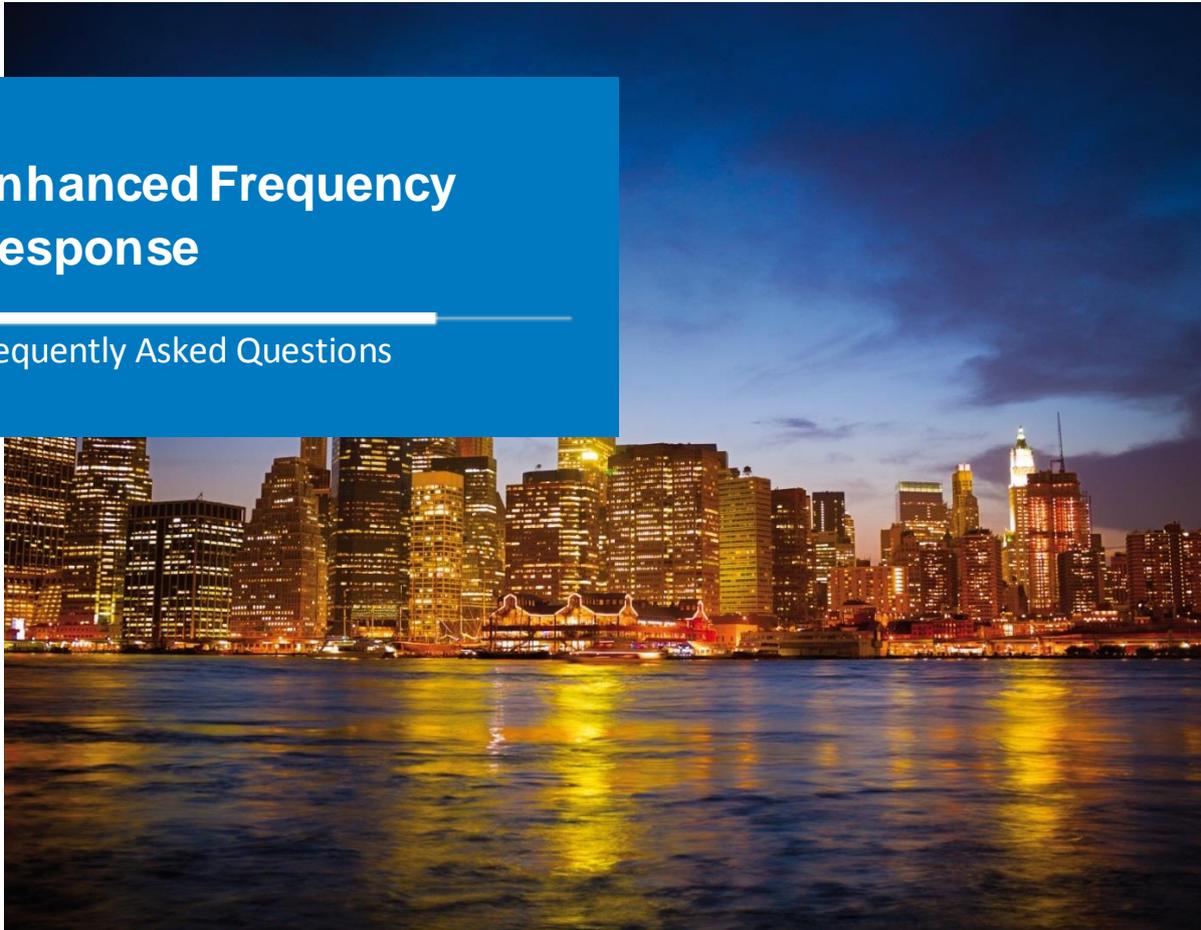


# Enhanced Frequency Response

Frequently Asked Questions



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## INTRODUCTION

This document has been written for all new providers of Enhanced Frequency Response (EFR).

EFR is a new service predominantly aimed at storage assets to provide frequency response in 1 second or less. The webinars held on the 14<sup>th</sup> October and 11<sup>th</sup> December as well as many questions from pre-qualified parties have helped us form this FAQ.

Further information on the service including second by second frequency data for 2014 and the Invitation for Expressions of Interest (EOI) can be located on the link below

<http://www2.nationalgrid.com/Enhanced-Frequency-Response.aspx>

## REQUIREMENTS and AVAILABILITY

### How will the Enhanced Service work with the current Frequency Response Services?

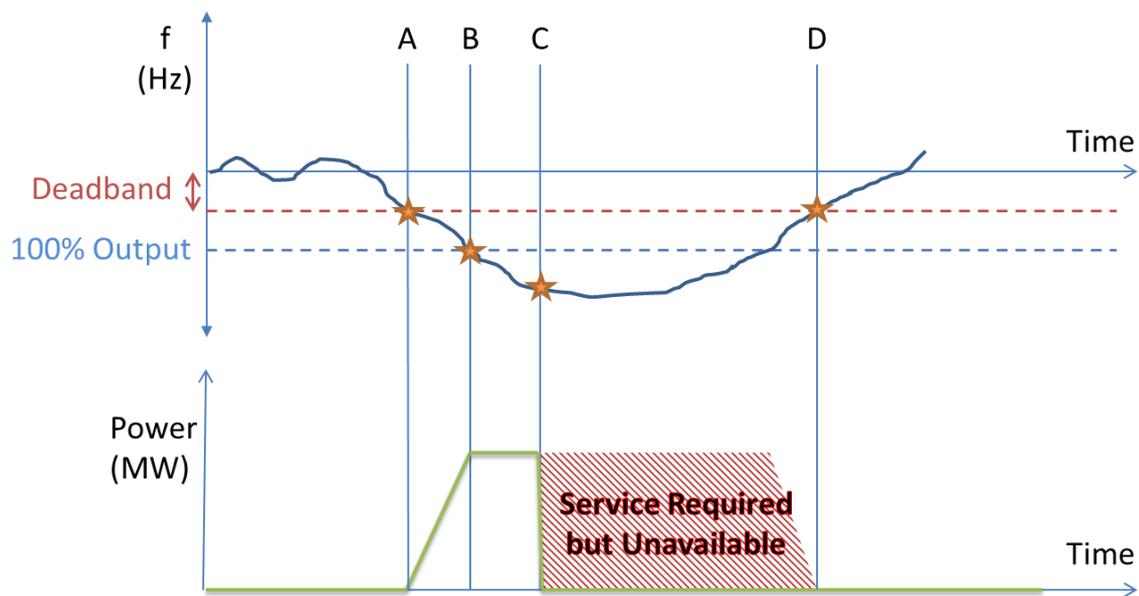
All balancing services work by converting capacity into power. One of the most critical considerations for any service is how fast it can be delivered, with shorter control cycles requiring faster services. Frequency management control cycles consume reserve provided by actions taken in longer-scale cycles. The diagram illustrates the control cycles and how frequency response services are used following a generation loss event. Faster services contain and stabilise frequency, before the slower services recover frequency and subsequently recover reserves.

### Will the unit be allowed to stop providing a service after 9 seconds or will this be dependent on whether it's within the required dead band?

The 9s was the theoretical time between the delivery of Enhanced response and the delivery of Primary, however we have now decided to move to a definition of Enhanced that includes both Primary and Secondary timescales, in order to facilitate a continuous service.

The main reason for this is that in the event that the frequency stayed outside the dead band range for longer than 9s, any assets which cease provision of the service would be flagged as being unavailable and would be subject to the performance criteria for availability, as shown below. When looking at historical frequency data, it is clear that this would result in an unacceptable amount of unavailability. Assets with short duration, fast response characteristics are more suited to post-fault frequency control, and the development of such a service will be progressed in parallel with EFR ([http://www.nationalgridconnecting.com/The\\_balance\\_of\\_power/](http://www.nationalgridconnecting.com/The_balance_of_power/)).

We will be providing more detail on what the minimum duration would be for assets with a finite energy capacity in due course.



- A: EFR requirement initiated
- B: 100% output achieved
- C: 9s duration
- D: EFR requirement ended

**How did you decide on 95% availability and what is the repercussion of not delivering?**

This level is in line with our Firm Frequency Response (FFR) Standard Term and Conditions.

NGET need certainty of availability to ensure security of supply and this will be measured second by second from providers metering and the availability factor will be actual against your tendered MW level

**Calculation of the Service Performance Measure**

A Service Performance Measure will be calculated per Settlement Period as the sum of the second by second ratio of Normalised Response against the envelope at a given frequency value. Normalised Response is the ratio of Actual Response delivered in that second against the Operational Capacity (which will be the tendered MW value unless a relief event has permitted a temporary reduction). If the Normalised Response is within the envelope, the SPM is set at 100%.

For example, the system frequency is F and a 10MW asset operates at 7MW in response to F. The Normalised Response is therefore 70% (7 divided by 10). The envelope limits at frequency F are 68%-71%, therefore the SPM is set at 100% for that second as 70% is within the envelope. If the envelope limits were 72%-75% then the assets would have under-delivered and the ratio would be calculated using the closest relevant limit, i.e.  $70\% / 72\% = 97.2\%$  (for over-delivery outside of the envelope the formula is reversed, i.e. the Normalised Response would be the denominator). The SPM is the sum of these ratios over a Settlement Period.

Please note that for any hours you have specified in the tender as not providing the service your Operational Capacity will be zero, i.e. these periods do not count in the calculation of the SPM (so Triad avoidance will not be penalised, for example).

### Calculation of the Availability Factor

The payment reduction will not be the SPM itself, there will be performance bandings in the same way as there are for other commercial frequency response services, e.g. a performance in the band 60%-95% will have a payment reduction to 75%. This payment reduction will affect the payment for that **settlement period only**.

Service Performance Measure in that SP	Availability Factor applying to that SP
<10%	0%
>10%, <60%	50%
>60%<95%	75%
>95%	100%

There may be instances whereby circumstances outside of a prudent operator’s control affect their availability, these specific events will be detailed in the SCTs and excluded from the calculation.

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### Service Requirements – Performance Factors



Performance in SP9 = 8/10 = 80%  
 Availability Factor: **0.75**

This example above shows a provider who has a flat availability of 10MW over a number of SPs. However, in SP9 the measured availability of the assets drops to 8MW for a short while (i.e. they are outside of the normalised operating envelope). There will be a deduction in payments for that SP as a result of the Availability Factor. The SPM was 80%, this falls into the band 60% - 95%, which results in an Availability Factor of 0.75, which equates to a payment reduction in the settlement period of 25%.

### Calculation of the Annual Service Performance Measure

The SPM will also be used to calculate an Annual Service Performance Measure, which will be the average of all SPMs over a year. If the ASPM is below 95%, NGET will look to discuss the underperformance with the provider with a view to identifying underlying causes and mitigation measures. Ultimately, this process could result in termination of the contract; however NGET would only exercise this as a final recourse.

When sizing a battery, please look at the frequency data and ensure that you meet the 95% availability. We have included 2014 second by second data on our website: <http://www2.nationalgrid.com/Enhanced-Frequency-Response.aspx>

For the avoidance of doubt, planned maintenance periods will count towards your SPM in both ways, i.e. you will not get paid for those Settlement Periods as the SPM will generate an Availability Factor of zero, and those Settlement Periods will be included in the calculation of the Annual Service Performance Measure.

As an example, an asset providing 15MW of EFR for 20 hours per day would have  $20 * 2 = 40$  half hourly settlement periods each with an SPM and Availability Factor. If it had an Availability Price of £5/MW/h it would be being paid:

$$15\text{MW} * £5/\text{MW}/\text{h} * 20 \text{ hours} = £1,500 \text{ per day}$$

If on one day it had three Settlement Periods where the SPM was calculated as being 90%, 84% and 55%, the Availability Factor for the periods would be 75%, 75% and 50% respectively. Therefore on that day it would be being paid (remembering that SPM applies to half-hourly settlement periods rather than whole hours):

$$(15\text{MW} * £5/\text{MW}/\text{h} * 18.5 \text{ hours}) + (15\text{MW} * £5/\text{MW}/\text{h} * 1 \text{ hours} * 75\%) + (15\text{MW} * £5/\text{MW}/\text{h} * 0.5 \text{ hours} * 50\%) = £1,462.50$$

### Do you have an idea of the optimum duration of a battery?

Our initial analysis indicated that a battery with a 45 minute duration (minimum operational state of charge to maximum operational state of charge) based on current frequency data and possibly one that minimizes or at least meets the 95% availability. However, this is currently under review, and we will be giving more guidance on the minimum duration required shortly. The maximum duration that we would value from an EFR service is 30 minutes, any ability of the assets to deliver energy beyond this timeframe has no additional value to NGET, however it is up to Applicants to size the energy capacity of their assets (where necessary).

In addition we are interested in understanding the degradation of the assets providing the service and any other parameters; this better helps us understand the value and lifespan of the battery.

**If the system/units are unavailable , does the supplier inform NGET?**

Yes. NGET will not be monitoring your assets continuously; it is up to the supplier to inform NGET when the service is unavailable and for that matter when it becomes available again. NGET must have access to live and historical metering data, and penalties will apply for not notifying periods of unavailability.

**Will we be penalised in the event of an extended frequency excursion outside the deadband?**

The performance criteria will only apply up to the duration of the service. Whilst this has yet to be fully defined, it is NGET's intention to exclude extended frequency excursions from the performance monitoring.

**Can Enhanced Frequency Response be provided together with the existing response services (P/S/H)**

The revised definition of EFR includes delivery in the timescales of P/S/H, however if you are not providing EFR you may provide standard frequency response through our existing procurement channels. To clarify further, we mean if you are contracted to provide a 20MW service for 20 hours a day through EFR, you do have the ability to tender the remaining 4 hours for Firm Frequency Response at the same time.

**Is the service requirement for both positive and negative control in parallel?**

Yes we expect the service to be symmetrical. This means that a tender for a 25MW EFR service must deliver 25MW high frequency response and 25MW low frequency response, and also that the duration of each must be the same, i.e. the assets must have the ability to deliver, for example, 15 minutes of high and 15 minutes of low frequency response.

**Can we tender a recovery period?**

No we would expect you to be available continuously, outside of any defined periods of unavailability.

**Would you expect the service repeatable**

Yes, we would expect the service to be repeatable i.e. continuous whilst outside dead band.

**Will the target frequency be 50.0Hz precisely?**

Yes we expect this to be the case, we are aware that in the past power stations have been given a target frequency of 49.95 or 50.05 occasionally, but we expect this to be 50.0Hz.

#### **Can aggregated assets apply?**

Yes absolutely, aggregated services will be considered.

#### **What do we do in the dead band?**

If your assets require it, you may manage your state of charge in the dead band so you are then ready to respond to the next frequency excursion. You may not provide other commercial services within the deadband that affect the delivery of EFR.

We would expect continuous delivery of response based on your defined parameters to meet the defined profile outside of the dead band; the maximum dead band allowable is +/- 0.1Hz and this would be used to recharge the battery. The dead band has been made wide to enable flexibility but of course can be tighter.

Within the deadband there will be a limit on the rate at which you may charge/discharge to recover your optimum state of charge, this will be communicated in due course.

#### **Is there an optimum number of MW that National Grid requires?**

Our target is around the 200MW mark, but if the offers are not economic this may be considerably less, or similarly if economic we may consider more.

The SOF published at the end of November does indicate that our longer term requirement is growing and again our initial analysis suggests two or three times as much, based on a number of assumptions.

#### **If we wish to be unavailable for certain windows , e.g. winter weekdays 16:30-18:30, will the periods of unavailability have to be declared up front in the 4 year contract or at the week ahead stage?**

Please declare this upfront. We would prefer 24/7 service , but we also require 95% availability throughout the 4 year term and need to know in advance when we will have the service available so we can plan the system requirements ahead of time.

If at week ahead stage you declare unavailable, aside from Force majeure events you would be assessed against the 95% availability performance factor.

## TENDER CRITERIA

### What is the minimum tender?

We would be happy to receive tenders up to 50MW, but the minimum would be 1MW. A cap of 50MW would remove any Grid Code concerns and would provide the opportunity to develop a pool of providers with different technologies and response characteristics, however we understand the economics may be improved with large scale.

We have reviewed this cap and have decided to retain it for this tender event in order to minimise risk when procuring a new service, however it is likely to be increased or removed for subsequent tenders. The cap will apply to the total capacity that an Applicant party can gain through the tender, this can be made up of a number of projects, and Applicants can tender in more than 50MW. For example, an Applicant could tender in four bids, each for a 50MW project, as long as the bids were sufficiently detailed through the application process and the relevant bid bond lodged.

For the avoidance of doubt there is no preferred size for each system, 50MW, 25MW, 1MW we do not mind and also no preference of size of aggregated blocks.

### Do you have any guidelines on availability and utilisation pricing?

We expect to have certain periods of the day when availability would be valued more. Value periods will be added to the Tender documentation.

For example we may have different value periods according to time of the day, week, month or even seasons, again we recognise this is important to developers therefore we intend to publish value periods as soon as possible.

We expect a continuous availability therefore we also expect 24/7 service and it is understood that tenders offering unlimited service will have greater value.

### Does location matter?

No, it shouldn't affect this as system response is universal; however we are aware of parts of the network that may have restrictions on availability and ramp rates. We will be engaging with the DNOs, in the meantime please contact our connections teams for further information.

<http://www2.nationalgrid.com/uk/services/electricity-connections/new-connection/>

Additionally there is no benefit to connect to a 400kv connection or whether we would prefer Transmission or Distribution connected.

### Are you looking for the most cost effective solution or are there points in the tender for reusing

### energy or environmental considerations?

Please refer to the tender assessment principles, you would not hold additional value for reusing energy or environmental considerations as this would result in differing treatment and we aim to be technologically agnostic.

### What is your test acceptance for EFR?

The test criteria and therefore acceptance has been outlined in the DSR Battery Storage Test Procedure for Frequency Response located in the link below. This will be updated to reflect the Enhanced Frequency response service:

<http://www2.nationalgrid.com/uk/services/balancing-services/service-guides/>

This document aims to provide guidance to Demand Side Response (DSR) and Battery Storage providers of frequency balancing services to National Grid. The report provides a description of what frequency balancing is, how it normally operates and how it has to be provided to National Grid. Further, the tests required to demonstrate the capability for providing frequency response are explained in the document (limited to DSR and Battery Storage). Where plant is required to demonstrate compliance with the Grid Code other testing will also be required.

NGET retain the right to witness test the performance of the assets prior to commencement of the term of the contract. We would also require that the providers retain 6 months of raw second by second metering data for audit purposes.

For testing purposes, data needs to be recorded every 0.01s (a 100Hz sampling rate) or better to validate a contract. Please note that this sampling rate is for testing only, not for ongoing operation, and therefore it is acceptable to have metering that does not have this level of accuracy.

For the avoidance of doubt, EFR is a dynamic service and therefore the static frequency tests do not apply.

### Do NGET have a list of approved metering suppliers?

No, the metering must adhere to the requirements of the BSC but we do not specify a specific supplier.

### Will a connection agreement be required to submit a Tender?

In order to ensure that all tenders received are for projects that have a realistic chance of commissioning, NGET requires that the following information is provided in advance of the tender event. This information should be provided in a single document (the "Application"), and once provided to NGET these criteria are fixed. If the information is not provided, or is incomplete, then

the party will not be able to participate in the tender event. Where there are specific mitigating circumstances for incomplete Applications, these should be made clear through the Application process, and will be considered conditions precedent for the contract. More detail will be provided in the ITT pack.

**Company Name** – Parties must provide NGET with the Certificate of Incorporation for the proposed tender party who will deliver, own and operate the assets providing the service (the “Applicant”), this is limited to one per pre-qualified party. This may be a SPV.

**Site Location** – Applicants must demonstrate they have a chosen site(s). This should include map, grid reference, site diagram, grid connection point, MPAN (where known). For DSR assets, MPANs, site addresses and contact details must be provided. For the avoidance of doubt, planning permission is not required at this stage.

**Programme of Works** – Applicants must be able to provide a programme of works for their proposed site location(s) and assets, ideally from their EPC contractor. This must include detail on milestones and mitigating measures.

**Connection Offer** – Applicants must demonstrate that they have a valid connection offer(s) for the site(s) in question, and that the connection date(s) is for no later than 18 months from contract award. If a connection offer is not provided, evidence that a connection application has been made should be provided instead, along with evidence that an offer is likely to be forthcoming with a date that will meet the required service start date. However the demonstration of such a connection offer with a valid connection date will be a condition precedent for any successful tender. For existing assets, evidence must be provided that the relevant connection agreement is in place to allow the service (e.g. BCA, BEGA, etc.). As with a new site, if this is not provided then evidence that a modification application or similar has been applied for will be considered.

**Land Rights** – Applicants must demonstrate they have the legal right to use the land defined in the site location(s). This may be through an option to lease the land for the term of the contract, an active lease for the term of the contract, or ownership of the land. For the avoidance of doubt, this does not include any easements between the site and connection point.

**Financing** – Applicants must demonstrate that they have agreed investment in place, either through demonstration of internal governance sign off or through a Letter of Intent from the funding party (subject to that party’s due diligence process), and that there are no conditions of that investment that may negatively impact on the provision of service. Any Letter of Intent must be specific to the project(s) named in the Application, and not be a general offer of funding to the Applicant. To clarify, whilst we understand that financial close will not be achieved prior to the tender process, we are looking for evidence that any financial backer has undertaken a review of the specific projects to be tendered in.

**Construction Contract** – Applicants must demonstrate they have either contracted with an EPC and/or OEM provider to deliver the proposed assets at the site location, or have received bids from EPC/OEM contractors for the proposed asset(s).

Application Declaration – Applicants must declare that the information contained and submitted in the Application is true and correct and that the relevant declarations are true and correct, and that the entirety of the same has been authorized by the board of directors of the Applicant.

**Will bids submitted with a positive Local Authority pre-application response to be looked upon favourably?**

No, the tender assessment process will only include quantitative aspects of each bid, e.g. price, availability, etc.

**After the deadline for Applications, will any supplemental or additional info be permitted?**

Yes, although the majority of information must be provided by the deadline to allow NGET to verify and confirm back to all the Applicants.

**What is the reason for being project specific in the application process?**

We want to ensure that all tenders received are for actual projects that have the best chance of delivery, and are not speculative enquiries. Being project specific ensures that a level of engineering, financial and regulatory due diligence has been undertaken.

**Will a project to be collocated with an existing plant (hence not requiring a new grid connection) be acceptable or be treated equally with other projects?**

All projects will be treated equally outside of the tender parameters. NGET must abide by the Procurement Guidelines set out as a requirement of Transmission Licence Condition C16, and can be found here: <http://www2.nationalgrid.com/UK/Industry-information/Electricity-codes/Balancing-framework/Transmission-license-C16-statements/>

**Can an asset providing EFR co-locate within an existing BMU, e.g. as a Power Park Module?**

Yes, as long as the EFR asset has separate metering to the required standard and the connection agreement has sufficient capability, e.g. TEC.

**Will a bid bond be required with respect to financial capability?**

During the call for the Expressions of Interest we did what evidence that the parties are able to finance the construction and commissioning of the project themselves (for new assets), or have pre-

agreed lending in place to finance the construction and commissioning, so we would expect the appropriate finance in place.

NGET is currently considering the use of bid bonds to ensure that Applicants submit viable projects. If chosen, it is likely that these will be similar to the arrangements used in the Capacity Market, i.e. £1k per 1MW tendered.

#### **Will there be a termination clause if we cannot obtain planning permission or a connection offer?**

There will always be a Termination Clause, however we haven't concluded what would trigger a termination. We may allow a limited right for parties to transfer successful bids to another site if they cannot connect at their initial location.

#### **What are the criteria for the Post Tender Milestone Test in February 2017?**

These are still being developed, however are likely to include connection agreement in place for no later than February 2018, planning permission granted, financial close achieved, etc.

#### **A four year contract doesn't appear long enough to cover investing in new assets and the costs of connection, would you consider a longer service term than four years?**

We recognise that four years is not very long when investing in new assets, however National Grid is a regulated business and therefore sanctioning contracts longer than two years because of the funding arrangement together with the forecasted market conditions involves us taking on an unacceptable level of risk. Four years is seen as a good balance between revenue certainty and risk mitigation.

The initial tender is for a service starting Winter 2017/18 for four years, however we are seeing a requirement for this type of service increasing over the next few years, therefore we intend to run regular tender events on an enduring basis. The SOF forecast volume of EFR is going up over the next 10 years.

We also recognise that from receiving an offer 18 months may not be sufficient time to finalise a connection agreement and be ready for commercial operation; this can be discussed at the time.

#### **Can we bid two separate tenders from units on the same site?**

Yes you can, we understand some characteristics may vary per unit so this approach is welcomed, however there will be a limit of 50MW of tenders that can be accepted.

You can propose different options with the same tender package, i.e. if you had a 10MW Battery that you wish to offer for 23hrs and also a separate offer for 18hrs a day, two offers from same unit.

#### **How are tenders assessed?**

The Assessment criteria are still to be defined and will be published prior to any tender. However we expect the tenders to be assessed against the alternative services such as P/S/H in the FFR market and also Mandatory Frequency Response holding.

For the avoidance of doubt we do not intend to reduce our normal FFR requirement for this tender procurement exercise.

#### **Can we deliver before 2017?**

Yes if you are ready, the maximum time will be 18 months post contract award.

#### **What are the penalty conditions for not commissioning in time for commercial operation?**

We expect the service to be ready for commercial operation no later than 18 months post contract award. In the event that this deadline is not met, NGET may permit a later commissioning date but this will reduce the term of the contract by an equivalent amount, e.g. if a 2 month delay was permitted, the term of the contract would be reduced to 46 months.

#### **Is there merit in passing through energy costs and levies to NGET to reduce the availability price?**

We are not proposing to offer pass through of energy costs such as imbalance, BSUoS and DUoS, along with consumption levies such as FiTs, Renewables Obligation Levies, Climate Change levies and CfDs at the present time. We understand that some or all of these costs are under review by the relevant bodies as to their applicability to storage sites.

#### **Is NGET taking into account in its assessment any competitive advantages that parties may have, e.g. Interconnectors do not pay TNUoS?**

Our services are technology neutral, and hence we do not consider individual parties' costs in making our assessment.

#### **Can we include other ancillary services in our tender?**

For this tender event we are only considering the provision of EFR. Parties may provide other services through the normal routes where they either do not impact on the EFR service, or outside of tendered EFR windows.

#### **What are the possible tendering criteria?**

These are still being determined, however it is likely to be limited to Availability Price (£/MW/h), Operational Capacity (MW), Availability Hours (Daily and Seasonal Variations). We are looking into whether there is value in including Width of Deadband and Width of Maximum Delivery.

**Will the Availability Price be indexed?**

No, the Availability Price is set for the duration of the term.

**Will each project bid into the auction on an individual SPV basis with bids submitted by the Pre-qualified Parent Development Company?**

The 50MW cap will apply at the Pre-Qualified Party level, i.e. a single Pre-Qualified party could not create a number of SPV delivery companies as Applicants and benefit from the 50MW cap applying to each SPV.

## PERFORMANCE & SETTLEMENT

### What information will you require for the Performance Assessment?

The accurate assessment of performance would require second-by-second metering data from the site(s) providing the service as a minimum. It is recognised however that we would expect delivery in sub-second timescales therefore we may see if we can get more granular data. During the assessment we will be monitoring MWs delivered in both directions (as required)

We will use commissioning test data, monthly performance data and regular spot checks to ensure you meet the required performance. We will also use second by second metering data to take account for time lag between measurement of Hz and the output in MW.

Metering parameters are defined in the Balancing and Settlement Code and every unit will be tested either physically or through validated data at NGET discretion.

We also expect to see your state of charge availability.

### How would I maintain 95% availability if the battery required maintenance?

This is still to be determined, but we recognise that just like any asset the battery would require occasional maintenance. If you have no maintenance throughout the year and the battery performs according to its defined parameters we would expect an availability of 100%, however any planned maintenance would eat into the availability factor for the period(s) in question.

Alternatively you could decide to tender only 23 hours per day and leave the remaining one hour for your maintenance.

Please identify in your tender if you wish to include periods of unavailability.

### How will the nomination process work?

At this moment in time it is expected that you will be deemed nominated unless you inform us otherwise.

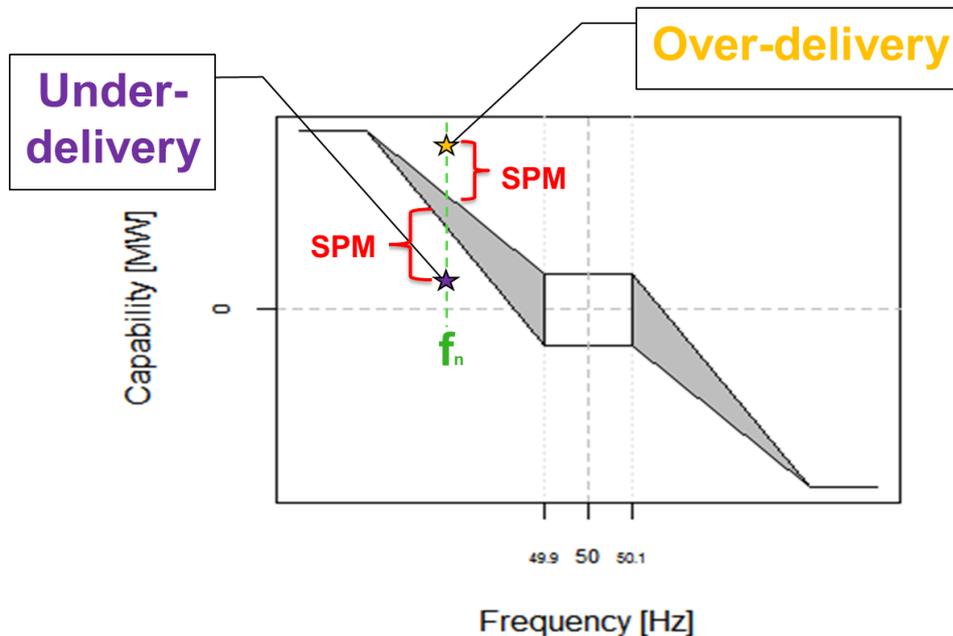
### Is performance based on availability only?

No, you will be assessed on your 95% availability against your tendered MW level, but also assessed on a quality performance factor.

Alongside our need to know how much frequency response is available ahead of time, we also need to know that the response we are getting is consistent, predictable and of good quality. Our Control Room plans the level of response, reserve, margin and voltage on assumptions about how assets will

perform, and therefore need to have assurance that the assets will perform consistently and as expected.

If an asset delivers fewer MWs than the Control Room expects, then any fall in frequency may not be arrested in good time to prevent a low frequency excursion. Equally, if too much response is provided this could result in the frequency recovering and overshooting 50Hz, and then there is a danger of a high frequency excursion. Therefore any deviation away from the expected response needs to be prevented. The quality factor provides an incentive to ensure providers stay within their response envelope at all times.



The example above shows the response envelope expected for EFR. At any frequency value (the x axis), the response provided by the assets should remain within the envelope. The y axis in this case is the percentage power delivery in respect of the declared availability of the assets at that time.

The green line represents the system frequency at a point in time ( $f$ ). If the assets were providing response at that time at a level shown by either the purple or orange stars, they would be under- or over-delivering, and this would cause issues for our control room. Therefore delivery outside of the envelop will be penalised through a percentage reduction in payment for that settlement period via the application of the Service Performance Measure (SPM), and this reduction will be the ratio of the actual delivery to the envelope (or the inverse for over-delivery). See also the response on 95% availability earlier.

Multiple occurrences of under- or over-delivery will result in an event of default, and further measures will be taken.

**What is your preferred minimum delivery time at 100% and 50%**

We would expect full delivery within sub second and maintain (whilst outside of deadband) for at least a further 15 minutes at 100% output.

## PROCUREMENT PROCESS

There are a number of charges imposed and obligations on suppliers depending on where you are connected, please find useful summary

	TNUoS	BSUoS	BSC (Losses & Imbalance)	GDUoS	Other
Tx Connected >50MW E&W	Generation and Demand (if taking over triads)	Daily charge to generators and suppliers of the Transmission Network both ways (Net if gen/demand in same SP if same BMU)	Yes	No	
Tx Connected Scotland >10MW – SHETL	Generation and Demand (if taking over triads)	Daily charge to generators and suppliers of the Transmission Network both ways (Net if gen/demand in same SP if same BMU)	Yes	No	
Tx Connected Scotland >30MW – SPT	Generation and Demand (if taking over triads)	Daily charge to generators and suppliers of the Transmission Network both ways (Net if gen/demand in same SP if same BMU)	Yes	No	
Dx Connected – With licenced supplier	N/A	N/A	No	Yes	Agreement with existing BSC party
Dx Connected – Supply exempt	N/A	N/A	Yes, (no if ABSVD)	Yes	Accede to the BSC (as a trading party) Need to trade in wholesale market BEGA would be required to access embedded benefits (such as TRIAD reduction)

## PROVISION OF SERVICE

### What is the payment structure?

Availability fee (£/MW/hr) – for making the service available to National Grid

### What are the payment conditions?

These are still to be defined; however we expect them to be same as the FFR SCT's payment conditions section 5.2, timings of payments can also be found in settlements website.

<http://www2.nationalgrid.com/uk/services/balancing-services/settlements/>

### Do we have to cover electricity losses during operation?

Yes the supplier will be responsible for any losses incurred during operation either through state of charge management or providing ancillary services.

Volume of Energy provided for the provision of the EFR service outside the dead band may be classified as ABSVD (Applicable Balancing Services Volume Data) where appropriate and where nominated as such by the relevant party (<https://www.elexon.co.uk/glossary/applicable-balancing-services-volume-data/>), which means that energy will be excluded from the imbalance calculation for that provider. In other words, energy used outside of the deadband for the purposes of providing a balancing service is not charged for. However the provider will be responsible for any costs whilst inside the dead band for SOC management. We would expect providers to use the 2014 frequency data to forecast utilisation and therefore any potential risks to imbalance. It is up to the provider to factor these risks into the availability price.

The ABSVD Methodology can be found here: <http://www2.nationalgrid.com/UK/Industry-information/Electricity-codes/Balancing-framework/Transmission-license-C16-statements/>

Please note that ABSVD covers the cost of the energy used providing balancing services at the meter point, however the imbalance position is calculated using Transmission Loss Multipliers and Line Loss Factors, so the ABSVD volumes will not match exactly the energy used.

### Does ABSVD volume count when calculating Triad demand?

Yes, ABSVD only excludes the energy volume from imbalance payments; it does not exclude it from the calculation of demand TNUoS in a Triad period.

For more information on TNUoS and transmission charging, please see the website: <http://www2.nationalgrid.com/UK/Industry-information/System-charges/Electricity-transmission-Charges/> or contacting the team at [charging.enquiries@nationalgrid.com](mailto:charging.enquiries@nationalgrid.com)

#### **Can we take part in TRIAD avoidance?**

Yes you can by making TRIAD periods unavailable, this should be notified in your tender submission.

#### **Can you receive Capacity Market payments?**

The Capacity Market Rules does not prevent an applicant participating in any applicable balancing service whilst having an obligation under the CM (Except long term STOR). Whilst EFR is not yet listed in the rules, we are working to have them included.

There may be an issue around delivery of the balancing service and whether the instructions delivered under the balancing service make it into the Adjusted Load Following Capacity Obligation (ALFCO) calculation. Some Balancing Services are already included and therefore not impacted – if not then you may be penalised for non-delivery should a stress event occur at the same time you are operating under a balancing service instruction.

This will be confirmed in the standard terms and conditions.

#### **Currently it seems there is nothing to prevent a 24/7 provision EFR Asset from participating in the Capacity Market and then dropping out of EFR service provision for the very small number of hours/year it may be called upon for CM provision?**

The CM was carefully designed to avoid this type of behaviour. If we look at STOR and FFR where we do not want people dropping out of the service during a system stress event and doing whatever we like, they are listed as “Relevant Balancing Services” under capacity market rules, the effect of which is to convert a capacity obligation during a stress event to an obligation to follow the terms of their STOR or FFR agreement.

EFR isn't in the Rules as a “Relevant Balancing Service” at present; however we will be proposing an amendment to the CM Rules to get EFR classified as a “Relevant Balancing Service” in due course.

#### **Can a successful contract be novated?**

A successful contract may be assigned to another party subject to NGET's approval. The party must have sufficient financial standing and technical expertise to perform the obligations set out in the contract.

#### **Will the contract allow for reopeners in the event of changes to the regulatory regime/transmission charging/code framework regimes for storage?**

This is unlikely. Any reopeners as a result of regulatory decisions would need to be carefully defined in the contract to avoid introducing significant uncertainty for both NGET and providers, and as the visibility of these changes and their impact upon parties is not always clear we consider it best for all to have certainty over their contractual obligations. Furthermore, storage may not be the only providers of EFR, and NGET must ensure that no technology type has an undue advantage.

**The opportunities for storage assets post-4 years is a key factor in deciding the economics of the project, what is your view of the market after the expiry of the contract term?**

EFR is a new service but one that will continue to grow as system inertia decreases and the largest losses on the system increase. We are anticipating that there will be annual tender events for long term fixed EFR, with monthly tender events for short term flexible EFR. It is these short term tenders events that we see being the opportunity for assets coming out of a long term EFR contract, however this is very speculative at present.

## DNO CONSIDERATIONS

Since the last webinar we have been proactively engaging with the DNOs. We are working collaboratively to ensure that should contracts be agreed we can mitigate any issues that the DNOs will face in providing unrestricted access and therefore impacting on the suppliers' availability. It is therefore vitally important that we work with them from now and throughout the process.

As soon as we have any specific examples of the restrictions or constraints we will of course share and communicate through either the FAQs or any subsequent webinars.

We have agreed to share the tender requirements and the standard terms with the DNOs once they have been agreed.

### **Will a DNO restriction impact our availability ?**

Yes, this could well be the case. We will consider this in the standard contract terms in addition to Force Majeure events and it may be the case that a DNO outage or restriction is covered, but if not then it will affect your availability.

### **If a Supplier is providing rapid response are you concerned that the frequency varies on the Distribution Network?**

We expect each unit to respond automatically to the system frequency and as a whole the system frequency is the same across the transmission and distribution systems, therefore there should be no problem.

We would like to understand what system you intend to deploy whether its individual units or a centrally dispatched system with aggregated units monitoring local system frequency. This information is expected in the EOI and if we believe there are issues with variance of system frequency we can discuss further.

### **DNOs may impose restrictions on offers, such as offers for certain windows, how will this be managed through the tender process?**

We recognise that most participants will be bidding without a grid connection offer or a limited offer (such as certain windows) and a tender may need to reflect this uncertainty. National Grid understands that a discussion with DNOs is critical to overcome such issues and is currently collating a number of questions to present to the DNOs.

There is also the question on how batteries are identified as generation or demand loads on the Distribution Network.

The EOI is hoping to capture all these issues so we can be fully armed when we engage with the DNOs and any updates will be presented in the future seminars and the FAQ's.

### **And what about the G59 Regulations on Embedded Generators?**

Yes we understand that having additional embedded generators connecting to the DNO must comply with the G59 regulations and having high volumes of MW's in fast timescales could cause issues with voltage and rate of changes of frequency , so it is important that we have this discussion with the DNOs. Sites looking to connect to DNO networks may also have reactive power requirements imposed as part of their connection applications, this is something that is dependent upon site location and should be discussed with the relevant DNO.

We will be looking at defining service parameters that will protect the frequency and rate of change to allow us to have a more stable frequency.

## GENERAL QUESTIONS

**The definition of the service is based around Primary and Secondary Dynamics, please could you explain these terms?**

**Primary Response:** The automatic increase in Active Power output of a Genset or, as the case may be, the decrease in Active Power Demand in response to a System Frequency fall. This increase in Active Power output or, as the case may be, the decrease in Active Power Demand must be in accordance with the provisions of the relevant Ancillary Services Agreement which will provide that it will be released increasingly with time over the period 0 to 10 seconds from the time of the start of the Frequency fall on the basis set out in the Ancillary Services Agreement and fully available by the latter, and sustainable for at least a further 20 seconds.

**Secondary Response:** The automatic increase in Active Power output of a Genset or, as the case may be, the decrease in Active Power Demand in response to a System Frequency fall. This increase in Active Power output or, as the case may be, the decrease in Active Power Demand must be in accordance with the provisions of the relevant Ancillary Services Agreement which will provide that it will be fully available by 30 seconds from the time of the start of the Frequency fall and be sustainable for at least a further 30 minutes.

**Can Interconnectors provide this service?**

Yes, this EFR service is not exclusively for Batteries, it is open to all technology types.

**How is this service different from the existing static frequency response that Interconnectors provide?**

This service doesn't replace our static requirements, it is addition to.

**Have you explored models in other markets and how they have implemented batteries?**

Yes we have looked at other markets. They tend to focus more on post fault controls, i.e. if there is a big drop in frequency or a big spike in frequency. Additionally in America the PJM model where a central signal instructs the battery what to do, so we have looked at a couple of different markets and we think this is similar but the technical parameters and the details will be different.

**Where can I find more information on your forecasted requirements?**

The System Operability Framework (SOF) was introduced in 2014 to provide a holistic view for our stakeholders of how radical changes in the energy landscape, identified in our Future Energy Scenarios (FES), impact future system operability.

<http://www2.nationalgrid.com/UK/Industry-information/Future-of-Energy/System-Operability-Framework/>

The latest version was published on the 30<sup>th</sup> of November 2015 and in here you will find forecast of EFR increasing as we are losing inertia.

#### **Are you also interested in domestic batteries?**

The EOI was focused upon large-scale battery projects; we believe the technical readiness and the commercial viability are more advanced. It will also be easier from a metering /settlement and instruction point of view.

We are not excluding domestic batteries, but you need to ensure that they all fiscally meet and communicate with National Grid.

#### **Are there any mothballed National Grid connections you would like us to consider using?**

Please refer to the connections team

<http://www2.nationalgrid.com/uk/services/electricity-connections/new-connection/>

#### **Do you have a forecast of the number of events you expect to see with the addition of the new wind generation and reduction of coal?**

At the moment no and it is very difficult to forecast as you would expect.

#### **How will the solution connect to the grid and what communication systems will be used?**

This is still to be explored but we will have to have some sort of dedicated communication system , this can be developed through further discussions. For the avoidance of doubt we do not intend to use anything like SRD.

Successful tenders must deliver an electronic platform for NGET to monitor live metering and state of charge data, and retrieve historical data.

#### **Will National Grid be interested in receiving financing for the project**

We are not looking to own and operate the assets ourselves. This is about the commercial opportunity to provide the service through the construction, owning and operation of the assets by a third party.

#### **How does this complement the DSR Requirements?**

We see this as part of the Power Responsive campaign where we have suggested that we are looking to procure 50% of ancillary services from Demand Side Response (DSR) providers; however this does not mean that we are favouring distribution-connected parties over transmission-connected parties.

We are co-ordinating our work with this campaign and continually reviewing our requirements over the next five to ten years.

You could suggest that distributed connected batteries fall into the categories in DSR, but all services we procure should complement each other.

**If Transmission Connected , will we have to pay demand TNUoS charges?**

Currently if you are transmission connected and classified as a generator and you took demand over triad periods then you would have to pay demand TNUoS . There is still a lot of uncertainty on what Storage is classified and of course charges and obligations and whether demand TNUoS is passed through; this is something that will be reviewing internally and also with DECC and OFGEM.

**Can you clarify NGET's view on the application of transmission tariffs to storage sites?**

Battery storage will be considered to be a generator rather than demand for the purposes of transmission charging, consistent with how we treat pumped storage. In terms of calculating TNUoS tariffs, we would treat it as conventional rather than intermittent as the generation is under the control of the operator. This is also consistent with pumped storage.

Pumped storage has a generic Annual Load Factor of 10.8% and prior to any historical data being available for battery storage assets we are proposing to use a similar figure. This is currently being investigated by the relevant team within NGET.

For more information on TNUoS and transmission charging, please see the website:

<http://www2.nationalgrid.com/UK/Industry-information/System-charges/Electricity-transmission-Charges/> or contacting the team at [charging.enquiries@nationalgrid.com](mailto:charging.enquiries@nationalgrid.com)

**What is your preferred configuration of connection, centralised or distributed?**

We have no preference; it is up to the supplier to propose their configuration.

**Some of the systems proposed use power on standby and generate losses in operation , will there be any discount for use of energy to provide this service?**

No there is no intention to add value to a tender offering these modes of operation.

**Will the proposed EU codes impact on the GB Frequency Response Provision and in particular EFR?**

At this moment in time we do not anticipate that the Grid Code harmonisation with the EU will have an impact on the service characteristics of Primary and therefore for that matter Enhanced. The EU proposed FCR (Frequency Containment Reserve) is a similar product to the GB Primary. Also we do

not expect this harmonisation to impact on our requirement. However, the guidelines on storage projects as currently drafted do require that assets have a minimum duration of 15 minutes.

#### **For Transmission-connected sites, how will the assets be expected to interact with the BM?**

The Balancing Mechanism (BM) is one of the tools NGET uses to balance electricity supply and demand close to real time. One of the requirements for a transmission-connected party is to input physical nominations (PNs) for each half-hourly settlement period (SP) to NGET. These PNs inform NGET of parties' proposed operating output during that period. For assets such as batteries, the PN would need to be zero for the period of operation, as otherwise the full range of the battery as tendered into EFR would not be available. For example, if a battery contracted to provide 50MW of EFR submitted a PN of 10MW, then it would only have 40MW remaining available in the event of a low frequency event, which would be a breach of the EFR contract.

Parties also submit "bids" and "offers" as part of the BM process. These bids and offers are prices that the parties are willing to accept to move their output either up or down. We would anticipate that parties such as batteries providing EFR would submit very high bid and offer prices to avoid NGET calling on them to move their PN, as NGET is obligated to accept bids and offers in strict price order.

More information can be found here: <http://www2.nationalgrid.com/UK/Our-company/Electricity/Balancing-the-network/>

#### **Will NGET be publishing more frequency data?**

No, NGET considers the 2014 frequency data provided to be representative of the frequency of the system.

#### **Will there be further tenders in future?**

Yes, we consider this to be the first procurement event of an enduring service. System inertia is forecast to continue to reduce, so the driver for an enhanced service will grow. The specifics of the technical requirements may further develop, for instance we may consider rate of change of frequency control rather than absolute frequency control, however this is undefined at present.