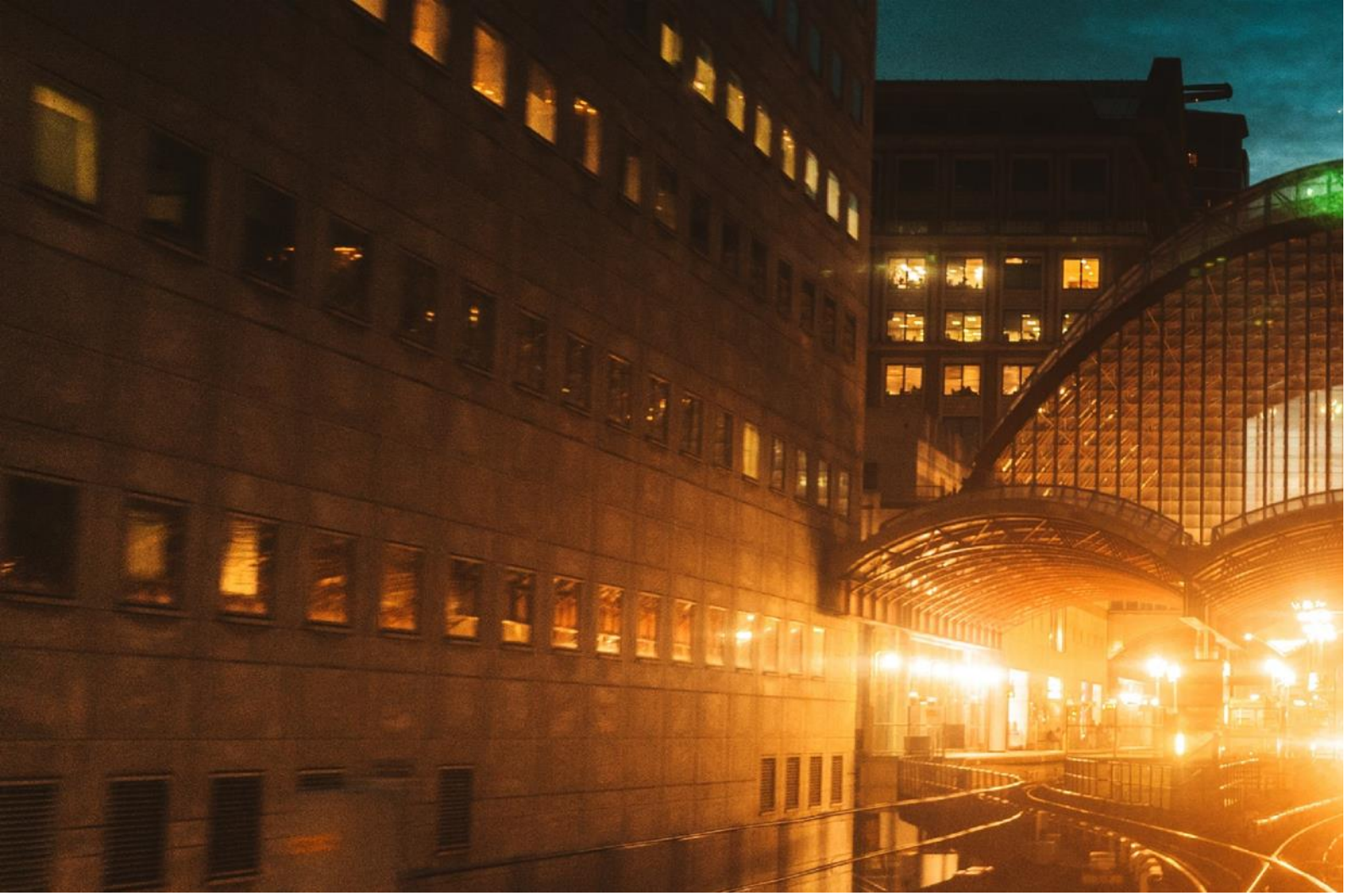
nationalgridESO

Wider Strategy for Flexibility from Intermittent Generation

31/03/2020



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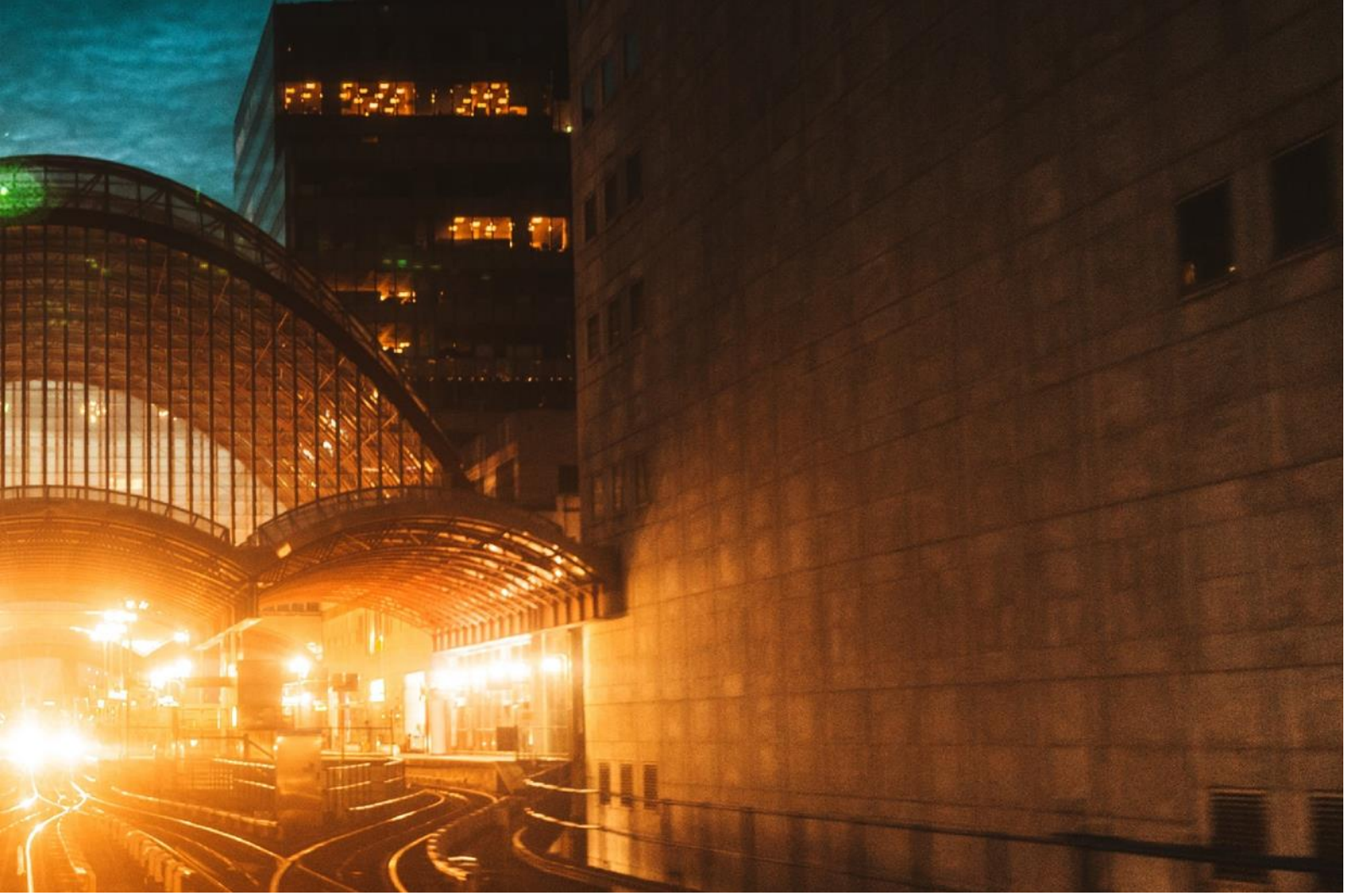


Introduction

In this report we provide an overview of our current markets and the barriers that we are aware exist for intermittent generation types, along with the work that we are doing to increase access to our markets for this specific technology group. With these enablers we hope to increase competition, unlock consumer value and facilitate open and transparent markets. These are some of the deliverables that we have committed to as part of the ESO Forward Plan[1], and we will be continuing to report progress through the monthly and quarterly Forward Plan progress reports[2].

As part of our mission to enable intermittent generation we want to ensure that we understand our stakeholders' views and opinions, and appreciate any feedback given on this document. We will be taking an agile approach to our plans ensuring that we take on board any feedback we are given throughout our timeline. If you have any feedback on this document, please contact the team at box.futureofbalancingservices@nationalgrideso.com.

[1] https://www.nationalgrideso.com/our-strategy/forward-plan
[2] https://www.nationalgrideso.com/our-strategy/forward-plan/how-were-performing

Market Views

Frequency Response

Background

As part of our role as Electricity System Operator, it is our responsibility to ensure that we maintain the frequency close to 50 Hz. This is because deviations beyond the secure limits of 49.5 Hz and 50.5 Hz can damage equipment or even cause blackouts. Frequency response is a valuable tool that we can use to manage system frequency. Frequency response providers either increase or decrease the amount of overall power on the network by taking appropriate action on a second by second basis so supply matches demand as closely as possible therefore reducing dangerous fluctuations in system frequency.

Currently our Frequency Response services are procured through three different markets:

- **Mandatory market**- which procures dynamic Primary, Secondary and High (PSH) via units in the Balancing Mechanism within day.

- **Firm Frequency Response (FFR) monthly tender**- which procures dynamic Primary, Secondary and High as well as Low Frequency Static (LFS) at month ahead.

- **Weekly auction trial**- which currently procures dynamic Low and High, and Low Frequency Static on weekly basis.

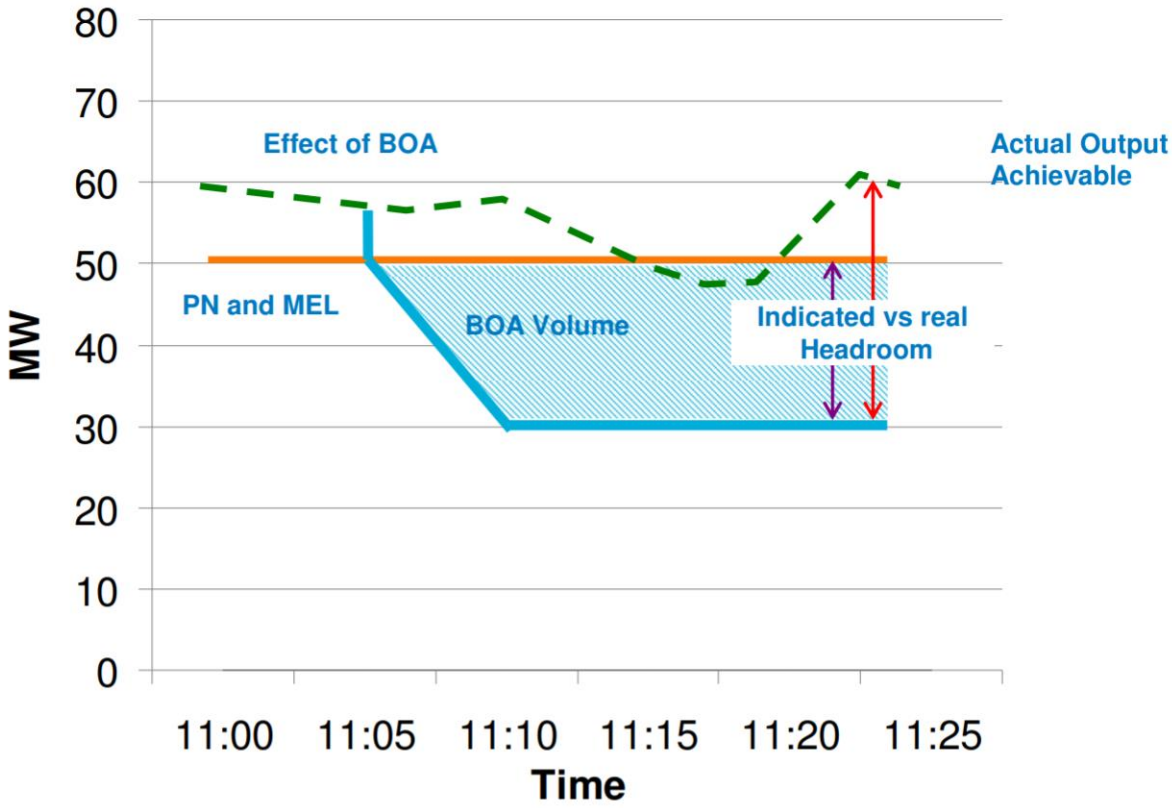
We recognise several barriers exist that impact accessibility to frequency response markets for intermittent generation. Notable barriers identified are:

High and Low Frequency Response Product - Frequency Response products Primary, Secondary and High (PSH) are procured as a bundled product. They are procured together as they are not a standard product, and each generator has different characteristics for them as they are the results of a commissioning test. This means that our scheduling, dispatch and settlement systems treat them as a single product. These system constraints are the reason why the Dynamic Low and High (DLH) product used in the auction is also a bundled product.

All generators must operate part-loaded (i.e. with output below the maximum) in order to provide this bundled frequency response, as they need the headroom to be able to turn up as well as down. When operating part-loaded, all generators will experience reduced revenue as they will be generating less active power to sell. For generators with a fuel-stock, such as gas, this is offset somewhat by the saving in unused fuel, which they can then use at another time. For intermittent generators, however, there is no fuel cost saving to be made, and they cannot store their fuel for later use. Therefore for these generators, operating at part-loaded is solely a cost that may or may not be recovered at a later date, depending on weather conditions.

Commercially, this means that the cost of providing frequency response as a bundle from intermittent generators tends to include a higher lost opportunity cost due to part-loading than the equivalent thermal generator.

Visibility of Power Available - Changing weather conditions in real time create uncertainty for wind in providing frequency response. If wind sites part-load to create headroom for low frequency response provision, or are responding to a high frequency event, the ESO control room has no visibility of the available active power that the site could provide if not taking response action (see chart below). The achievable headroom could be much higher or lower than the ESO thinks is the case, with the uncertainty increasing over time.



This means that assessment of the headroom at these sites is difficult, and without real time data from wind sites to enable better assessment of the available headroom it creates a risk to safe and secure operation of the system.

Procurement Timescales - Firm Frequency Response monthly tender is too far ahead of delivery, because the weather is not accurately predictable one month ahead of delivery and this creates a risk that contracted obligations will not be met and associated penalties will be incurred.

Developments

High and Low Frequency Response Product - Whilst we note that there is no technical reason why intermittent generation cannot provide low and high frequency response simultaneously, we recognise that this is an unattractive commercial area for wind operators. There are a number of developments in progress which will address this issue:

1) We are in the process of implementing a new settlement system for all balancing services, which will allow for more flexibility in settling different, new and non-standard products such as any future high-only frequency response product.
2) We are continuing to develop our control scheduling and dispatch systems to integrate new functionality and engage with new operational parameters such as power available (see below) and state of energy signals.
3) As stated in the Response and Reserve Roadmap[3], we are also focusing on the commercial viability of future dynamic products (Dynamic Containment, Regulation and Moderation). To make these become an attractive commercial area for wind operators, we will separate procurement of LF and HF response services where possible. The HF response services would only require the wind farms to reserve foot room and reduce load while the frequency is high, hence the wind farm operator has no need of curtailing its output to part-load prior the delivery of service. In Q1 2020/21 we will engage with external stakeholders on our vision for these end-state frequency response services and take industry feedback into our detailed implementation plan.

Visibility of Power Available – Intermittent generation operators have access to on-site wind speed data as well as information on the operational characteristics of their assets. This data is combined to create a signal know as Power Available, which represents the power that should be available from the assets at current environmental conditions. Providing that signal to the ESO control room will allow control engineers to understand what the generators could be doing, and therefore give them confidence when instructing intermittent units into frequency response mode. Grid Code modification proposal GC0063 created an obligation on new wind farms to provide the signal, and we have an ongoing project to integrate this data with the National Grid ESO control room. It will allow the control room to have a view of wind operators potential outputs on a second by second basis which reduces risk when calling on their services.

Phase 1 of the Power Available project is due to "Go-Live" in April 2020. It will provide visibility to the ESO control room of the Power Available signal on control room screens from all wind farm sites and indicate whether the signal is accurate (according to the agreed Quality Standard methodology). The Control Room engineers have been trained to read the screens and to manage their total response holding when calling wind for MFR using the PA signal. The Power Available signal will also be used in settlement of MFR using the methodology in Section 4 of the CUSC. This means that there will be alignment between the commercial and technical aspects of MFR provision from PPMs and both are better set up for provision from wind.

Phase 2 will expand on the learnings of Phase 1 implementing several fixes to the way in which our Balancing Mechanism systems use and understand MW provided by windfarms. There will be a change to the XBID arrangements to properly value wind farms operating above their Physical Nomination (PN) rather than considering them free to unwind, and the introduction of a weekly accuracy report to continue to help wind providers improve their operational signalling. Additionally, Phase 2 will start to blend PA data with wind forecasts to provide a view ahead of time to further assist control room engineers in integrating wind providers into the response mix. Phase 2 of the PA project is expected to be delivered towards the end of FY 2020/21.

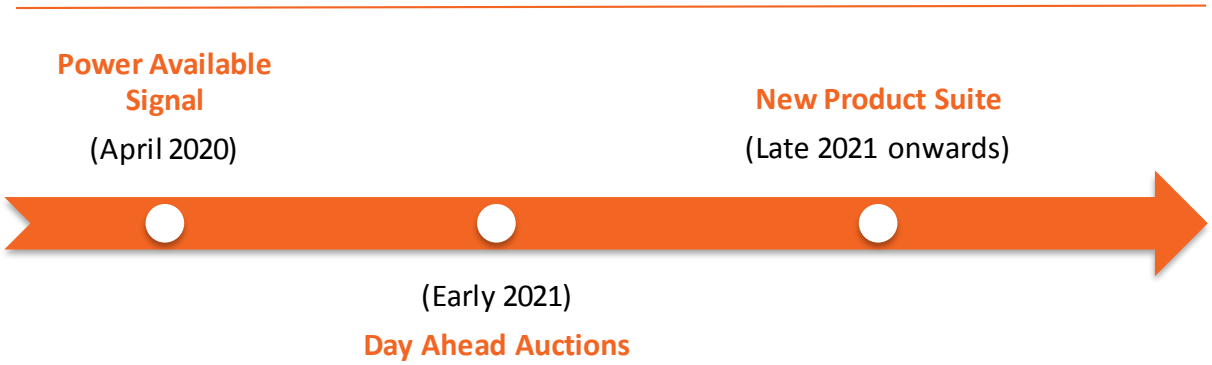
Procurement Timescales - To address barriers to participation due to the long lead times for the monthly FFR auction, we are currently developing a single market platform that will procure response services on day ahead timescales. This single market platform is currently in its trial phase

[3] https://www.nationalgrideso.com/document/157791/download

and procuring dynamic low and high (DLH) and low frequency static (LFS) response, through a weekly auction for delivery at day ahead.

In the current trial, generators can offer their availability from within day up to 7 days ahead, and therefore intermittent generators can bid in availability for the time horizon which they feel best balances achievable revenue against the risk of under-delivery as a result of changing weather. The day ahead platform will increase the opportunity for intermittent generation to participate, and is planned for early 2021.

Timeline for Key Frequency Response Enablers



Reserve

Background

National Grid ESO contracts with fast acting providers who standby to deliver a pre-agreed amount of power in the event there is an unforeseen change in demand or generation. Reserve power is not delivered as rapidly as frequency response but sees a greater volume of electricity onto the grid. Currently our reserve is provided via two products, Short Term Operating Reserve (STOR) and Fast Reserve. Historically, STOR has been procured via tenders held three times a year, covering 'seasons' which are typically 6-10-week periods across two years. Similar to STOR, Fast Reserve has previously been procured via a monthly tender.

We recognise several barriers exist that impact accessibility to these markets for intermittent generation. Notable barriers identified are:

Procurement Timescales – Due to weather forecasting being increasing unreliable more than a few days ahead of time, intermittent generators have not been able to participate in these markets as they cannot guarantee that they will be available for instruction by the control room. This creates a risk that contracted obligations will not be met and associated penalties will be incurred.

Product Requirements – Reserve services require some headroom is sterilised in order to allow for assets to increase their output on instruction, and typically intermittent generation will be seeking to

operate at full output to maximise generation when the resources are available (as discussed in the frequency response section.

Developments

We are addressing the barriers mentioned above by implementing the following enablers.

Procurement Timescales – We have introduced a within day Optional Reserve product for providers with STOR and Fast Reserve framework agreements and who also have the Ancillary Services Dispatch Platform (ASDP) installed. ASDP is an API-based communications system between the control room and individual providers, which allows for monitoring and instruction of assets in real time. Providers can offer STOR or Fast Reserve with utilisation only prices for upcoming STOR windows or 4-hourly EFA blocks at a lead time of around 60-90 minutes, depending on service.

We will also be undertaking a holistic review of our reserve products later in 2020/21, with the intention of moving them to the single market platform at day ahead timescales. This review will include detail of how they will interact with both new frequency response products, spin gen and pan-European Standard products (Trans European Replacement Reserve Exchange (TERRE) and Manually Activated Reserves Initiative (MARI) as well as other elements of Electricity Balancing Guideline (EBGL) and the recast Electricity Regulation and a plan for implementation.

There are also within day reserve products which will be available from the summer 2020, through the Trans-European Replacement Reserve Energy (TERRE) platform[4]. This will allow providers to access markets across Europe to provide reserve energy in 15 minute blocks through hourly auctions.

All the above developments will allow intermittent generators access to markets at close to real time, which will address the issue of weather uncertainty which is creating a barrier to entry.

Product Requirements – The requirement for an increase in energy is fundamental to the product design, and therefore the need for some headroom is intrinsic to reserve services. We are therefore not progressing any changes to this at present.

Restoration

Background

A total or partial shutdown of the national electricity transmission system (NETS) is an unlikely event. However, if it happens, we are obliged to make sure there are contingency arrangements in place to ensure electricity supplies can be restored in a timely and orderly way. Black start is a procedure to recover from such a shutdown.

[4] https://www.nationalgrideso.com/document/139921/download

During a black start event, the service requires the provider to start up its main generator(s), carry out initial energisation of sections of the national electricity transmission system and distribution network, and support sufficient demand to create and control a stable 'power island'.

The black start service is procured from power stations that have the capability to start main blocks of generation onsite, without reliance on external supplies. This has typically been procured from a slowly reducing number of traditional providers.

We recognise several barriers exist that impact accessibility to this market for intermittent generation. Notable barriers identified are:

Firmness of Availability – the black start service requires a guarantee that the energy required, and its magnitude, are available at any time. Due to weather forecasting issues, this is not possible for intermittent generation, which limits their ability to offer this service.

Size and Location of Assets – the black start service requires that the asset can energize in block sizes of 50MW, in order for DNOs to be able to reconnect blocks of load. It is also restricted to assets connected at transmission voltages, in order to ensure energization of the necessary circuits and to ensure that generators have the necessary communications infrastructure. As there are significant volumes of intermittent generation connected at distribution voltages, these requirements are also a barrier to those parties.

Developments

We recognise the need for a more competitive and accessible way of procuring black start as the technology mix on the system changes, which is why we are working with SP Energy Networks and ENTI on a Network Innovation Competition (NIC) funded project called Distributed ReStart[5]. The project is a three-year program running from January 2019 to March 2022 that will develop and demonstrate new approaches to enabling black start services from distributed energy resources.

Examples of distributed energy resources include:

- Natural gas turbines
- Biomass generators
- Embedded hydro power stations
- Wind turbines
- Solar panels

The project is a three-year programme (Jan 2019 – Mar 2022) that will develop and demonstrate new approaches to enabling Black Start services from Distributed Energy Resources (DER). Case studies on the SP Distribution (SPD) and SP Manweb (SPM) networks will be used to explore options and then design and test solutions through a combination of:

- detailed off-line analysis
- stakeholder engagement and industry consultation
- desktop exercises
- real-life trials of the re-energisation process.

[5] https://www.nationalgrideso.com/innovation/projects/distributed-restart

The project will assess the capability of distribution networks and installed DER, including wind and other intermittent generation, to deliver an effective black start service, and identify the technical requirements which should apply on an enduring basis.

The benefits of Distributed Energy Resources are that they provide an alternative to traditional large generators, and could reduce the costs associated with large generator readiness. Increased participation from distribution connected generators is also necessary as larger thermal plant which typically provided this service close. This project could therefore provide an opportunity for intermittent generation to participate in the black start market.

Other services

The three service areas that we have focused on in this report are the ones that we understand, from stakeholder feedback, have the greatest barriers to market entry for intermittent generators. Whilst there are improvements required in the markets for other services, such as reactive power, our understanding is that these apply to all technology types. However, if you would like to raise issues or discuss the contents of this report further, please contact your Account Manager in the first instance, or the team at box.futureofbalancingservices@nationalgrideso.com.

Further Information

More information on our development of our balancing services and markets can be found through the following channels:

- The Future of Balancing Services Newsletter, sign up here: https://subscribers.nationalgrid.co.uk/h/d/3AD3ADAD9EC37E09
- The Future of Balancing Services webpage: https://www.nationalgrideso.com/research-publications/future-balancing-services
- The 2020/21 Forward Plan: https://www.nationalgrideso.com/our-strategy/forward-plan
- The quarterly Forward Plan progress report: https://www.nationalgrideso.com/our-strategy/forward-plan/how-were-performing
- The RIIO-2 Business Plan for 2021 onwards: https://www.nationalgrideso.com/our-strategy/business-planning-riio/riio-2-final-business-plan

For information on the current products and markets contact your Account Manager, or the Balancing Services team (commercial.operation@nationalgrideso.com). For information on future products and markets, contact the Ancillary Services Development team (box.futureofbalancingservices@nationalgrideso.com).

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