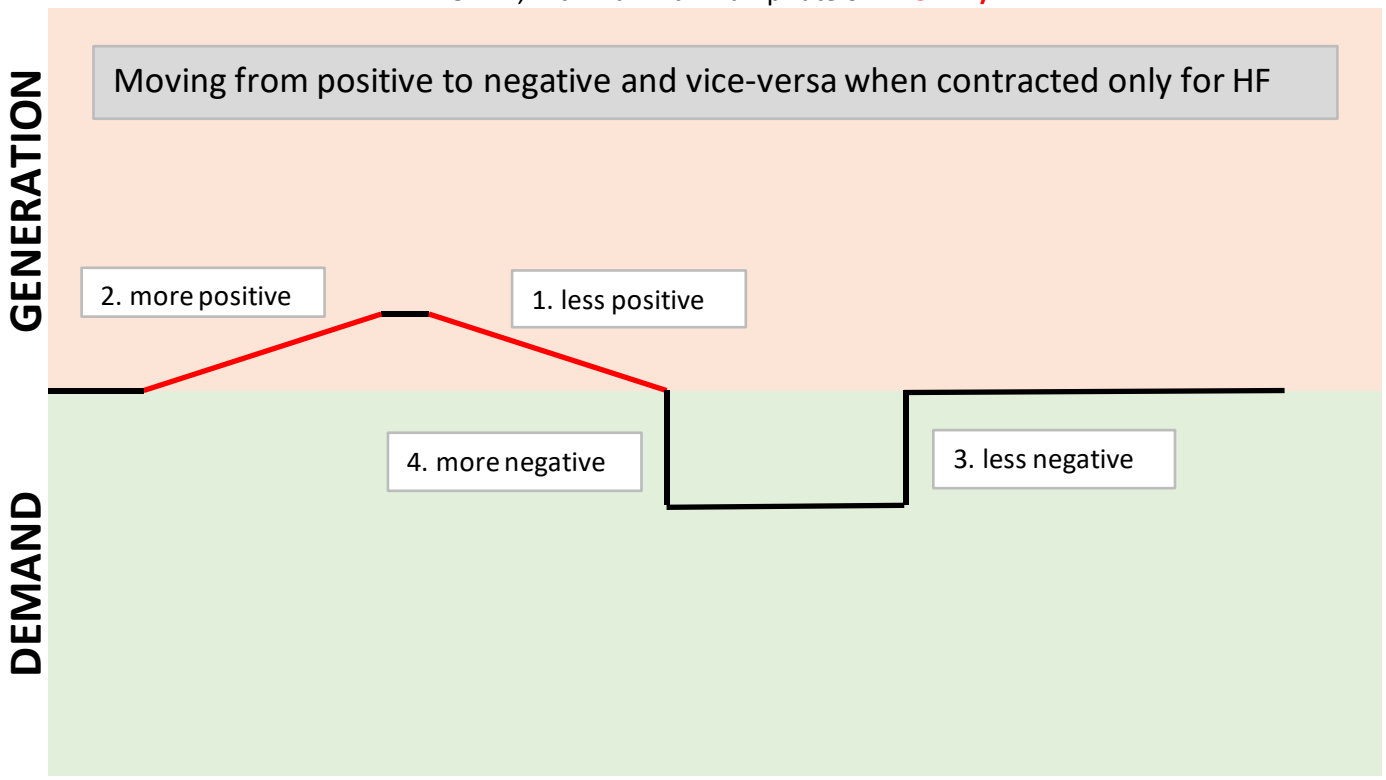
In this scenario we have a unit providing only one of HF or LF, hence there is only one ramp rate to be applied (calculated from either the HF quantity or from the LF quantity).

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).

One sided delivery - HF only

~~**LF:** 50MW, with maximum ramp rate of **2.5MW/min**~~

HF: 25MW, with maximum ramp rate of **1.25MW/min**

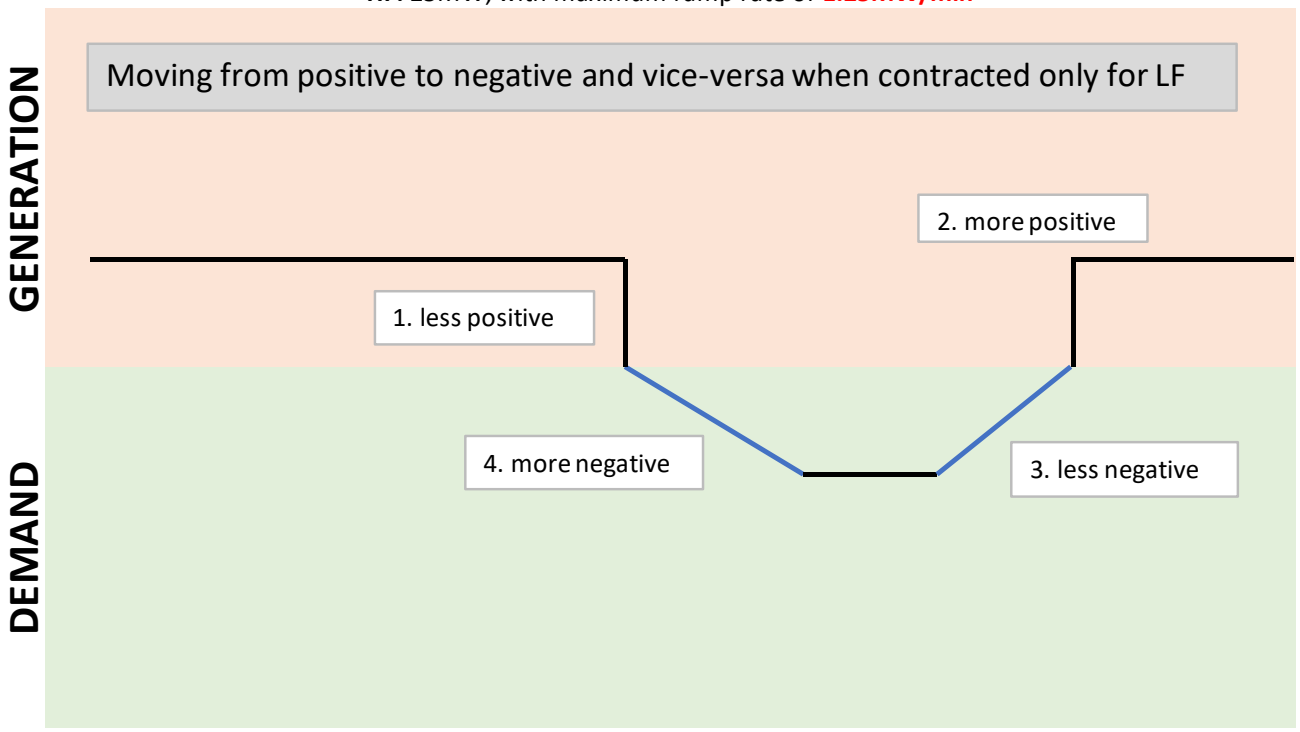


In the **second** example we see how the baseline related to SoE management is limited by the quantity of LF (the blue baseline). The baseline to increase generation is unrestricted by the DC ramp rate limitation (other Grid Code limits will still apply).

One sided delivery - LF only

LF: 50MW, with maximum ramp rate of **2.5MW/min**

~~**HF:** 25MW, with maximum ramp rate of **1.25MW/min**~~



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.

	DC-low only		DC-high only		DC-low and DC-high	
Operational State	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