April 2018

Monthly Balancing Services Summary 2018/19

nationalgrid

Contents

1. Introduction

1.1 What are "balancing services"?

Electricity can't be stored in large quantities, so we need to find ways to match supply with demand. That's part of National Grid's role. We call it "balancing", and we do it minute by minute.

We sometimes use balancing for other reasons, too, such as a sudden surge in demand during a televised sporting event, or if a power station suddenly stops generating because of a technical problem.

To help us with balancing, we buy in (procure) services from suppliers. These are "balancing services". We use them to keep the transmission system (or "grid") running in an efficient, economical and coordinated way. And that means everyone can get a steady flow of electricity.

For more detail about balancing, have a look at https://**www.nationalgrid.com/uk**. Look under Electricity, and then Balancing services.

1.2 Why do we need this report?

We publish many statements and market reports about how we procure and use balancing services. You'll find these on our web site at **www.nationalgrid.com/uk**, under Electricity, then Market operations and data.

We also want to give more details about the balancing actions we're taking. That's why we produce a monthly summary in the form of this report, so everyone can see what's what.

1.3 What's in the report?

This report shows the costs associated with balancing the system in order to keep electricity flowing steadily in April 2018.

The report presents balancing costs in these main sections:

- services we've procured through the Balancing Mechanism.
- services we've procured through trading.
- services we've procured through ancillary services.
- Services we've procured through SO-to-SO transactions.

The report also presents information on all the balancing services supplied to National Grid. It uses charts and tables to show:

- which balancing services we've used in the month
- the volume for each service, month by month in megawatts per hour (MWh) unless otherwise stated.
- the cost for each service, month by month in pounds sterling (£ million) usually to two decimal places.

We base the information on data we had when we published the report, to give an idea of what we've done in the month. We sometimes get updated information later on. If that happens, we don't publish a revised version for the month. But we do update the charts and tables to show the latest information when we publish the report for the following month.

1.4 Balancing Costs categories included in the report

In April 2018, we used market arrangements or bilateral contracts to manage:

- Energy Imbalance
- Operating reserve
- Other Reserves
- STOR
- Constraints
- Negative Reserves
- Fast Reserves
- Response
- Reactive
- ROCOF
- Black Start
- Others categories

You can read more about our procurement guidelines on our web site at **www.nationalgrid.com/uk**. Look under Electricity, then Market operations and data, and Transmission license C16 statements and consultations.

1.5 What are "balancing mechanism" (BM) and "non-balancing mechanism" (non-BM) services?

Because electricity cannot be stored, it needs to be manufactured at the time of demand. One of the tools National Grid uses to achieve the balancing act between electricity supply and demand at just the right time is called "balancing mechanism" (BM). It is the buying and selling of energy by National Grid Electricity Control Centre.

When an electricity generator, such as a power station or large wind farm, connects to the grid, we register it as a "balancing mechanism unit" (BMU). A BMU is used as a unit of trade in the BM, and is the smallest grouping of plant or equipment that we can meter separately; therefore, a single generator might register as more than one BMU. Suppliers with BMUs are referred to as BM Suppliers.

When National Grid predicts that there will be a discrepancy between the amount of electricity produced and that which will be in demand during a certain time period, we may accept a 'bid' or 'offer' from a BMU to either increase or decrease generation (or demand).

In some instances, National Grid also uses balancing services supplied by companies not registered as BMUs. Those suppliers tend to be smaller generators, for example small wind farm with two or

three turbines or a small conventional-fired unit. We call those suppliers "non-balancing mechanism" (non-BM) suppliers, and traditionally it has not been possible to change their output or usage within the BM timescales.

1.6 What we don't include in the report

There are some details that we can't publish here because:

- Contracts with suppliers of balancing services include confidentiality agreements.
- Data about some types of balancing services aren't always available every month.
- We have removed the BSUoS forecast from the MBSS and created a separate BSUoS report which is published on our website. The benefit of doing this is that we can publish the BSUoS outturn and forecast sooner. The See Market Operations and Data, Forecast Volumes and Cost, Monthly BSUoS Forecast.

Where we show monthly total costs, we don't include the acceptance of bids or offers in the balancing mechanism. But if ancillary services include a service that we've procured through the balancing mechanism and we've used it (so we've made a "utilisation payment"), we do show the bid and offer volumes and costs.

Information on bid and offer acceptances is in our Balancing Principles Statement at **www.nationalgrid.com/uk**. Electricity, then Market operations and data, and Transmission license C16 statements and consultations. More information is available from the Balancing Mechanism Reporting Service (BMRS) at www.bmreports.com.

2. Overview of Balancing Cost

This section provides an overview of balancing costs we have incurred in April 2018.

The total spent to balance the system for the month is £57.9m. This is the total cost charged to generators and suppliers through BSUoS. You can find a copy of our monthly BSUoS report on our website at **www.nationalgrid.com/uk.** Look under Electricity, Market operations and data, Forecast volumes and costs. The cost is broken down to £20.8m spent in the Balancing Mechanism, £4.2m spent on Trades, £33.4m spent on Ancillary Services, £0m spent on SO-to-SO transactions, and -£0.6m recouped from system losses, non-delivery, and reconciliation costs.

Figure 1: Total balancing costs

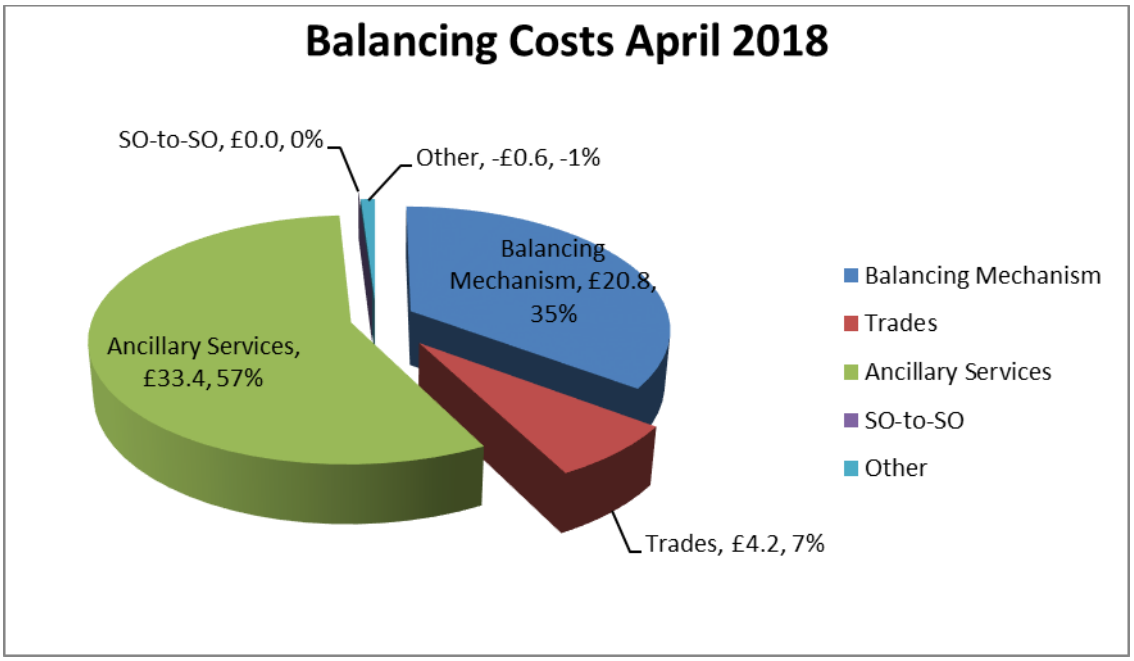
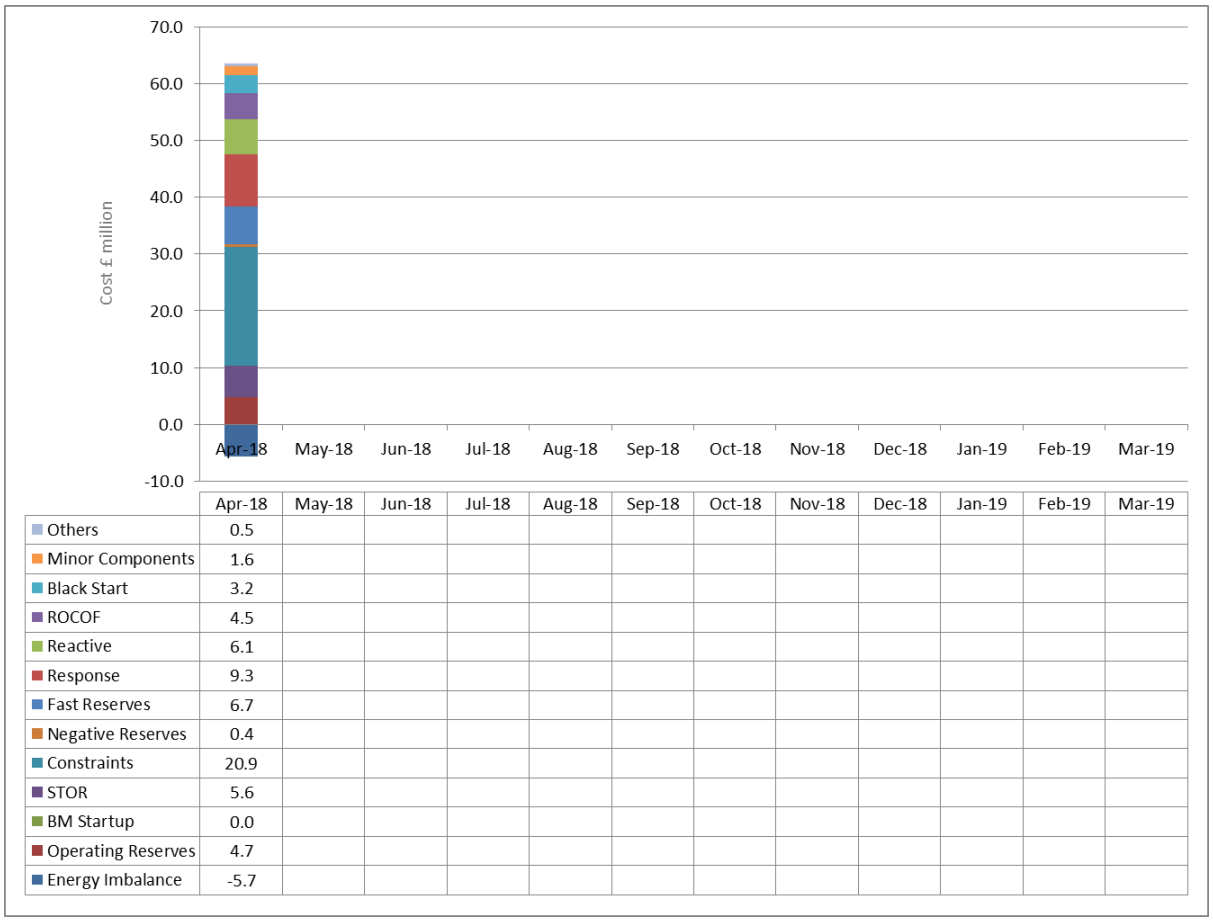


Figure 1

2.1 Total Balancing Services

The following table shows the total balancing expenditure of £57.9m for April 2018 broken down by balancing cost category in pounds sterling (£ million).

Figure 2: Total balancing cost by category

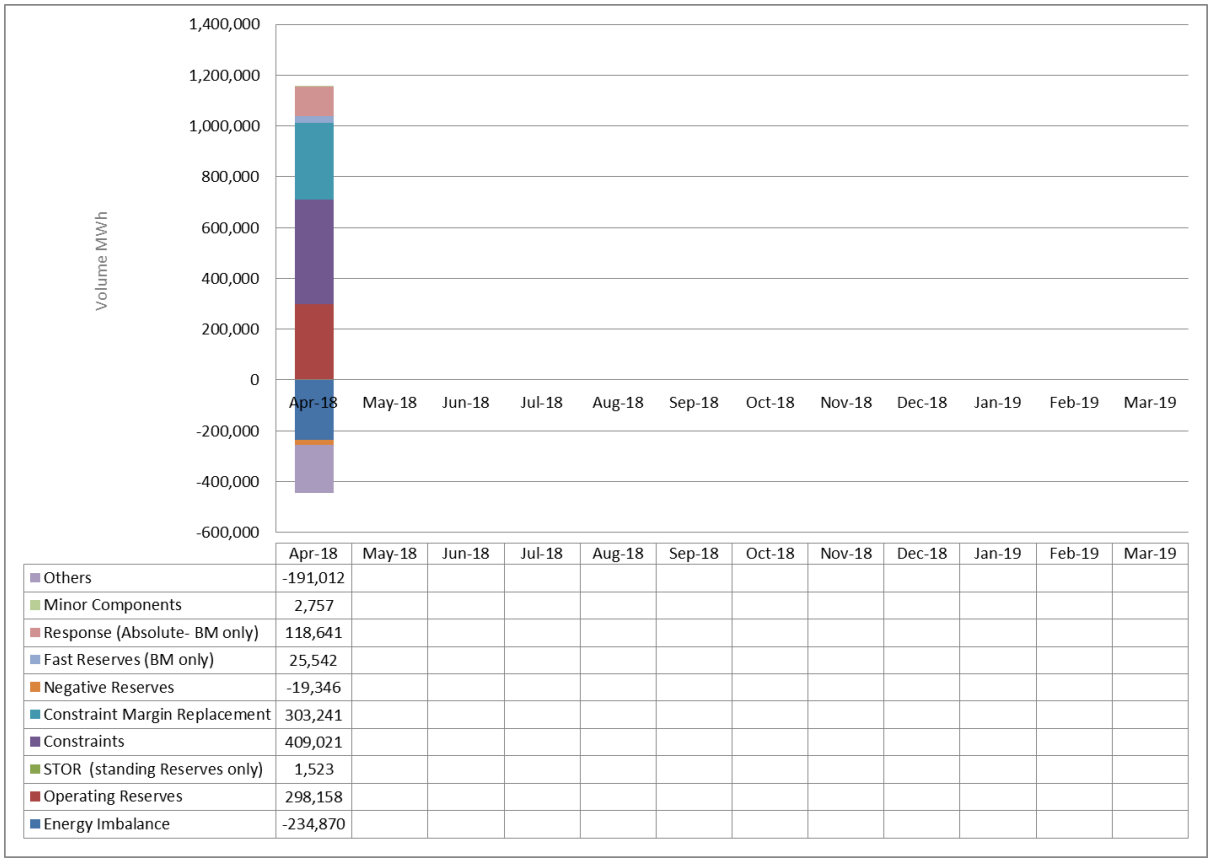


	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Others	0.5											
Minor Components	1.6											
Black Start	3.2											
ROCOF	4.5											
Reactive	6.1											
Response	9.3											
Fast Reserves	6.7											
Negative Reserves	0.4											
Constraints	20.9											
STOR	5.6											
BM Startup	0.0											
Operating Reserves	4.7											
Energy Imbalance	-5.7											

Figure 2

The following table shows the total balancing volume of 948,525 MWh for April 2018, broken down by balancing categories. The table only includes volumes used in trades and the BM. For a more cohesive view of all the volumes utilized, please refer to individual balancing categories in Section 3.

Figure 3: Total Balancing Services Volume (MWh)



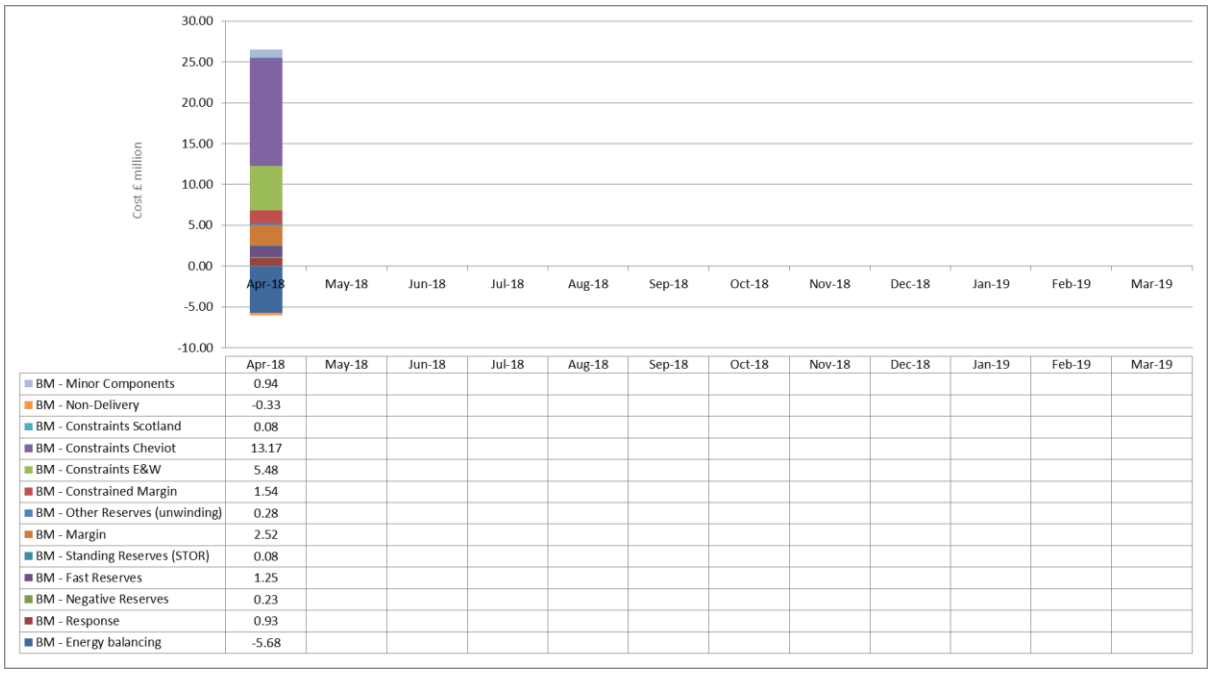
	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Others	-191,012											
Minor Components	2,757											
Response (Absolute- BM only)	118,641											
Fast Reserves (BM only)	25,542											
Negative Reserves	-19,346											
Constraint Margin Replacement	303,241											
Constraints	409,021											
STOR (standing Reserves only)	1,523											
Operating Reserves	298,158											
Energy Imbalance	-234,870											

Figure 3

2.2 Balancing Mechanism

This section provides a summary of costs incurred in the Balancing Mechanism for the reporting month. Total cost for the month was £20.8 million. The chart and table show the costs incurred in, and the volume used for each balancing category. For detail of the actions taken in the BM see Elexon's BMRS website https://www.bmreports.com.

Figure 4: Total balancing cost by category, in pounds sterling (£m)

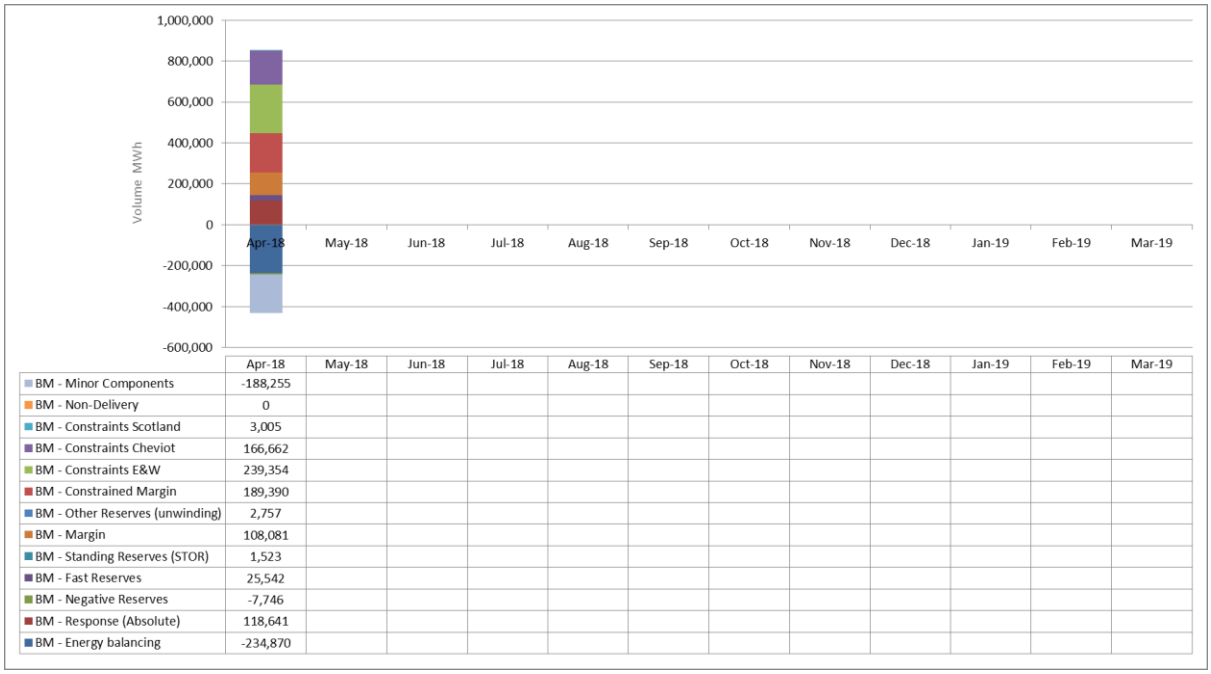


	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
BM - Minor Components	0.94											
BM - Non-Delivery	-0.33											
BM - Constraints Scotland	0.08											
BM - Constraints Cheviot	13.17											
BM - Constraints E&W	5.48											
BM - Constrained Margin	1.54											
BM - Other Reserves (unwinding)	0.28											
BM - Margin	2.52											
BM - Standing Reserves (STOR)	0.08											
BM - Fast Reserves	1.25											
BM - Negative Reserves	0.23											
BM - Response	0.93											
BM - Energy balancing	-5.68											

Figure 4

The figure below provides the summary of some of the volumes utilized in the Balancing mechanism in April 2018.

Figure 5: B**alancing Mechanism volume, in megawatt hours MWh**



	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
BM - Minor Components	-188,255											
BM - Non-Delivery	0											
BM - Constraints Scotland	3,005											
BM - Constraints Cheviot	166,662											
BM - Constraints E&W	239,354											
BM - Constrained Margin	189,390											
BM - Other Reserves (unwinding)	2,757											
BM - Margin	108,081											
BM - Standing Reserves (STOR)	1,523											
BM - Fast Reserves	25,542											
BM - Negative Reserves	-7,746											
BM - Response (Absolute)	118,641											
BM - Energy balancing	-234,870											

2.3 Trading

This section includes information about forward trading, including non-locational and BMU-specific trading and pre-gate BMU transactions.

We use three categories of trading:

- forward trading – negotiated bilateral contracts, which can be tailored to suit the parties' needs
- power exchanges – electronic trade-matching systems, where participants enter the prices at which they're prepared to buy or sell electricity
- energy balancing contracts – agreements for services that help us balance the system; we use these mainly when a power plant stops working or produces less energy than expected.

You'll find more detail on our website at **www.nationalgrid.com/uk**. Look under Electricity, Balancing services, and then Trading.

2.3.1 Forward trading

We sometimes buy or sell electricity (in advance of the balancing mechanism process), called "forward trading". It helps us balance the system and manage system issues ahead of real time.

The total cost of forward trading in April was: £3.96 million

The absolute volume of forward trades for April: 142,484 MWh

Figure 4: Forward trading cost, in pounds sterling (£m)

	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Sell	2.38											
Buy	1.58											

Figure 4

Figure 5: Forward trading volumes, in megawatt hours (MWh)

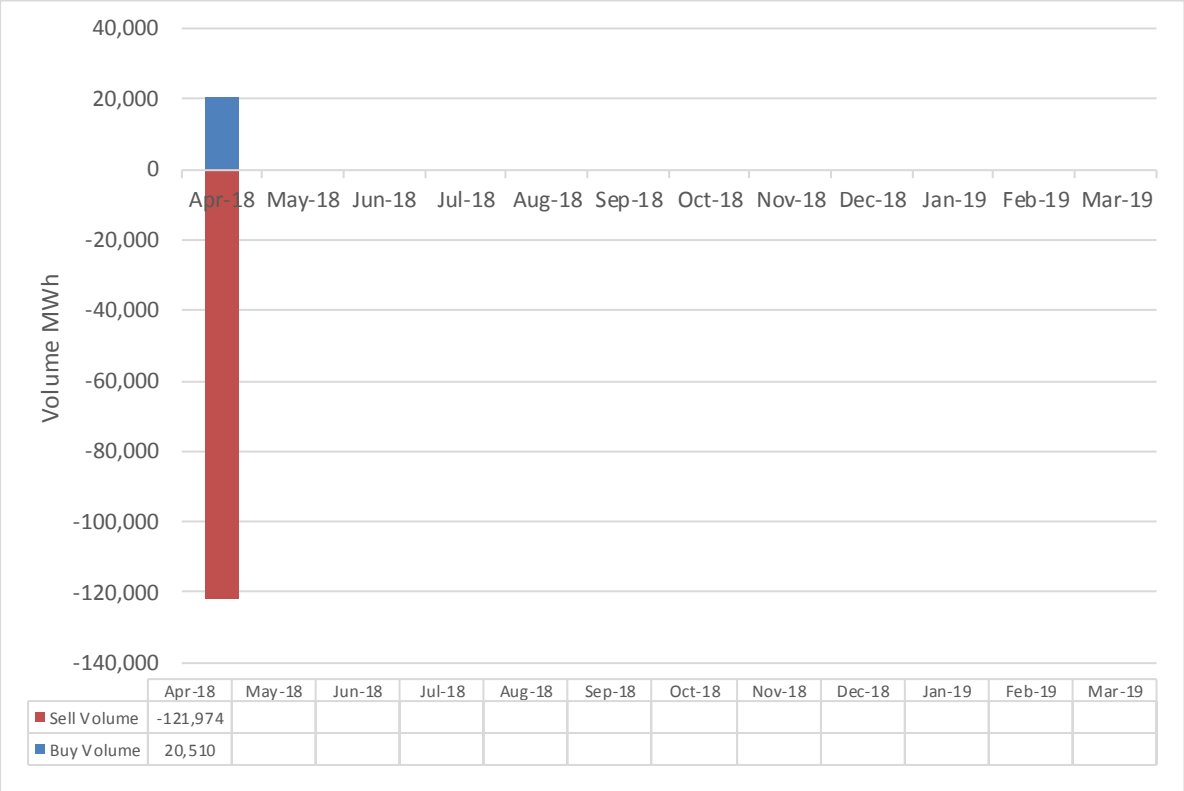


Figure 5

2.4 Ancillary Services

We sometimes enter into extra contracts with suppliers to help us manage electricity grid issues. We call these "ancillary services" sometime abbreviated to AS. The total amount we spent on ancillary services in April 2018 was £33.4 million.

A guide to the ancillary services we procure can be found on our website at **www2.nationalgrid.com/uk**. Look under Electricity, Balancing services, Balancing Services overview.

Figure 6: Summary of ancillary services cost, in pounds sterling (£m)

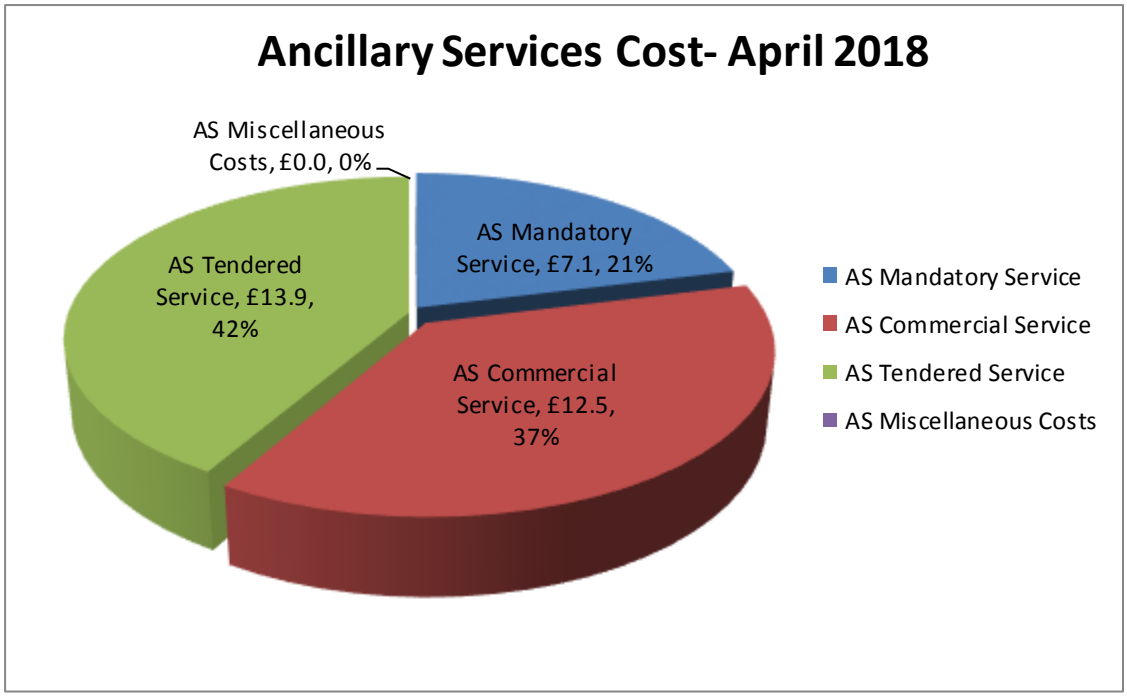
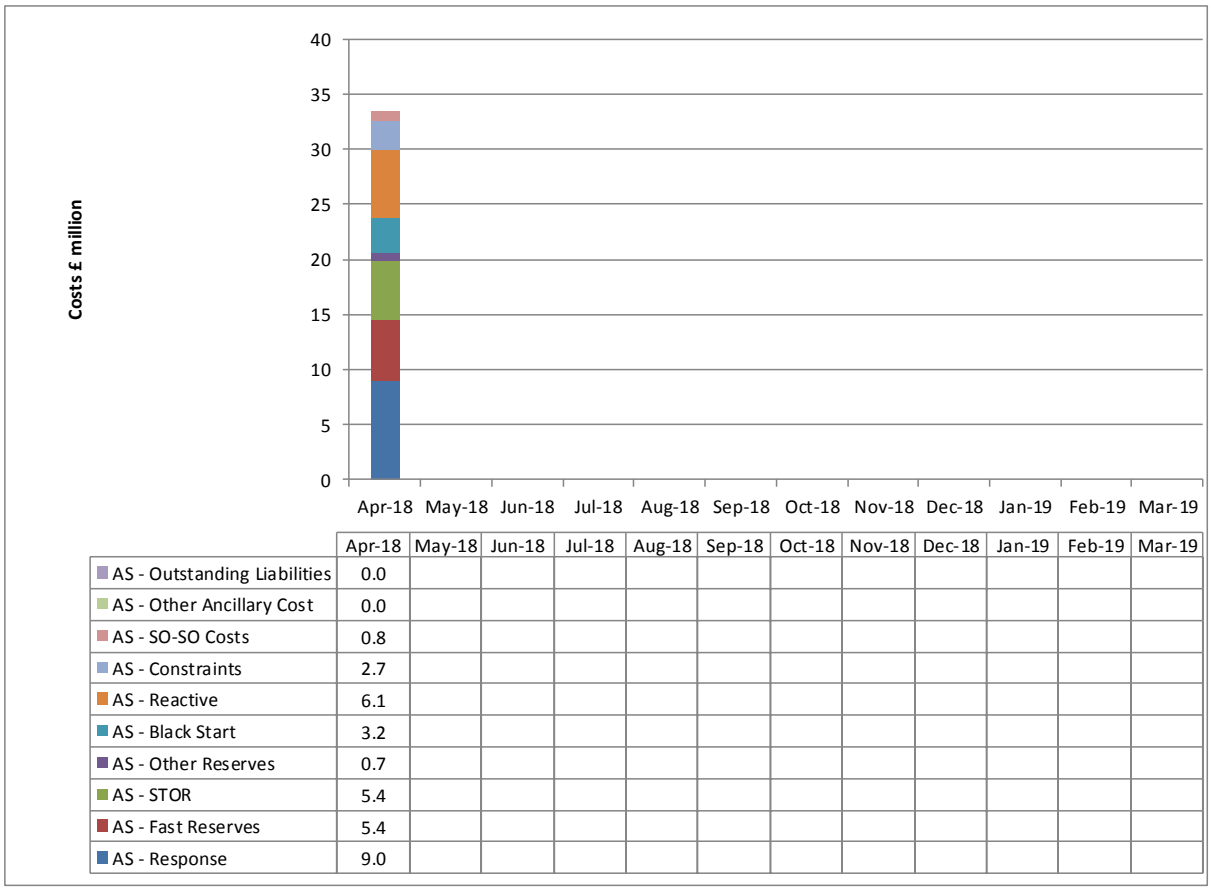


Figure 6

The chart divides the costs into "mandatory", "commercial", and "tendered" service types. Costs attributed to our tendered services frameworks, for example Firm Frequency Response, Fast Reserve and STOR. Mandatory costs are for ancillary services that participants are required to provide under the Grid Code, or as part of their connection agreement, for example reactive power, and some types of generator intertrip. Commercial services cover ancillary service contracts that are not part of our tendered services frameworks, for example black start costs, and demand turn-up services.

Figure 7: Summary of Ancillary services costs, in pounds sterling (£m)



	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
AS - Outstanding Liabilities	0.0											
AS - Other Ancillary Cost	0.0											
AS - SO-SO Costs	0.8											
AS - Constraints	2.7											
AS - Reactive	6.1											
AS - Black Start	3.2											
AS - Other Reserves	0.7											
AS - STOR	5.4											
AS - Fast Reserves	5.4											
AS - Response	9.0											

Figure 7

The left-hand column shows the type of service we are providing the costs for. You'll find explanations of these on our website at **www2.nationalgrid.com/uk**. Look under Electricity, then Balancing services.

2.4.1 Ancillary services from non-BM providers

We use the term "demand side response" (DSR) to describe a collection of services that help us balance supply and demand for electricity. Consumers can contribute to these services by changing their demand for electricity in real time. For example, they can use less electricity than normal during peak times or move their heavy usage to off-peak times.

DSR services include:

- frequency response
- short-term operating reserve (STOR)
- fast reserve.

Figure 8: Ancillary services from Non BM and BM providers, £ million

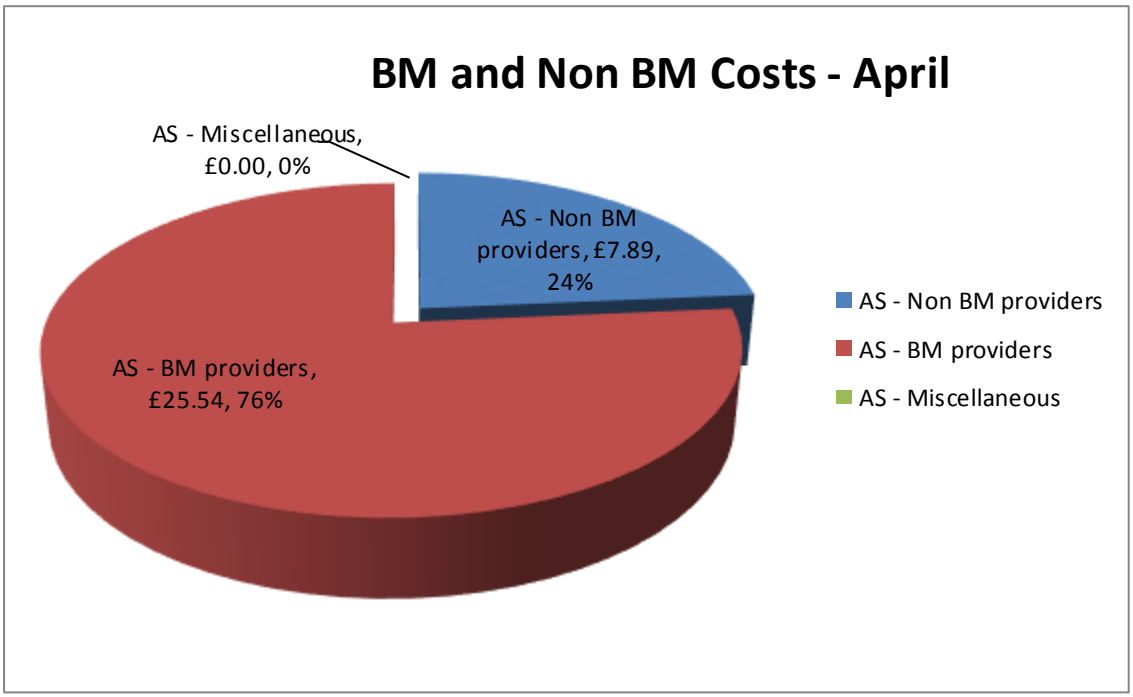
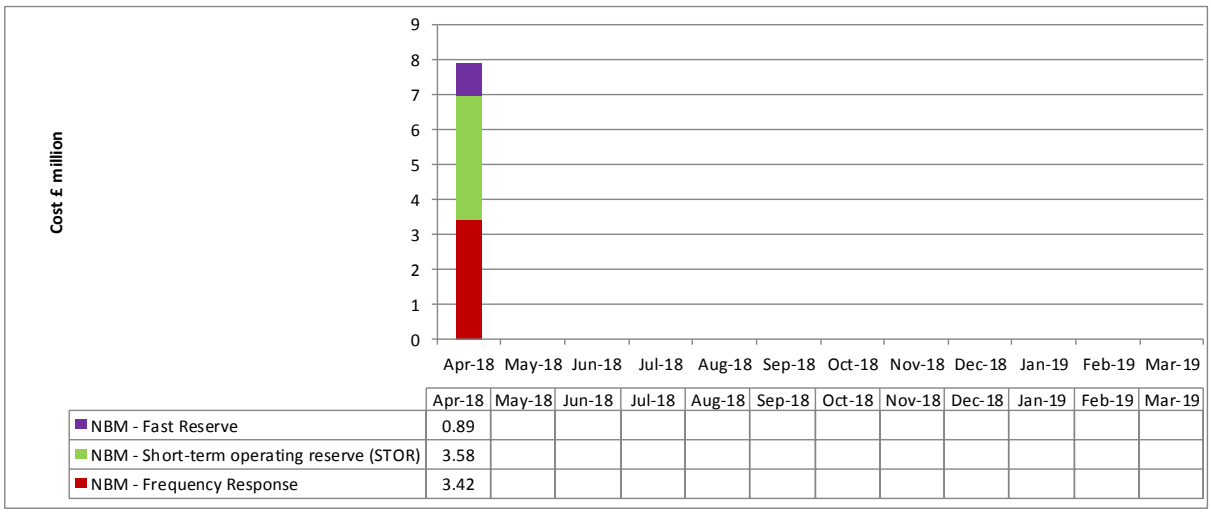


Figure 8

There's more detail about the services from by non-BM providers on our website at **www2.nationalgrid.com/uk**. Look under Our services, Balancing services, then Demand Side Response.

Figure 9: Ancillary services costs from non-BM providers, in pounds sterling (£m)



	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
NBM - Fast Reserve	0.89											
NBM - Short-term operating reserve (STOR)	3.58											
NBM - Frequency Response	3.42											

Figure 9

2.5 SO-SO Services

SO-SO services are provided by other System Operators, the costs will be negative if we receive any revenue for providing balancing services to other system operators.

There were no costs due to SO-SO services in April 2018.

3. Balancing Categories

This section breaks down each of the costs categories, into BM and Non BM, and by the different service types that make up each cost category.

3.1 Energy Imbalance

3.1.1 Definition

Energy imbalance is the difference between the amount of energy generated in real time, the amount of energy consumed during that same time, and the amount of energy sold ahead of the generation time for that specific time period. The monthly energy imbalance cost can be negative or positive depending whether the market was predominantly long or short. For further information on energy imbalance see the Elexon website at **www.elexon.co.uk/operations-settlement/.**

3.1.2 Energy Imbalance Volume and Expenditure

Figure 10: Energy imbalance, in pounds sterling (£m)

Figure 10

Figure 11: Energy imbalance volume, in megawatt hours MWh

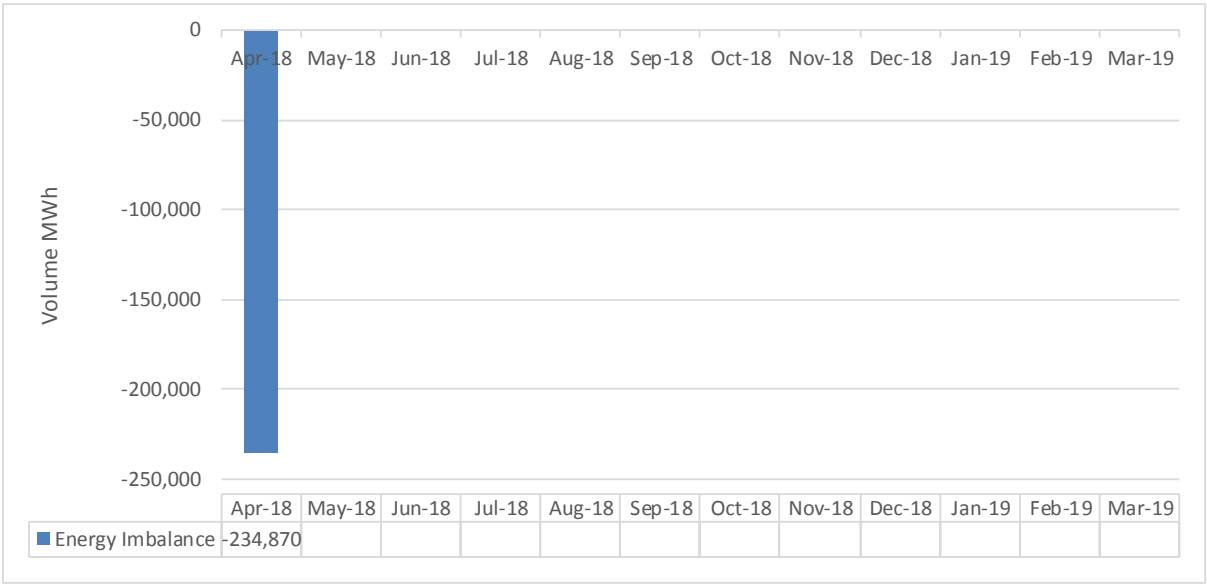


Figure 11

3.2 Operating Reserve

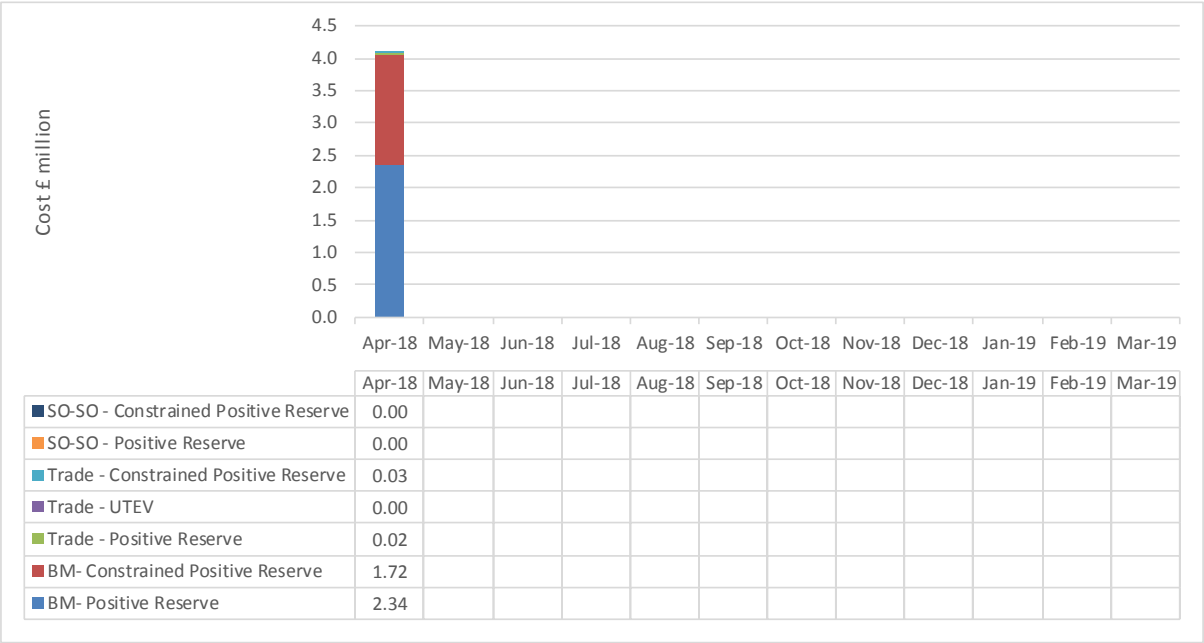
3.2.1 Definition

This section covers positive reserve that is managed in the BM, through trades, or SO-SO services. There are Ancillary Services that provide positive reserve which are covered in later sections. 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 changes or generation breakdowns.

3.2.2 Operating Reserve Volume and Expenditure

The charts show the cost of managing positive reserve across the BM, trading and SO-SO services. Constrained positive reserve is the additional costs of maintaining sufficient reserve levels caused by system constraints. For example, the option to maintain positive reserves on generation in one part of the network might be removed because of a system constraint that limits the energy that can be exported from that area. This reduces the reserve options available and increases the cost.

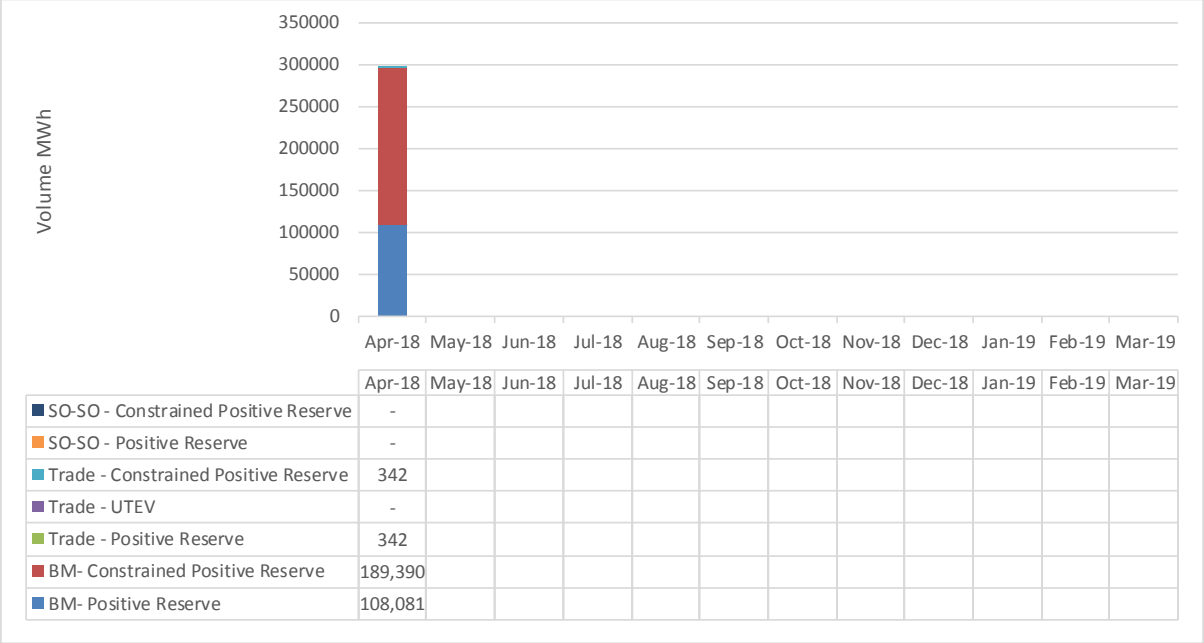
Figure 12: Positive reserve, in pounds sterling (£m)



	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
SO-SO - Constrained Positive Reserve	0.00											
SO-SO - Positive Reserve	0.00											
Trade - Constrained Positive Reserve	0.03											
Trade - UTEV	0.00											
Trade - Positive Reserve	0.02											
BM- Constrained Positive Reserve	1.72											
BM- Positive Reserve	2.34											

Figure 12

Figure 13: Positive reserve volume, in megawatt hours MWh



	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
SO-SO - Constrained Positive Reserve	-											
SO-SO - Positive Reserve	-											
Trade - Constrained Positive Reserve	342											
Trade - UTEV	-											
Trade - Positive Reserve	342											
BM- Constrained Positive Reserve	189,390											
BM- Positive Reserve	108,081											

Figure 13

3.3 STOR

3.3.1 Definition

Short-term operating reserve (STOR) allows us to have extra power in reserve for when we need it. It helps us 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.

National Grid aims to procure a minimum of 1800MW of STOR per year (subject to economics). Forecasting demand is getting more difficult due to the growth of intermittent wind and solar generation. STOR is therefore being increasingly used to ensure that imbalances on the system can be managed

You can find more detail about STOR, and the timetable for future tenders, on our web site at **www2.nationalgrid.com/uk**. Look under Our services, Balancing services, and then Reserve services.

3.3.2 Paying for STOR

We procure short-term operating reserve (STOR) through competitive tendering three times a year. To make sure we have enough STOR available through the year, we procure suppliers through:

- balancing mechanisms (BM)
- non-balancing mechanisms (non-BM).

We make two kinds of payments to suppliers:

- availability payments – these are what we pay to suppliers to be available to supply STOR to us at certain times, and we pay them by balancing and non-balancing mechanisms (which we call BM STOR and non-BM STOR)

- utilisation payments –we pay these when we use the STOR supplied, and we pay them through non-balancing mechanisms (non-BM STOR).

We don't make utilisation payments for BM STOR as an ancillary service; we pay for that through the BM bids and offers process. But we've included it in this report so we can show the total amount we've spent on STOR.

3.3.3 STOR Volume and Expenditure

We accepted a total STOR volume of:

- 3,695 MW for season 12.1
- 3,739 MW for season 12.2.

Table 1 shows the actual (or "outturn") and contracted figures for April 2018.

Error! Reference source not found.**: STOR volumes and costs**

	Outturn	Contracted
Volume weighted average availability price	£6.56 per MWh	£4.06 per MWh
Volume weighted average usage price	£49.89 per MWh	£123.92 per MWh
Megawatts available	2,179 MW	3,696 MW

Table 1

The total amount we spent on the utilization and availability for BM and non-BM STOR providers in April 2018 was:

- £5.56 million.

That total cost breaks down into:

- £1.99 million in BM STOR
- £3.56 million in Non-BM STOR

Figure 14: Total Non-BM and BM STOR cost, in pounds sterling (£m)

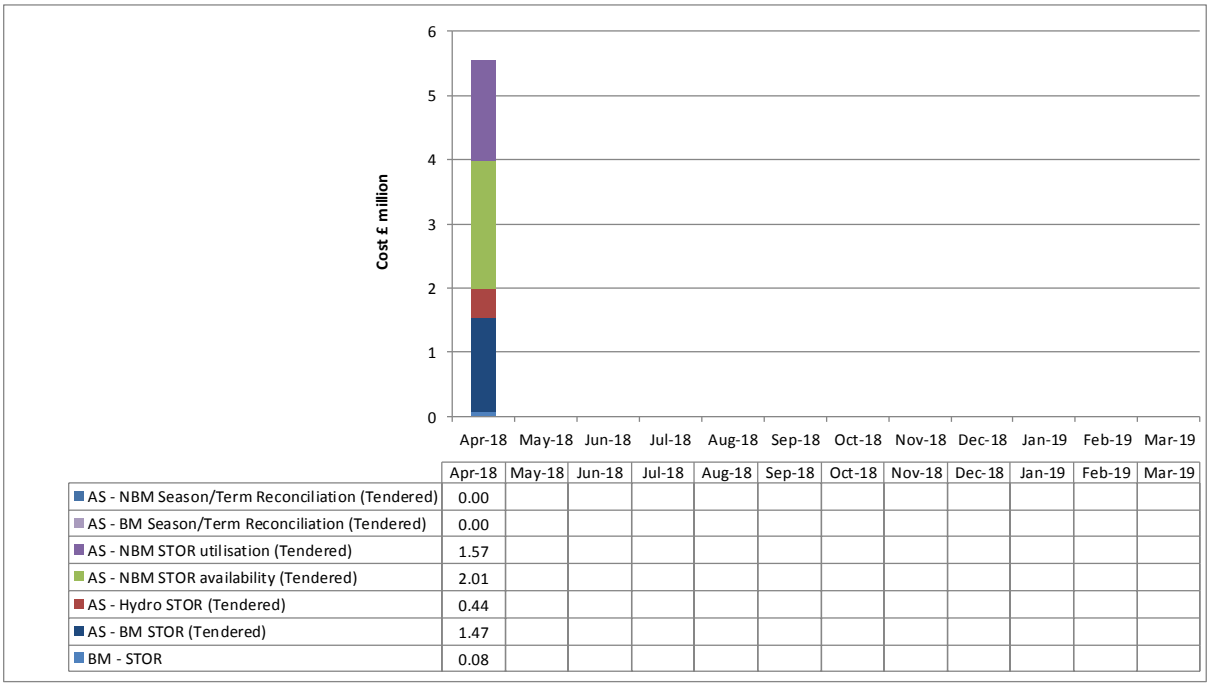
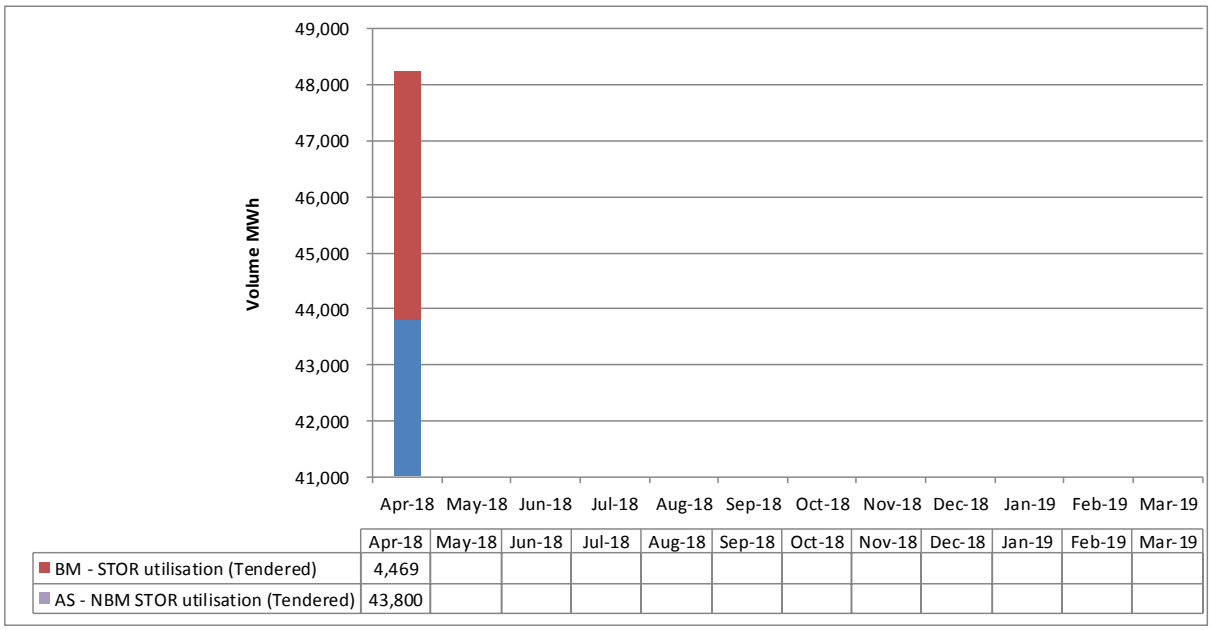


Figure 14

Figure 15: Tendered STOR utilization volume, in megawatt hours (MWh)



	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
BM - STOR utilisation (Tendered)	4,469											
AS - NBM STOR utilisation (Tendered)	43,800											

Figure 15

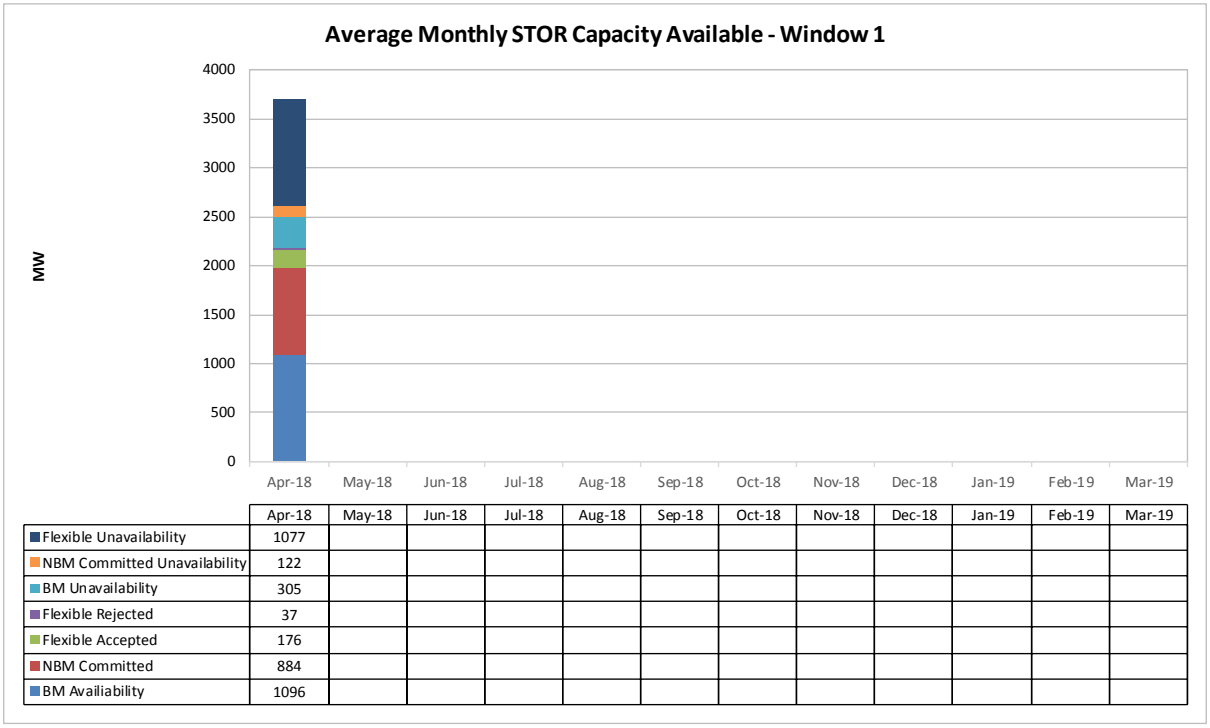
Please note that figure 15 above is missing a small volume from BM STOR (non-tendered) attributed to £0.08m

The total volume of STOR we used in April 2018 was:

- 48,269 MWh.

The charts below show the volume of BM and non-BM STOR, which was made available to use in window 1 and 2.

Figure 16 and Figure 17: STOR availability volume, in megawatts (MW)

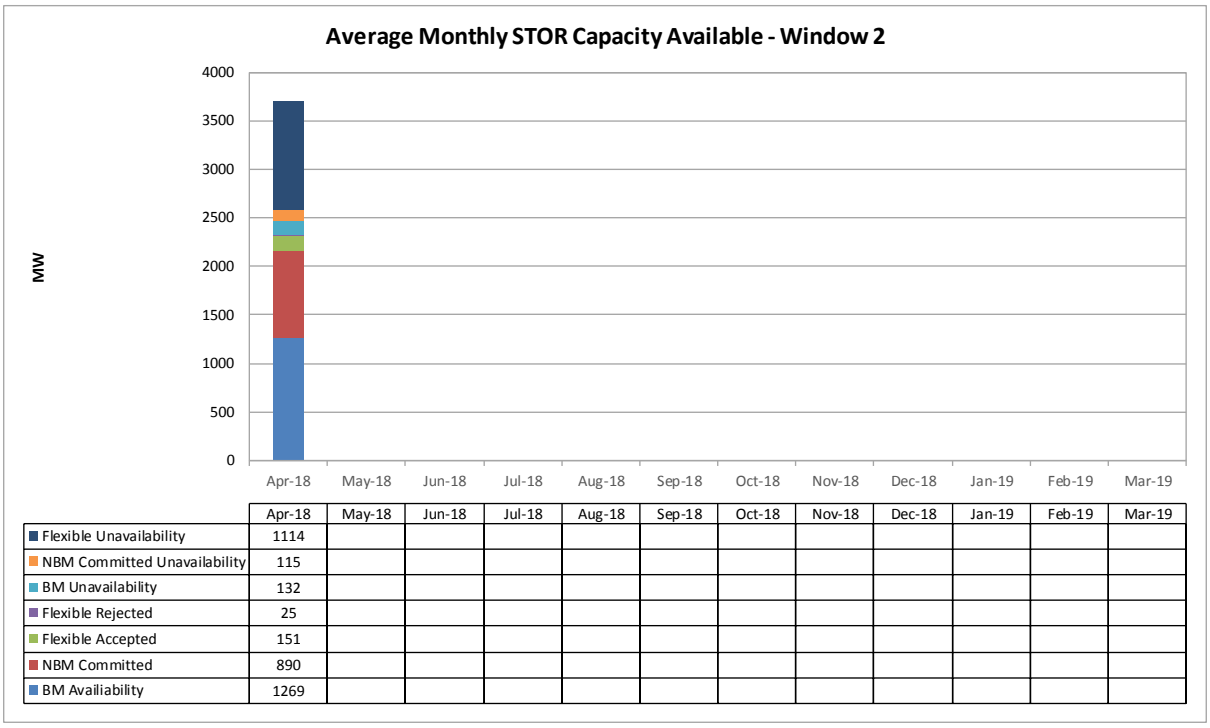


	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Flexible Unavailability	1077											
NBM Committed Unavailability	122											
BM Unavailability	305											
Flexible Rejected	37											
Flexible Accepted	176											
NBM Committed	884											
BM Availiability	1096											

Figure 16

The daily average availability of STOR for Window 1 in April 2018 was:

- 2,156 MW



	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Flexible Unavailability	1114											
NBM Committed Unavailability	115											
BM Unavailability	132											
Flexible Rejected	25											
Flexible Accepted	151											
NBM Committed	890											
BM Availiability	1269											

Figure 17

The daily average availability of STOR for Window 2 in April 2018 was:

- 2,310 MW

The daily average availability is calculated by taking the BM availability, plus the Non – BM committed, plus the flexible accepted availability in MWs, and dividing by the number of days in the month.

3.4 Other Reserves

3.4.1 Definition

This section includes the other contracted reserve services that help to offset the cost of managing reserve in the BM.

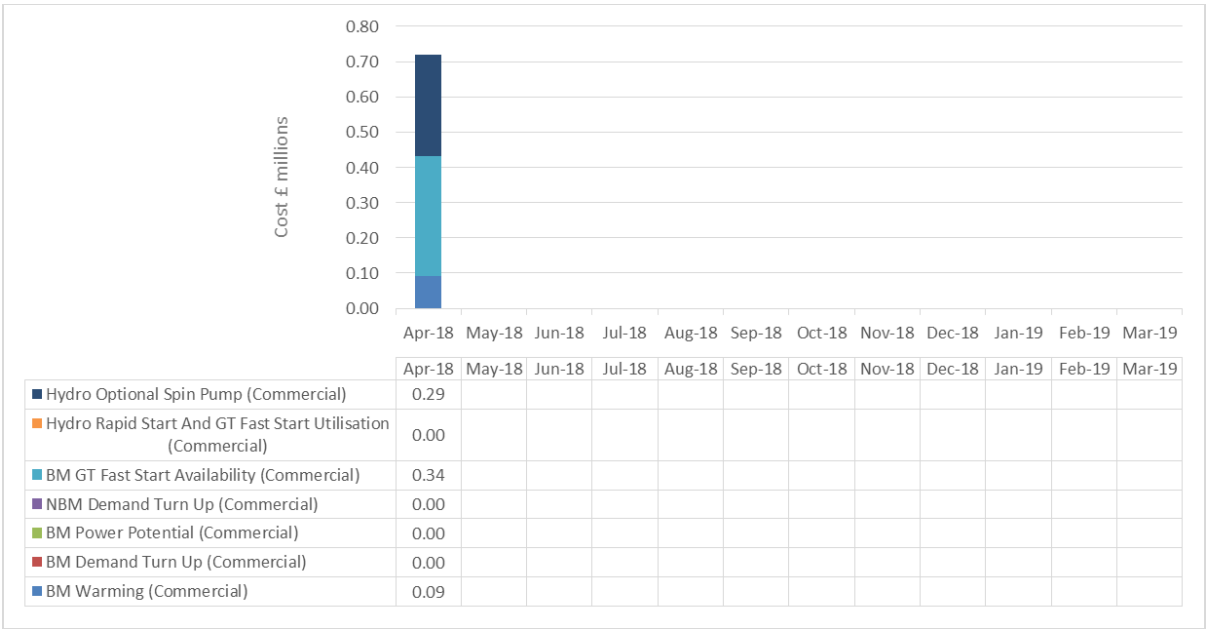
Details of the reserve types presented here can be found on our website. Look for Balancing services, [list of all balancing services.]

3.4.2 Paying for Other Reserves

Reserves in this section are paid for through commercial contracts, the demand turn-up service for example has an annual tender round.

3.4.3 Other Reserves Volume and Expenditure

Figure 18: Other reserves cost, in pounds sterling (£m)



	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Hydro Optional Spin Pump (Commercial)	0.29											
Hydro Rapid Start And GT Fast Start Utilisation (Commercial)	0.00											
BM GT Fast Start Availability (Commercial)	0.34											
NBM Demand Turn Up (Commercial)	0.00											
BM Power Potential (Commercial)	0.00											
BM Demand Turn Up (Commercial)	0.00											
BM Warming (Commercial)	0.09											

Figure 18

Error! Reference source not found. below shows utilisation and availability stats for the different reserve types. Some are in MWh and some show how many sites available or instructions issued.

Table 2: Other Reserves utilisation and availability data

	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Hydro Optional Spin Pump availability (MWh)	20,733											
Hydro Rapid Start And GT Fast Start utilisation (MWh)	0											
BM GT Fast Start Availability number of sites	20											
NBM Demand Turn Up utilisation (MWh)	0											
BM Power Potential utilisation (MWh)	0											
BM Demand Turn Up utilisation (MWh)	0											
BM Warming instructions	3											

Table 2

3.5 Constraints

3.5.1 Definition

A constraint is when the flow of electricity in an area of the grid is limited by the grid's capacity.

We sometimes ask a generator to reduce, or constrain, the amount of electricity it's producing. When we do that, we still need the electricity it would have produced – so we can balance the system – but we can't move it in or out of a certain area. We 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: we might need to produce more energy in some areas, which means we need to reduce production elsewhere

3.5.2 Managing Constraints

It's important that we manage these constraint activities. If we don't, equipment might be damaged or areas of the grid might be at risk of shutting down.

To deal with constraints, we use a range of mechanisms, including BM bids and offers, pre-gate BMU transactions, trading, system-to-system (SO to SO) services, and contracted services.

We break down constraints into three groups:

- Transmission Constraints
- Voltage Constraints
- Rocof Constraints

3.5.3 Constraints Volume and Expenditure

The total spent on constraints in April was £20.9m. Figure 19 shows the constraint costs broken down by BM, trades, SO-SO and ancillary services.

Figure 19: Constraints costs, in pounds sterling (£m)

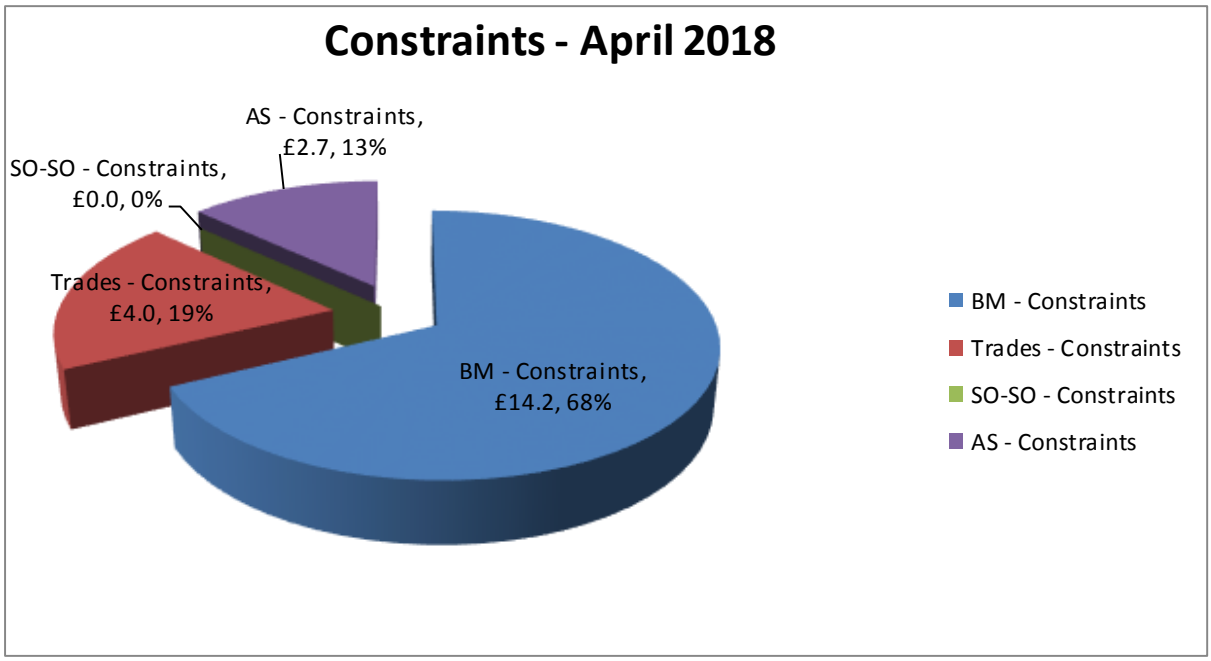


Figure 19

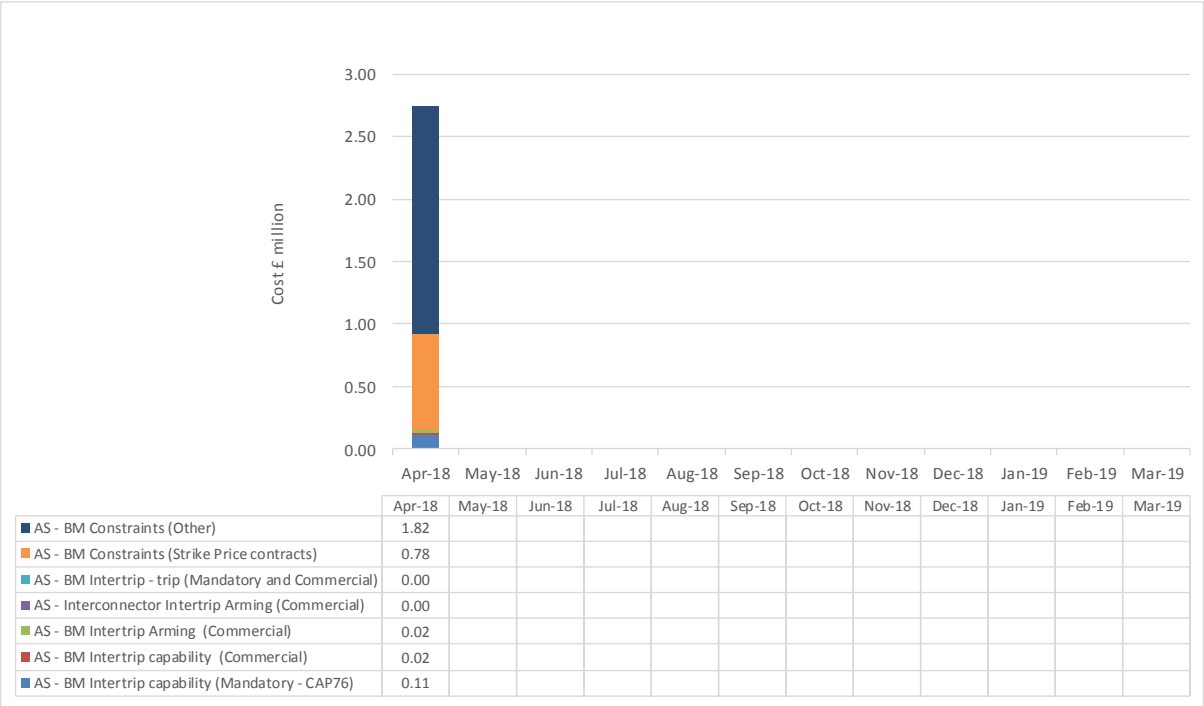
The BM constraint costs are broken down by England and Wales, Scotland and Cheviot regions in the BM costs section of this report.

Figure 20: Constraint volume, in megawatt hours (MWh)

Figure 20

The total spent on ancillary services to manage constraints was £2.74 million, and are broken down further in Figure 21.

Figure 21: Ancillary service constraint costs, in pounds sterling (£m)



	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
AS - BM Constraints (Other)	1.82											
AS - BM Constraints (Strike Price contracts)	0.78											
AS - BM Intertrip - trip (Mandatory and Commercial)	0.00											
AS - Interconnector Intertrip Arming (Commercial)	0.00											
AS - BM Intertrip Arming (Commercial)	0.02											
AS - BM Intertrip capability (Commercial)	0.02											
AS - BM Intertrip capability (Mandatory - CAP76)	0.11											

Figure 21

3.5.4 Constraint actions by fuel type

This section shows how the constraint costs for the reporting month break down by generator fuel type.

Table 3 and Table 4 show the costs of the two types of payments we make, in pounds sterling (£ million):

- payments to manage the constraint – our costs in constraining electricity generation
- payments to rebalance the system – our payments to participants to bring the system back into balance

Positive values show the costs to National Grid. Negative values show receipts. "Other" includes all fuel types not reported separately and includes hydro, open-cycle gas turbine (OCGT), demand side suppliers, and nuclear.

Most of the constraint costs are payments for suppliers to reduce or increase their output of electricity. But when managing constraints, we incur costs in other ways too. For example, we might use an intertrip service or bilateral contract to reduce the overall costs to consumers. As these costs arise because of the constraint, we've included them in the tables.

Table 3: Breakdown of constraint costs by fuel type, for April 2018

April 2018	All Values £m		
Fuel Type	**Payments to Manage Constraint**	**Payments to Rebalance System**	**Net**
COAL	0.30	1.46	1.76
GAS	-1.00	14.83	13.83
INTERCONNECTOR	-0.55	-0.32	-0.87
WIND	7.28	0.04	7.32
OTHER	0.10	-1.25	-1.15
Total	6.14	14.76	20.90

Table 4 : Breakdown of constraint costs by fuel type, for the year to date

FY2018-2019	All Values £m		
Fuel Type	**Payments to Manage Constraint**	**Payments to Rebalance System**	**Net**
COAL	0.30	1.46	1.76
GAS	-1.00	14.83	13.83
INTERCONNECTOR	-0.55	-0.32	-0.87
WIND	7.28	0.04	7.32
OTHER	0.10	-1.25	-1.15
Total	6.14	14.76	20.90

3.6 Negative Reserve

3.6.1 Definition

A negative reserve service 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 and wind.

3.6.2 Paying for negative reserve

The negative reserve in this section is paid for through the BM, trades and SO-SO. There are ancillary services that are used to offset the cost of negative reserve (for example, demand turn-up), these are covered in the Other Reserves section of the report.

3.6.3 Negative Reserve Volume and Expenditure

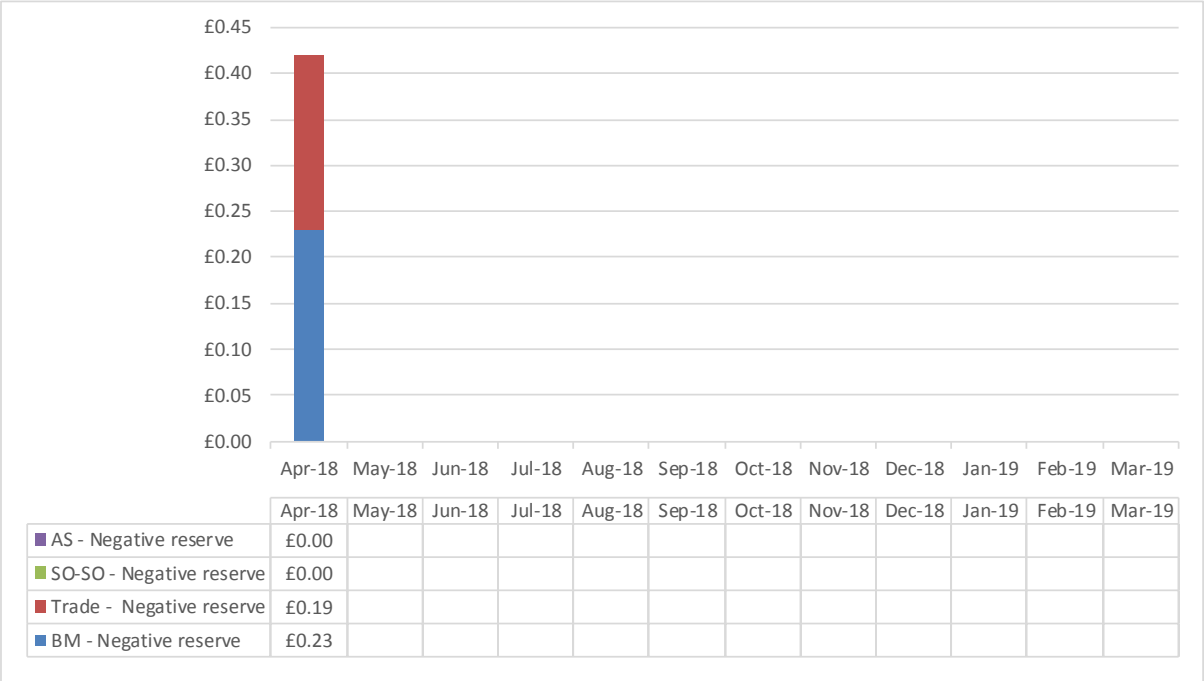
The total amount we paid for negative reserve in April 2018 was:

- £0.42 million.

The total volume of negative reserve we procured in April 2018 was:

- 19,356 MWhrs.

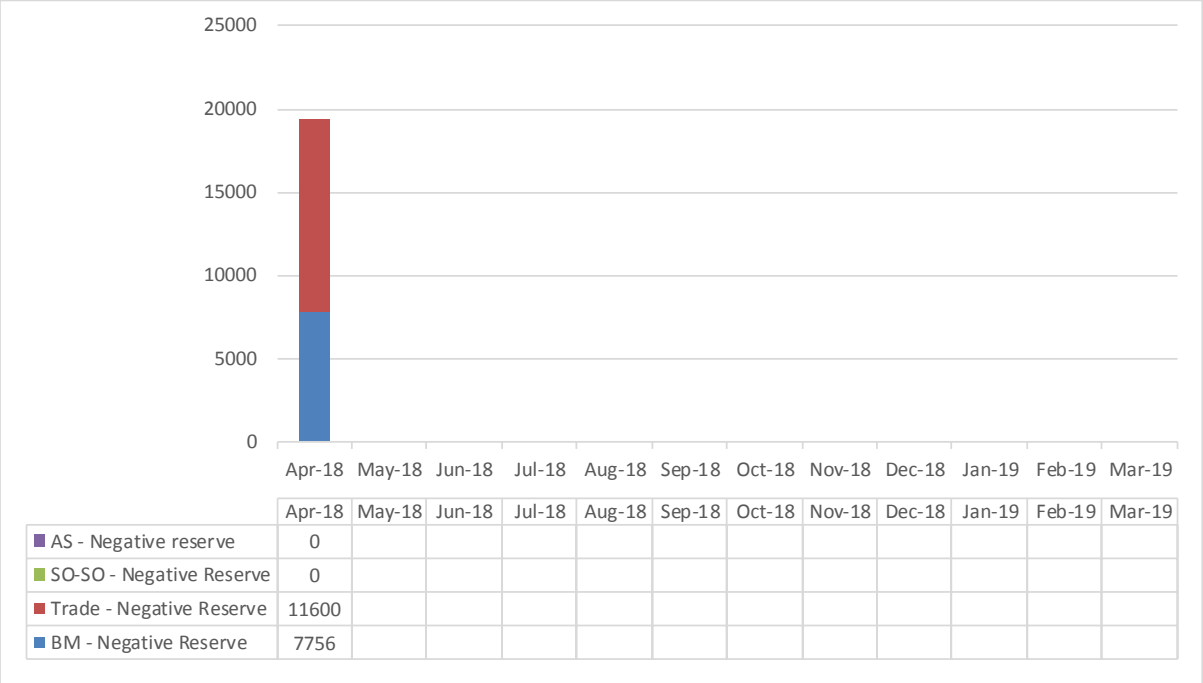
Figure 22: Negative reserve cost, in pounds sterling (£m)



	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
AS - Negative reserve	£0.00											
SO-SO - Negative reserve	£0.00											
Trade - Negative reserve	£0.19											
BM - Negative reserve	£0.23											

Figure 22

Figure 23: Negative reserve volume, in megawatt hours (MWh)



	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
AS - Negative reserve	0											
SO-SO - Negative Reserve	0											
Trade - Negative Reserve	11600											
BM - Negative Reserve	7756											

Figure 23

3.7 Fast Reserve

3.7.1 Definition

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 and providing a minimum of 50MW.

National Grid currently breaks down the Fast Reserve into three categories: Firm Fast Reserve, Optional Fast Reserve for BM and Non-BM suppliers, and Optional Spin gen.

You can find more detail about fast reserve on our web site at **www2.nationalgrid.com/uk**. Look under Our services, Balancing services, and then Reserve services.

3.7.2 Paying for Fast reserve

We procure Firm Fast reserve through a competitive monthly tendering process.

Only Suppliers who have entered into a Fast Reserve Framework Agreement can provide the Optional Fast Reserve service. This service is called upon through requests from the National Grid Electricity Control centre.

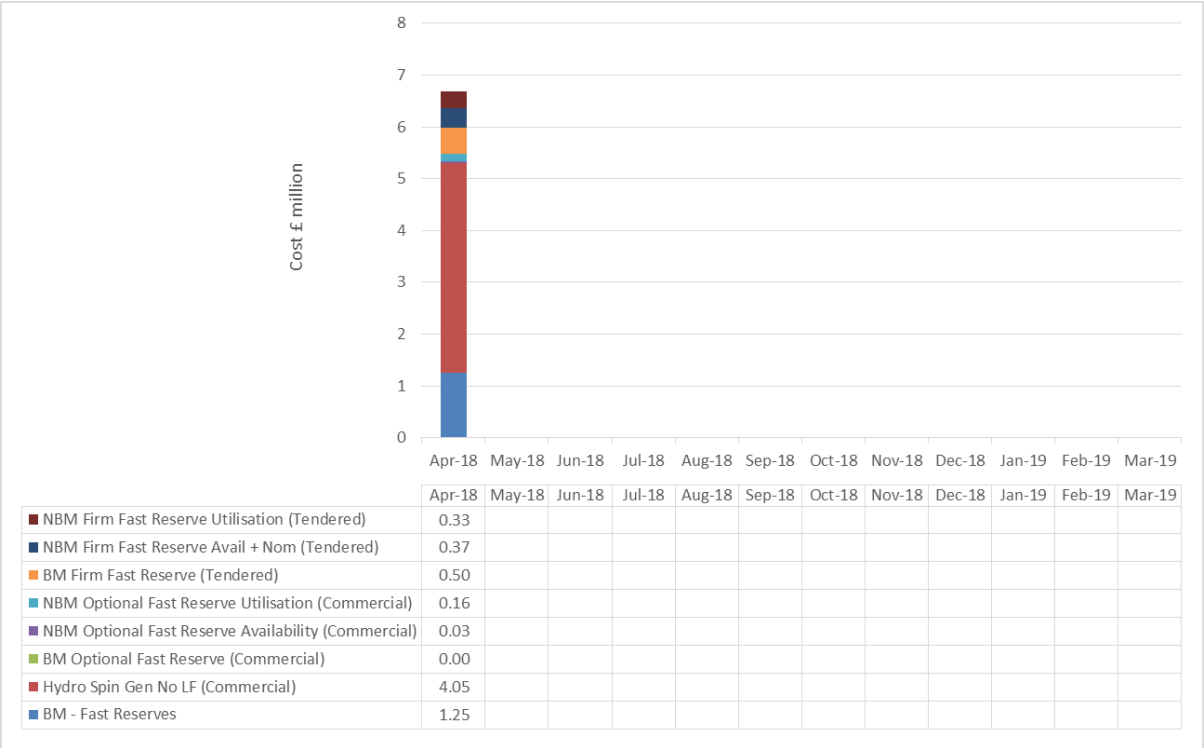
We procure Optional Spin Gen (for Hydro Pump Storage only) via bilateral agreements, and the services are called upon through requests from the National Grid Electricity Control centre.

We make four types of payments to suppliers:

- availability payments in £/hours – these are what we pay to suppliers to be available to supply Fast Reserve to us at certain times.
- positional payments in £/hour – for firm fast reserve services only.
- window initiation payments in £/firm window – for firm fast reserve services only.
- utilisation payments in £/MWh – we pay these when we actually use the Fast Reserve. We pay them the Capped Bid-Offer price for use of the service through the BM, or the Firm Fast Reserve Energy Fee for non-BM providers.

3.7.3 Volumes and expenditure

Figure 24: Fast Reserve services costs, in pounds sterling (£m)



	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
NBM Firm Fast Reserve Utilisation (Tendered)	0.33											
NBM Firm Fast Reserve Avail + Nom (Tendered)	0.37											
BM Firm Fast Reserve (Tendered)	0.50											
NBM Optional Fast Reserve Utilisation (Commercial)	0.16											
NBM Optional Fast Reserve Availability (Commercial)	0.03											
BM Optional Fast Reserve (Commercial)	0.00											
Hydro Spin Gen No LF (Commercial)	4.05											
BM - Fast Reserves	1.25											

Figure 24

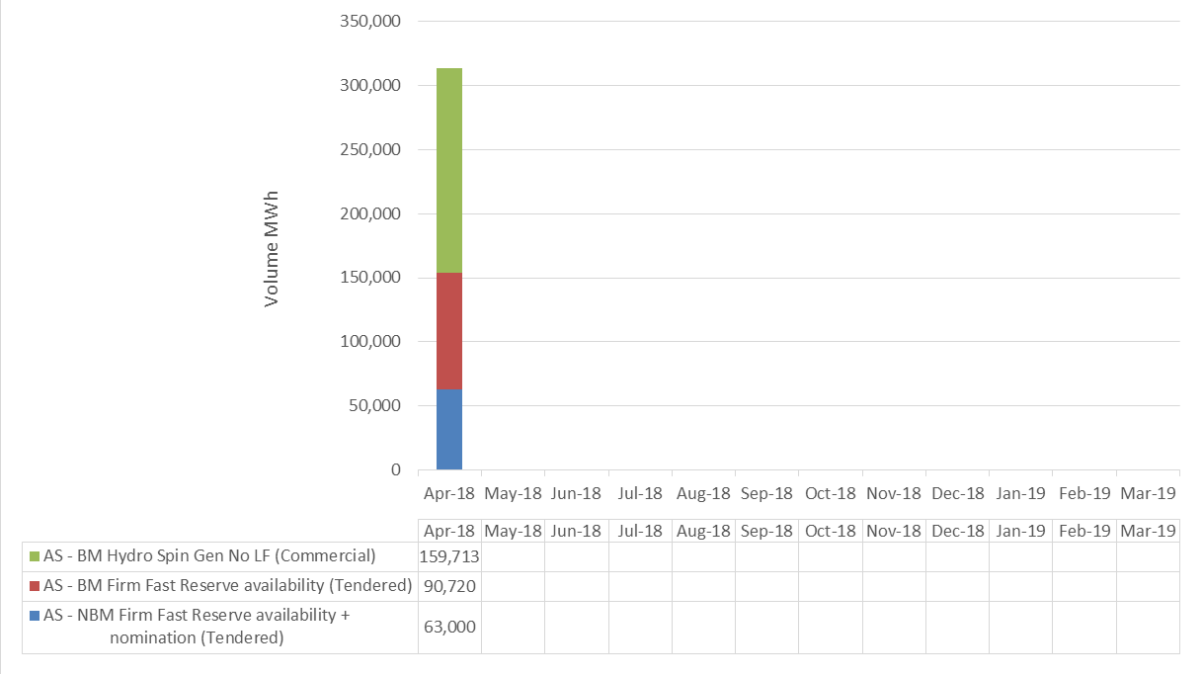
The total amount we paid for fast reserve in April 2018 was:

- £6.7 million.

That cost breaks down into

- £5.8 million in BM
- £0.9 million from non BM providers

Figure 25: Fast Reserve services volume, in megawatt hours (MWh)



	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
AS - BM Hydro Spin Gen No LF (Commercial)	159,713											
AS - BM Firm Fast Reserve availability (Tendered)	90,720											
AS - NBM Firm Fast Reserve availability + nomination (Tendered)	63,000											

Figure 25

3.8 Response

3.8.1 Definition

Response is a service we use 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. There are three types of frequency response known as "primary", "secondary" and "high". The difference between primary and secondary is the speed at which they act recover the system frequency. Both primary and secondary react to low frequency conditions, and high response reacts to high system frequency conditions, restoring the frequency to normal operational limits.

More information about frequency response and the service we procure can be found on our website. Look under Balancing Services, Frequency Response Services.

3.8.2 Paying for Response

We procure response through the BM and through the Firm Frequency Response monthly tender process.

3.8.3 Response Volume and Expenditure

The total amount we paid for response in April 2018 was:

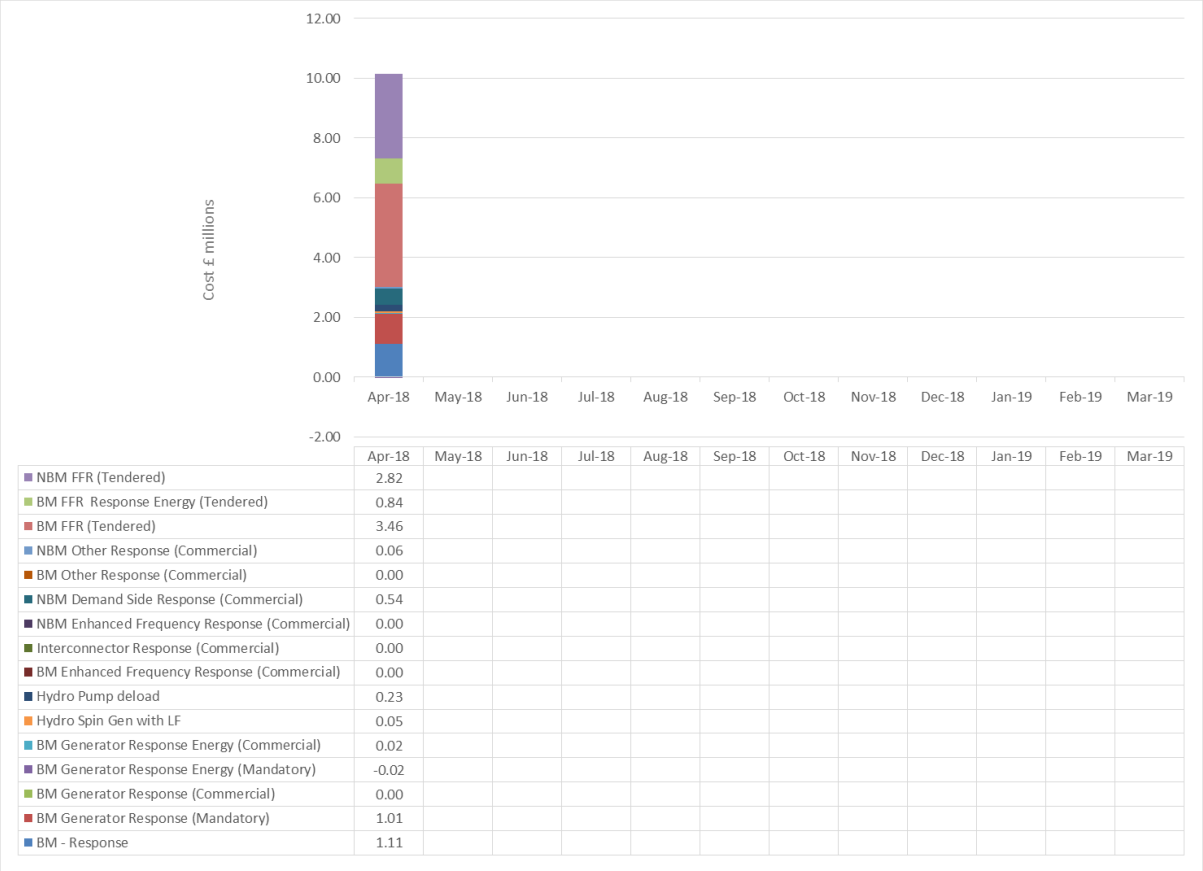
- £10.13 million.

The response holding volume in April 2018 was:

- Primary: 446,015 MWh
- Secondary: 630,909 MWh
- High: 405,946 MWh

These figures exclude enhanced frequency response as the data has a one month lag. Data for this reporting month will be providing in the next report.

Figure 26: Response services costs, in pounds sterling (£m)



	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
NBM FFR (Tendered)	2.82											
BM FFR Response Energy (Tendered)	0.84											
BM FFR (Tendered)	3.46											
NBM Other Response (Commercial)	0.06											
BM Other Response (Commercial)	0.00											
NBM Demand Side Response (Commercial)	0.54											
NBM Enhanced Frequency Response (Commercial)	0.00											
Interconnector Response (Commercial)	0.00											
BM Enhanced Frequency Response (Commercial)	0.00											
Hydro Pump deload	0.23											
Hydro Spin Gen with LF	0.05											
BM Generator Response Energy (Commercial)	0.02											
BM Generator Response Energy (Mandatory)	-0.02											
BM Generator Response (Commercial)	0.00											
BM Generator Response (Mandatory)	1.01											
BM - Response	1.11											

Figure 26

Figure 27 shows the dynamic and static response holding volumes in TWh, for primary, secondary and high response types (P, S, and H on the chart).

Figure 27: Response services volume, primary, secondary and high, in megawatt hours (MWh)

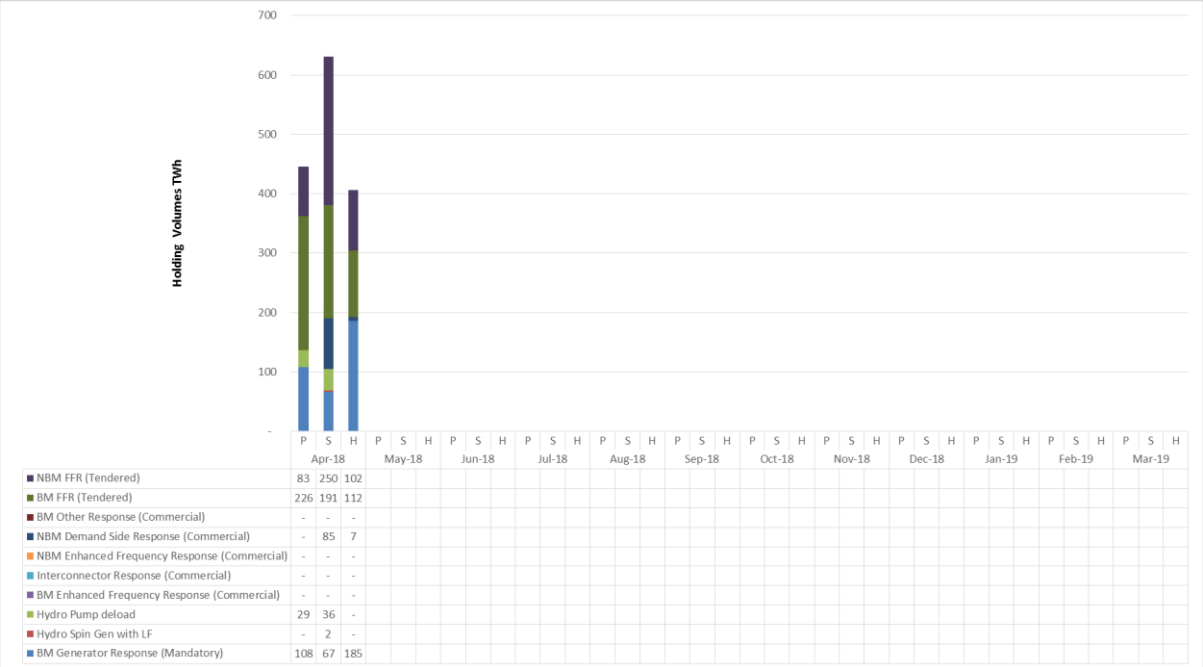


Figure 27

3.9 Voltage control - reactive power

3.9.1 Definition

We manage voltage levels across the grid to make sure we stay within our operational standards and avoid damage to transmission equipment. Voltage levels are controlled by reactive power, and we 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 on our web site at **www2.nationalgrid.com/uk**. Look under Our services, Balancing services, then Reactive power services.

3.9.2 Paying for Reactive Services

Generators covered by the requirements of the Grid Code are required to have the capability to provide reactive power. There is a payment mechanism that is updated monthly in line with market indicators. The latest utilisation and payment figures can be found on our website. Look under Balancing services, reactive power services, market information.

3.9.3 Reactive Services Volume and Expenditure

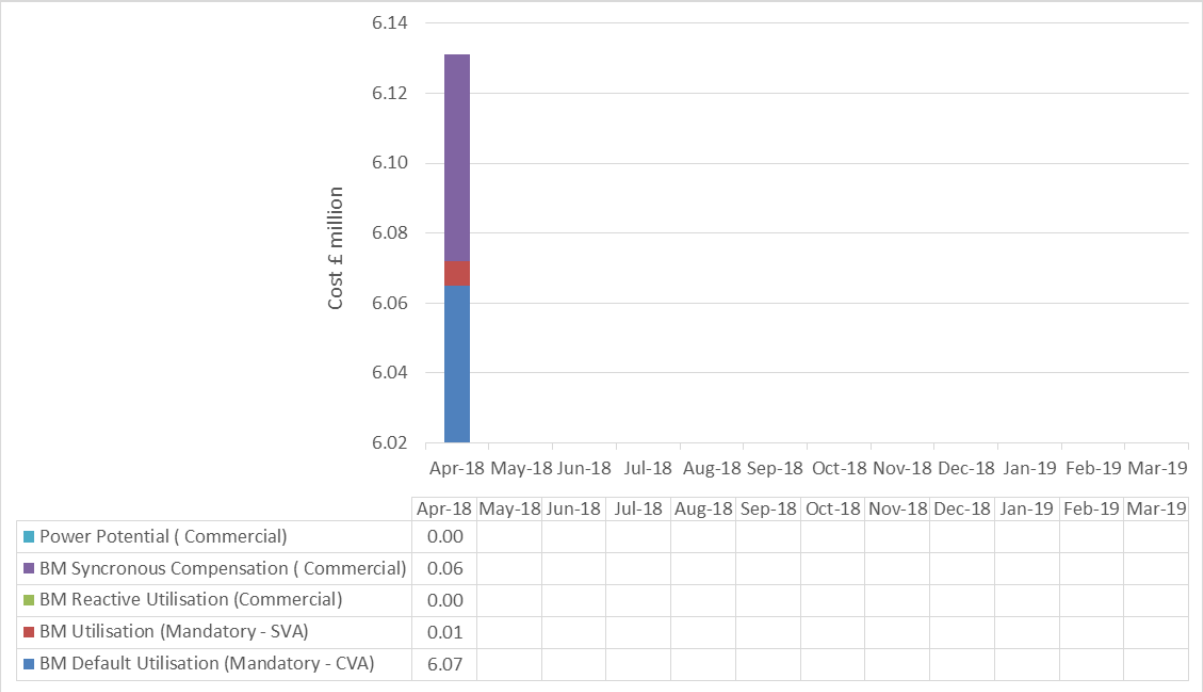
The total amount we paid for Reactive Services in February 2018 was:

- £6.13 million.

The total volume of reactive power used in February 2018 was:

- 2,051,518 MVArh.

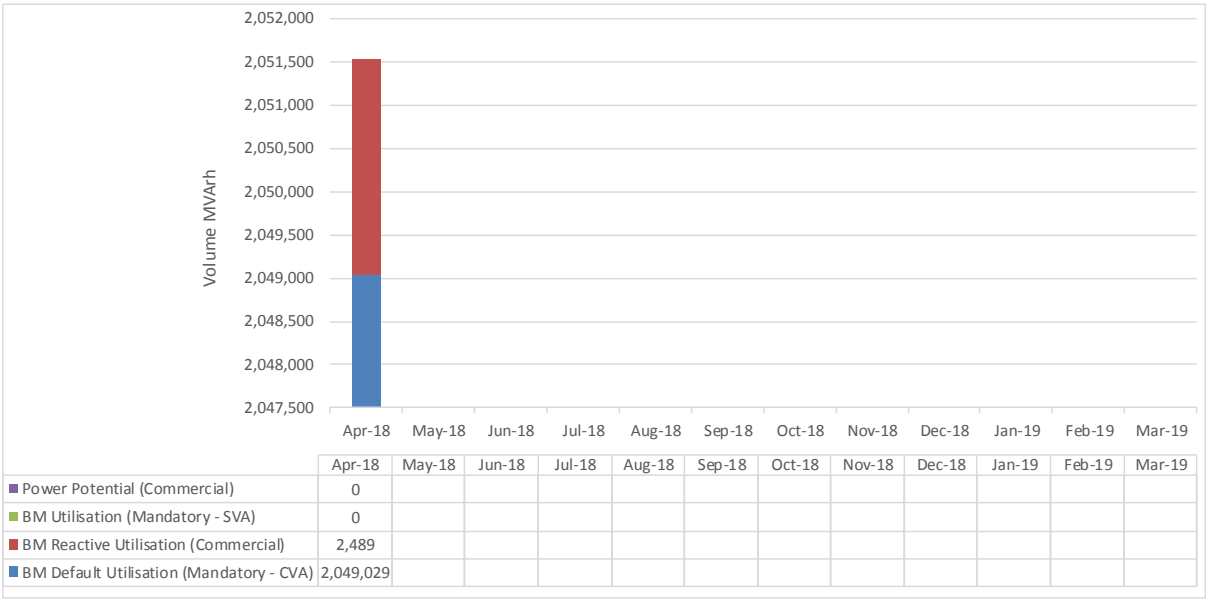
Figure 28: Costs of reactive power, in pounds sterling (£ million)



	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Power Potential (Commercial)	0.00											
BM Syncronous Compensation (Commercial)	0.06											
BM Reactive Utilisation (Commercial)	0.00											
BM Utilisation (Mandatory - SVA)	0.01											
BM Default Utilisation (Mandatory - CVA)	6.07											

Figure 28

Figure 29: Volume of reactive power volume, in mega volt amp reactive hours (MVArh)



	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Power Potential (Commercial)	0											
BM Utilisation (Mandatory - SVA)	0											
BM Reactive Utilisation (Commercial)	2,489											
BM Default Utilisation (Mandatory - CVA)	2,049,029											

Figure 29

3.10 ROCOF

3.10.1 Definition

This is the cost of managing a system issue called ROCOF, which stands for rate of change of frequency. Some embedded generators use protection relays that monitor the rate of change of system frequency to detect a fault on the network. When the protection detects that the rate of change of frequency higher is higher than a set threshold, the generator is tripped, or taken off the system. The protection relay is a safety measure, to make sure that the embedded generator is never connected to an islanded part of the network following a system fault. The increase in wind and PV generation means that the rate of change of frequency on the system can be higher than was historically allowed for following the loss of a large generator or interconnector. We need to reduce the size of the largest possible infeed loss to make sure that the ROCOF protection relays are not triggered, resulting in further loss of generation after a fault.

3.10.2 Paying for ROCOF

We manage the largest infeed loss through forward trades, and the BM.

3.10.3 ROCOF Expenditure

Figure 30: ROCOF costs, in pounds sterling (£ million)

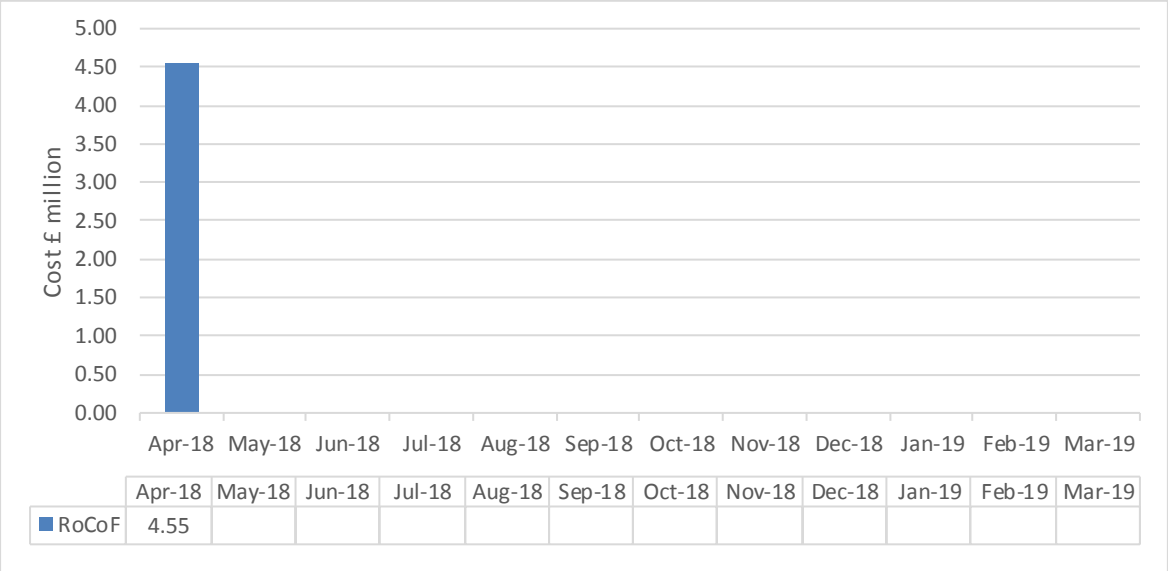


Figure 30

3.11 Black Start

3.11.1 Definition

If a power station shuts down unexpectedly, we have to be able to get it up and running again very quickly. We call this "black start". It means we can start up each power station in turn and reconnect them to the grid one by one.

In this sort of emergency, a power station can get its electricity supply from a small back-up generating plant on the same site. But not all power stations have one of these, so we have agreements with others suppliers. They help us make sure we have enough black start arrangements in place in case we need them.

You can find more detail about black start on our web site at **www2.nationalgrid.com/uk**. Look under Our services, Balancing services, then System security.

3.11.2 Paying for Black Start

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

- availability payments – what we pay suppliers to be available to supply black start to us
- warming payments – what we pay suppliers to maintain readiness when they are not running anyway in the energy market
- capital contributions – the cost of setting up black start capability
- other payments – for example, for testing

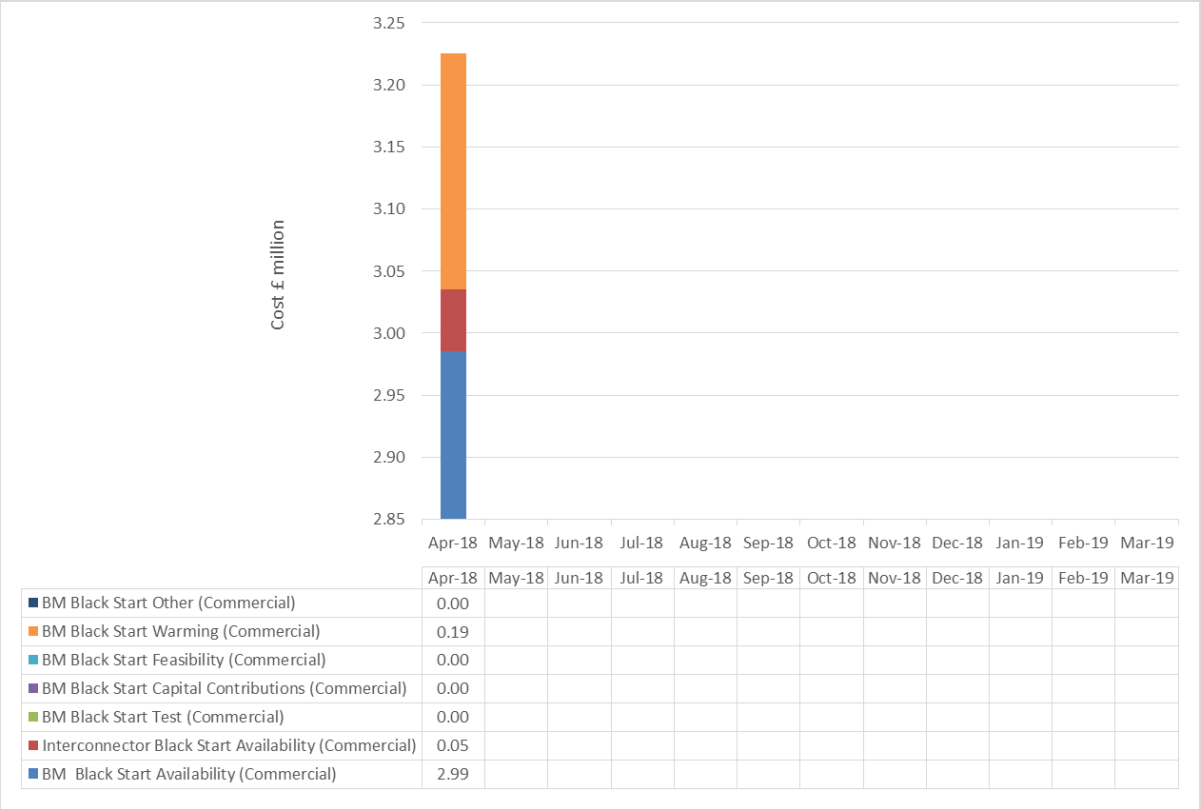
3.11.3 Black Start Volume and Expenditure

Figure 31 shows the amount we spent on black start, in pounds sterling (£ million).

The amount we spent on black start contracts was:

- £3.23 million.

Figure 31: Black start services costs, in pounds sterling (£ million)



	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
BM Black Start Other (Commercial)	0.00											
BM Black Start Warming (Commercial)	0.19											
BM Black Start Feasibility (Commercial)	0.00											
BM Black Start Capital Contributions (Commercial)	0.00											
BM Black Start Test (Commercial)	0.00											
Interconnector Black Start Availability (Commercial)	0.05											
BM Black Start Availability (Commercial)	2.99											

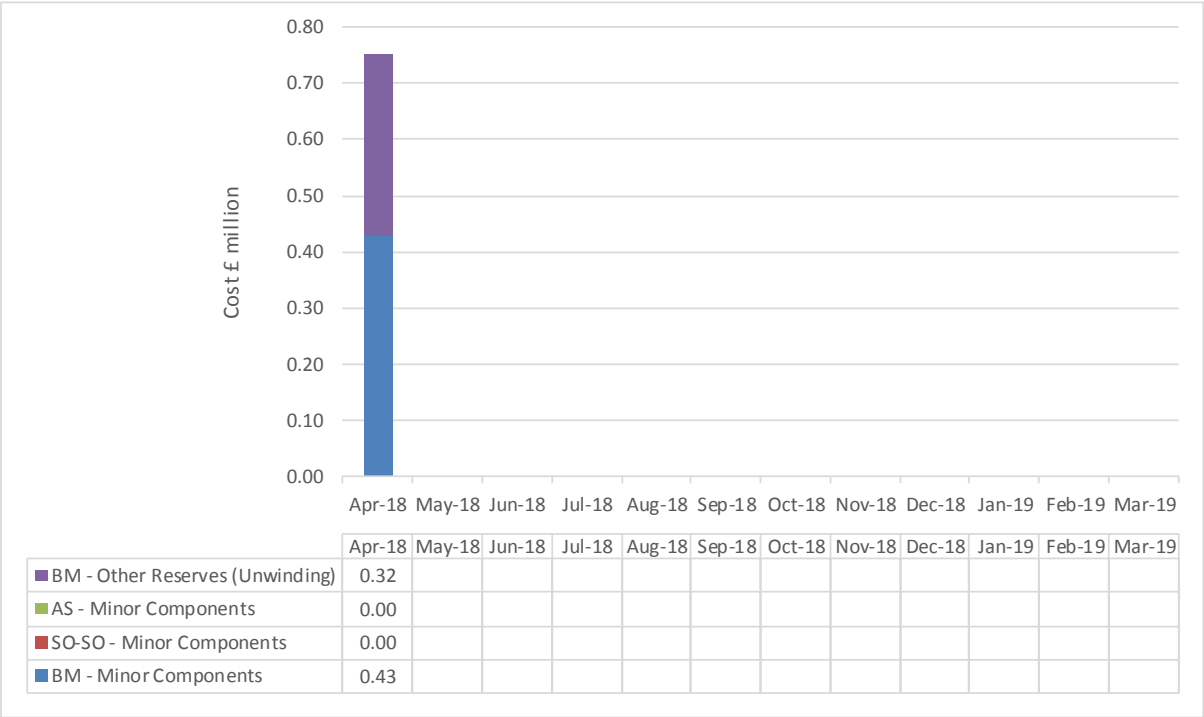
Figure 31

3.12 Others

The costs reported in this sections account for:

1. BM actions, which are not easily accounted for in the previously reported categories such as the cost of using the trading platform.
2. Other general cost, trading option fees, bank charges, sterling adjustments
3. Reconciliation

Figure 32: Other costs, in pounds sterling (£ million)



	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
BM - Other Reserves (Unwinding)	0.32											
AS - Minor Components	0.00											
SO-SO - Minor Components	0.00											
BM - Minor Components	0.43											

Figure 32

4. Other Information

4.1 New Wind Generation

There were no new connections in April 2018.

BMU ID	Month First Metered	Connection Area	Max Metered MW

Table 5

4.2 How we manage Wind generation

Energy generated by wind farms varies according to how windy it is. Sometimes there is very little wind, and on other days wind generation could be too strong such that the turbines shut down automatically for their own protection.

Sometimes we ask some wind farms to stop generating, or reduce output, because very high wind may affect the transmission network, causing constraints. Where economic we may also use wind powered units to resolve other system issues such as frequency management or to create flexibility across the GB generation portfolio in the same way as we would use any other type of generation for these services.

4.2.1 Payments to Wind Powered Generation

The table below shows the payments made to wind powered generation since the 2010/11 financial year. There were no payments to wind powered generation prior to this. All payments to wind powered generation are included regardless of the reason that this cost was incurred.

£m	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
Payments to Wind powered generation	0.2	34.1	7.6	49.7	65.3	96.8	83.2	108.0	7.4

Table 6

4.2.2 Monthly Breakdown of Wind Farm Payments

The graph below shows the monthly total payments to wind powered generation this financial year:

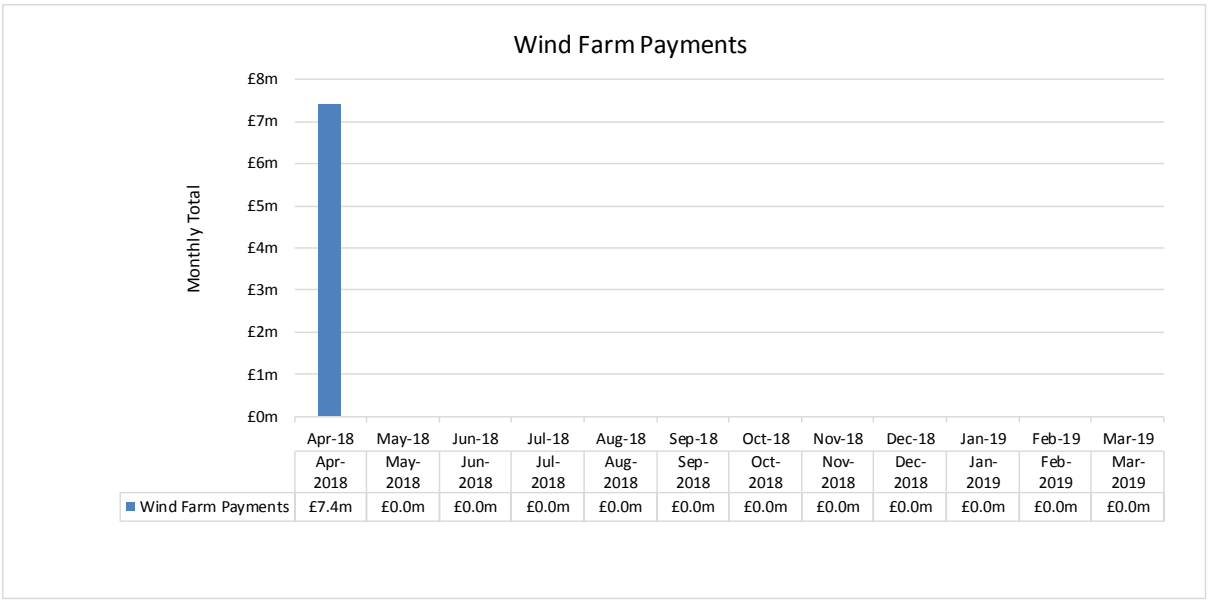

Wind Farm Payments
Monthly Total
£8m
£7m
£6m
£5m
£4m
£3m
£2m
£1m
£0m
Apr-18
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Jan-19
Feb-19
Mar-19
Apr-2018
May-2018
Jun-2018
Jul-2018
Aug-2018
Sep-2018
Oct-2018
Nov-2018
Dec-2018
Jan-2019
Feb-2019
Mar-2019
Wind Farm Payments
£7.4m
£0.0m
£0.0m
£0.0m
£0.0m
£0.0m
£0.0m
£0.0m
£0.0m
£0.0m
£0.0m
£0.0m

Figure 33

5. Further information

You'll find more detail about balancing services on our web site at **www2.nationalgrid.com/uk**.

We publish a number of documents in line with the Electricity Transmission Standard Licence Conditions (Condition C16: Procurement and use of balancing services). These documents include:

- Daily Balancing Costs – Information about the daily costs resulting from balancing the system. Find the report on our web site under Electricity, Market, operations, and data, then System balancing reports.
- Monthly BSUoS Report – Information about the daily BSUoS charge resulting from balancing the system. Find the report on our web site under Electricity, Market, operations, and data, then System balancing reports.
- Procurement Guidelines Report – information about the balancing services that we're going to procure. Find the report on our web site under Our services, Balancing services, then Procurement guidelines.
- Balancing Principles Statement – information about balancing mechanism bid and offer acceptances. Find it under Industry information, Electricity codes, Balancing frameworks, then C16 Statements.

6. Questions and feedback

If you have any questions or comments about our electricity balancing services, or anything in this report, please email us at **BSIS@nationalgrid.com**.

We'll look forward to hearing from you.