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Annual Balancing Services Spend Report

Published in accordance with Standard Condition C16 of National Grid Electricity System Operator Transmission Licence

Effective Date: 17th June 2022

Version Number: 1.0

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Contents

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Table of Figures

1. Version Control

Version No.	Date	Version / Amendment
1.0	17/06/2022	Initial Version

2. Purpose of Report

NGESO have created this report in accordance with Clause 8, Part G of Ofgem's Electricity Transmission Licence Standard Conditions.

A statement from an independent auditor accompanies this report, confirming that the report is accurate and detailing the auditor's independent assessment of the extent to which NGESO has complied with the relevant statements contained within the published Procurement Guidelines and Balancing Principles Statement.

The purpose of this report is to document the total spend made by National Grid ESO (NGESO) on Balancing Services throughout the previous regulatory year (April 2021 – March 2022). The report discusses the total costs that have been calculated and how they have been incurred in accordance with the following publications:

- **Procurement Guidelines v20.0** - This document sets out the Procurement Guidelines which NGESO is required to establish in accordance with Standard Condition C16 of the Transmission Licence. The purpose of the guidelines is to set out the kinds of Balancing Services which they may be interested in purchasing, together with the mechanisms by which such Balancing Services will be purchased within the next financial year. The Procurement Guidelines can be found online here: https://www.nationalgrideso.com/industry-information/codes/balancing-settlement-code-bsc/c16-statements-and-consultations
    - v19.0 was published in April 2021 and later revised in August, Ofgem decision link for this publication can be found here: https://www.ofgem.gov.uk/publications/decision-use-our-power-direction-relation-mid-term-revision-ngeso-procurement-guidelines-statement-2021-2022
    - v20.0 was updated because NGESO established a methodology for the procurement of a new product, Net Transfer Capacity (NTC). The product is designed to allow NGESO to manage system stability and other constraints. Interconnectors can present large losses to the system, either from importing or exporting electricity and NGESO has shown that such losses cannot be managed without a product like NTC
- **Balancing Principles Statement v19.0** – the purpose of this document is to define the broad principles and criteria by which NGESO will determine at different times and in different circumstances, which Balancing Services will be used to operate the transmission system efficiently and effectively. This document is required under Standard Condition C16 of the Transmission Licence

Scope of Report

The following Balancing Services are within scope for this report:

- Ancillary Services, including services procured through Pathfinders
- Forward Trades
- System Operator (SO) to SO Transactions (made via the interconnectors)

Out of Scope

The following services are out of scope for this report:

- **Bids or offers accepted through the Balancing Mechanism (BM).** This is where parties can submit an "offer" to sell energy (through increase of generation or decrease of consumption) and a "bid" to buy energy (through increase of consumption or decrease of generation) at prices set by the parties.

3. Introduction

NGESO are responsible for balancing demand and supply every minute of every day to ensure the security and quality of electricity supply across Britain's transmission system. This activity is required because electricity cannot be stored in large quantities. In order to do this, NGESO buy in (procure) services from balancing service providers ("providers"). These are called "Balancing Services" and they are used to keep the transmission system (or "grid") running in an efficient, economical and coordinated way. That means everyone can get a steady flow of electricity. More information about Balancing Services can be found on NGESO's website:

https://www.nationalgrideso.com/electricity-transmission/industry-information/balancing-services

This report details the various Balancing Services that NGESO procure and how much was spent on them in the preceding regulatory year.

As mentioned previously, the spend covered in this report is made up of the following types of purchase:

- **Ancillary Services** – NGESO enter into contracts with providers to secure services which are used to help manage operability challenges. These contracts are secured either bilaterally, via competitive tenders, mandatory agreements or via a Pathfinder. Pathfinders are projects (usually resulting in a tender) which look to find the most cost-effective way to address issues in the electricity system. The services contracted here are called "Ancillary Services".
- **Forward Trading** – in order to balance the system or manage system issues, NGESO will procure electricity in advance of the balancing mechanism process. These are forward trades.
- **Pathfinders** – these are projects which look to find the most cost-effective way to address issues in the electricity system created by changes to the mix of generation seen in the grid across recent years. These projects will include a competitive tender.
- **SO-SO Transactions** – these are SO-SO services, provided by other System Operators made via the interconnectors. The costs will be negative if we receive any revenue for Balancing Services provided to other System Operators.

Some services reported within this document are split into BM and NBM (for non-BM) categories. This refers to whether the provider's asset is registered within the BM as a BMU or not.

4. Annual Spend Overview

This year's high balancing costs have been predominately driven by high prices in the BM and throughout the market. As the cost of gas and emissions has gone up, there have been significant increases in the day ahead power prices, impacting the cost of the actions taken to balance the system. This is most relevant when seeking to increase the output of generation (buy/offer). It is less relevant when seeking to decrease the output of generation (sell/bid), as these actions often involve renewable generation, which is not impacted by gas prices.

Whilst power prices continued to rise throughout the year, Winter 2021/22 saw historic spikes in gas prices, the largest of which were seen in mid-December and early March. These were largely as a result of coming out of the pandemic and also because of concerns around gas supply due to low levels of storage and uncertainty surrounding Russian flows of gas into Europe. Russia's invasion of the Ukraine caused large volatility in the market as traders were anticipating the flows through Ukraine and Belarus could be cut off. These worries remain.

Throughout the winter months there were a number of periods of tight margins where scarcity pricing meant that actions were taken at prices up to £4,000/MWh to meet Operating Reserve levels and maintain system security.

Over the previous regulatory year, NGESO spent a total of £949,468,653.62 on Balancing Services (excluding Balancing Services which have been acquired through the acceptance of an offer or bid in the Balancing Mechanism (BM), provided such offer or bid was not made pursuant to any prior agreement). The figures below show a breakdown of this spend by service categories.

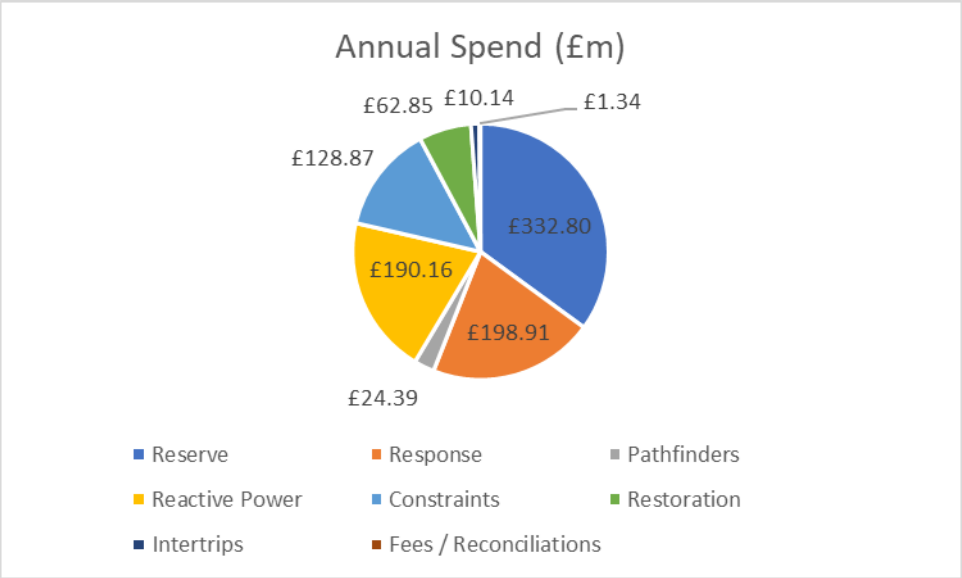

Figure 1 Balancing Services Annual Spend

Service	Annual Spend(£m)
Reserve	£332.80
Response	£198.91
Pathfinders	£24.39
Reactive Power	£190.16
Constraints	£128.87
Restoration	£62.85
Intertrips	£10.14
Total	£949.47

Figure 2 Balancing Services Annual Spend Figures (£m)

5. Reserve

At certain times of the day, NGESO need access to sources of extra power in the form of either increased generation or reduced demand. This enables them to manage any electricity demand which may be greater than forecast. The additional power sources available are called “Reserve Services”.

In total, NGESO spent £332,799,729.06 on reserve services throughout the previous regulatory year. The below figures and following sections break this down by specific services.

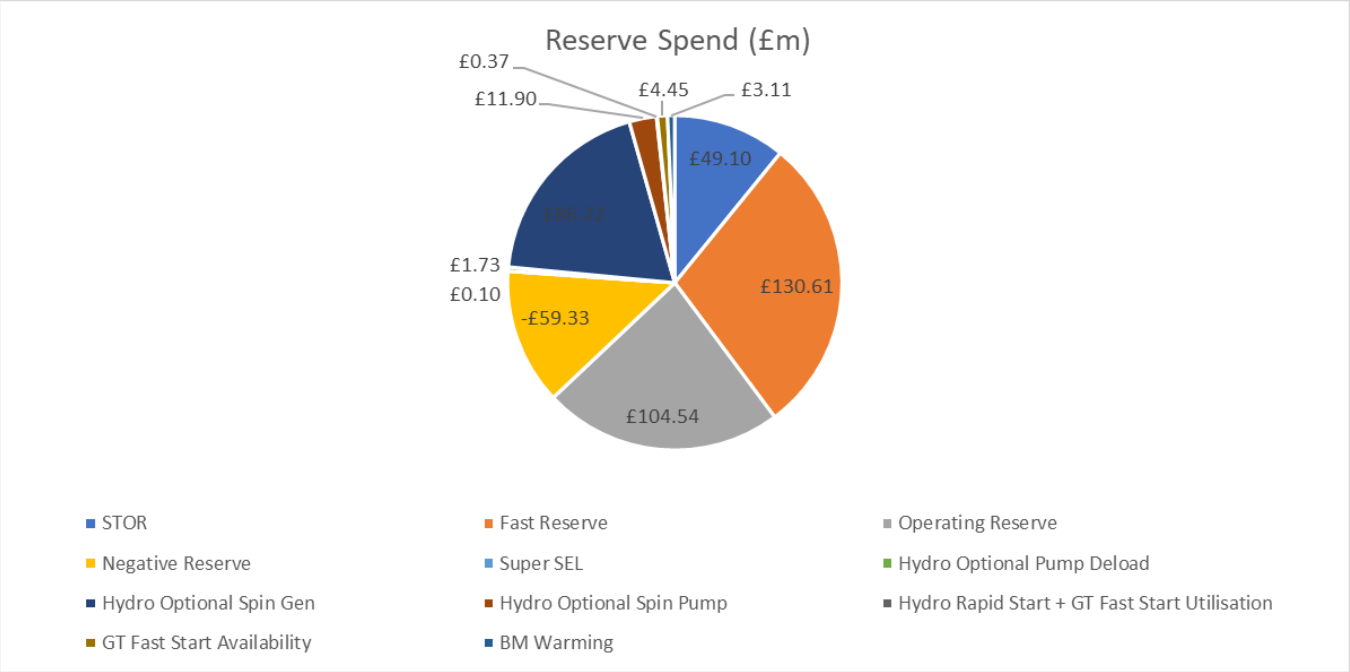

Figure 3 Reserve Services Annual Spend – Chart

Service	Spend (£m)
STOR	£49.10
Fast Reserve	£130.61
Operating Reserve	£104.54
Negative Reserve	-£59.33
MaxGen	£0
Super SEL	£0.10
Hydro Optional Pump Deload	£1.73
Hydro Optional Spin Gen	£86.22
Hydro Optional Spin Pump	£11.90
Hydro Rapid Start + GT Fast Start Utilisation	£0.37
GT Fast Start Availability	£4.45
ODFM	£0
Power Potential	£0
Demand Turn-up	£0
BM Warming	£3.11
Total	£332.80

Figure 4 Reserve Services Annual Spend – Table

STOR

Short-term Operating Reserve (STOR) allows NGESO to have extra power in reserve for when it's needed. It helps to meet extra demand at certain times of the day or if there's an unexpected drop in generation. The requirement for STOR is dependent upon the demand profile at any time. The STOR year starts in April, and is split into six seasons, which specify the Availability Windows where STOR is required each day. NGESO aims to procure a minimum of 1700 megawatts (MW) of STOR per day (subject to requirements). This consists of around 360MW of legacy long-term contracts and around 1340MW auction based. Since April 2021, STOR has been purchased through a daily, pay-as-clear auction process. The results are published here: https://data.nationalgrideso.com/ancillary-services/short-term-operating-reserve-stor-day-ahead-auction-results.

NGESO purchases two types of STOR: firm and optional. The firm service can be provided by both BM and NBM providers. They must make the service available for all availability windows and the only reason for the service not to be delivered is if the site is technically unable to do so. If a tender is accepted, NGESO commit to buying all of the services offered. The optional service is only open to NBM providers. Initial declarations of availability are made towards the start of the previous week and can later be refined. NGESO does not commit to buying any of the services offered.

Meeting the requirement depends on liquidity in the market and if the volume can be secured at a lower cost than the alternative actions.

We make two types of payments for STOR:

- **Availability Payments** – Paid (£/MW/Hr) for the hours in which the firm service has been made available. This paid as "pay as clear" through the daily auction. This is not applicable to the optional service
- **Utilisation Payments** – Applicable to firm and optional service. Paid £/MWh for the energy delivered.

You can find more detail about the STOR service on our website https://www.nationalgrideso.com/industry-information/balancing-services/reserve-services/short-term-operating-reserve.

In total, NGESO spent £49,099,677.33 on STOR last regulatory year. Please see the below figure and bar chart for further breakdown.

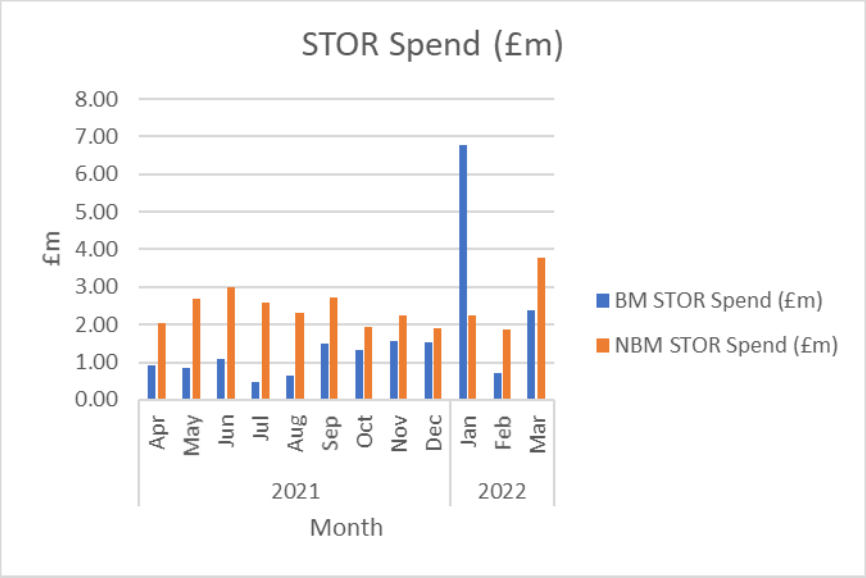

Figure 5 Monthly Spend on STOR – Chart

Month	BM STOR Spend (£m)	NBM STOR Spend (£m)
Apr	0.93	2.03
May	0.84	2.69
Jun	1.09	2.98
Jul	0.46	2.59
Aug	0.66	2.32
Sep	1.51	2.71
Oct	1.33	1.95
Nov	1.57	2.25
Dec	1.52	1.89
Jan	6.78	2.26
Feb	0.71	1.86
Mar	2.37	3.78
Total	**19.78**	**29.32**

Figure 6 Monthly Spend on STOR – Table

As shown within the above figures, the BM STOR spend for January was significantly higher than other months. This is because January '22 was the first month in which a revised Buy Order methodology was implemented for the STOR Day-Ahead auctions. Principally, the methodology allowed for the use of a significantly higher Buy Order price for a STOR Day-Ahead auction for delivery dates on which the system margin was forecast to be tight. The aim of these amendments was to address the issues faced in late 2021, where days characterised by tight system margin frequently coincided with a significant drop in auction participation due to higher financial returns available for providers outside of the STOR market.

What the chart does not show is the shortfall cost i.e., the cost incurred to secure any shortfall in STOR volume that wasn't secured via the auction in real time via the BM. Traditionally, this real-time procurement is far more expensive that procuring the same volume at the Day-Ahead level through the auction. Thus, while the month of January was evidently more expensive in terms of pure auction cost, this additional cost offset much larger costs that would have been incurred had we continued to observe shortfalls in STOR volume contracted at the Day-Ahead level.

While the revised methodology remained in place beyond January, there were no days charactered by tight system margin conditions; a significantly higher Buy Order price was therefore not required.

Fast Reserve

Fast Reserve provides the rapid and reliable delivery of active power through an increased output from generation or a reduction in consumption from demand sources, following receipt of an electronic dispatch instruction from National Grid. Fast Reserve service must commence within two minutes following instruction, at rates of 25MW or greater per minute.

Over the previous regulatory year, NGESO secured its full Fast Reserve volume via the Optional Fast Reserve service, procured on the day by the National Grid Electricity Control Centre. Only providers who have entered into a Fast Reserve Framework Agreement can provide the Optional Fast Reserve service.

Two types of payments are made for the Optional Fast Reserve service:

- **Availability Payments in £/hours** – these are what we pay to providers to be "armed", available to supply Fast Reserve
- **Utilisation Payments in £/MWh –** paid for the energy delivered under the service

In total, NGESO spent £130,614,929.09 on Fast Reserve last year. This was all on non-BM Optional Fast Reserve. Monthly breakdown can be seen below.

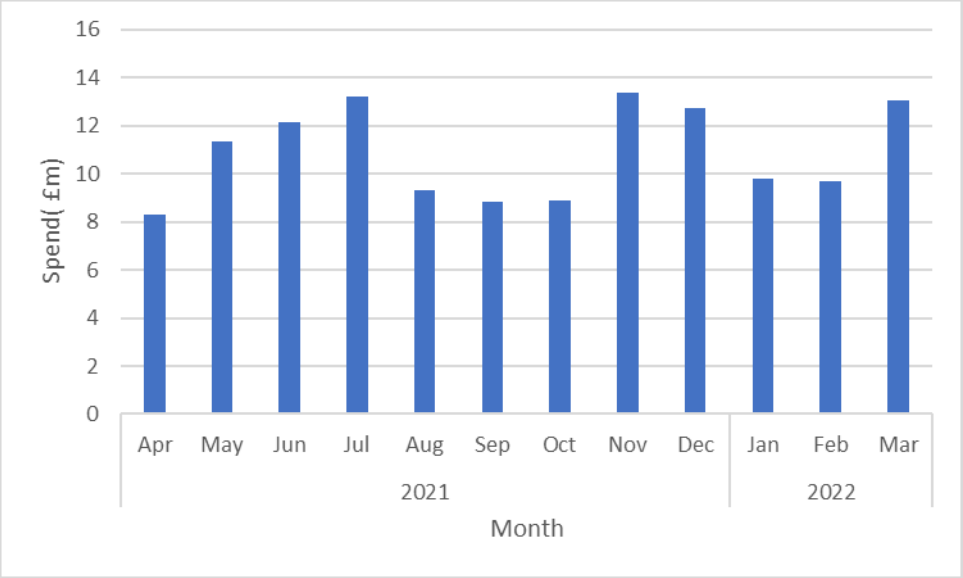

Figure 7 Monthly Spend Fast Reserve – Chart

Month	Non-BM Optional Fast Reserve Spend (£m)
Apr	8.30
May	11.33
Jun	12.15
Jul	13.21
Aug	9.32
Sep	8.81
Oct	8.88
Nov	13.36
Dec	12.73
Jan	9.78
Feb	9.70
Mar	13.04
Total	130.61

Figure 8 Monthly Spend Fast Reserve - Table

Operating Reserve

Operating or Positive Reserve is required to operate the transmission system securely and provides the reserve energy required to meet the demand when there are shortfalls, due to demand forecast changes or generation breakdowns.

The spend on Operating Reserve in scope for this report is procured through:

- **SO-SO Interconnector Capability Payments -** payments made to other SOs for high frequency (HF) / low frequency (LF) response capability
- **SO-SO Transactions -** purchases of energy from neighbouring SOs, to provide additional operating reserves*
- **Forward Trades -** purchases of energy in forward markets, usually over Interconnectors, to provide additional operating reserves

In total, NGESO spent £104,539,635.04 on Operating Reserve over the previous regulatory year. Please see the below figure for further breakdown.

Month	SO-SO Interconnector Capability Payments	SO-SO Transactions*	Forward Trades
Apr	0.32	0.06	2.18
May	0.29	0.00	0.06
Jun	0.29	0.00	0.54
Jul	0.31	0.00	0.24
Aug	0.30	0.00	0.11
Sep	0.29	0.00	0.68
Oct	0.29	0.00	3.63
Nov	0.27	0.00	19.38
Dec	0.14	0.00	23.92
Jan	0.12	-0.01	22.17
Feb	0.12	0.00	8.75
Mar	0.15	0.00	19.95
Total	**2.89**	**0.04**	**101.61**

Figure 9 Monthly Spend Operating Reserve

Negative Reserve

Negative Reserve can provide the flexibility to reduce generation or increase demand to ensure supply and demand are balanced. The service is held in reserve to cover unforeseen fluctuations in demand, or generation from demand side PV (photovoltaic/solar) and wind.

The spend on Negative Reserve in scope for this report is procured through

- **SO-SO Transactions -** sales of energy to neighbouring TSOs to provide additional negative reserves*
- **Forward Trades -** sales of energy in forward markets, usually over Interconnectors, to provide additional negative reserves

*please note, the SO-SO costs in this report are subject to change and will be updated if required

The total net payment to NGESO for Negative Reserve last regulatory year is -£59,326,657.17. This is the net of payments made by NGESO for energy and money received for energy sold by NGESO over the interconnector. Please see the below figures for the separated breakdown.

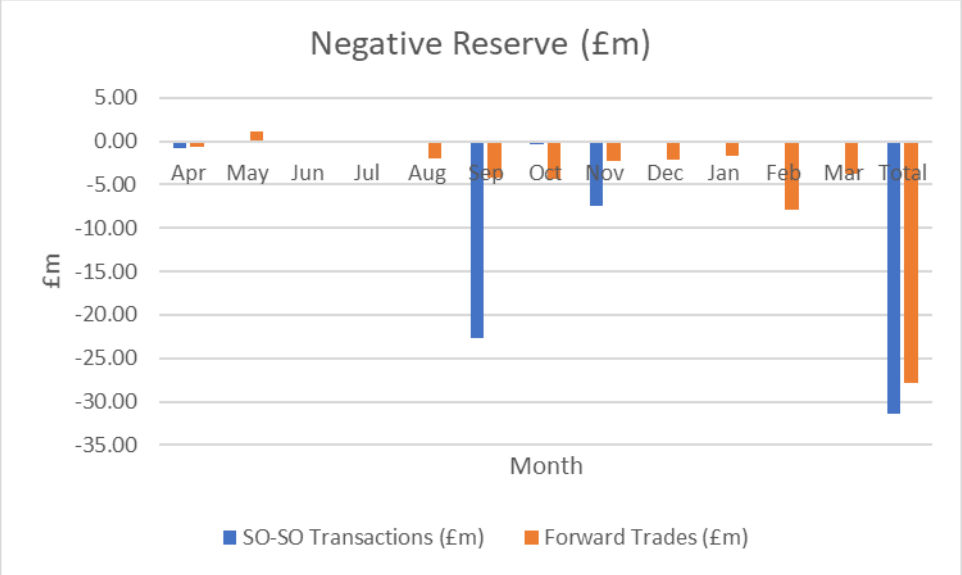

Figure 10 Monthly Spend Negative Reserve – Chart

*please note, the SO-SO costs in this report are subject to change and will be updated if required

Month	SO-SO Transactions (£m)*	Forward Trades (£m)
Apr	-0.81	-0.60
May	0.00	1.19
Jun	0.00	-0.02
Jul	-0.06	-0.13
Aug	0.00	-1.94
Sep	-22.74	-4.26
Oct	-0.33	-4.41
Nov	-7.45	-2.21
Dec	0.00	-2.14
Jan	0.00	-1.65
Feb	0.00	-7.96
Mar	0.00	-3.79
Total	-31.40	-27.92

Figure 11 Monthly Spend Negative Reserve – Table

Maximum Generation (MaxGen)

The Maximum Generation (MaxGen) service allows access to capacity which is outside of the generator's normal operating range in times of system stress. The service would be used to provide additional, short term generation output following the issuing of an Emergency Instruction.

Providers are paid a Utilisation Payment (£/MWh) once the service is utilised, and energy delivered. The agreed Utilisation Payment is included within each providers' Commercial Services Agreement (CSA).

NGESO are no longer actively procuring this service. Existing contracts were put in place via bilateral negotiations and will remain in place until the sites close or the contracts are terminated.

No MaxGen services were procured or paid for during the previous regulatory year.

Super SEL (Stable Export Limit)

Super SEL is utilised to directly reduce the minimum generation level (Stable Export Limit - SEL) of generators synchronized to the system. Super SEL contract enactment will be through a trading instruction. Dispatch will be via the Balancing Mechanism to reduce output to the new lower SEL if required. The live data

*please note, the SO-SO costs in this report are subject to change and will be updated if required

file is refreshed every ten minutes. The Super SEL service can be used to access additional negative reserve during periods of low demand and high inflexible generation output.

Super SEL is procured through bilateral agreements. Providers will be paid an agreed Enactment Payment (£/MW/hr) for the periods between start up period and end time.

In total, NGESO spent £98,600.00 on Super SEL last year. This was only used between 1st and 4th January 2022 this regulatory year.

Hydro Optional Pump De-load

Hydro Optional Pump De-load is the provision of Primary and Secondary frequency response where hydro units will automatically stop pumping (de-load to 0MW) when a certain real-time frequency trigger level is reached. This reduces the pumping unit's contribution to system demand helping the frequency to increase. When required, it will be instructed in real-time by the National Grid Electricity Control Centre and the unit must be pumping to deliver this. This service was procured through bilateral contracts and providers are paid in accordance with terms set out in their CSAs. In total, NGESO spent £1,732,830.27 on Hydro Optional Pump De-load this regulatory year.

Hydro Optional Spin Gen

Hydro Optional Spin Gen is very similar to the previous service, however, instead of the unit ceasing to pump, this service instead triggers the unit to start generating. This is instructed in real-time by the National Grid Electricity Control Centre. Whilst instructed to provide this the unit will spin in air using a small amount of demand to do so. When the frequency trigger is reached, the water barriers will be opened, and the unit will start generating to help increase the frequency. This service was procured through bilateral contracts and providers are paid in accordance with terms set out in their CSAs.

In total, NGESO spent £86,219,405.70 on Hydro Optional Spin Gen with LF this regulatory year.

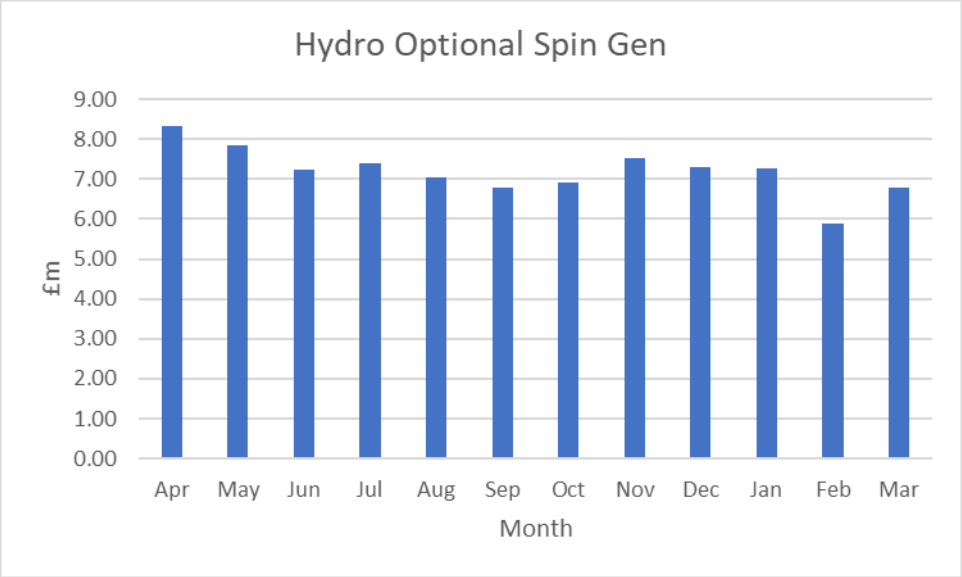

Figure 12 Hydro Optional Spin Gen Monthly Spend

Hydro Optional Spin Pump

This is a payment for the period that a unit is instructed to provide the Spin Pump service, which allows BM units to provide Reserve and Synchronous Compensation. This service is an optional, bilateral service which is contracted via providers' CSAs, the £s payment for this service is included within this document.

In total, NGESO spent £11,897,794.25 on this service last year. Please see the below figure for further breakdown.

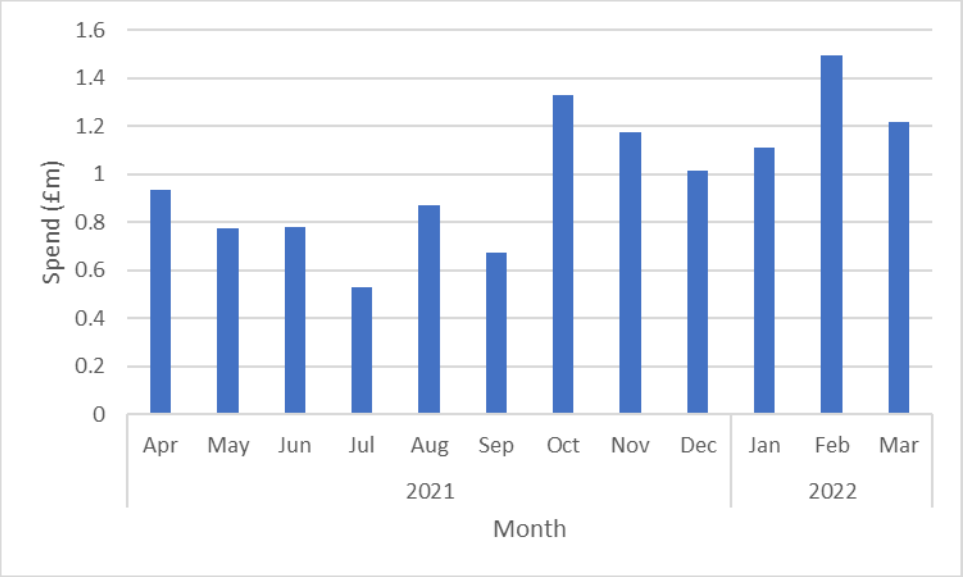

Figure 13 Monthly Spend Hydro Optional Spin Pump – Chart

Hydro Rapid Start and GT Fast Start Utilisation & GT Fast Start Availability

Hydro Rapid Start is a payment made following a rapid synchronisation of a BMU to the GB transmission system when instructed by the NGESO control room. Gas Turbine (GT) Fast Start utilisation payment is made following a rapid synchronisation of the BM unit to the GB Transmission System following a frequency excursion below a pre-set limit. This service is an optional, bilateral service which is contracted via providers' Commercial Services Agreements.

Service providers of Hydro Rapid Start will be paid a £s figure when the service is provided. Providers of Fast Start will be paid the following payments:

- Availability Rate (£/h)
- Start Up Payment (£/start)
- Automatic Delivery Payment for every 15 minutes of active power (£)
- Continuation Rate (£/min)

The specific prices for all of these will be included within the provider's CSA.

In total, NGESO spent £365,000 on Utilisation of this this service last year. In total, NGESO spent £4,450,539.50 on Availability payments for this service

ODFM (Optional Downward Flexibility Management)

The ODFM service was developed in 2020 to mitigate low electricity demand risks resulting from unprecedented changes caused by the Covid-19 pandemic. NGESO ran a consultation for all eligible providers to respond to. They were then qualified and registered before submitting their service fee for each asset. Once registered they had the option to adjust their service fee for a week ahead procurement window. Providers were paid a £/MW/h applied to the period during which they were instructed to turn down.

This service was not required within the regulatory year April 2021 – March 2022 as demand levels did not reach the low level seen previously, which would have triggered the requirement. Therefore, there has been no spend for this service.

Power Potential

Power Potential was a project which has now completed and so there was no spend for this service during the last regulatory year. The project was a collaboration between NGESO, UK Power Networks and generators on the south coast distribution networks to develop and trial a regional reactive power market.

Demand Turn-up

The Demand Turn Up (DTU) service encourages large energy users and generators to either increase demand or reduce generation at times of high renewable output and low national demand. There are two types of DTU, fixed and optional. Fixed DTU was procured via tender in February 2018 for a 1st May 2018 start. It required providers to provide fixed availability windows for which they are guaranteed availability payments. They will also then receive utilisation payments when the service is utilised. Optional DTU was then available to providers who were unsuccessful in the fixed tender or were unable to meet the tender deadlines. Optional DTU providers can change availability and utilisation prices to reflect market conditions.

This service was not tendered within the previous regulatory year and therefore there has been no spend. Again, this is due to demand not reaching the low levels previously seen.

BM Warming

This service covers both BM Start Up and Hot Standby. BM Start Up is the process of bringing the generating unit to a state where it is capable of synchronising with the system within BM timescales. Hot Standby holds the generating unit in this state of readiness. The unit will then either remain in Hot Standby until the end of its capability or be instructed to run via an offer in the BM.

This service is procured via bilateral contracts. There are two forms of payment for the BM start up service:

- **BM start up payment (£/hour)** – providers may submit up to three payment rates depending on the different lead times of a start-up instruction. These payments are designed to cover the costs associated with getting a unit ready for dispatch
- **Hot standby payment (£/h)** – these payments are designed to cover the cost of sustaining a generating unit in a state of readiness

Providers are able to submit their own prices for both BM start up and hot standby. These prices can be updated up to a maximum of once a week. Submitted prices inform the economic assessment to determine which providers are dispatched.

In total, NGESO spent £3,107,975.06 on this service last year. Please see the below chart for further breakdown.

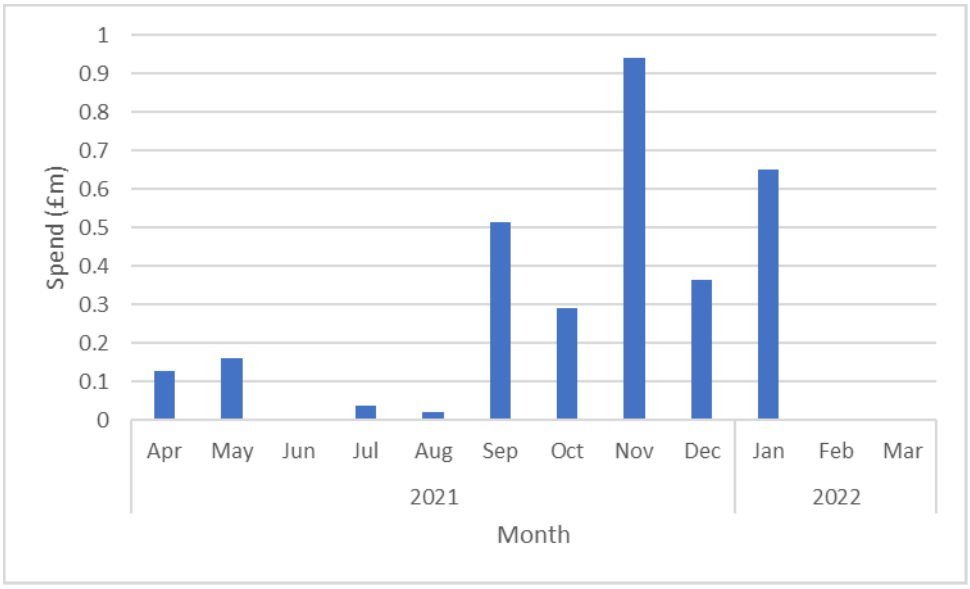

Figure 14 Monthly Spend BM Warming – Chart

6. Response

Response is a service used to keep the system frequency close to 50Hz. Fast acting generation and demand services are held in readiness to manage any fluctuation in the system frequency which could be caused by a sudden loss of generation or demand.

More information about Frequency Response and the service we procure can be found on the NGESO website https://www.nationalgrideso.com/industry-information/balancing-services/frequency-response-services.

In total, NGESO spent £198,912,960.69 on Response services throughout the previous regulatory year. The below figure and following sections break this down by specific services.

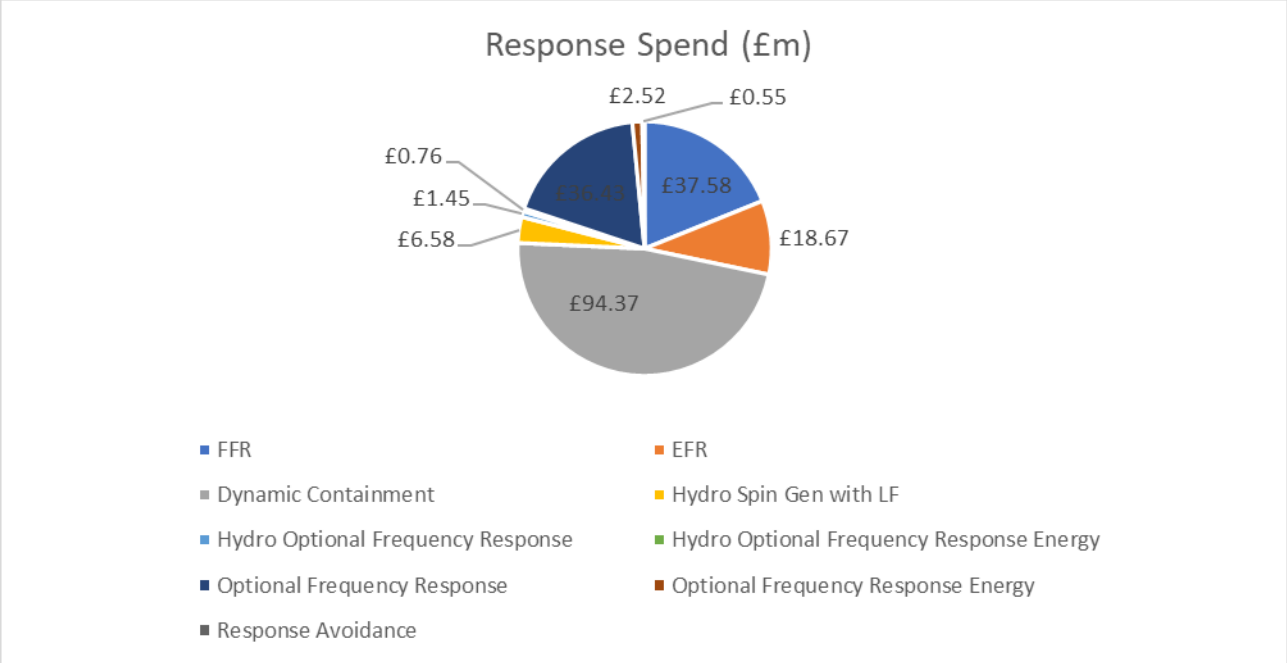

Figure 15 Response Services Annual Spend

Firm Frequency Response (FFR)

NGESO procure FFR through a competitive monthly tendering process. The results are published in the market information report: https://data.nationalgrideso.com/ancillary-services/firm-frequency-response-market-information. . Meeting the requirement for FFR depends on liquidity in the market and if the volume can be secured at a lower cost than the alternative actions.

Additional Response, when required, is also procured through Mandatory Frequency Response (MFR) in the Balancing Mechanism. Only BMUs are able to offer MFR. Meeting the requirement for FFR depends on liquidity in the market and if the volume can be secured at a lower cost than the alternative actions.

Five types of payments are made to FFR providers:

- **Availability payments in £/hr –** for the hours for which a provider has tendered be able to deliver the service.
- **Nomination payments in £/hr –** a holding fee for each hour used within FFR nominated windows.

- **Window initiation payments in £/window –** for each FFR nominated window that we instruct within the tendered frames.
- **Tendered window revision fee in £/hr –** we notify providers of window nominations in advance and, if the provider allows, this payment is payable if we subsequently revise this nomination.
- **Response energy fee in £/MWh –** based upon the actual response energy provided in the nominated window and as per a defined calculation set out within the CUSC. This is represented as "Energy" within the below chart and table, all other costs above are included within the other categories.

NGESO also carried out a trial to purchase FFR on a weekly basis via auction. This trial came to an end in November 2021 so there is some spend for this trial as shown in the figures below.

In total, NGESO spent £37,577,241.66 on FFR last year. Please see the below figures for further breakdown.

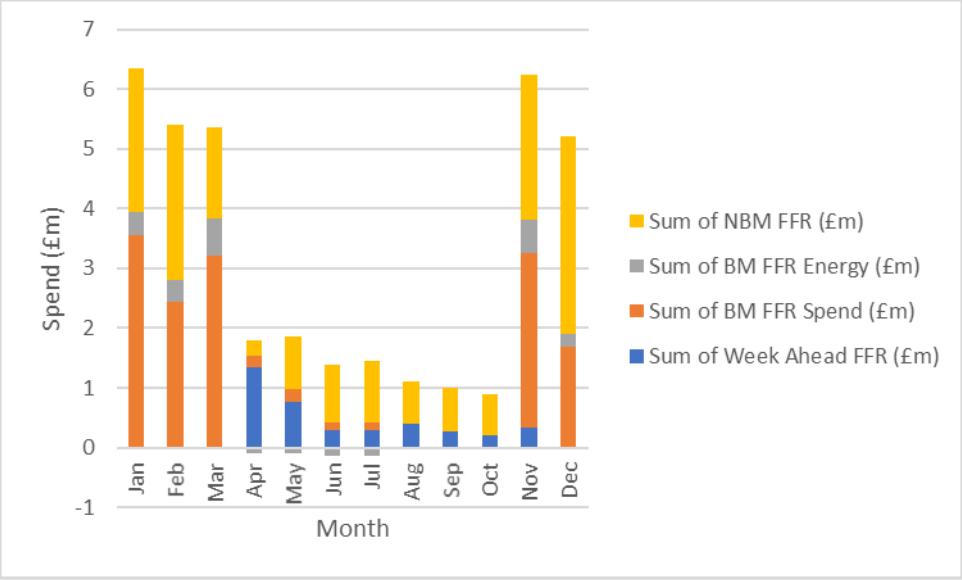

Figure 16 Monthly FFR Spend Breakdown – Chart

Month	Week Ahead FFR (£m)	BM FFR (£m)	BM FFR Energy (£m)	NBM FFR (£m)
Apr	1.35	0.19	-0.09	0.25
May	0.76	0.22	-0.10	0.88
Jun	0.29	0.14	-0.14	0.97
Jul	0.28	0.14	-0.15	1.03
Aug	0.41	0.00	0.00	0.70
Sep	0.27	0.00	0.00	0.73
Oct	0.21	0.00	0.00	0.68
Nov	0.33	2.93	0.57	2.43
Dec	0.00	1.69	0.22	3.30
Jan	0.00	3.56	0.37	2.41
Feb	0.00	2.44	0.36	2.60
Mar	0.00	3.21	0.63	1.51
Total	3.90	14.52	1.67	17.49

Figure 17 Monthly FFR Spend Breakdown – Table

Enhanced Frequency Response (EFR)

EFR was procured as a one-off tender in 2016, awarding four-year contracts as an incentive to invest in new capability to provide faster response. It is a dynamic service where the active power changes proportionally in response to changes in system frequency. To provide EFR, response must be within one second to frequency deviations and operate in frequency sensitive mode within the operational envelope and associated restrictions set out in the invitation to tender. The total payment reported is an availability payment.

EFR will no longer be actively procured due to the newly developed frequency response product suite. Some legacy contracts remain in place because of late commissioning (post March 2018). These contracts will conclude by Summer 2022. After that there will only be one remaining contract which was created with a number of extension periods built in.

In total, NGESO spent £18,667,026.50 on EFR last year. Please see the below figure and bar chart for further breakdown.

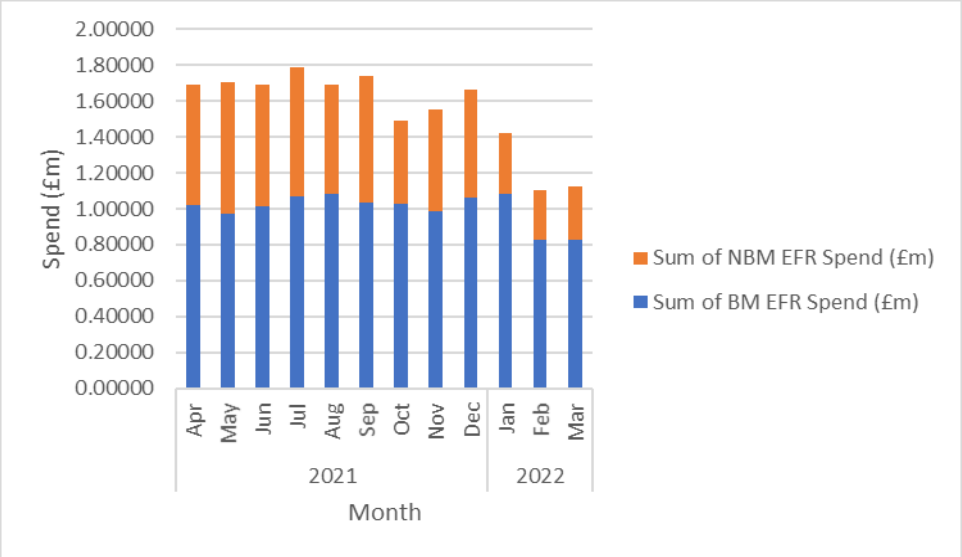

Figure 18 Monthly Spend EFR – Chart

Month	BM EFR	NBM EFR
Apr	1.02	0.67
May	0.97	0.74
Jun	1.01	0.68
Jul	1.07	0.72
Aug	1.09	0.61
Sep	1.04	0.70
Oct	1.03	0.46
Nov	0.99	0.57
Dec	1.06	0.60
Jan	1.08	0.34
Feb	0.83	0.27
Mar	0.83	0.30
Total	12.02	6.64

Figure 19 Monthly Spend EFR – Table

Dynamic Containment (DC)

DC is designed to operate post-fault, i.e., for deployment after a significant frequency deviation to meet the most immediate need for faster-acting Frequency Response.

DC is procured via a day ahead auction. The results are published here: https://data.nationalgrideso.com/ancillary-services/dynamic-containment-data.

A 4 day ahead forecast is published here https://data.nationalgrideso.com/ancillary-services/dynamic-containment-4-day-forecast and longer-term indicative requirements can be found within the market information report here: https://data.nationalgrideso.com/ancillary-services/firm-frequency-response-market-information.

Meeting the requirement depends on liquidity in the market and if the volume can be secured at a lower cost than the alternative actions.

Providers are paid an availability price only as provided within the tender.

In total, NGESO spent £94,366,783.55 on DC last year. Please see the below figures for further breakdown.

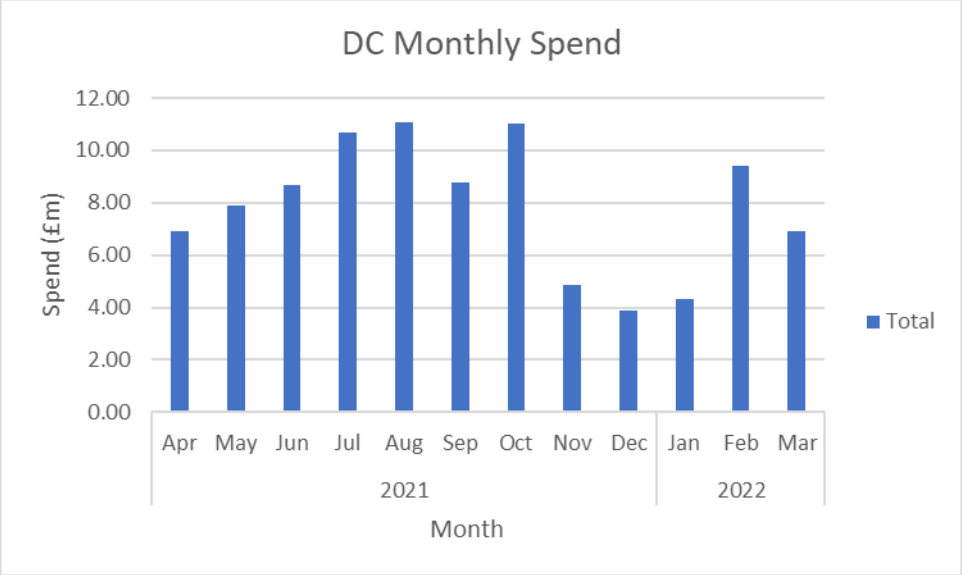

Figure 20 Monthly Spend DC – Chart

Month	Monthly Spend (£m)
Apr	6.90
May	7.87
Jun	8.67
Jul	10.69
Aug	11.09
Sep	8.76
Oct	11.01
Nov	4.86
Dec	3.86
Jan	4.31
Feb	9.42
Mar	6.93
Total	94.37

Figure 21 Monthly Spend DC – Table

Hydro Spin Gen with LF

Under this service a hydro unit will be triggered to start generating. It is instructed in real-time by National Grid Electricity Control Centre. Whilst instructed to provide this the unit will spin in the air using a small amount of demand to do so. When the frequency trigger is reached, the water barriers will open, and the unit will start generating to help increase the frequency.

NGESO spent £6,577,422.29 on this service over the previous regulatory year.

Hydro Optional Frequency Response

This is the provision of Primary and Secondary frequency response where a hydro unit will automatically increase its output from its scheduled position according to the real-time frequency. This is a static service that triggers at a set frequency level. When the frequency trigger level is reached, the unit will automatically increase its output to maximum generation helping to increase the system frequency. It is armed in real-time by the National Grid Electricity Control Centre. The unit must be generating at its Part Load Point to be able to provide/deliver this.

Over the previous regulatory year, NGESO spend a total of £2,217,588.72 on this service, made up of £1,454,831.67 for service availability and £762,757.05 for energy.

Generator Frequency Response

This spend line is inclusive of both mandatory and commercial frequency response. Mandatory Frequency Response (MFR) is a service that generators connected to the Transmission network must have the capability to deliver in accordance with the Grid Code. Once connected, the detail of capability is contained within each provider's Mandatory Service Agreement (MSA). After which, generators may submit holding prices to deliver MFR into a system called FRPS monthly. The National Grid Electricity Control Centre will instruct MFR based on volume requirements and the lowest cost in the stack based on the holding prices. A calculator called FRPF runs every 30 mins to determine the stack.

The commercial element in this context relates to a small number of bilateral contracts that are settled in the same way as MFR but with different pricing. Specifically, the MFR price submission is monthly however, the bilateral contact price submission is on an ad-hoc basis by the service provider.

Over the previous regulatory year, NGESO spent a total of £38,956,381.12 on generator response, this is made up of £36,433,221.29 on service availability and £2,523,159.83 on response energy.

Response Avoidance

These are Forward Trades made to reduce the volume of Response required by the system and enable the Response costs which would be incurred via MFR to be avoided.

In total, NGESO spent £550,516.85 on Response Avoidance trades last year.

7. Stability Pathfinder – Phase 1

Traditionally, synchronous generation has provided stability requirements (inertia, Short Circuit Level & Reactive Power support) as a natural by-product. As more non-synchronous generation enters the system and traditional generators are de-commissioned, NGESO needs alternative sources of stability.

The Stability Pathfinders allow NGESO to test procurement approaches for long term stability requirements, but they still rely on the dispatch of synchronous generation in the Balancing Mechanism to ensure stability.

Phase 1 of the stability pathfinder was looking for the most cost-effective way to increase inertia (stored energy), provide short circuit level and the ability to dispatch the assets to provide Reactive Power. A request for information was issued in July 2019 and a tender concluded in January 2020 awarding 12 contracts to 5 different providers. Upon contract award there is a period of building the capability and thus far 8 contracts have gone live, many throughout the 2021 – 2022 regulatory year.

Phase 2 and Phase 3 of the pathfinder did not incur any spend over the previous regulatory year.

Going forward, the NGESO hope to develop a stability market that could offer a route to access stability services through an open, transparent, and competitive market.

In total, NGESO spent £24,390,532.63 on Phase 1 stability contracts last year.

8. Voltage Pathfinder

The voltage pathfinder looks for the most cost-effective ways to address high voltage system issues created by the need to absorb more Reactive Power on the transmission network. This need is the result of a drop in both minimum demand and power consumption on distribution networks. The first step was to develop a regional options assessment process for high voltage system issues. The plan was then to look at distribution and market-based solutions as well as the more traditional transmission-based solutions.

NGESO launched a long-term tender in Nov 2019 for a Reactive Power service to meet a static need in the Mersey region. The 9-year contract, starting 1 April 2022, is part of a new approach to procuring reactive power to determine whether a third party can deliver a more economical solution compared to the network asset alternative. This tender was open to potential providers embedded within the Distribution network as well as at Transmission level, including those that were not yet connected.

Prior to this service going live, NGESO launched an EOI for services in this region for 2021/22 and the spend associated with this is contained within the figures for Constraints – For Voltage Support figures. The spend was £5,218.

9. Reactive Power

The NGESO manage voltage levels across the grid to ensure they stay within operational standards and avoid damage to transmission equipment. Voltage levels are controlled by Reactive Power, and NGESO pay providers to help manage voltage levels on the system by controlling the volume of Reactive Power that they absorb or generate.

You can find more detail about Reactive Power at https://www.nationalgrideso.com/, under Balancing Services, then Reactive Power services.

Generators covered by the requirements of the Grid Code are required to have the capability to provide Reactive Power. Payment for the service will start from the date that the reactive capability has been tested and the final Mandatory Services Agreement (MSA) is signed. Providers are paid via the default payment mechanism. Under the default payment mechanism all service providers are paid for utilisation in £/MVArh. The utilisation payment is updated monthly in line with market indicators as set out in Schedule 3 of the Connection and Use of System Code (CUSC) The latest utilisation payment figures can be found on NGESO's website. Look under Balancing Services, Reactive Power services, obligatory Reactive Power market information https://www.nationalgrideso.com/industry-information/balancing-services/reactive-power-services/obligatory-reactive-power-service?getting-paid

In total, NGESO spent £190,158,811.19 on Reactive Power last year. Please see the below figures for further breakdown.

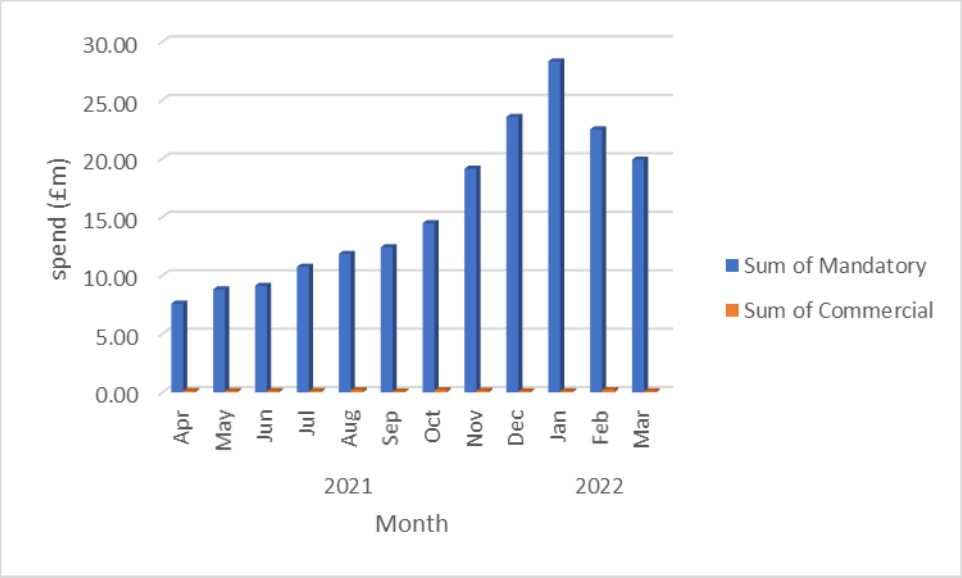

Figure 22 Monthly Spend Reactive Power – Chart

Row Labels	Mandatory (£m)	Commercial (£m)
Apr	7.61	0.12
May	8.82	0.13
Jun	9.13	0.12
Jul	10.76	0.13
Aug	11.85	0.20
Sep	12.43	0.08
Oct	14.49	0.19
Nov	19.15	0.15
Dec	23.57	0.10
Jan	28.32	0.10
Feb	22.51	0.19
Mar	19.91	0.10
Total	188.54	1.62

Figure 23 Monthly Spend Reactive Power – Table

10. Constraints

Running the transmission network requires actions to protect equipment, enable access to the system, keep within the Security and Quality of Supply Standard (SQSS) and prevent the loss of large parts of the network. In order to do this, NGESO sometimes ask a generator to reduce, or constrain, the amount of electricity it's producing. The electricity it would have produced is still required – so the system is balanced – but it cannot be moved into or out of a certain area. NGESO make up the difference by buying energy from another generator in a different part of the transmission network. It can also happen the other way around, NGESO may need to produce more energy in some areas, which means they need to reduce production elsewhere.

It's important that these constraint activities are managed. If not, equipment might be damaged, or areas of the grid might be at risk of shutting down. To deal with constraints, NGESO use a range of mechanisms, including:

- BM bids and offers (out of scope of this report)
- Trading
- System-to-System (SO to SO) services, and,
- Contracted services (i.e. tenders or bilateral contracts)

Constraint trades are broken down into 3 groups: transmission, voltage and ROCOF (Rate of Change of Frequency).

The net total spend for constraints last year was £128,874,491.24 Please see the below figures for further breakdown.

Month	Voltage (£m)	Transmission (£m)	ROCOF (£m)
Jan	11.09	0.09	0.00
Feb	19.82	0.25	0.03
Mar	16.17	0.55	0.00
Apr	3.43	0.00	-2.57
May	5.31	0.00	-7.71
Jun	5.66	0.00	-15.96
Jul	7.88	-7.79	-14.98
Aug	14.55	-0.55	-23.42
Sep	9.43	0.00	-11.02
Oct	23.58	0.09	-2.86
Nov	15.80	15.23	2.09
Dec	14.51	2.75	0.04
Total	147.25	10.62	-76.35

Figure 24 Monthly Spend on Constraint Trades – Table

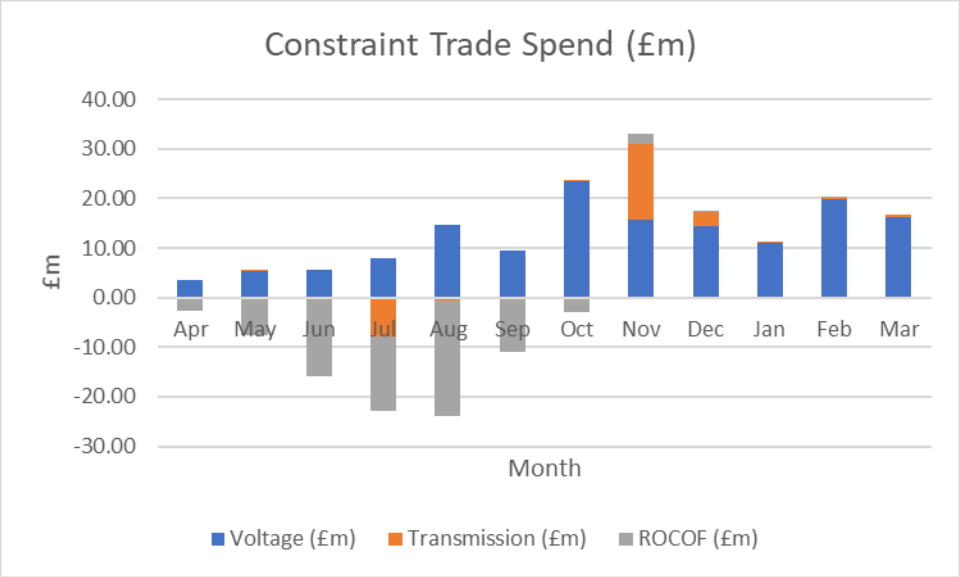

Figure 25 Monthly Spend on Constraint Trades - Chart

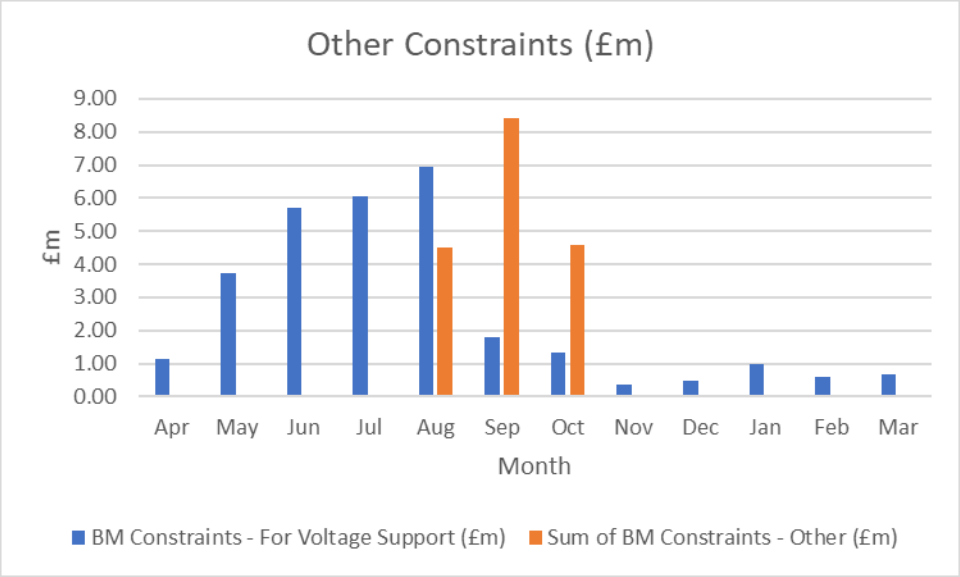

Figure 26 Monthly Spend on Other Constraints

11. Restoration

Restoration is the procedure used to restore power in the event of a total or partial shutdown of the transmission system. A total or partial shutdown of the national electricity transmission system 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. We use Restoration Services to recover from such a shutdown and NGESO have agreements with providers in order to do so. You can find more detail about Restoration on NGESO's web site at www.nationalgrideso.com, under Balancing Services, then System Security https://www.nationalgrideso.com/balancing-services/system-security-services/restoration-services

Restoration Services are procured via competitive tenders and bilateral agreements. No new Restoration contracts were signed during the previous regulatory year, however, there were a number of short-term extensions which were signed to contracts. Extensions were made on existing terms and conditions.

NGESO make various types of payments (depending on several factors):

- **Availability Payments - t**hese are paid to the service provider to maintain capability throughout the year and offered as part of a tender or bilateral contract negotiation
- **Capital Investment:** new Black Start service providers are likely to require significant capital investment. This is typically agreed at the start of the contract and is either paid upfront before the service commences, smeared over the duration of the contract or at pre-agreed periods
- **Feasibility Studies:** costs covered by NGESO for new providers looking to demonstrate that the unit can provide Restoration capability. NGESO will ensure any costs incurred by service providers have been procured in an economic manner and as such would expect providers to tender for the work where possible with evidence to the extent where possible. The feasibility study costs are agreed in the commercial side letter between NGESO and the provider.
- **Testing**: NGESO will work together with the provider to develop a strategy to test the unit at the most economic and efficient time, mitigating any distortion to the market and all providers will be tested at least every three years in accordance with the EU Code. Like the feasibility study costs, the parties agree the basis of payment in a commercial side letter.
- **Warming Requirements**: Black Start providers must be able to respond in a specified time, (normally within two hours), to be deemed available for Black Start. If service providers of certain technology types

have not generated for a period, the units may not be warm enough to meet that response time. In such circumstances, NGESO will assess the overall availability in the region, and may instruct a capable unit for warming to maintain the minimum service level. This is typically during summer months when demand is lower and contracted stations are on outage or out of merit. Spend on warming may be instructed through the BM, trades, or by forward contracting. The costs are calculated based on what has been agreed either through a forward's contract or in the case of a trade through a Schedule 7A or in the BM through a BoA and like availability payments, the cost is paid monthly.

In total, NGESO spent £62,852,738.52 on Restoration Services last year. Please see below for a further breakdown.

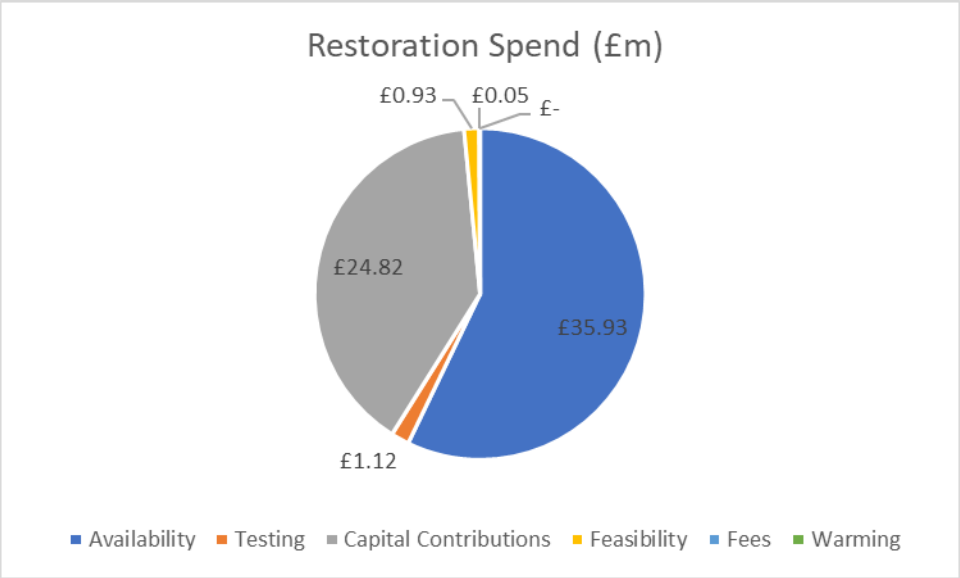

Figure 27 Spend Breakdown for Restoration - Chart

Cost Component	Annual Spend (£m)
Availability	35.93
Testing	1.12
Capital Contributions	24.82
Feasibility	0.93
Fees	0.05
Warming	0.00
Total	62.85

Figure 28 Spend Breakdown for Restoration - Table

12. Intertrips

NGESO may approach potential service providers directly if a specific requirement is identified. Intertrip Services are required as an automatic control arrangement where generation may be reduced or disconnected following a system fault event.

Intertrips are split into 3 categories:

- **Interconnector Intertrips** - intertrips agreed with interconnectors to manage the system. Split into capability and Intertrips payments in the data below
- **BM** - commercial Intertrips used for managing constraints on the system.
- **Cap-76** - operational intertrips agreed with providers as part of their connection agreement, used to manage local outages.

In total, NGESO spent £10,135,107.92 on Intertrip Services last year. Please see the below figures for further breakdown.

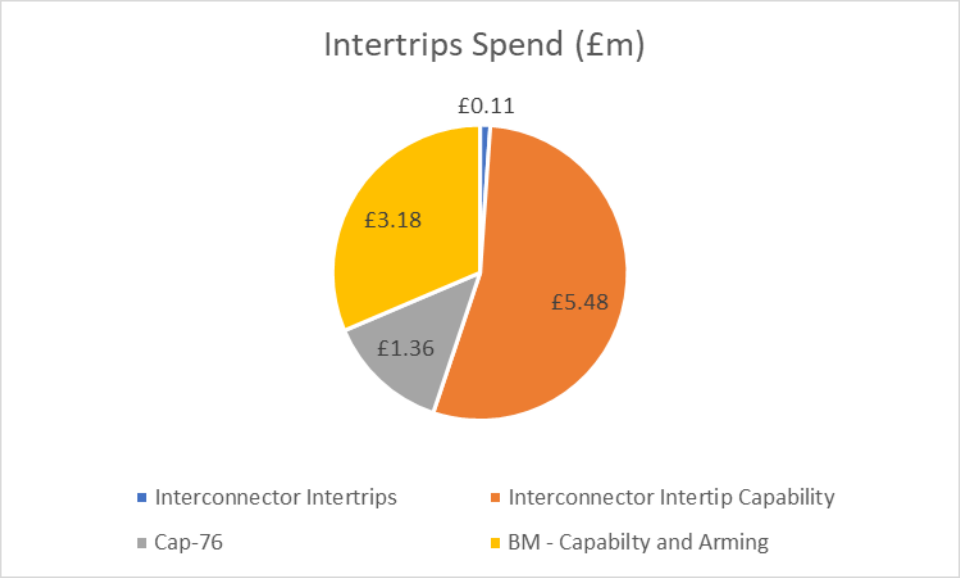

Figure 29 Spend Breakdown for Intertrips

13. Fees and Reconciliations

Fees and Liabilities have been included here for completeness – primarily, they are estimates of amounts due to service providers in respect of payments that will be made in the future to cover disputes raised, however, they also cover amounts due to Suppliers that we were unable to pay due to issues obtaining to verified bank account information. A small amount relates to interest payments made in relation to adjustments paid.

Total figure for fees and reconciliations over the previous regulatory year is £1,344,282.36.