ESO

Annual Balancing Services Spend Report 2022 / 2023

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

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1. Version Control

Version No.	Date	Version / Amendment
1.0	21/06/2023	Report for 2022 – 2023 Regulatory Year
1.1	15/08/2023	• Footnote added to Winter Contingency Contracts • NTC Spend Table amended to better identify the period in which the interconnectors were not operational

2. Purpose of Report

The Electricity System Operator (ESO) 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 ESO 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 ESO on Balancing Services throughout the previous regulatory year (April 2022 – March 2023). The report discusses the total costs that have been calculated and how they have been incurred in accordance with the following publications:

- **Procurement Guidelines v22.0** - This document sets out the Procurement Guidelines which ESO is required to establish in accordance with Standard Condition C16 of the Transmission Licence for the period covered within this report. 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: C16 statements and consultations | ESO (nationalgrideso.com)
    - v21.0 was published in April 2022 following the standard annual consultation, this was later revised in November 2022 to v22.0 to incorporate changes required for the Demand Flexibility Service
- **Balancing Principles Statement v21.0** – the purpose of this document is to define the broad principles and criteria by which ESO will determine at different times and in different circumstances, which Balancing Services will be used to operate the transmission system efficiently and effectively for the period covered by this report. This document is required under Standard Condition C16 of the Transmission Licence and can be found online here: C16 statements and consultations | ESO (nationalgrideso.com)
    - v20.0 was published in April 2022 following the standard annual review, this was later revised in October 2022 to v21.0 to incorporate the Winter Contingency Contracts

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

ESO 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. To do this, ESO procure Balancing Services from providers which are used to keep the transmission system (or "grid") running in an efficient, economical, and coordinated way. That means everyone is delivered a steady flow of electricity. More information about Balancing Services can be found on ESO's website: https://www.nationalgrideso.com/industry-information/balancing-services.

This report details the various Balancing Services that ESO procured and the associated cost for the preceding regulatory year (April 2022 – March 2023).

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

- **Ancillary Services** – ESO enter 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. The services contracted here are called "Ancillary Services"

- **Forward Trading** – to balance the system or manage system issues, ESO will procure electricity in advance of the balancing mechanism (BM) 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.

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 BM Unit (BMU) or not.

Any figures which are reported as negative numbers represent a payment to the ESO.

Please note – the figures reported in this document were correct at the time or shortly before submission and publication. Late invoices, adjustments and disputes can occur and mean minor adjustments to spend figures.

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4. Annual Spend Overview

For the regulatory year April 2022 – March 2023, ESO spend a total of £2,605,754,746.04 on Balancing Services. Last year's reported spend was £949,468,653.62, meaning an increase this year of £1,656,286,092.42 or 174%. This significant increase has been driven by several factors.

Balancing costs through Q1 were significantly higher than Q1 last year and increased throughout the quarter. The increase in non-constraint costs compared with the same period last year was the result of scarcity pricing, and high gas prices driving up prices for Operating Reserve (OR), Response and Reactive Power. The constraint costs increase compared with last year was the result of continued high wholesale prices, combined with higher wind levels and reduced boundary capability due in part to an increase in system outages.

Throughout the summer, persistent high gas prices again contributed to increased spend in Operating Reserve, Short Term Operating Reserve (STOR), Response and Reactive Power despite an overall decrease in actions. Higher constraint costs than the previous year were also incurred because of high wholesale prices and a large volume of actions required due to high wind and system outages.

Winter Contingency Contracts were added to the costs from October 2022. In response to the disruption of gas supplies to Europe, the Secretary of State approached the ESO to secure additional non-gas capacity over winter 2022/23. The ESO contracted five generation units across three coal fired power stations to stay available across the winter to provide extra generation should it be needed to ensure electricity security of supply. These contracts began in October 2022 and are a key driver of the significant increase in costs over the winter period.

The costs for the third quarter of the year continued to be higher than last year's outturn Q3 spend with November's balancing spend the highest for this financial year and the second highest on the record. December's balancing costs decreased compared to October and November this year. Although the non-constraint volume of actions was slightly lower in the third quarter compared to the same period last year, the non-constraint costs were significantly higher. The significant increase in non-constraint costs compared with last year was the result of the winter contingency contracts, tight system margins and price scarcity.

Throughout Q4, overall costs decreased month on month but remained higher than the previous year. Of note: Operating Reserve margins were healthier throughout January and February and wholesale costs lower, but March did see an increase in costs for this category as a result of high prices being submitted by units which were required to maintain reserve levels. Cleared costs of procuring STOR were higher and costs both increased within Q4 and remained higher than the same period last year. In addition, increases were seen in Reactive costs.

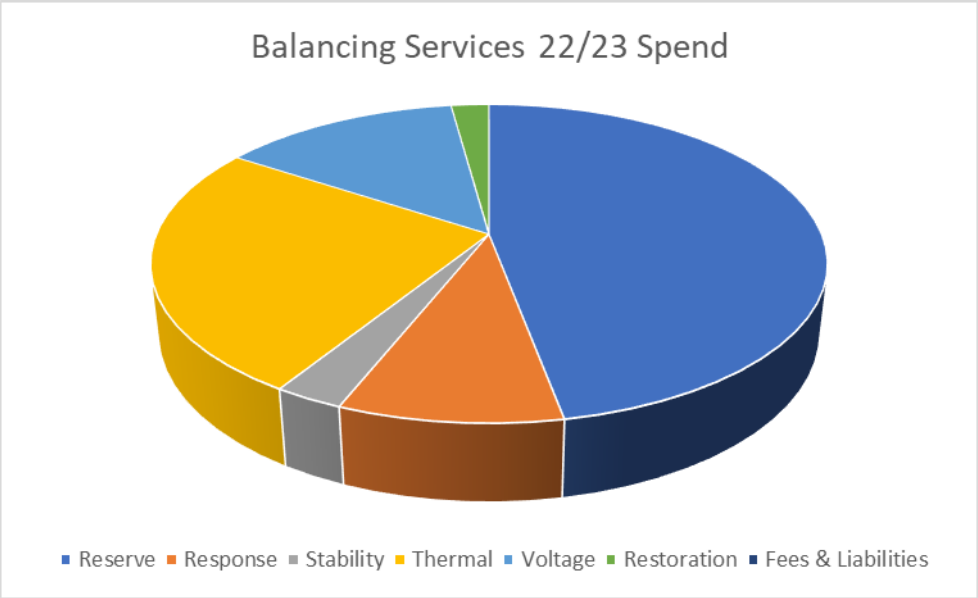

Figure 1 Total Balancing Services Spend Chart

Spend Category	Spend (£)
Reserve	1,225,544,239.97
Response	235,725,400.79
Stability	73,431,078.30
Thermal	660,676,608.14
Voltage	354,077,228.91
Restoration	56,194,965.35
Fees & Liabilities	105,224.58
Total	2,605,754,746.04

Figure 2 Total Balancing Services Spend Table

5. Reserve

At certain times of the day, ESO 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, ESO spent £1,225,544,239.97 on reserve services throughout the previous regulatory year. The below figures and following sections break this down by specific services.

Short-term Operating Reserve (STOR)

Short-term Operating Reserve (STOR) allows ESO 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 previously started in April, and is split into six seasons, which specify the Availability Windows where STOR is required each day. ESO aims to procure a minimum of 1600 megawatts (MW) of STOR per day (subject to requirements). This consists of around 400MW of legacy long-term contracts and around 1200MW auction based. Since April 2021, STOR has been purchased through a daily, pay-as-clear auction process. The results are published here: ESO Data Portal: Short Term Operating Reserve (STOR) Day Ahead Auction Results - Dataset| National Grid Electricity System Operator (nationalgrideso.com).

ESO 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, ESO commit to buying all 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. ESO 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 (£/MWh) 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 here: Short term operating reserve (STOR) | ESO (nationalgrideso.com).

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In total, ESO spent £77,214,208.35 on STOR last regulatory year. Please see the figures below for further detail.

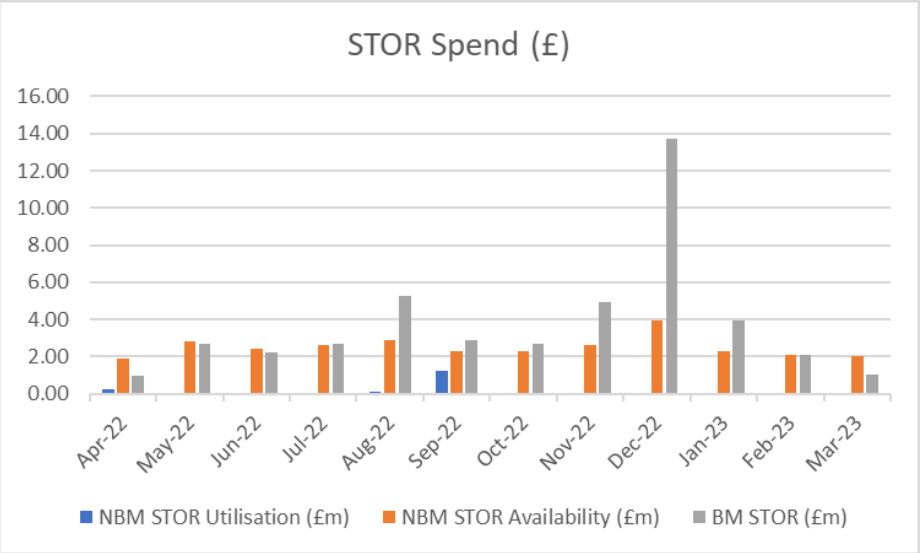

Figure 3 STOR Spend Breakdown Chart

Month	NBM STOR Utilisation (£m)	NBM STOR Availability (£m)	BM STOR (£m)
Apr-22	0.25	1.92	0.97
May-22	0.00	2.81	2.71
Jun-22	0.03	2.46	2.25
Jul-22	0.06	2.64	2.67
Aug-22	0.10	2.91	5.25
Sep-22	1.21	2.29	2.89
Oct-22	0.06	2.31	2.71
Nov-22	0.00	2.65	4.92
Dec-22	0.00	3.94	13.72
Jan-23	0.01	2.32	3.94
Feb-23	0.00	2.08	2.08
Mar-23	0.00	2.03	1.03
Total	1.72	30.35	45.14

Figure 4 STOR Spend Breakdown Table

As can be seen within the reporting, December spend on BM STOR was particularly high. The first half of December 22 saw tight margins which were reflected in STOR participants' prices, hence the cleared costs of procuring the service increased.

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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 the Electricity National Control Centre (ENCC). Fast Reserve service must commence within two minutes following instruction, at rates of 25MW or greater per minute.

Over the previous regulatory year, ESO secured its full Fast Reserve volume via the Optional Fast Reserve service, procured on the day by ENCC. 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, ESO spent £113,932,302.80 on Fast Reserve last year. This was all on non-BM Optional Fast Reserve. Further breakdown can be seen below.

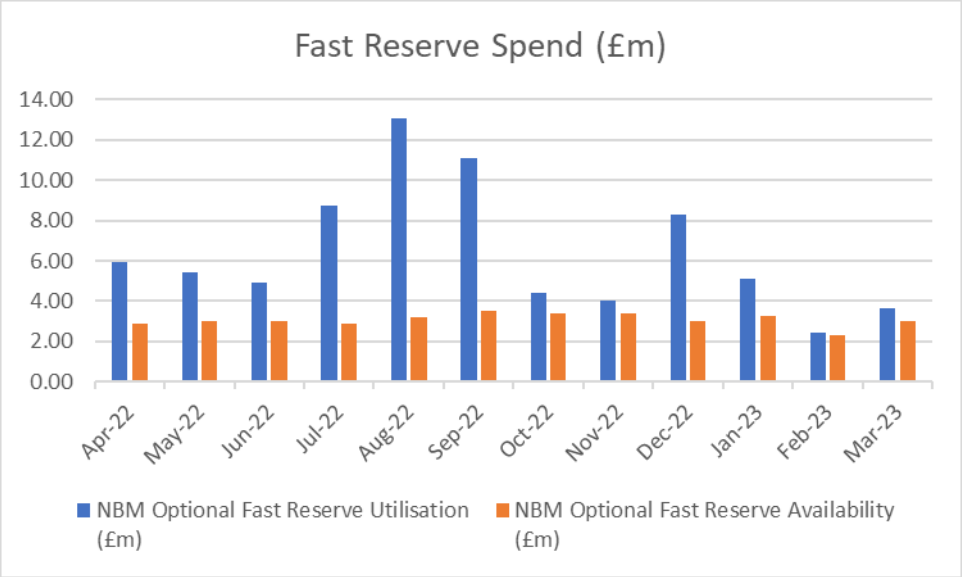

Figure 5 Fast Reserve Spend Breakdown Chart

Month	NBM Optional Fast Reserve Utilisation (£m)	NBM Optional Fast Reserve Availability (£m)
Apr-22	5.91	2.88
May-22	5.40	3.03
Jun-22	4.88	3.00
Jul-22	8.74	2.90
Aug-22	13.10	3.21
Sep-22	11.08	3.50
Oct-22	4.42	3.40
Nov-22	4.04	3.35
Dec-22	8.31	3.02
Jan-23	5.12	3.24
Feb-23	2.45	2.31
Mar-23	3.64	2.99
Total	77.10	36.84

Figure 6 Fast Reserve Spend Breakdown Table

As can be seen above, costs for August and September were particularly high, the main driver for this was high wholesale market prices.

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 Trades -** purchases of energy from neighbouring SOs, to provide additional operating reserves
- **Emergency Assistance (EA) and Emergency Instruction (EI) -** EA is a request for support from the connected SO. If this request is going to cause that System Operator a security issue, the request can be rejected, or the availability withdrawn. EI is a mandatory instruction to the Interconnector operator to alter the flow immediately. This is done without coordination with the connected System Operator unless the connected SO is already in an emergency state. If the connected System Operator is already in an Emergency state, ESO will coordinate with that SO as much as possible to obtain a solution applicable form all parties. EA prices are dependent upon the arrangements agree with the connected SO. Some are a fixed price; others are reflective of any necessary rebalancing actions taken by the assisting SO and others are reflective of the cash out price for the relevant settlement period. EI are priced at the Imbalance costs to the interconnector owners in both the GB and connected countries markets

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

In total, ESO spent £603,744,729.84 on Operating Reserve over the previous regulatory year. Please see the below figures for further details.

Category	Spend (£m)
SO-SO Trades	1.13
EA and EI	0.24
SO-SO Interconnector Capability Payment	0.47
Trades (Margin)	601.91
Total	603.74

Figure 7 Operating Reserve Spend Breakdown Table

Month	Trades Margin (£)
Apr-22	8.10
May-22	29.00
Jun-22	13.71
Jul-22	47.85
Aug-22	191.08
Sep-22	90.02
Oct-22	31.75
Nov-22	72.75
Dec-22	87.51
Jan-23	9.09
Feb-23	16.79
Mar-23	4.26
Total	601.91

Figure 8 Trades Margin Spend Breakdown Table

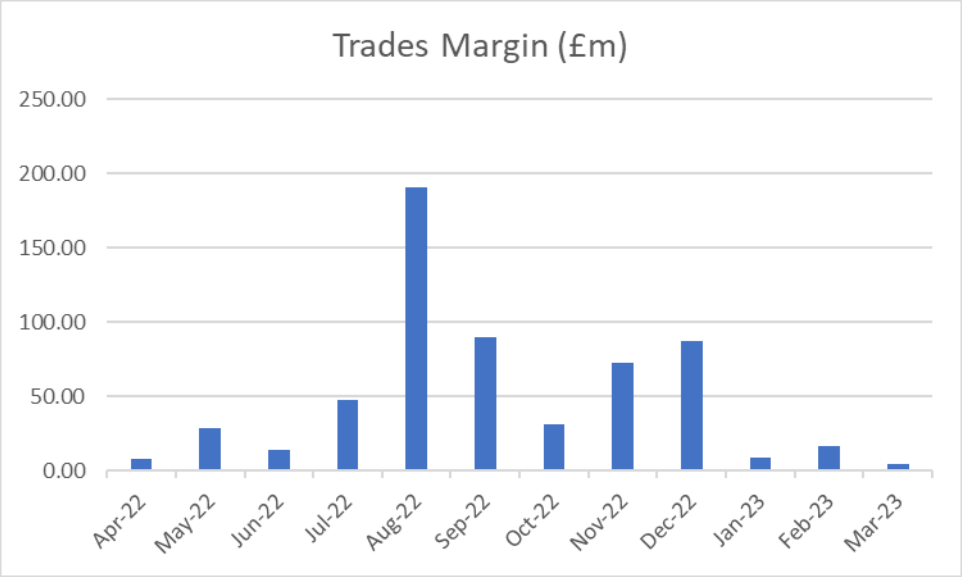

Figure 9 Trades Margin Spend Breakdown Chart

Prices can be seen to spike to in August 22, this was as a result of high prices submitted by units which were required to maintain reserve levels.

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 Trades -** sales of energy to neighbouring TSOs to provide additional negative reserves
- **EA and EI –** as described above
- **Forward Trades -** sales of energy in forward markets, usually over Interconnectors, to provide additional negative reserves

The total net payment to NGESO for Negative Reserve last regulatory year is -£21,763,535.01. 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.

Category	Spend (£m)
SO-SO Trades	-2.56
EA and EI	-0.11
Trades	-19.09
Total	-21.76

Figure 10 Negative Reserve Spend Breakdown Table

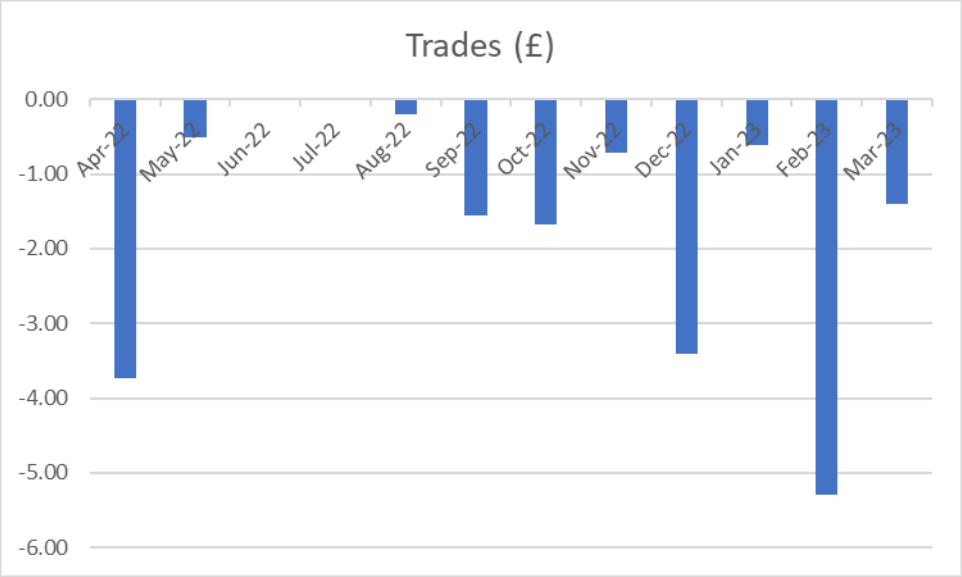

Figure 11 Negative Reserve Spend Breakdown Chart

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 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 (£/MWh) for the periods between start up and end time. The payment can be considered a compensation to the generator for running outside of their normal operating parameters.

In total, NGESO spent £118,900 on Super SEL last year. This was used on 5th October 2022, 15th and 16th October 2022 and 1st and 2nd November 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 ENCC and the unit must be pumping to deliver this.

This service was procured through bilateral contracts and providers are paid a £/h amount in accordance with terms set out in their CSAs.

In total, NGESO spent £71,618.41 on Hydro Optional Pump De-load this regulatory year.

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Hydro Optional Spin Gen

Hydro Optional Spin Gen is 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 ENCC. Whilst instructed to provide this the unit will spin in air using a small amount of demand to do so.

This service was procured through bilateral contracts and providers are paid a £/h amount in accordance with terms set out in their CSAs.

In total, NGESO spent £80,446,591.68 on Hydro Optional Spin Gen this regulatory year. Please see below for a further breakdown on the spend.

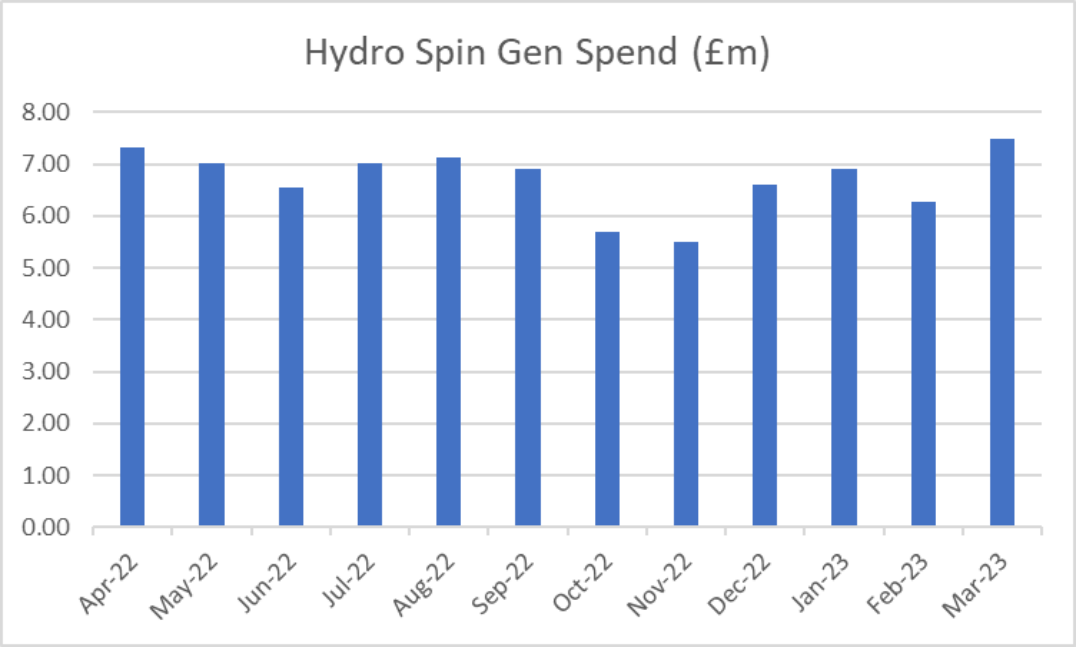

Figure 12 Hydro Optional Spin Gen Spend Breakdown Chart

Month	Hydro Spin Gen Spend (£m)
Apr-22	7.32
May-22	7.01
Jun-22	6.56
Jul-22	7.02
Aug-22	7.14
Sep-22	6.92
Oct-22	5.70
Nov-22	5.51
Dec-22	6.61
Jan-23	6.91
Feb-23	6.27
Mar-23	7.49
Total	80.45

Figure 13 Hydro Optional Spin Gen Spend Breakdown Table

Hydro Optional Spin Pump

This service is similar to the previously mentioned hydro services but occurs when a unit is instructed to begin pumping. 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 £/h payment for this service is included within this document.

In total, NGESO spent £14,102,365.96 on this service last year. Please see the below figure for further breakdown.

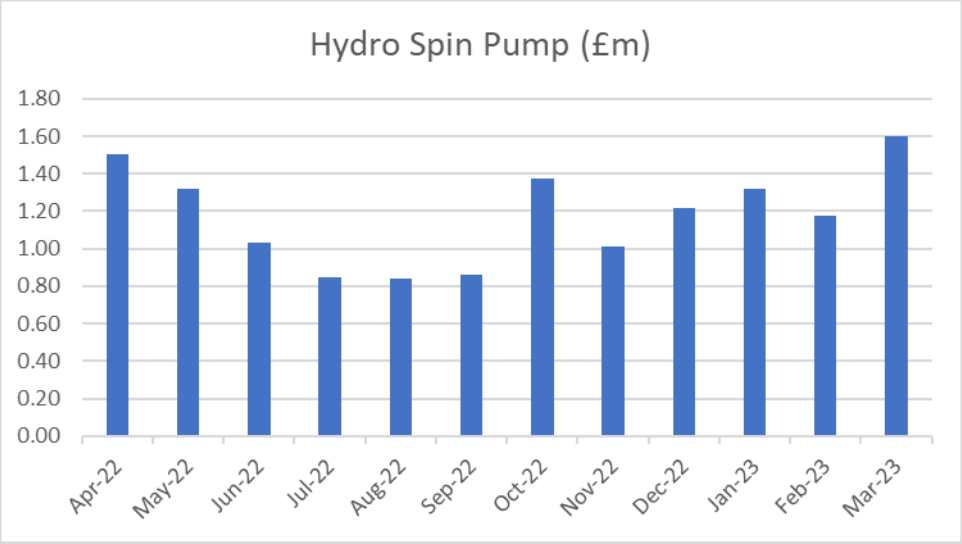

Figure 14 Hydro Spin Pump Spend Breakdown Chart

Month	Hydro Spin Pump (£m)
Apr-22	1.51
May-22	1.32
Jun-22	1.03
Jul-22	0.85
Aug-22	0.84
Sep-22	0.86
Oct-22	1.37
Nov-22	1.01
Dec-22	1.22
Jan-23	1.32
Feb-23	1.17
Mar-23	1.60
Total	14.10

Figure 15 Hydro Spin Pump Spend Breakdown Table

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 when instructed by ENCC.

A Gas Turbine (GT) Fast Start utilisation payment is made following a rapid synchronisation of the BMU 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' CSAs.

Service providers of Hydro Rapid Start will be paid a £s figure when the service is provided.

Providers of GT 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.

ESO did not incur any spend for utilisation of this service during the previous regulatory year. However, a total of £4,461,068.36 was paid in availability payments.

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 can 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 £3,012,003.35 on this service last year. Please see the below chart for further breakdown.

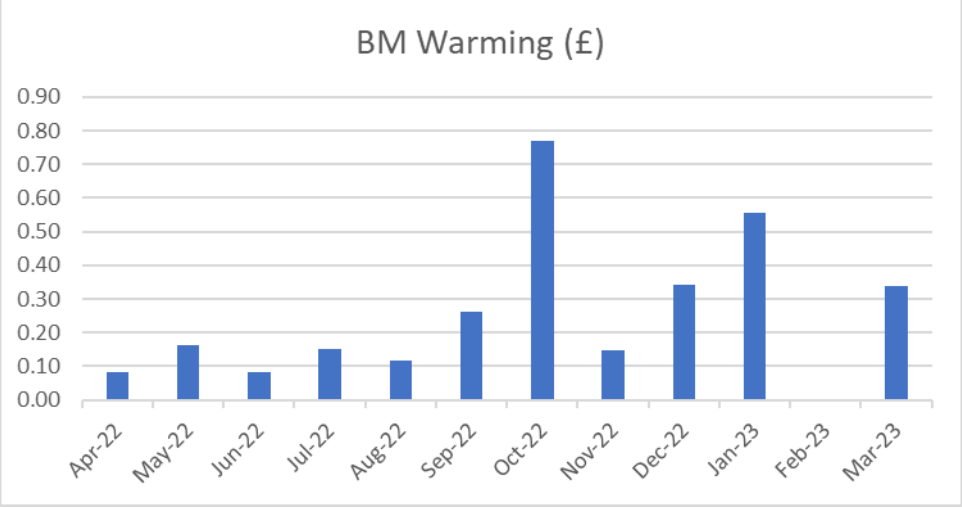

Figure 16 BM Warming Spend Breakdown Graph

Month	BM Warming (£)
Apr-22	0.08
May-22	0.16
Jun-22	0.08
Jul-22	0.15
Aug-22	0.12
Sep-22	0.26
Oct-22	0.77
Nov-22	0.15
Dec-22	0.34
Jan-23	0.56
Feb-23	0.00
Mar-23	0.34
Total	3.01

Figure 17 BM Warming Spend Breakdown Table

Demand Flexibility Service (DFS)

DFS is a new service which was developed by ESO and launched in November 2022 for use over the 2022/2023 winter. The service was introduced as an "Enhanced Action" (meaning it would only be utilised after the usual BAU actions to secure sufficient margin had been taken, more regarding the "Order of Actions" over Winter 2022/2023 can be found here: https://www.nationalgrideso.com/industry-information/winter-operations) and aimed to allow the ESO to access additional flexibility when national demand is at its highest – during peak winter days – not currently accessible to the ESO in real time.

Providers interested in the service (namely energy suppliers and aggregators) were invited to register their interest via the ESO's SMP (Single Market Platform) system and following several checks they were then added to a list of approved providers. End consumers participated in this service directly with their suppliers / aggregators and (not via direct interaction with ESO).

When a DFS event was notified at the day ahead horizon, approved providers could bid into the service and the winning bidders would then need to ask their end consumers to turn down their demand during the event. ESO paid providers based on demand reduction delivered. End consumers were incentivised based on the contract agreed with their providers (e.g., donation to charity, payment, credits against energy bills, entry into raffles, etc).

To incentivise participation in this new service which was specified as an "Enhanced Action" only, ESO agreed to run a maximum of 12 demonstration events between November 2022 and March 2023. These tests had a guaranteed acceptance price of £3,000/MWh. This figure was based on feedback gained from industry engagement, in particular the Energy UK working group. It was determined that £3,000/MWh was the level needed to drive participation at a domestic level.

The service ended on 31st March 2023 but the team at ESO are currently developing an improved version of the service through industry workshops and feedback ready for launch in time for winter 2023/2024 subject to consultation.

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In total, ESO spent £10,985,023.40 on the DFS service over the last regulatory year. Please see below for further breakdown.

Please note, for reporting purposes and BSUoS recovery the costs have been equally allocated across days within this report. However, greater costs would have been incurred for days on which there were live events or tests.

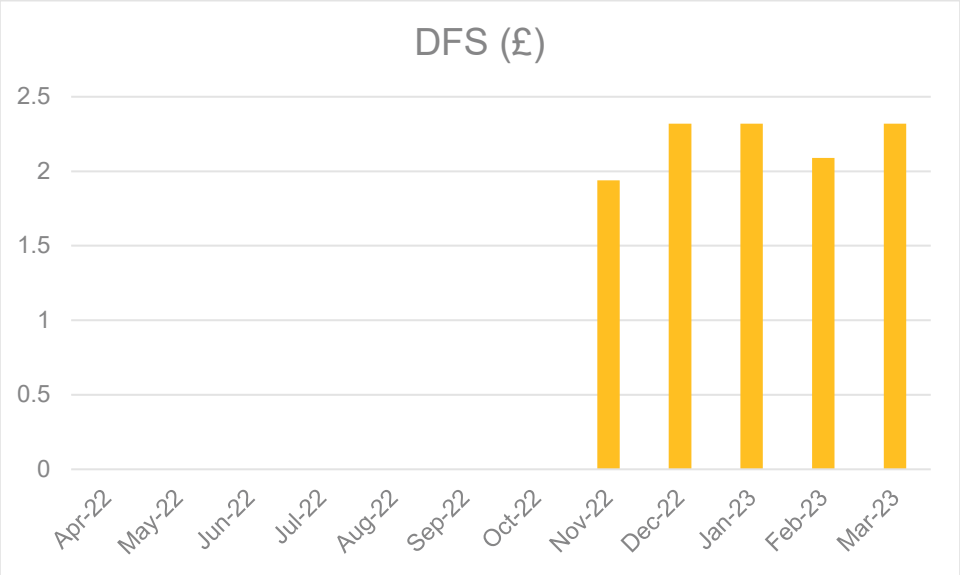

Figure 18 DFS Spend Breakdown Chart

Month	DFS (£)
Apr-22	0.00
May-22	0.00
Jun-22	0.00
Jul-22	0.00
Aug-22	0.00
Sep-22	0.00
Oct-22	0.00
Nov-22	1.94
Dec-22	2.32
Jan-23	2.32
Feb-23	2.09
Mar-23	2.32
Total	10.99

Figure 19 DFS Spend Breakdown Table

Interconnector Net Transfer Capacity Payments (NTCs)

Net Transfer Capacity is the method by which System Operators (SOs) on both sides of each interconnector can restrict the capacities released to the interconnector auctions. They are required to ensure that system security, security of supply can be maintained at all times. NTCs are obtained through trilaterally agreed procedures for each interconnector between the connected SOs and the interconnector. The NTC compensation payments are made under the "Methodology for GB Commercial Arrangements" relating to Interconnector Capacity Calculation. Only interconnectors covered under this arrangement are included within this addendum, as such, not all interconnectors are included within the data.

In total, ESO spent £35,997,165.80 on NTCs in the previous regulatory year. Please see below for further breakdown. Spend has significantly increased from 21/22 (spend during 21/22 was £3,205,827.28) as a result of a number of factors:

- Only two interconnectors are currently part of the Methodology for GB Commercial Arrangements, and they went live in October 2021 and May 2022
- One of these connections is into a heavily congested area of the network, thus increasing the congestion even further. As a result, ESO's use of NTCs has increased in order to maintain and ensure system security
- One of the Interconnectors had to be managed via NTCs as there was no Intraday and thus ESO had no commercial options to manage the flow (such as trading)
- The conflict in Ukraine and the resulting energy crisis caused energy prices to increase steeply and as the NTC compensation is paid based on market costs, the price paid for each MW of compensation rose significantly

Month	UK - Norway (£m)*	Change from Previous Year	UK - France (£m)**	Change from Previous Year	Total (£m)
Apr-22	0.00	Interconnector was not operational	0.00	Interconnector was not operational	0.00
May-22	0.00		0.11		0.11
Jun-22	0.98		1.91		2.88
Jul-22	2.48		0.00		2.48
Aug-22	1.54		0.00		1.54
Sep-22	6.12		0.00		6.12
Oct-22	3.53	1.98	0.00		3.53
Nov-22	5.58	5.58	0.02		5.60
Dec-22	2.80	2.70	0.00		2.80
Jan-23	4.11	4.10	-0.01		4.10
Feb-23	4.91	4.76	0.00		4.91
Mar-23	1.95	0.57	-0.03		1.92
Total	34.01	30.82	1.99		36.00

Figure 20 NTC Spend Breakdown (£m)

*Reason – Largest securable loss

**Reason - Constraints

Winter Contingency Contracts

The Winter Contingency Contracts were entered into with a number of coal fired power stations in order to provide further security of supply over Winter 2022/2023 which was forecast to be particularly tight in terms of margin. The request to enter into these bilateral agreements was made by BEIS (the Department for Business, Energy & Industrial Strategy), now known as DESNZ (Department for Energy, Security and Net Zero). These contracts were only to be utilised as "Enhanced Actions", similar to DFS. For more information on the order of actions please see ESO's website: https://www.nationalgrideso.com/industry-information/winter-operations.

In total, ESO spent £303,221,797.03 [1]on the Winter Contingency Contracts over the last regulatory year.

These costs were made up of the following components:

- Procurement of coal
- Operational costs to make the units available
- Allowable maintenance costs for the duration of the service
- Other variable costs properly incurred by the Generators

Please note, for reporting purposes and BSUoS recovery the costs have been equally allocated across the Winter period 1st October to 31st March 2023 days within this report.

6. Response

Response is a service used to keep the system frequency within +/-1% of 50Hz as required by ESO's licence obligation. 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 services ESO procure can be found on the ESO website:

https://www.nationalgrideso.com/industry-information/balancing-services/frequency-response-services

In total, ESO spent £235,725,400.79 on Response services throughout the previous regulatory year. The below figure and following sections break this down by specific services.

Firm Frequency Response (FFR)

ESO 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 whether or not the volume can be secured at a lower cost than the alternative actions (i.e., the BM).

Additional Response, when required, is also procured through Mandatory Frequency Response (MFR) in the BM. Only BMUs can offer MFR.

FFR is made up of:

- **Static FFR –** a non-dynamic frequency response service which is triggered at a defined frequency deviation. It is provided within 30 seconds and sustained until 30 minutes following the point at which the frequency trigger was reached. Currently month ahead procurement, from FY23/24 this will move to day ahead
- **Dynamic FFR -** is a continuously provided service used to manage the normal second-by-second changes on the system. This is being phased out over the period FY23/24 as the new dynamic response services (DC, DM, DR) offset this requirement

[1] Please note, some of this spend will be offset by the revenues achieved through the sale of coal to be completed at a future date. This will result in a change to BSUoS figures. As at the date of publication, none of the coal has been sold back to the market

ESO

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 breakdown, all other costs above are included within the other categories.

In total, ESO spent £64,338,351.09 on FFR last year. Please see the below figures for further breakdown.

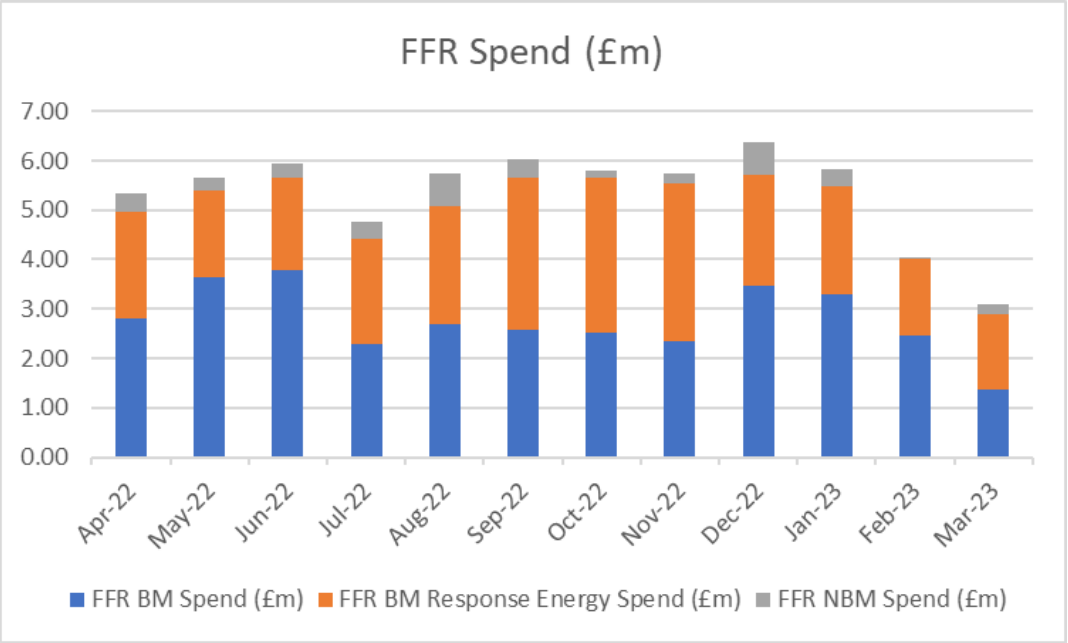

Figure 21 FFR Spend Breakdown Chart

Month	FFR BM Spend (£m)	FFR BM Response Energy Spend (£m)	FFR NBM Spend (£m)
Apr-22	2.81	2.15	0.38
May-22	3.64	1.76	0.26
Jun-22	3.80	1.86	0.30
Jul-22	2.30	2.11	0.36
Aug-22	2.68	2.39	0.68
Sep-22	2.57	3.08	0.37
Oct-22	2.52	3.15	0.12
Nov-22	2.34	3.19	0.22
Dec-22	3.46	2.26	0.65
Jan-23	3.28	2.19	0.35
Feb-23	2.47	1.54	0.01
Mar-23	1.37	1.51	0.21
Total	33.24	27.19	3.92

Figure 22 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 of 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 (£/MW/hr).

EFR will no longer be actively procured due to the newly developed frequency response product suite. Some legacy contracts remained in place for the previous regulatory year due to late commissioning (post March 2018) or contracted extension options.

In total, NGESO spent £5,046,611.74 on EFR last year.

DC, DM & DR

Dynamic Containment (DC), Dynamic Moderation (DM) and Dynamic Regulation (DR) make up ESO's new suite of Dynamic Response Services. Together they work to control system frequency and keep it within the licence obligations of 50Hz plus or minus 1%. DM provides fast acting pre-fault delivery for particularly volatile periods, DR is the staple slower pre-fault service and DC is a post-fault service.

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

A 4 day ahead forecast is published here for DC 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. DM and DC requirements are published on the data portal here: ESO Data Portal: Ancillary Services | National Grid Electricity System Operator (nationalgrideso.com).

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

Winning providers are paid an availability price only as determined by the pay-as-clear auction.

In total, NGESO spent £109,092,170.38 on DC, £1,073,025.58 on DM and £8,646,236.95 on DR last year. Please see the below figures for further breakdown. It should be noted that the DM and DR spend is lower than DC spend because these two services were launched later (March 2022) than DC which as a result has a more established and mature market.

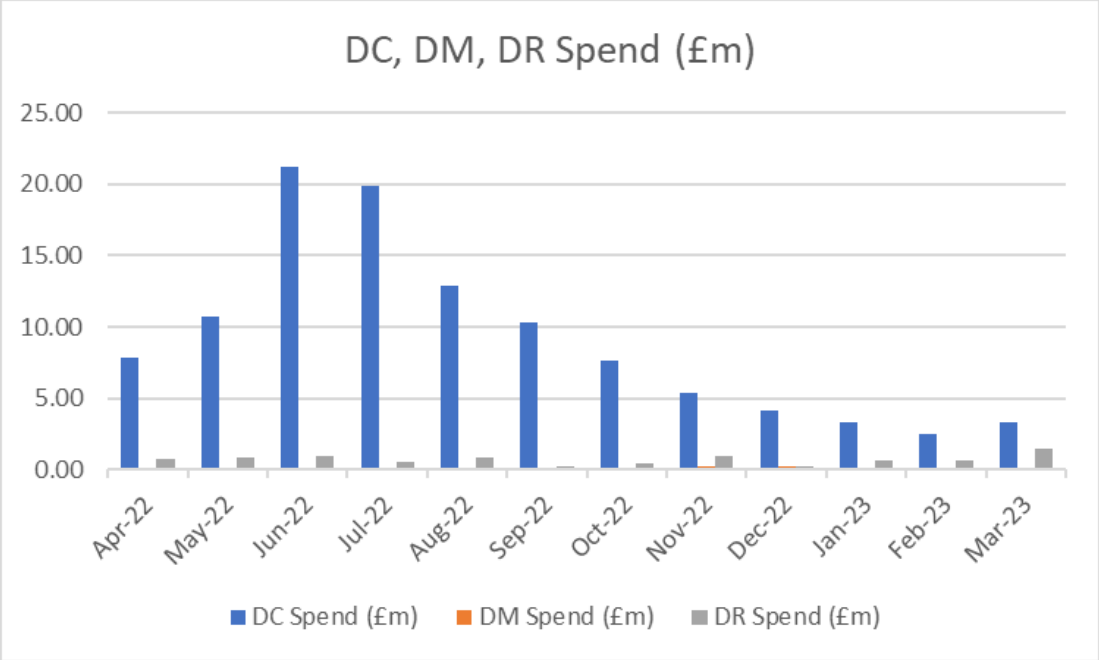

Figure 23 DC, DM, DR Spend Breakdown Chart

Month	DC Spend (£m)	DM Spend (£m)	DR Spend (£m)
Apr-22	7.83	0.00	0.79
May-22	10.69	0.06	0.85
Jun-22	21.20	0.04	0.93
Jul-22	19.86	0.01	0.52
Aug-22	12.93	0.02	0.89
Sep-22	10.32	0.07	0.22
Oct-22	7.65	0.04	0.48
Nov-22	5.33	0.20	0.96
Dec-22	4.12	0.20	0.22
Jan-23	3.36	0.19	0.64
Feb-23	2.52	0.13	0.69
Mar-23	3.29	0.11	1.46
Total	109.09	1.07	8.65

Figure 24 DC, DM, DR Spend Breakdown Table

Hydro Spin Gen with LF

Similar to the Optional Hydro Spin Gen under Reserve, under this service a hydro unit will be instructed to start generating in real-time by ENCC. Whilst instructed to provide this the unit will spin in the air using a small amount of demand to do so. However, in this instance when the frequency trigger is reached, the water barriers will open, and the unit will start generating to help increase the frequency.

ESO spent £297,420.98 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 ENCC. The unit must be generating at its Part Load Point to be able to provide/deliver this.

Over the previous regulatory year, ESO spend a total of £1,257,486.03 on this service, made up of £540,273.03 for service availability and £717,213.00 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 ENCC 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 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, ESO spent a total of £29,421,398.29 on generator response, this is made up of £27,511,318.51 on service availability and £1,910,079.78 on response energy.

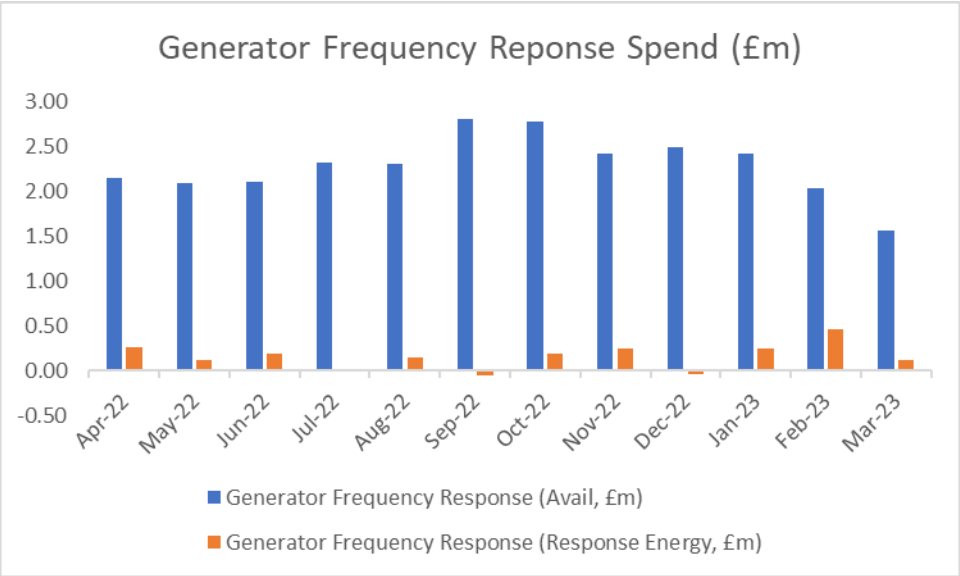

Figure 25 Generator Frequency Response Spend Breakdown Chart

Month	Generator Frequency Response (Avail, £m)	Generator Frequency Response (Response Energy, £m)
Apr-22	2.15	0.27
May-22	2.09	0.12
Jun-22	2.10	0.19
Jul-22	2.33	0.00
Aug-22	2.30	0.15
Sep-22	2.80	-0.05
Oct-22	2.78	0.19
Nov-22	2.43	0.25
Dec-22	2.50	-0.03
Jan-23	2.42	0.24
Feb-23	2.03	0.46
Mar-23	1.57	0.12
Total	27.51	1.91

Figure 26 Generator Frequency Response Spend Breakdown Table

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, ESO spent £16,552,699.74 on Response Avoidance trades last year.

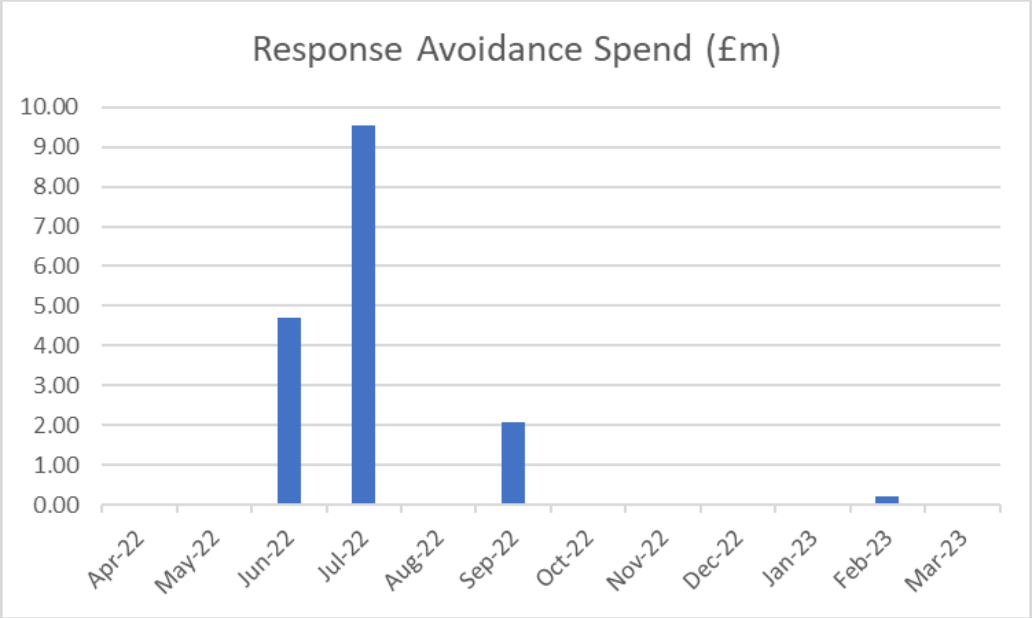

Figure 27 Response Avoidance Spend Breakdown Chart

Month	Response Avoidance Spend (£m)
Apr-22	0.00
May-22	0.00
Jun-22	4.72
Jul-22	9.52
Aug-22	0.00
Sep-22	2.08
Oct-22	0.00
Nov-22	0.00
Dec-22	0.00
Jan-23	0.00
Feb-23	0.23
Mar-23	0.00
Total	16.55

Figure 28 Response Avoidance Spend Table

7. Stability

Stability is the inherent ability of the system to quickly return to acceptable operation following a disturbance. The term is used to describe a broad range of topics, including inertia, short circuit level and dynamic voltage. If the system becomes unstable it could lead to a partial or total system shut down leading to the disconnection of consumers. To keep the power system stable, we need to maintain sufficient amounts of inertia, SCL and dynamic voltage support.

Stability services have traditionally been provided by synchronous generation, which can contribute inertia and Short Circuit Level (SCL) when supplying the grid with electricity, as well as dedicated network assets. Some forms of low-carbon generation do not automatically provide the same level of stability as they are non-synchronous. Therefore, ESO need to procure additional stability services to ensure the system can be operated with the same stability in a low-carbon world. To date, these have been procured via a number of Pathfinder tenders. Phase 1 is now live. Phase 2 and 3 tenders have concluded but the contracts are not yet live so spend has not yet been incurred on the services.

On a more enduring basis, ESO are looking to develop a Stability Market and work has already commenced on this project. You can find out more at this link: https://www.nationalgrideso.com/future-energy/projects/stability-market-design

Stability Pathfinder Phase 1

Phase 1 of the stability pathfinder was looking for the most cost-effective way to increase inertia, 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. All contracts for this phase are now live.

In total, ESO spent £73,431,078.30 on Phase 1 stability contracts last year. Please see below for further breakdown.

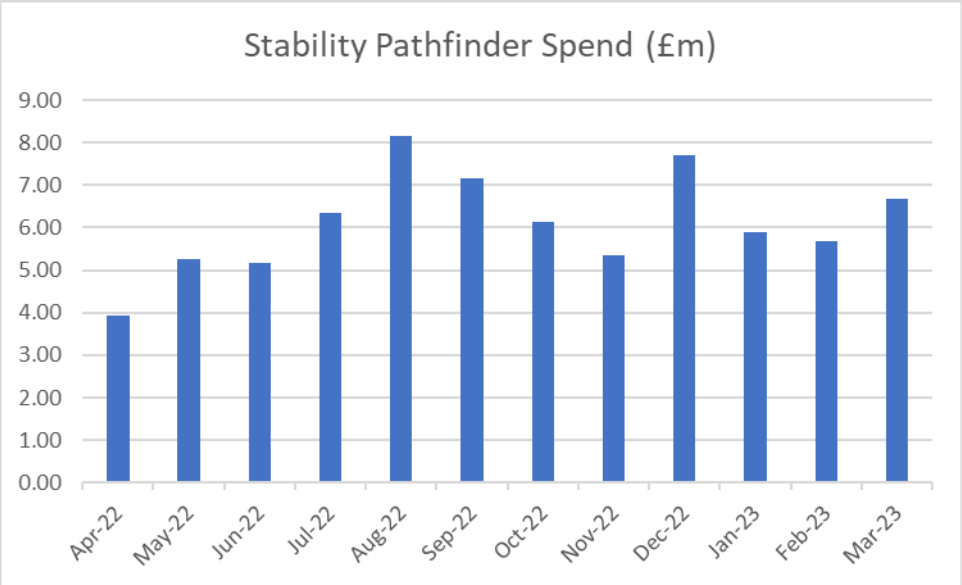

Figure 29 Stability Pathfinder Spend Breakdown Chart

Month	Stability Pathfinder Spend (£m)
Apr-22	3.92
May-22	5.27
Jun-22	5.16
Jul-22	6.33
Aug-22	8.14
Sep-22	7.16
Oct-22	6.12
Nov-22	5.34
Dec-22	7.72
Jan-23	5.88
Feb-23	5.69
Mar-23	6.69
Total	73.43

Figure 30 Stability Pathfinder Spend Breakdown Table

8. Thermal

There are several types of constraints but one of the most common on the network are thermal constraints. Thermal constraints refer to an area of the network where the power is congested due to the thermal capacity of the equipment. At times, to ensure system security, the ESO must reduce generation / increase demand behind a constraint and increase generation / reduce demand in front of the constraint to ensure generation and demand remain in balance.

Costs incurred in managing these thermal constraints are mitigated wherever possible through innovative commercial solutions which avoid reliance on the BM. These include:

- **Constraint Management Intertrip Services (CMIS) –** secures a pre-determined volume of generation capacity which can be reduced to 0MW almost instantaneously in the event of a fault. Contracts are awarded yearly via a competitive tender and providers are paid an arming fee (£/Settlement Period) and a tripping fee (£/trip). The service is live on the B6 boundary between England and Scotland and the EC5 boundary in East Anglia is under consultation
- **Trades –** trades are carried out, outside of the BM in order to secure volume ahead of a fault
- **BM Constraints for Voltage Support -** This category is for Constraints Payments entered into for the purpose of voltage support

- **BM Constraints - Other -** This category is for Constraints Payments entered into for purposes other than voltage support
- **Interconnector Intertrips** – the interconnectors will be paid an arming fee and capability fee for reducing their volume in the event of a fault
- **Intertrips via Commercial Contracts** – providers are paid an arming fee and capability fee for reducing their volume in the event of a fault

In total, ESO spent £660,676,608.14 on Thermal services in the past regulatory year. See below for further breakdown.

CMIS

In total, ESO spent £10,063,508.98 on CMIS in the past regulatory year. See below for further breakdown.

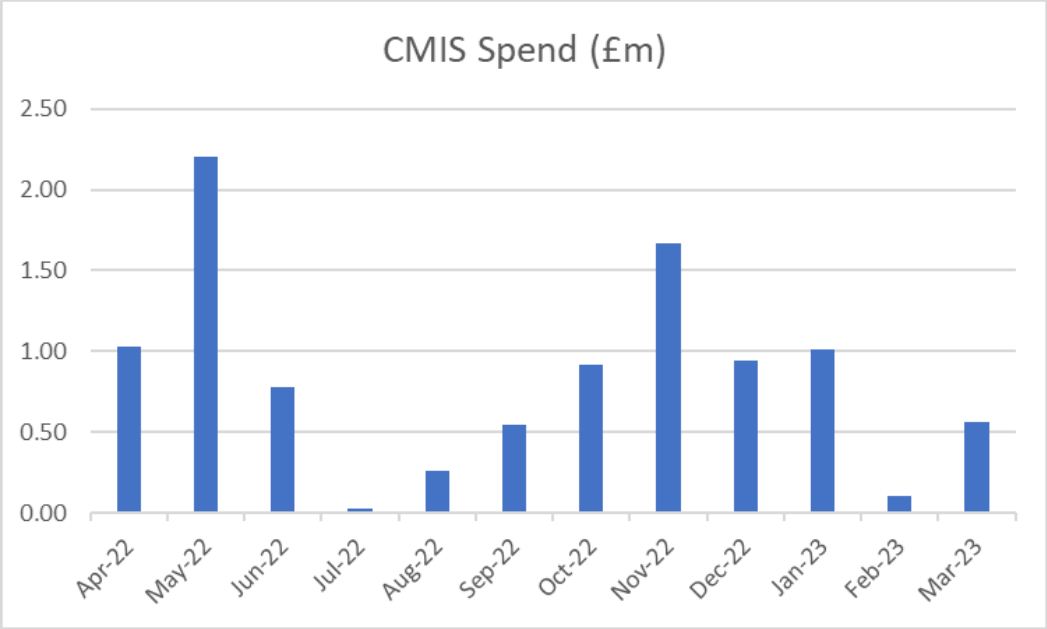

Figure 31 CMIS Spend Breakdown Chart

Month	CMIS Spend (£m)
Apr-22	1.03
May-22	2.20
Jun-22	0.78
Jul-22	0.03
Aug-22	0.26
Sep-22	0.55
Oct-22	0.92
Nov-22	1.66
Dec-22	0.94
Jan-23	1.01
Feb-23	0.10
Mar-23	0.56
Total	10.06

Figure 32 CMIS Spend Breakdown Table

Trades

In total, ESO spent £632,037,282.10 on Thermal trades in the past regulatory year. See below for further breakdown.

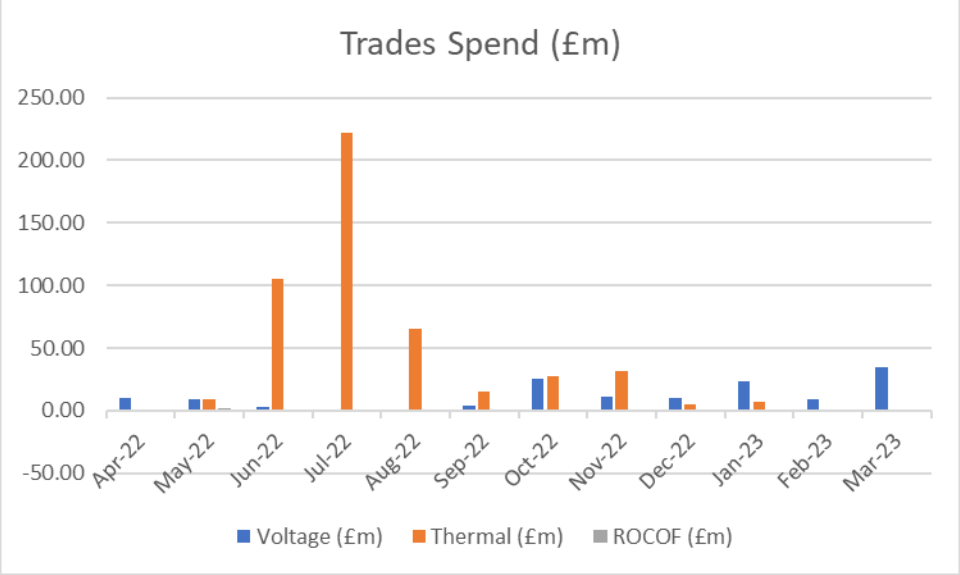

Figure 33 Trades Spend Breakdown Chart

Month	Voltage (£m)	Thermal (£m)	ROCOF (£m)
Apr-22	9.95	0.00	0.36
May-22	9.19	9.53	2.19
Jun-22	3.00	105.41	0.00
Jul-22	0.99	221.64	0.00
Aug-22	0.00	65.28	0.34
Sep-22	4.05	14.93	-0.09
Oct-22	25.56	27.03	0.00
Nov-22	10.98	31.79	0.00
Dec-22	10.57	4.54	0.00
Jan-23	23.53	7.50	0.00
Feb-23	9.31	1.26	0.00
Mar-23	34.68	-1.47	0.00
Total	141.80	487.43	2.80

Figure 34 Trades Spend Breakdown Table

The figures above show a spike in Thermal trade spend in July. On 20th July 2022, high power prices from the continent drove all Southeast interconnectors to export power to the continent. This, combined with London demand, drove power flows across network boundaries that were impacted by unplanned outages. ESO carried out trades on the interconnectors to help manage the power flows across the network boundaries in the Southeast of England. Scarce supplies of power on the continent resulted in extreme prices leading to an especially large constraint spend. Wednesday 6 and Tuesday 12 July were also especially expensive days. Periods of windy weather and a significant number of new outages requiring a larger volume of actions to reduce generation to manage thermal constraints were the main driver behind these expensive days.

BM Constraints

In total, ESO spent £3,644,202.40 on BM constraints in the past regulatory year. See below for further breakdown.

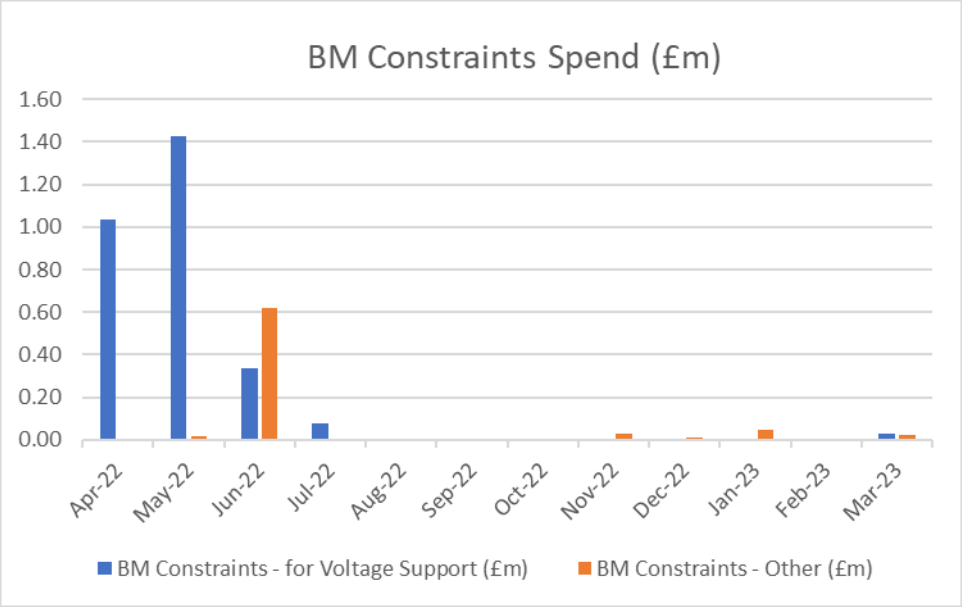

Figure 35 BM Constraints Breakdown Graph

Month	BM Constraints - for Voltage Support (£m)	BM Constraints - Other (£m)
Apr-22	1.03	0.00
May-22	1.43	0.01
Jun-22	0.34	0.62
Jul-22	0.08	0.00
Aug-22	0.00	0.00
Sep-22	0.00	0.00
Oct-22	0.00	0.00
Nov-22	0.00	0.03
Dec-22	0.00	0.01
Jan-23	0.00	0.05
Feb-23	0.00	0.00
Mar-23	0.03	0.02
Total	2.90	0.74

Figure 36 BM Constraints Spend Breakdown Table

Intertrips

In total, ESO spent £14,931,614.66 on Intertrips in the past regulatory year. See below for further breakdown.

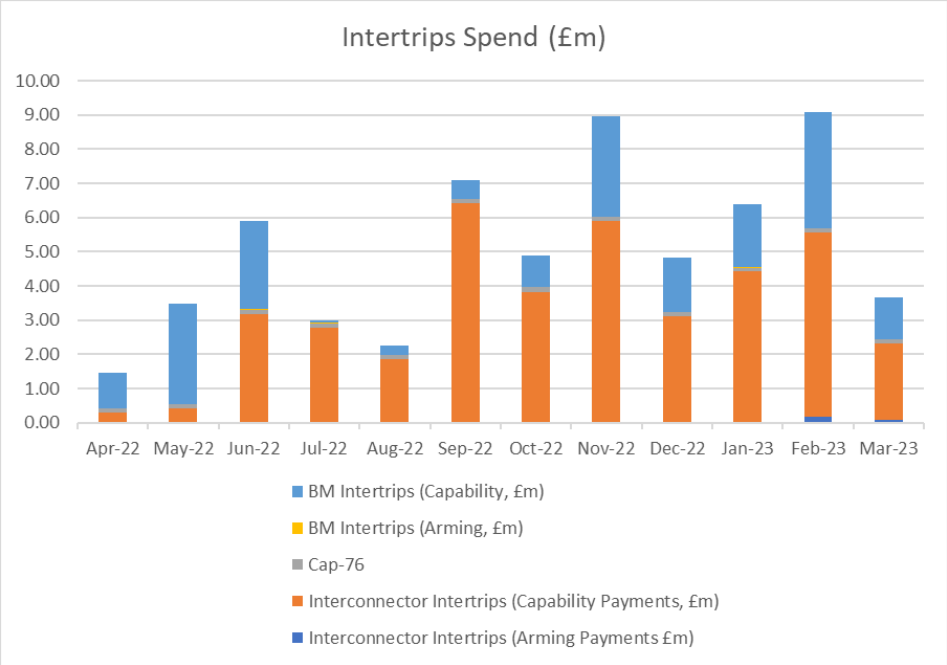

Figure 37 Intertrips Spend Breakdown Chart

Month	Interconnector Intertrips (Arming Payments £m)	Interconnector Intertrips (Capability Payments, £m)	Cap-76	BM Intertrips (Arming, £m)	BM Intertrips (Capability, £m)
Apr-22	0.00	0.30	0.12	0.01	1.03
May-22	0.00	0.42	0.13	0.01	2.94
Jun-22	0.00	3.18	0.12	0.01	2.58
Jul-22	0.00	2.79	0.13	0.01	0.05
Aug-22	0.00	1.85	0.13	0.01	0.26
Sep-22	0.00	6.42	0.12	0.01	0.55
Oct-22	0.00	3.83	0.13	0.01	0.92
Nov-22	0.00	5.90	0.12	0.01	2.93
Dec-22	0.00	3.10	0.12	0.01	1.58
Jan-23	0.01	4.41	0.12	0.01	1.84
Feb-23	0.18	5.40	0.11	0.01	3.39
Mar-23	0.08	2.23	0.12	0.01	1.24
Total	0.27	3.81	1.45	0.15	9.26

Figure 38 Intertrips Spend Breakdown Table

9. Voltage

The ESO 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 ESO pay providers to help manage voltage levels on the system by controlling the volume of Reactive Power that they absorb or inject.

You can find more detail about Reactive Power https://www.nationalgrideso.com/industry-information/balancing-services/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: https://www.nationalgrideso.com/industry-information/balancing-services/reactive-power-services/obligatory-reactive-power-service?getting-paid.

There are also some commercial agreements which are in place with providers for Reactive Power.

To try and mitigate some of the significant spend on reactive power ESO launched a number of pathfinder tenders, Mersey and Pennines. Both tenders have concluded with the Mersey contracts live and delivering the service. Pennines is still in construction phase. Providers under these contracts are paid in £/Settlement period for their availability.

In total, NGESO spent £354,077,228.91 on Reactive Power last year. This was made up of £2,749,695.46 spend on the commercial contracts, £350,417,719.85 on mandatory payments and £909,813.60 on the Mersey Pathfinder. Please see the below figure for further breakdown.

Month	Reactive Power (Commercial, £m)	Reactive Power (Mandatory, £m)	Mersey Pathfinder (£m)
Apr-22	0.14	22.22	0.08
May-22	0.11	27.73	0.08
Jun-22	0.17	17.89	0.08
Jul-22	0.20	20.48	0.08
Aug-22	0.09	25.27	0.08
Sep-22	0.21	37.51	0.08
Oct-22	0.22	43.19	0.08
Nov-22	0.26	37.03	0.08
Dec-22	0.53	36.27	0.08
Jan-23	0.32	32.64	0.08
Feb-23	0.29	30.01	0.08
Mar-23	0.22	20.18	0.08
Total	2.75	350.42	0.91

Figure 39 Voltage Spend Breakdown Table

ESO

10. 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, ESO are obliged to make sure there are contingency arrangements in place to ensure electricity supplies can be restored in a timely and orderly way. Restoration Services are used to recover from such a shutdown and ESO have agreements with providers in order to do so. You can find more detail about Restoration on ESO's web site at Electricity System Restoration Standard | ESO (nationalgrideso.com)

Restoration Services are procured via regional, competitive tenders and bilateral agreements. No new Restoration contracts were signed during the previous regulatory year, however, there were several short-extensions to existing contracts.

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

- **Availability Payments -** these 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 Restoration 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 ESO for new providers looking to demonstrate that the unit can provide Restoration capability. ESO 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 ESO and the provider.
- **Testing -** ESO 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 -** Restoration providers must be able to respond in a specified time, (normally within two hours), to be deemed available for Restoration. 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, ESO 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 £56,194,965.35 on Restoration Services last year. Please see below for a further breakdown.

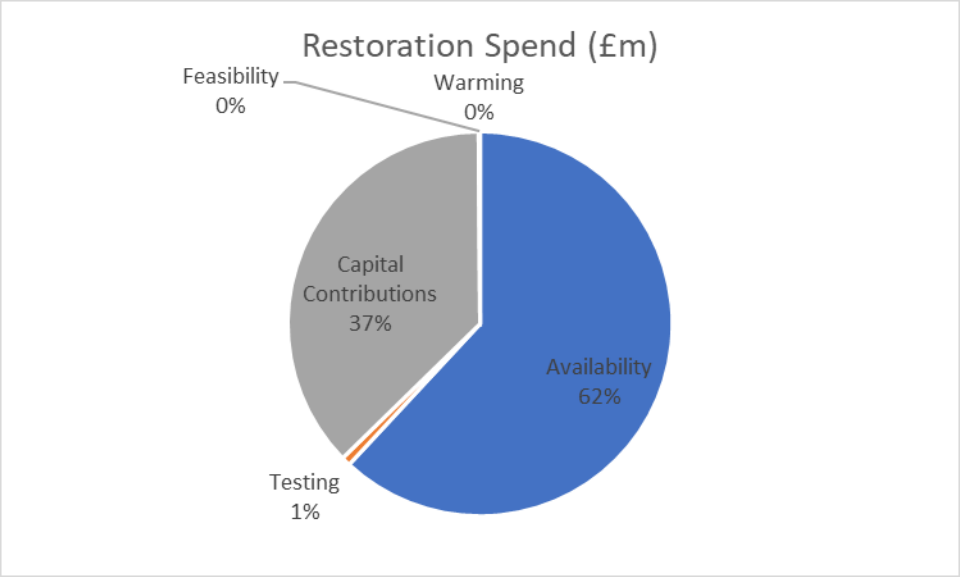

Figure 40 Restoration Spend Breakdown Chart

Cost Component	Annual Spend (£m)
Availability	34.80
Testing	0.43
Capital Contributions	20.90
Feasibility	0.07
Warming	0.00
Total	56.19

Figure 41 Restoration Spend Breakdown Table

11. Fees and Liabilities

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 providers 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 £105,224.58.