Monthly Balancing Services Summary 2018/19

February 2019

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Overview

Introduction

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 **www.nationalgrideso.com**, and then Balancing services.

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.nationalgrideso.com**, under Balancing Services, then C16 statements and consultations.

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.

What’s in the report?

This report shows the costs associated with balancing the system in order to keep electricity flowing steadily in May 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 megawatt hours (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.

Balancing Costs categories included in this report

We use market arrangements or bilateral contracts to manage:

- Energy Imbalance
- Operating Reserve
- STOR
- Constraints
- Negative Reserve
- Fast Reserve
- Response
- Other Reserve
- Reactive
- Black Start
- Other

You can read more about our procurement guidelines on our web site at **www.nationalgrideso.com**, under Balancing Services, then C16 statements and consultations.

What are "Balancing Mechanism" (BM) and "non-Balancing Mechanism" (NBM) providers?

Because electricity cannot be stored, it needs to be generated 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.

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.

Information on bid and offer acceptances is in our Balancing Principles Statement at **www.nationalgrideso.com**, under Balancing Services, then C16 statements and consultations. More information is available from the Balancing Mechanism Reporting Service (BMRS) at www.bmreports.com.

2

Balancing Costs Summary

Overview of Balancing Costs

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

The total spent to balance the system for the month is £83.91 m. 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.nationalgrideso.com**. Look under Balancing data, Forecast volumes and costs. The figures in this report may differ to those in the BSUoS report due to updated data since the publication of the BSUoS report.

The cost is broken down to £36.18 m spent in the Balancing Mechanism, £10.25 m spent on Trades, £37.82 m spent on Ancillary Services,-£0.12 m spent on SO-to-SO transactions, and -£0.22 m for system losses, non-delivery, and reconciliation costs.

Total balancing costs (£m)

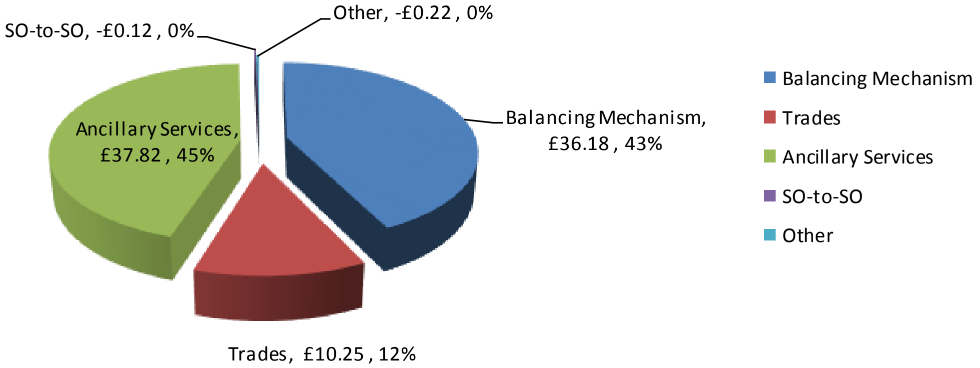
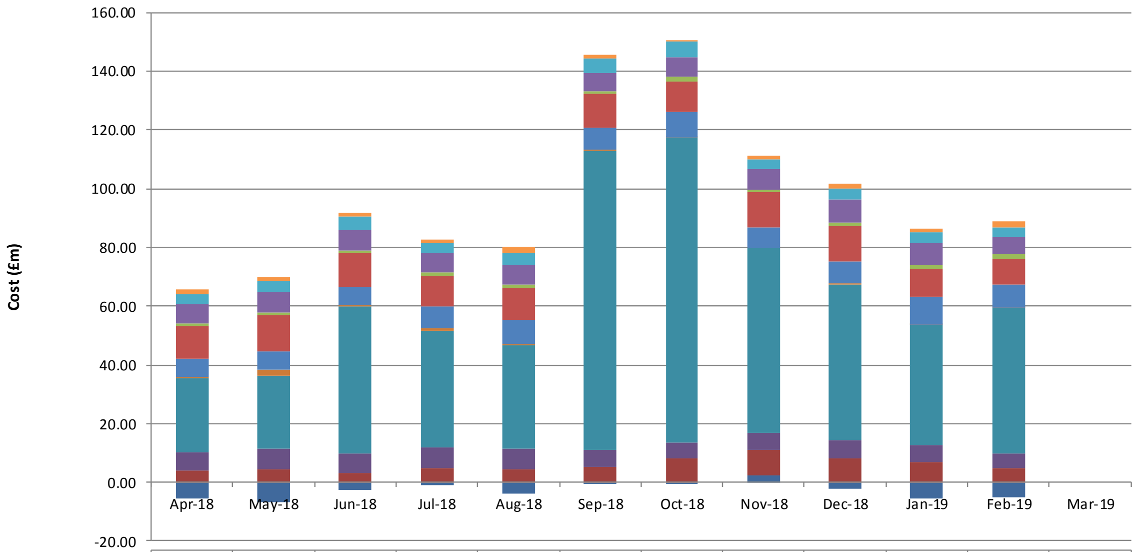


Figure 1

Total Balancing Services

The following graph shows the total balancing expenditure of £83.91 m for the month broken down by balancing cost category in pounds sterling (£ million).

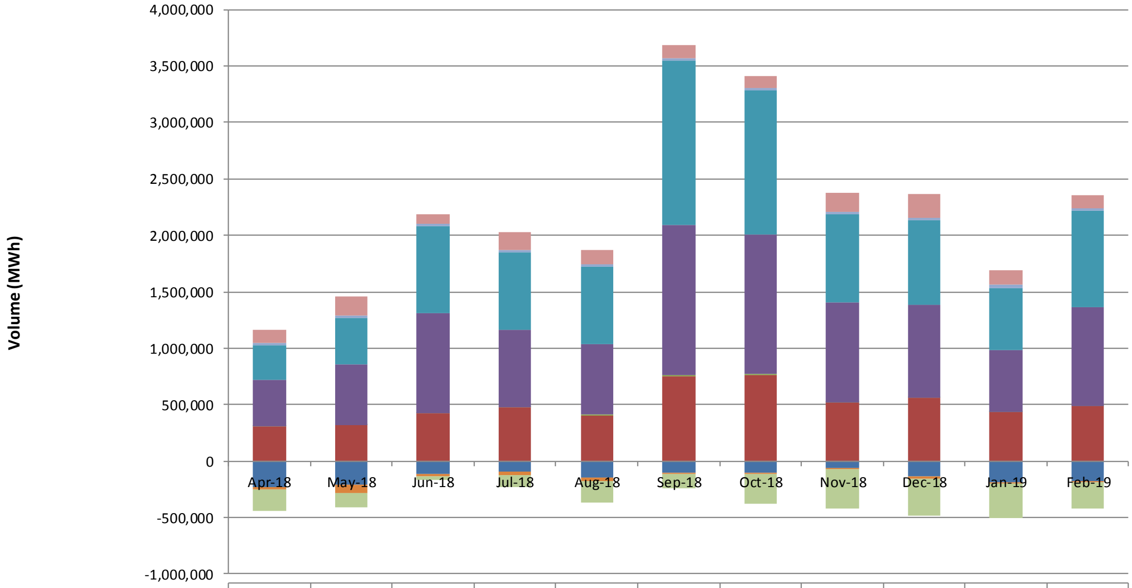
Total balancing cost by category



	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Minor Components	1.41	1.06	1.19	1.21	2.04	1.38	0.50	1.13	1.69	1.20	1.96	
Black Start	3.66	3.70	4.53	3.34	4.01	4.65	5.15	3.48	3.85	3.66	3.30	
Reactive	6.52	7.12	7.41	6.61	6.76	6.15	7.01	6.70	7.64	7.48	6.07	
Other Reserve	0.79	0.92	0.83	1.16	1.15	1.06	1.34	0.84	1.52	1.36	1.38	
Response	11.02	12.21	11.46	10.54	10.76	11.39	10.51	12.01	11.76	9.69	9.05	
Fast Reserve	6.46	6.47	6.01	7.56	8.23	7.63	8.46	7.03	7.45	9.29	7.71	
Negative Reserve	0.42	2.06	0.41	0.57	0.40	0.56	0.21	0.37	0.39	0.24	0.08	
Constraints	25.15	24.82	50.12	39.66	35.34	101.50	103.99	62.68	53.25	40.68	49.47	
STOR	6.10	7.04	6.65	7.37	6.81	5.77	5.37	5.84	6.00	6.04	5.24	
Operating Reserve	4.06	4.38	3.26	4.65	4.48	5.40	8.02	8.54	8.16	6.75	4.67	
Energy Imbalance	-5.68	-6.76	-2.81	-1.11	-3.90	-0.67	-0.04	2.48	-2.33	-5.50	-5.13	

Figure 2

The following graph shows the total balancing volume for the month, broken down by balancing categories. For a more cohesive view of all the volumes utilised, please refer to individual balancing categories in Section 3.



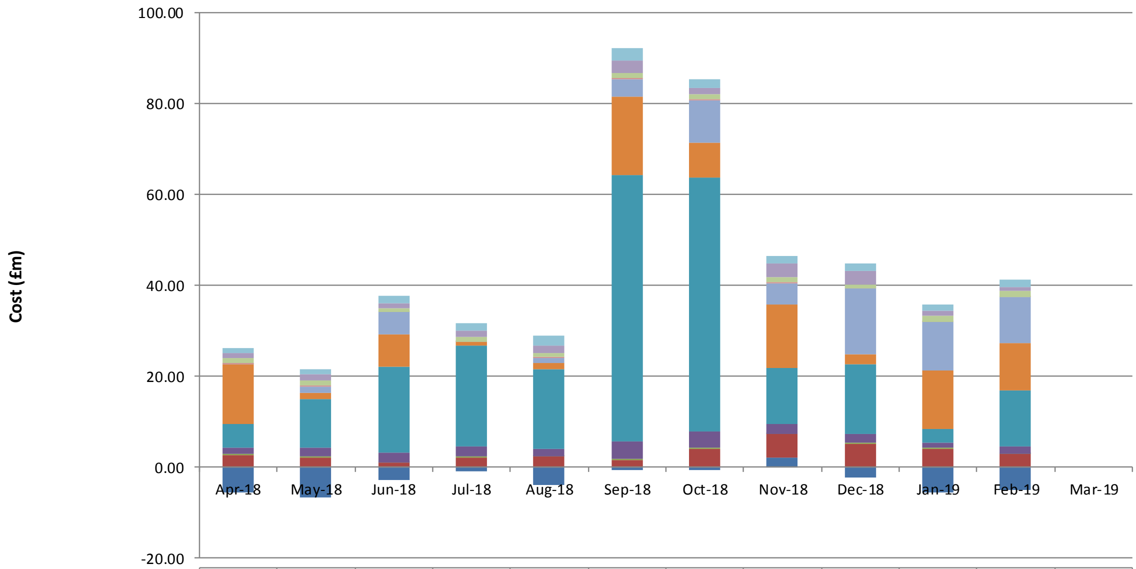
	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19
Minor Components	-188,477	-131,097	-35,927	-103,509	-188,704	-122,224	-257,920	-346,432	-327,902	-307,151	-238,200
Response (Absolute- BM only)	118,700	163,141	84,191	155,219	123,418	112,777	101,072	161,366	213,344	125,119	109,928
Fast Reserve (BM only)	20,280	20,732	22,178	20,999	20,844	24,067	25,330	22,259	17,975	27,471	22,146
Negative Reserve	-19,346	-64,281	-14,167	-27,963	-32,375	-14,743	-19,064	-11,526	-15,223	-11,466	-4,291
Constraint Margin Replacement	309,394	418,683	773,345	687,376	687,639	1,454,136	1,271,867	790,133	755,672	550,744	853,436
Constraints	408,422	529,712	879,229	685,088	627,450	1,332,422	1,237,083	879,294	817,588	546,431	882,588
STOR (BM only)	4,612	4,634	3,484	5,105	4,767	8,120	5,897	1,838	1,480	1,785	1,030
Operating Reserve	302,051	317,986	424,555	473,973	405,985	750,839	765,483	519,181	563,747	433,511	481,576
Energy Imbalance	-234,870	-215,244	-117,412	-96,008	-150,870	-105,024	-99,560	-65,427	-138,263	-184,154	-182,508

Figure 3

Balancing Mechanism

This section provides a summary of costs incurred in the Balancing Mechanism for the reporting month. Total cost for the month was £36.18 m. 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 www.bmreports.com.

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

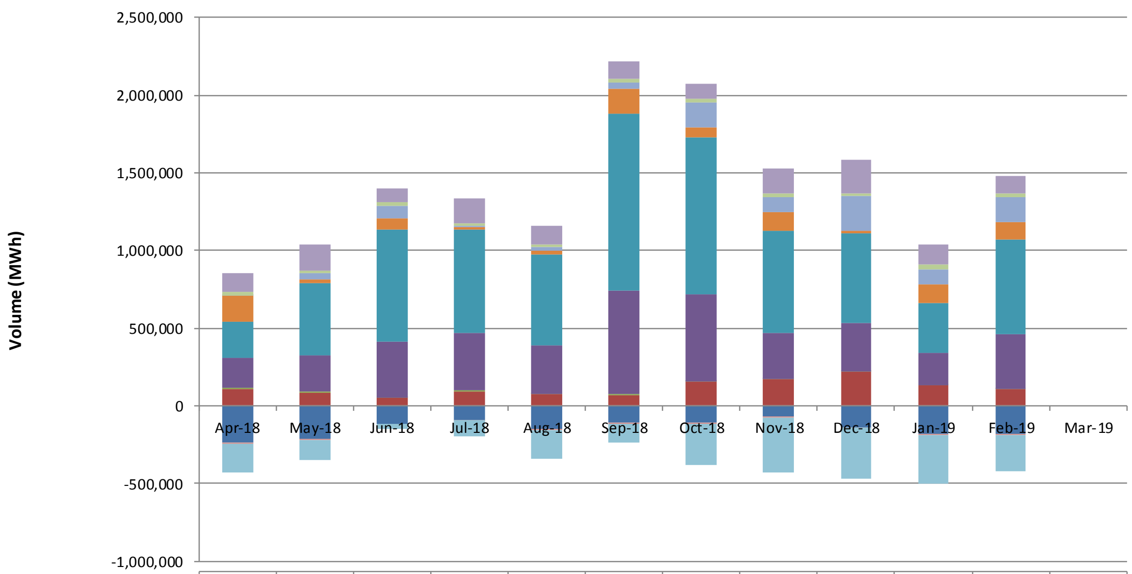


	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
BM - Minor Components	1.22	1.15	1.59	1.53	2.45	2.75	1.95	1.48	1.70	1.24	1.61	
BM - Response	0.93	1.36	1.01	1.54	1.53	2.66	1.52	3.01	2.88	1.33	0.97	
BM - Fast Reserve	1.08	1.03	0.87	0.84	0.94	0.99	0.96	1.16	0.89	1.16	1.29	
BM - Negative Reserve	0.23	0.08	0.07	0.02	0.12	0.45	0.20	0.36	0.04	0.08	0.07	
BM - Constraints Scotland	0.08	1.55	4.75	0.23	1.25	3.80	9.33	4.63	14.55	10.70	10.08	
BM - Constraints Cheviot	13.20	1.34	7.21	0.81	1.38	17.09	7.77	13.91	2.11	12.97	10.38	
BM - Constraints E&W	5.14	10.70	19.01	21.99	17.47	58.79	56.01	12.51	15.45	2.82	12.34	
BM - Constrained Margin	1.48	1.85	2.06	2.39	1.46	3.73	3.40	1.97	1.92	1.31	1.59	
BM - STOR	0.32	0.28	0.18	0.27	0.19	0.32	0.29	0.18	0.13	0.15	0.10	
BM - Operating Reserve	2.51	2.13	0.86	1.99	2.29	1.57	4.04	5.03	5.20	4.03	2.86	
BM - Energy balancing	-5.68	-6.71	-2.75	-1.05	-3.87	-0.75	-0.64	2.17	-2.41	-5.58	-5.11	

Figure 4

The graph below provides the summary of the volumes utilised in the Balancing Mechanism for the reporting month.

Balancing 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	-188,477	-130,158	-34,503	-102,537	-188,038	-123,309	-266,122	-351,526	-328,634	-311,858	-237,837	
BM - Response	118,700	163,141	84,191	155,219	123,418	112,777	101,072	161,366	213,344	125,119	109,928	
BM - Fast Reserve	20,280	20,732	22,178	20,999	20,844	24,067	25,330	22,259	17,975	27,471	22,146	
BM - Negative Reserve	-7,746	-2,620	-1,634	-873	-6,190	-7,494	-9,741	-8,926	-3,971	-3,645	-3,741	
BM - Constraints Scotland	3,005	39,299	80,675	4,154	21,175	33,597	154,021	99,928	225,107	103,550	159,331	
BM - Constraints Cheviot	166,662	22,780	73,651	20,935	20,713	162,883	70,713	119,280	13,036	117,233	117,439	
BM - Constraints E&W	238,755	467,633	724,902	659,999	585,562	1,135,941	1,011,750	660,085	579,446	324,147	605,818	
BM - Constrained Margin	191,477	230,520	359,282	373,393	313,812	670,268	553,963	295,754	315,122	206,149	352,216	
BM - STOR	4,612	4,634	3,484	5,105	4,767	8,120	5,897	1,838	1,480	1,785	1,030	
BM - Operating Reserve	108,968	86,766	49,168	92,972	72,419	67,012	153,872	168,278	217,741	129,042	107,765	
BM - Energy balancing	-234,870	-214,304	-116,049	-94,895	-150,203	-106,651	-108,868	-70,776	-139,447	-182,240	-182,145	

Figure 5

For Figure 5 and Figure 3, the volumes represented are defined below:

Category	Volume Definition	Comment
Energy Balancing	Net Volume	Positive and Negative volumes
Operating Reserve	Gross Volume	Positive volumes only
STOR	Absolute Volume	Positive and Negative volumes
Constrained Margin	Gross Volume	Positive volumes only
Constraints (all regions)	Absolute Volume	Positive and Negative volumes
Negative Reserve	Gross Volume	Negative volumes only
Fast Reserve	Net Volume	Positive and Negative volumes
Response	Absolute Volume	Positive and Negative volumes
Other	Net Volume	Positive and Negative volumes

Trading

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

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.nationalgrideso.com**. Look under Balancing services, and then Trading.

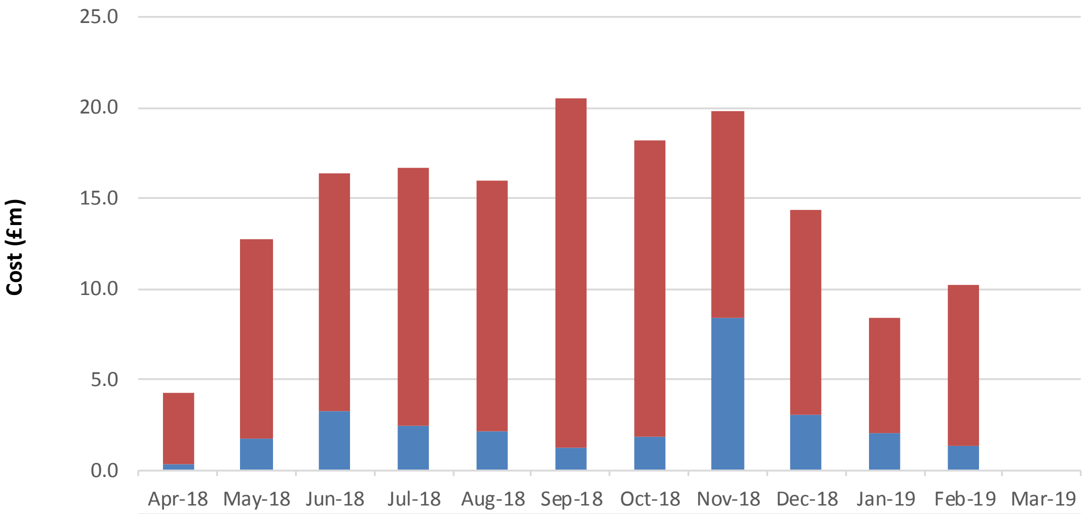
Forward Trading

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 was: £10.25 m

The absolute volume of forward trades: 281,634 MWh

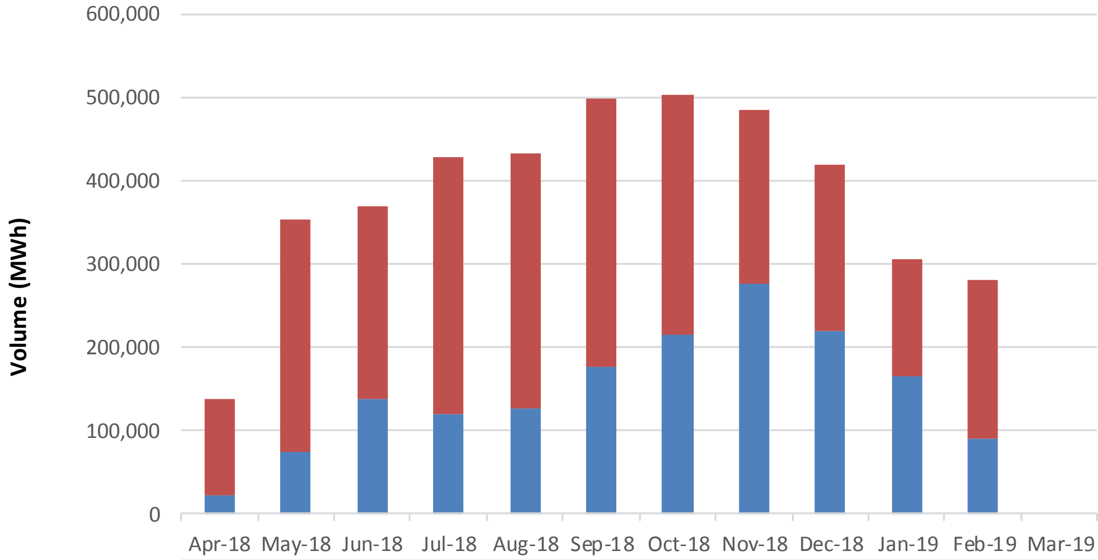
Forward trading cost, in pounds sterling (£m)



	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 Cost	3.9	11.0	13.1	14.2	13.8	19.3	16.4	11.4	11.3	6.4	8.9	
Buy Cost	0.3	1.7	3.3	2.5	2.1	1.2	1.8	8.4	3.0	2.0	1.3	

Figure 6

Forward trading volumes, 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
Sell Volume	116182.0	281479.5	231333.4	309497.0	306662.2	324343.6	287177.0	207470.2	199822.9	139914.2	190646.9	
Buy Volume	22190.00	73582.50	139079.5	119046.5	126069.0	176040.5	215568.0	277397.0	219661.0	166624.5	90986.80	

Figure 7

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 was £37.82 m.

A guide to the Ancillary Services we procure can be found on our website at **www.nationalgrideso.com**. Look under Balancing services, Balancing Services overview.

Summary of Ancillary Services cost, in pounds sterling (£m)

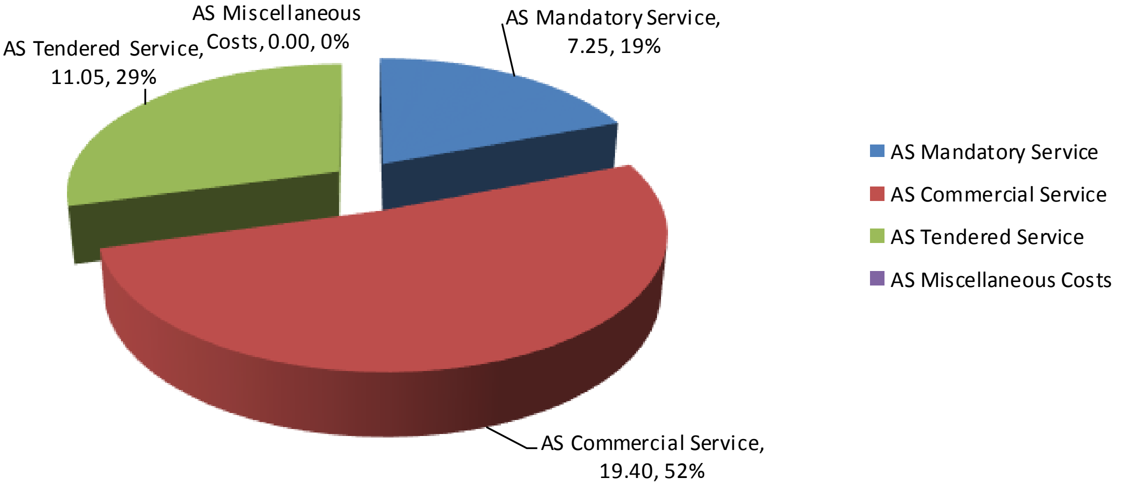
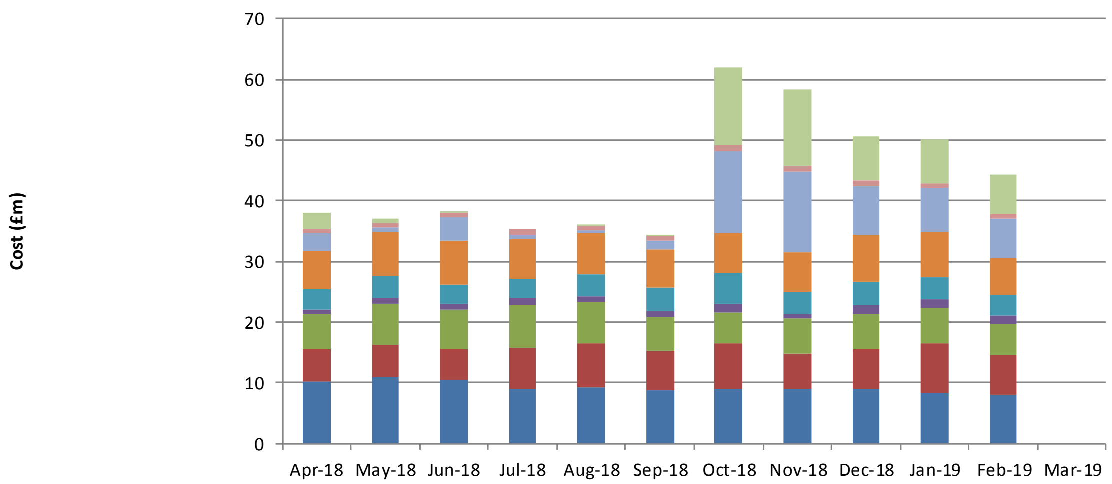


Figure 8

The chart divides the costs into “mandatory”, “commercial”, and “tendered” service types. Tendered costs are 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.

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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
AS - Other Ancillary Cost	2.60	0.53	0.19	0.00	0.12	0.27	12.90	12.65	7.41	7.12	6.52	
AS - SO-SO Costs	0.80	0.71	0.72	0.77	0.80	0.78	0.91	0.77	0.82	0.80	0.67	
AS - Constraints	2.87	0.93	3.77	0.84	0.39	1.58	13.51	13.31	8.16	7.28	6.69	
AS - Reactive	6.39	7.12	7.41	6.61	6.76	6.15	6.74	6.70	7.64	7.48	6.07	
AS - Black Start	3.37	3.67	3.23	3.06	3.57	3.84	5.07	3.48	3.85	3.66	3.29	
AS - Other Reserves	0.79	0.92	0.83	1.16	1.15	1.06	1.34	0.84	1.52	1.36	1.38	
AS - STOR	5.77	6.76	6.47	7.10	6.62	5.45	5.08	5.66	5.87	5.89	5.14	
AS - Fast Reserves	5.38	5.44	5.14	6.71	7.29	6.64	7.50	5.87	6.56	8.13	6.48	
AS - Response	10.09	10.85	10.45	8.99	9.23	8.72	8.99	9.00	8.88	8.36	8.10	

Figure 9

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 **www.nationalgrideso.com**. Look under Balancing services.

Ancillary Services from non-BM providers

As referenced previously, there are a number of participants that are not registered to participate in the BM, but can provide Ancillary Services. Costs associated with these providers include availability (or contract) costs and utilisation costs, and are reported within the Ancillary Services cost categories.

Non-BM participants currently provide the following services:

- Frequency Response
- Short-term Operating Reserve (STOR)
- Fast Reserve
- Demand Turn-Up (part of Other Reserve)

'AS – Miscellaneous' costs relate to other Ancillary costs, such as liabilities, currency adjustments and costs associated with trading.

Ancillary Services from Non BM and BM providers, £ million

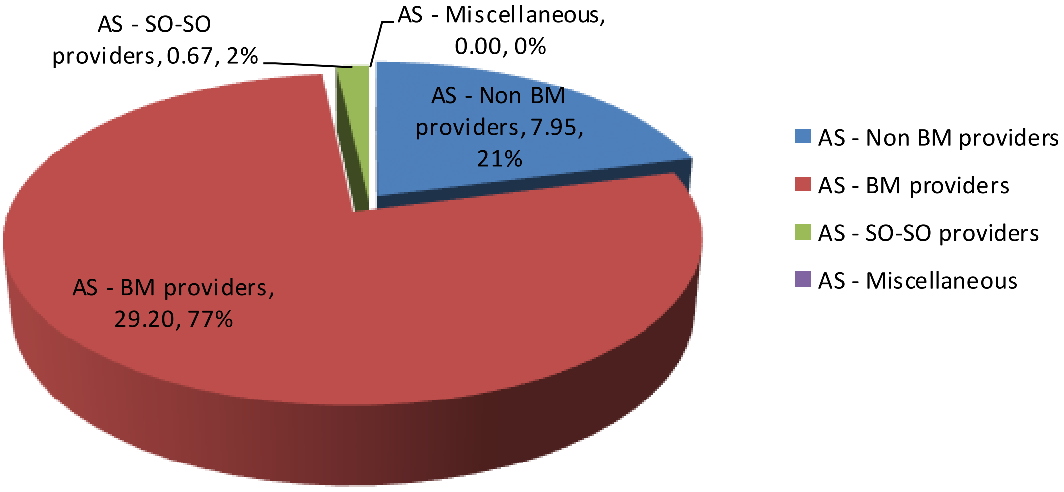
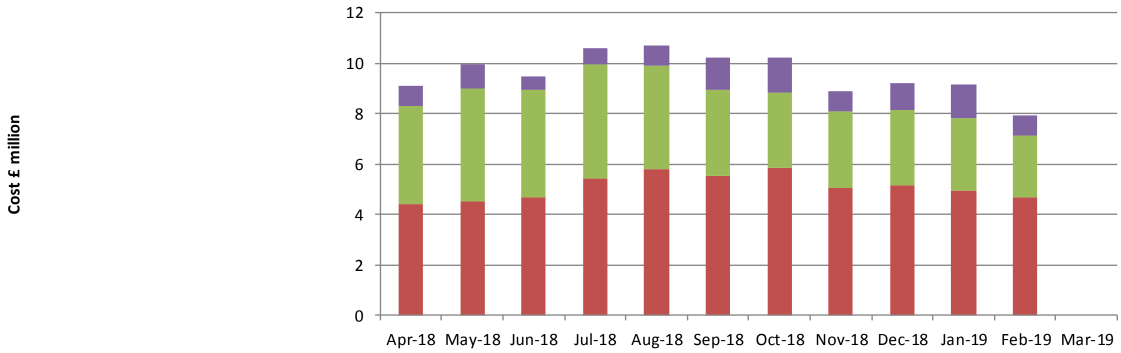


Figure 10

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

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	0.84	0.92	0.55	0.63	0.77	1.26	1.35	0.80	1.06	1.31	0.84	
NBM - Short-term operating reserve (STOR)	3.86	4.50	4.25	4.55	4.12	3.44	2.98	3.03	2.98	2.88	2.45	
NBM - Frequency Response	4.40	4.51	4.68	5.40	5.79	5.51	5.87	5.07	5.17	4.95	4.65	

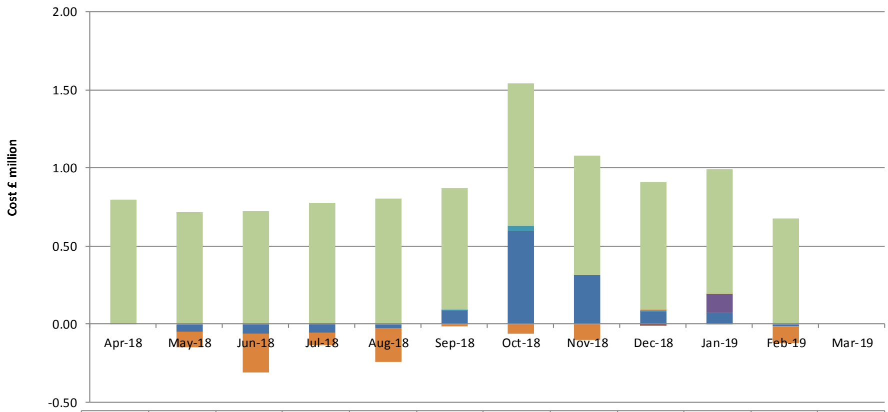
Figure 11

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.

The total amount we spent on SO-SO services in the month was £0.55 m.

BM and Ancillary Services costs from SO-SO 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
AS - SO-SO Interconnector Capability (Commercial)	0.80	0.71	0.72	0.77	0.80	0.78	0.91	0.77	0.82	0.80	0.67	
SO-SO Constraints	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
SO-SO Invoked by External Parties	0.00	-0.10	-0.25	-0.08	-0.21	-0.02	-0.06	-0.10	0.01	0.00	-0.11	
SO-SO Ramping	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	
SO-SO Footroom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	
SO-SO Constrained Margin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
SO-SO Margin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
SO-SO Energy Trades	0.00	-0.05	-0.06	-0.06	-0.03	0.08	0.59	0.31	0.08	0.07	-0.02	

Figure 12

3

Balancing Costs Detail

Balancing Categories

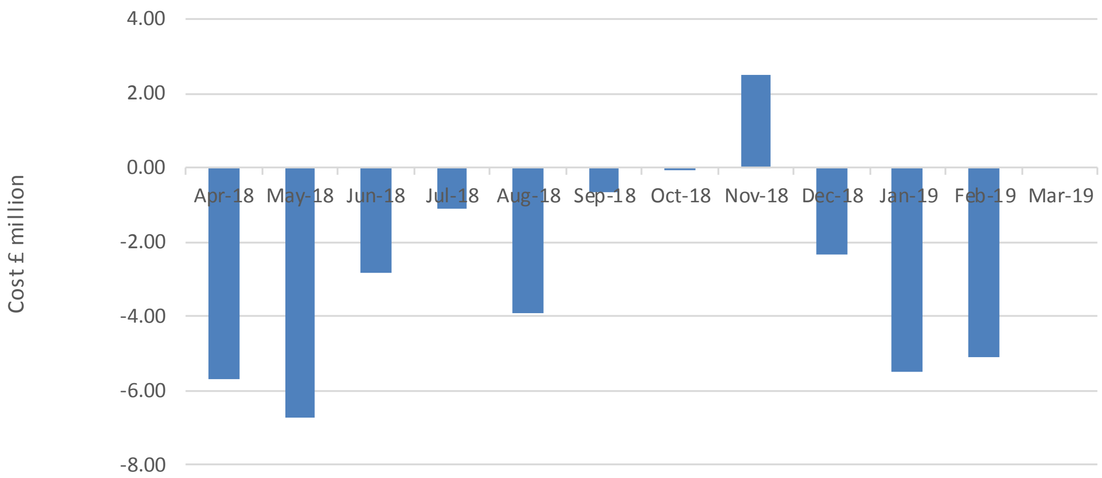
Energy Imbalance

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/.

Energy Imbalance Volume and Expenditure

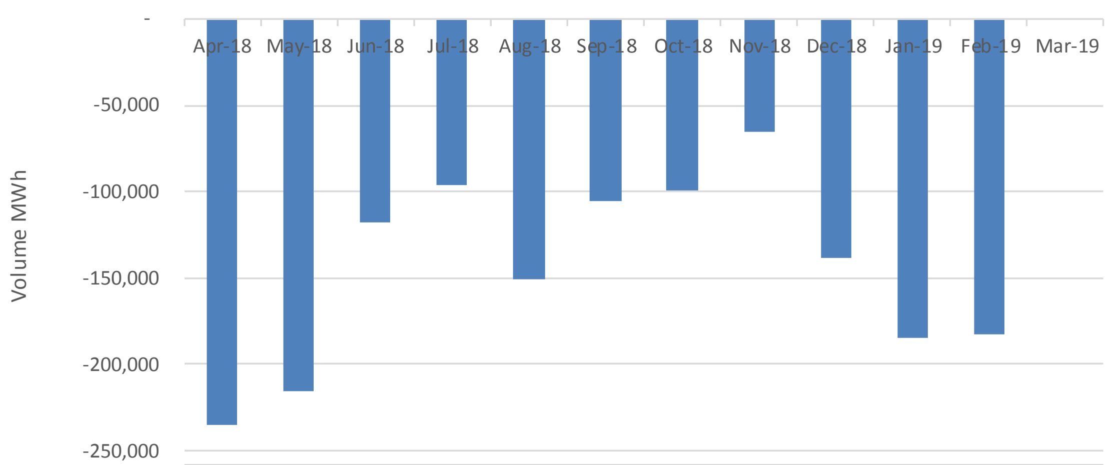
Energy Imbalance, in pounds sterling (£m)



	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Energy Imbalance	-5.68	-6.76	-2.81	-1.11	-3.90	-0.67	-0.04	2.48	-2.33	-5.50	-5.13	

Figure 13

Energy Imbalance 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
Energy Imbalance	-234,870	-215,244	-117,412	-96,008	-150,870	-105,024	-99,560	-65,427	-138,263	-184,154	-182,508	

Figure 14

Operating Reserve

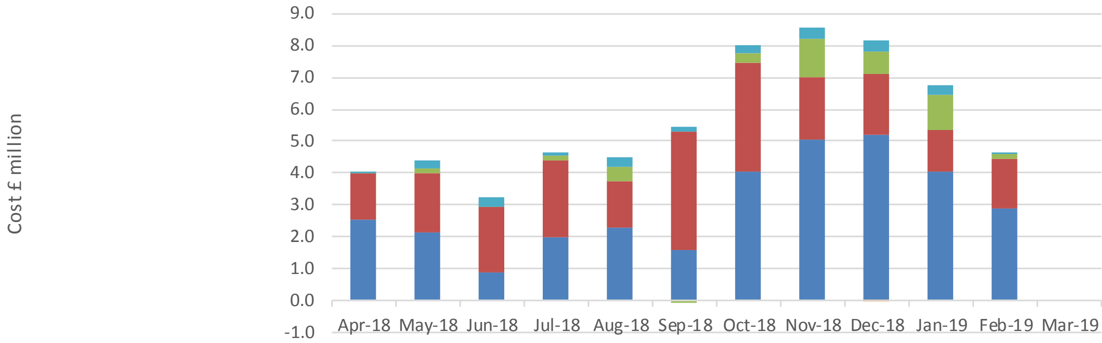
Definition

This section covers Positive Reserve that is managed in the BM, through trades, or SO-SO services. 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.

Operating Reserve Volume and Expenditure

The charts show the cost of managing Operating Reserve across the BM, trading and SO-SO services. Constrained Operating Reserve is the additional cost of maintaining sufficient reserve levels caused by system constraints. For example, the option to maintain Operating Reserve 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 potentially increases the cost.

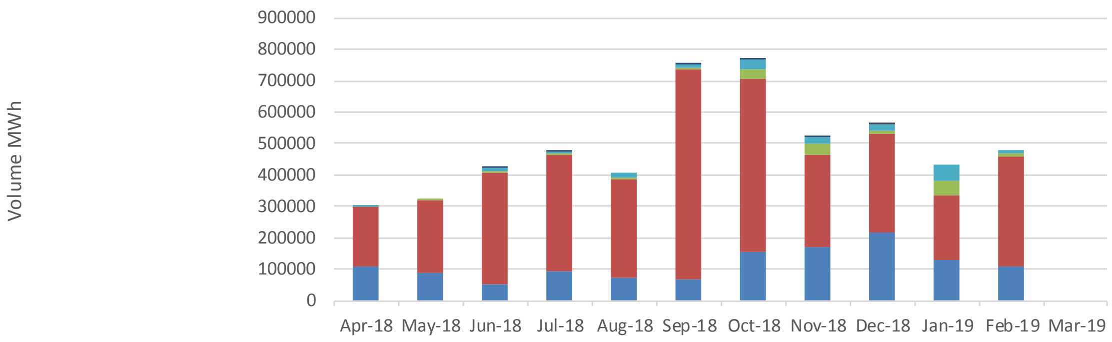
Operating Reserve, in pounds sterling (£m)



	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 Operating Reserve	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
SO-SO - Operating Reserve	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Trade - Constrained Operating Reserve	0.04	0.22	0.31	0.12	0.29	0.17	0.29	0.34	0.36	0.31	0.08	
Trade - UTEV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Trade - Operating Reserve	0.03	0.19	0.04	0.14	0.45	-0.07	0.30	1.19	0.68	1.11	0.13	
BM - Constrained Operating Reserve	1.48	1.85	2.06	2.39	1.46	3.73	3.40	1.97	1.92	1.31	1.59	
BM - Operating Reserve	2.51	2.13	0.86	1.99	2.29	1.57	4.04	5.03	5.20	4.03	2.86	

Figure 15

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 Operating Reserve	-	-	294	186	-	489	143	255	145	-	-	
SO-SO - Operating Reserve	-	-	-	-	-	-	-	-	403	-	-	
Trade - Constrained Operating Reserve	1,263	-	13,093	5,609	13,791	8,258	28,968	17,079	21,134	50,287	13,026	
Trade - UTEV	-	-	-	-	-	-	-	-	-	-	-	
Trade - Operating Reserve	343	700	2,720	1,813	5,963	4,812	28,539	37,816	9,203	48,033	8,569	
BM - Constrained Operating Reserve	191,477	230,520	359,282	373,393	313,812	670,268	553,963	295,754	315,122	206,149	352,216	
BM - Operating Reserve	108,968	86,766	49,168	92,972	72,419	67,012	153,872	168,278	217,741	129,042	107,765	

Figure 16

STOR

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 May, 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 **www.nationalgrideso.com**. Look under Balancing services, and then Reserve services.

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 that are both BM and no-BM participants.

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. Both BM and non-BM participants are paid for availability.
- utilisation payments – we pay non-BM participants these for using the STOR service.

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.

STOR Volume and Expenditure

The current reporting month falls in Season 12.6 for 2018/19. These seasons were available for tenders in tender rounds 11 to 12 for long term tenders and tender rounds 31 to 36. A total of 4238MW was accepted for Season 12.6.

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

STOR Volumes and Prices

	Outturn	Contracted
Volume weighted average availability price	£6.59/MWh	4.15/MWh
Volume weighted average utilisation price	£30.70/MWh	119.38/MWh
Megawatts available	2,554 MW	4,238 MW

Table 1

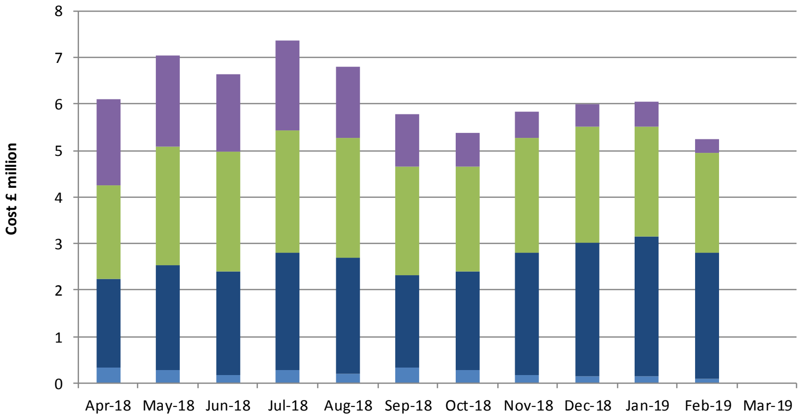
The total amount we spent on the utilisation and availability for BM and non-BM STOR providers in the month was:

- £5.24m

That total cost breaks down into:

- £2.79m to BM STOR providers
- £2.45m to Non-BM STOR providers

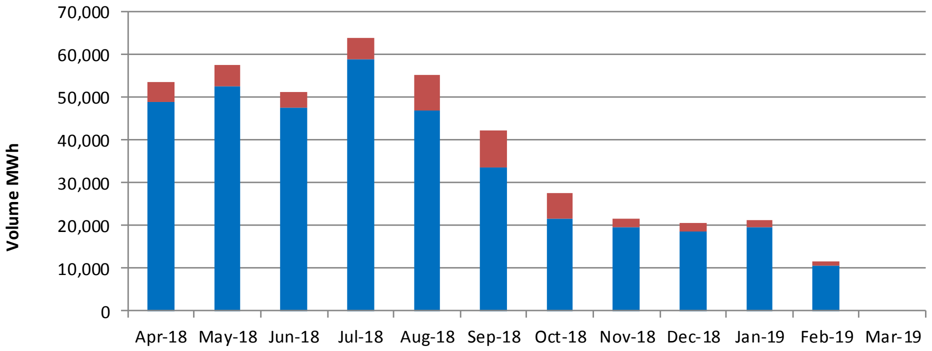
Total Non-BM and BM STOR cost, in pounds sterling (£m)



	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 - NBM Season/Term Reconciliation (Tendered)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
AS - BM Season/Term Reconciliation (Tendered)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
AS - NBM STOR utilisation (Tendered)	1.85	1.96	1.68	1.95	1.55	1.11	0.72	0.56	0.48	0.52	0.29	
AS - NBM STOR availability (Tendered)	2.02	2.54	2.57	2.61	2.57	2.33	2.26	2.47	2.50	2.35	2.16	
AS - BM STOR (Tendered)	1.91	2.26	2.22	2.55	2.50	2.00	2.10	2.63	2.89	3.01	2.69	
BM - STOR	0.32	0.28	0.18	0.27	0.19	0.32	0.29	0.18	0.13	0.15	0.10	

Figure 17

Tendered STOR utilisation 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 STOR utilisation (Tendered)	4,469	4,942	3,481	4,972	8,369	8,643	5,894	1,997	1,742	1,661	1,030	
AS - NBM STOR utilisation (Tendered)	48,983	52,527	47,632	58,800	46,903	33,517	21,721	19,649	18,769	19,596	10,469	

Figure 18

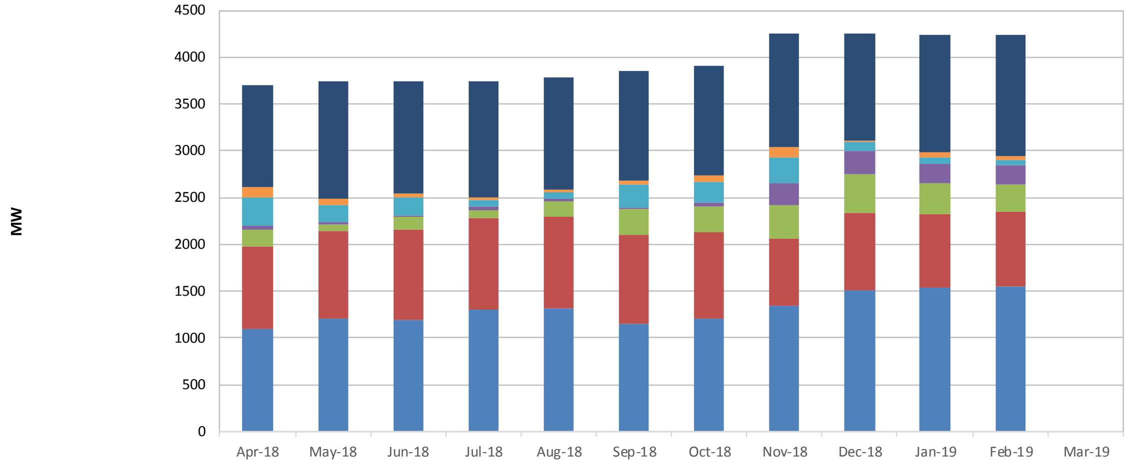
NOTE: We are currently investigating the discrepancy in BM STOR volumes between those reported here and in Figure 5.

The total volume of STOR we used in the month was:

- 11,499 MWh

The graphs below show the volume of BM and non-BM STOR, which was made available to use in window 1, window 2 and window 3.

Average STOR availability volume, in megawatts (MW) – Window 1



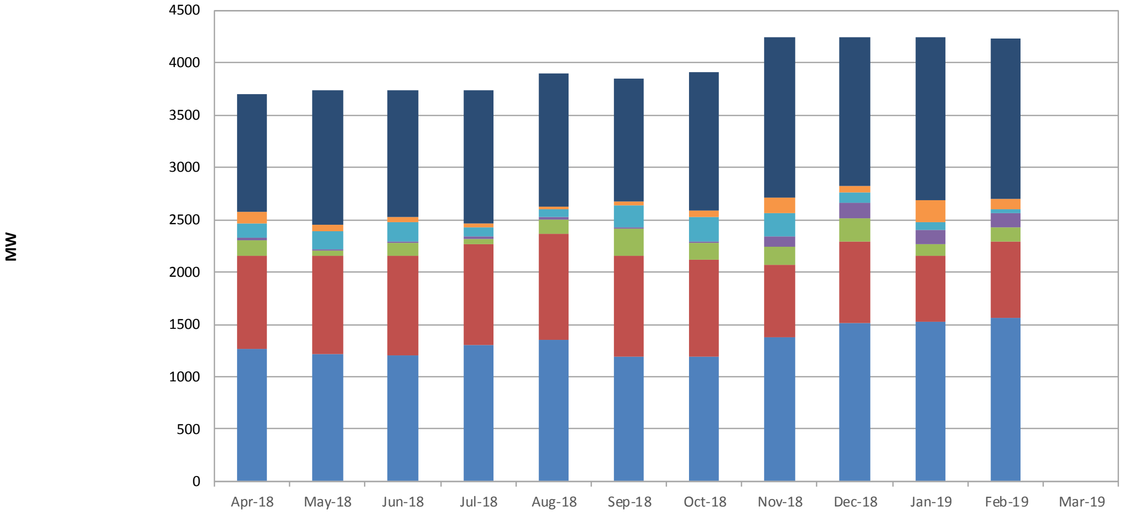
	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Flexible Unavailability	1077	1254	1190	1233	1203	1171	1174	1209	1144	1261	1301	
NBM Committed Unavailability	122	64	45	28	22	43	70	108	8	52	41	
BM Unavailability	305	186	191	79	73	248	219	272	99	68	54	
Flexible Rejected	37	23	19	37	29	12	33	244	249	208	203	
Flexible Accepted	176	73	141	81	157	271	285	349	408	332	294	
NBM Committed	884	938	957	974	980	960	920	729	829	785	796	
BM Availiability	1096	1201	1196	1308	1317	1148	1206	1337	1510	1540	1549	0

Figure 19

The average availability of STOR for Window 1 in the month was:

- 2,639 MW

STOR availability volume, in megawatts (MW) – Window 2



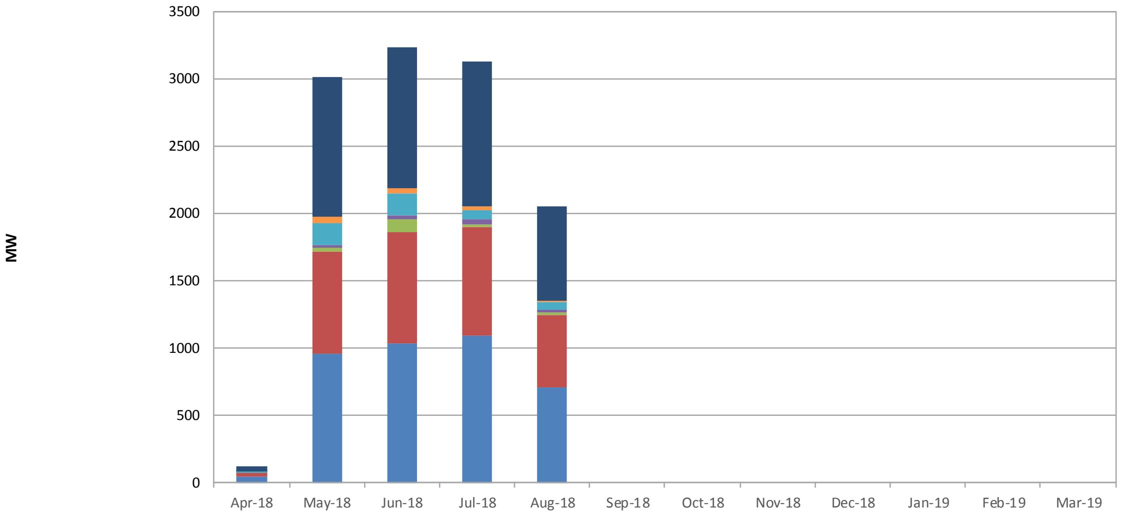
	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Flexible Unavailability	1114	1288	1215	1276	1272	1181	1315	1538	1428	1556	1534	
NBM Committed Unavailability	115	56	40	39	22	38	70	145	55	213	102	
BM Unavailability	132	173	187	79	78	207	228	228	97	77	44	
Flexible Rejected	25	19	17	33	25	8	17	97	155	138	130	
Flexible Accepted	151	42	118	40	135	264	160	167	219	107	134	
NBM Committed	890	946	962	963	1013	966	920	692	782	624	735	
BM Availiability	1269	1214	1200	1308	1356	1190	1197	1381	1512	1532	1559	

Figure 20

The average availability of STOR for Window 2 in the month was:

- 2,428 MW

STOR availability volume, in megawatts (MW) – Window 3



	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	43	1040	1052	1077	701	0	0	0	0	0	0	
NBM Committed Unavailability	2	51	40	34	10	0	0	0	0	0	0	
BM Unavailability	3	162	166	71	56	0	0	0	0	0	0	
Flexible Rejected	1	20	20	34	21	0	0	0	0	0	0	
Flexible Accepted	1	29	98	21	18	0	0	0	0	0	0	
NBM Committed	31	757	828	806	540	0	0	0	0	0	0	
BM Availiability	44	956	1036	1092	705	0	0	0	0	0	0	

Figure 21

Window 3 is only valid for Season 2 which runs from April to August.

Other Reserves

Definition

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

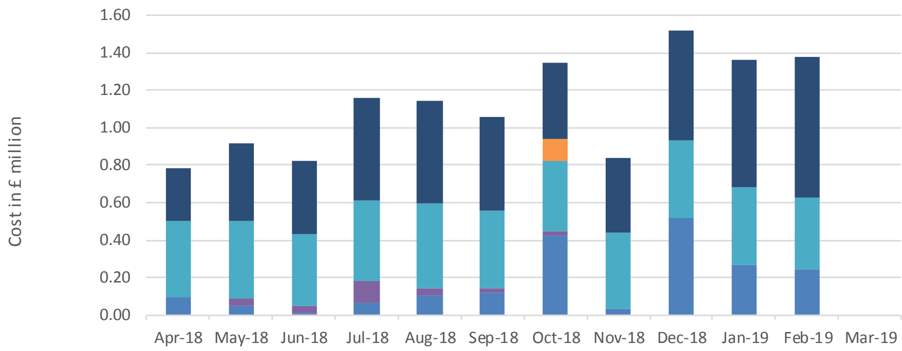
Details of the reserve types presented here can be found on our website. Look for Balancing services, list of all balancing services.

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.

Other Reserves Volume and Expenditure

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	0.42	0.39	0.55	0.55	0.50	0.40	0.40	0.59	0.68	0.75	
Hydro Rapid Start And GT Fast Start Utilisation (Commercial)	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	
BM GT Fast Start Availability (Commerial)	0.41	0.42	0.39	0.43	0.46	0.41	0.38	0.40	0.41	0.41	0.38	
NBM Demand Turn Up (Commerical)	0.00	0.03	0.04	0.11	0.04	0.03	0.03	0.00	0.00	0.00	0.00	
BM Power Potential (Commercial)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
BM Demand Turn Up (Commercial)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
BM Warming (Commercial)	0.09	0.05	0.01	0.07	0.10	0.12	0.42	0.03	0.52	0.27	0.25	

Figure 22

Table 2 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.

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	27,100	26,412	38,712	37,027	35,267	29,192	28,274	41,613	48,898	51,930	
Hydro Rapid Start And GT Fast Start utilisation (MWh)	0	0	0	0	0	0	138	0	0	0	0	
BM GT Fast Start Availability number of sites	20	19	18	17	19	19	17	19				
NBM Demand Turn Up utilisation (MWh)	0	0	0	0	0	0	0	0	0	0	0	
BM Power Potential utilisation (MWh)	0	0	0	0	0	0	0	0	0	0	0	
BM Demand Turn Up utilisation (MWh)	0	0	0	0	0	0	0	0	0	0	0	
BM Warming instructions	3	5	1	6	3	7	27	4	20	22		

Table 2

Constraints

Definition

Running the transmission network also requires actions to protect equipment, enable access to the system, keep within the SQSS[1] and prevent the loss of large parts of the network.

In order to do this, 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.

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

Constraints Volume and Expenditure

The total spent on constraints in was £49.47m. Figure 23 shows the constraint costs broken down by BM, trades, SO-SO and Ancillary Services.

Constraints costs, in pounds sterling (£m)

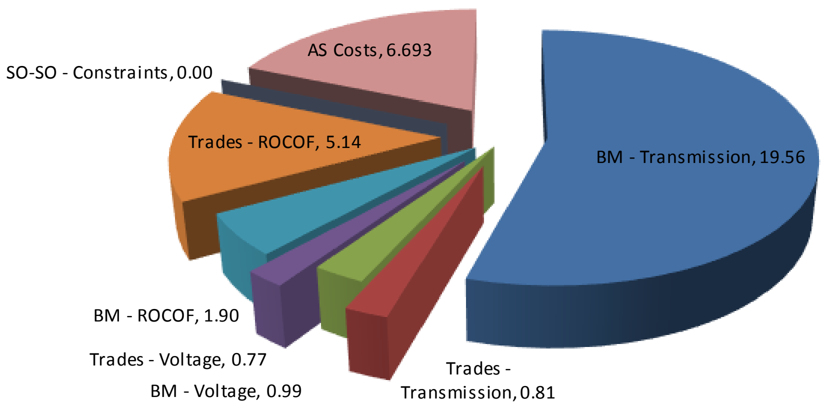
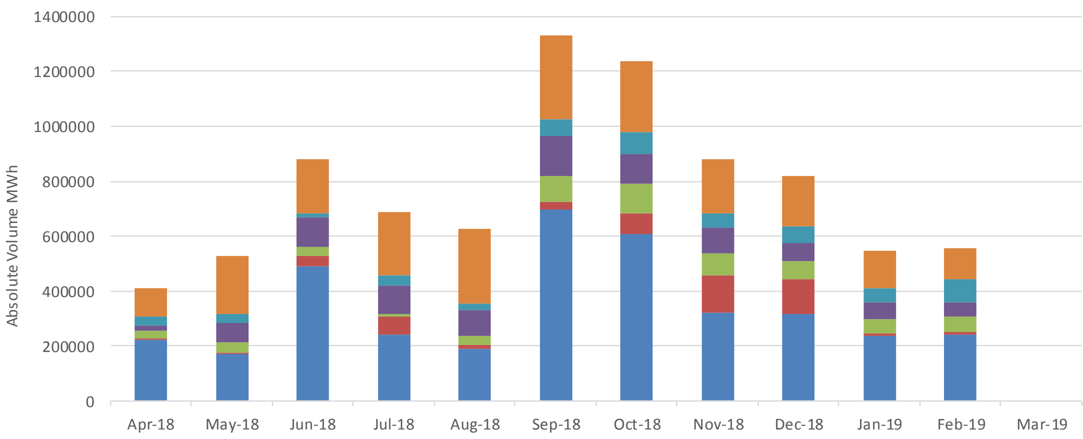


Figure 23

[1] Security and Quality of Supply Standard

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

Constraint volume, in megawatt hours (MWh)

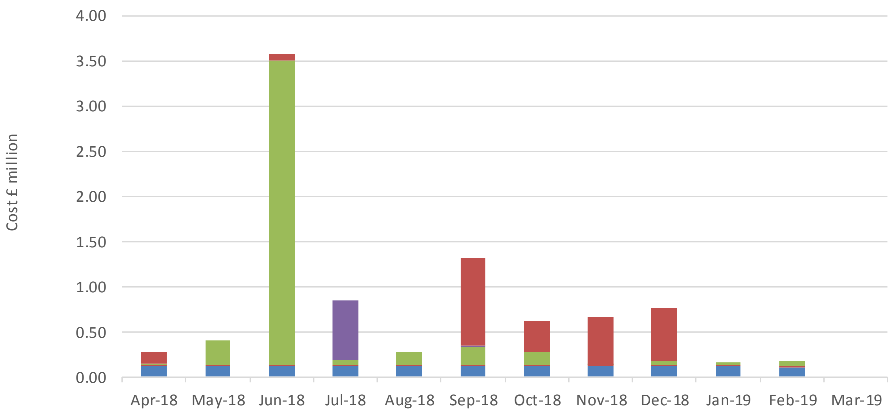


	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Trades - ROCOF	101715	215551	194532	226187	273122	307416	256074	198000	182050	134216	114323	0
BM - ROCOF	31162	29151	14146	40904	22166	61304	79616	52451	59003	52124	83141	0
Trades - Voltage	20584	70648	108480	100645	98325	144326	111349	94125	66899	61305	52373	0
BM - Voltage	28569	38819	32252	9743	30702	93318	104847	76760	64557	52110	57219	0
Trades - Transmission	2867	6503	39289	67527	14720	28118	77645	136497	129143	11498	5975	0
BM - Transmission	223525	169041	490530	240083	188415	697941	606953	321460	315936	235331	242804	0

Figure 24

The total spent on ancillary services to manage constraints was £m, and are broken down further in Figure 25.

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	0.13	0.00	0.08	0.00	0.00	0.98	0.34	0.53	0.58	0.00	0.00	
AS - BM Intertrip - trip (Mandatory and Commercial)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
AS - Interconnector Intertrip Arming (Commercial)	0.00	0.00	0.00	0.65	0.00	0.01	0.00	0.00	0.00	0.00	0.00	
AS - BM Intertrip Arming (Commercial)	0.02	0.27	3.38	0.06	0.14	0.20	0.14	0.01	0.04	0.03	0.05	
AS - BM Intertrip capability (Commercial)	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	
AS - BM Intertrip capability (Mandatory - CAP76)	0.11	0.12	0.11	0.12	0.12	0.11	0.12	0.11	0.12	0.12	0.10	

Figure 25

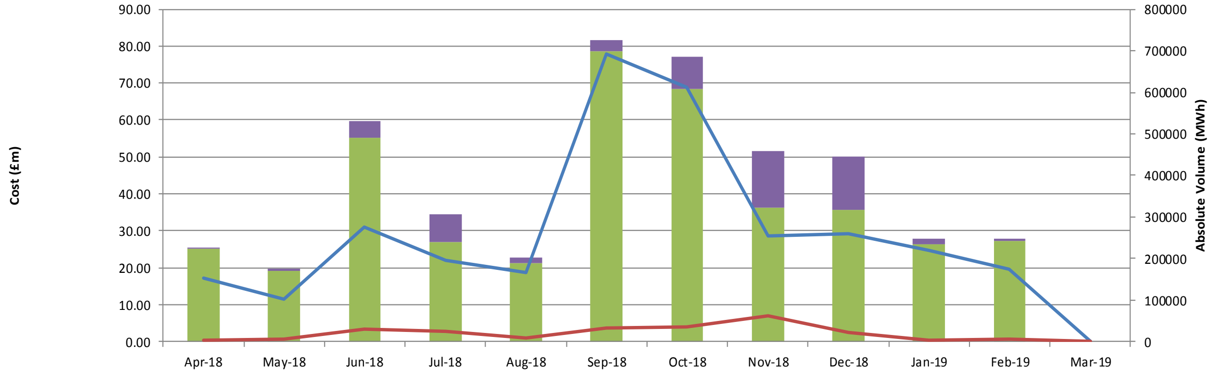
Transmission

These costs are incurred when we need to increase or decrease power flows from one part of the network to another.

Costs are largely incurred in the BM and via trades. Occasionally contracts are entered into if it is economic to do so.

Figure 26 to Figure 28 show costs (represented by lines) and volumes (represented by columns)

Transmission BM and Trade costs (£m) and volumes (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
Trades - Transmission	2867	6503	39289	67527	14720	28118	77645	136497	129143	11498	5975	0
BM - Transmission	223525	169041	490530	240083	188415	697941	606953	321460	315936	235331	242804	0
BM - Transmission	17.32	11.61	31.11	22.02	18.85	77.83	68.93	28.49	29.17	24.66	19.56	0.00
Trades - Transmission	0.32	0.63	3.44	2.69	0.90	3.59	3.90	7.04	2.55	0.44	0.81	0.00

Figure 26

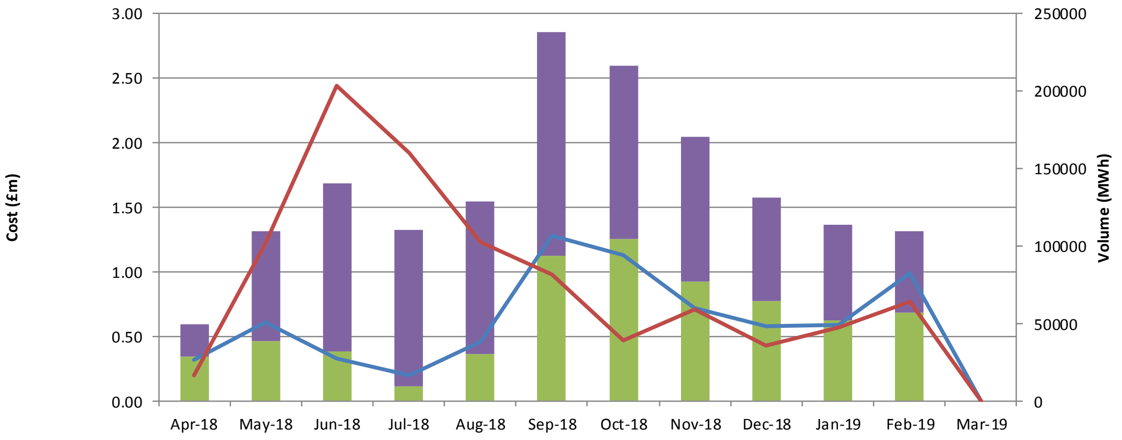
Voltage

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. These costs are reported in the Reactive Power section.

In order to access Reactive Power, sometimes a generator is required to be synchronised to the network. In this case, we must buy the energy from the generator in order for the reactive power to be delivered.

We currently procure this service through the BM and Trades.

Voltage BM and Trade costs (£m) and volumes (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
Trades - Voltage	20584	70648	108480	100645	98325	144326	111349	94125	66899	61305	52373	0
BM - Voltage	28569	38819	32252	9743	30702	93318	104847	76760	64557	52110	57219	0
BM - Voltage	0.31	0.60	0.33	0.20	0.46	1.28	1.13	0.72	0.58	0.59	0.99	0.00
Trades - Voltage	0.20	1.22	2.44	1.92	1.23	0.98	0.47	0.71	0.43	0.56	0.77	0.00

Figure 27

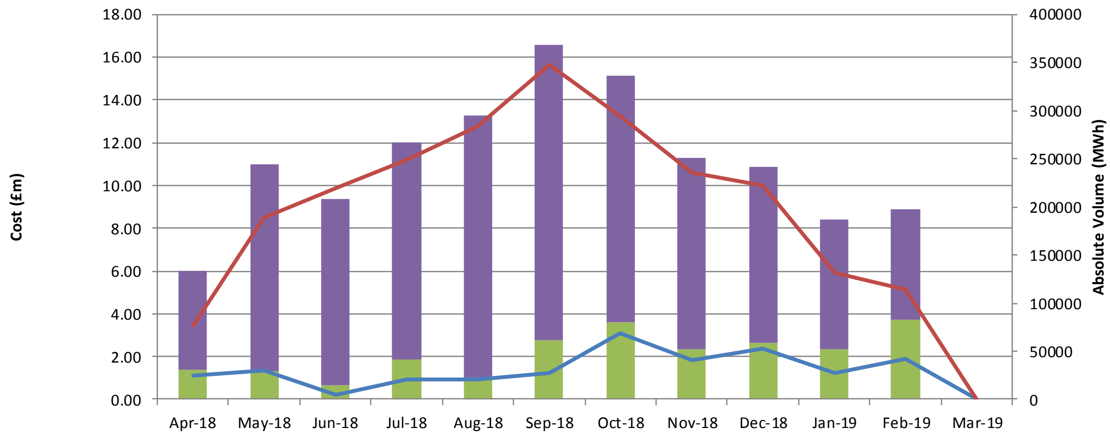
Rate of Change of Frequency (ROCOF)

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 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 have two options available to us; we can 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; or we can bring on more generation to increase the amount of inertia on the system – inertia helps the system to cope in the event of a large infeed loss and reduces the rate at which frequency changes.

We currently procure ROCOF actions in the BM or through Trades.

ROCOF BM and Trade costs (£m) and volumes (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
Trades - ROCOF	101715	215551	194532	226187	273122	307416	256074	198000	182050	134216	114323	0
BM - ROCOF	31162	29151	14146	40904	22166	61304	79616	52451	59003	52124	83141	0
BM - ROCOF	1.09	1.37	0.24	0.91	0.93	1.25	3.10	1.84	2.36	1.25	1.90	0.00
Trades - ROCOF	3.45	8.47	9.88	11.21	12.78	15.67	13.27	10.57	10.00	5.90	5.14	0.00

Figure 28

Constraint actions by fuel type

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

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.

Breakdown of constraint costs by fuel type, for February 2019

Fuel Type	Payments to Manage Constraint	Payments to Rebalance System	Net Cost
COAL	0.09	0.74	0.83
GAS	0.45	36.11	36.55
INTERCONNECTOR	-1.47	-1.10	-2.56
WIND	9.95	0.00	9.95
OTHER	4.46	0.24	4.70
Total	13.48	35.99	49.47

Table 3

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

Fuel Type	Payments to Manage Constraint	Payments to Rebalance System	Net Cost
COAL	4.53	49.79	54.32
GAS	-17.96	387.82	369.86
INTERCONNECTOR	-19.03	0.88	-18.14
WIND	135.62	0.03	135.66
OTHER	31.83	13.12	44.96
Total	135.01	451.64	586.65

Table 4

Negative Reserve

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.

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.

Negative Reserve Volume and Expenditure

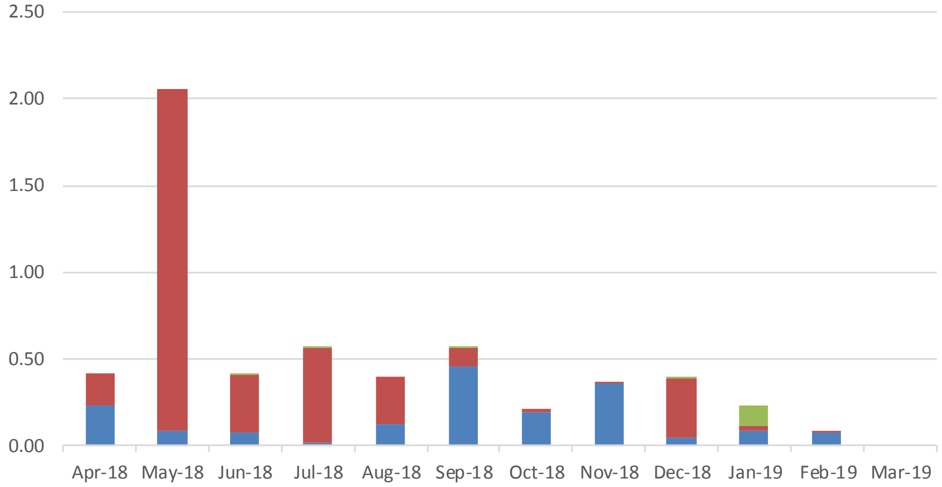
The total amount we paid for Negative Reserve in the month was:

- £0.07 million

The total volume of Negative Reserve we procured in the month was:

- -4,291 MWh

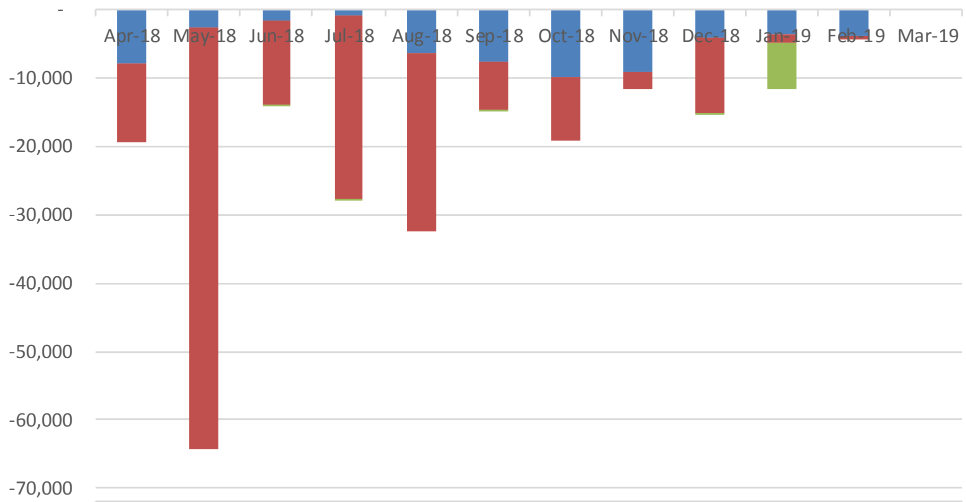
Negative Reserve cost, in pounds sterling (£m)



	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
SO-SO - Negative reserve	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	
Trade - Negative reserve	0.19	1.97	0.33	0.55	0.28	0.11	0.02	0.01	0.35	0.03	0.00	
BM - Negative reserve	0.23	0.08	0.07	0.02	0.12	0.45	0.20	0.36	0.04	0.08	0.07	

Figure 29

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
SO-SO - Negative Reserve	-	-	-233	-328	-	-49	-	-	-196	-6,621	-	
Trade - Negative Reserve	-11,600	-61,661	-12,300	-26,763	-26,185	-7,200	-9,324	-2,600	-11,056	-1,200	-550	
BM - Negative Reserve	-7,746	-2,620	-1,634	-873	-6,190	-7,494	-9,741	-8,926	-3,971	-3,645	-3,741	

Figure 30

Fast Reserve

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 **www.nationalgrideso.com**. Look under Balancing services, and then Reserve services.

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.

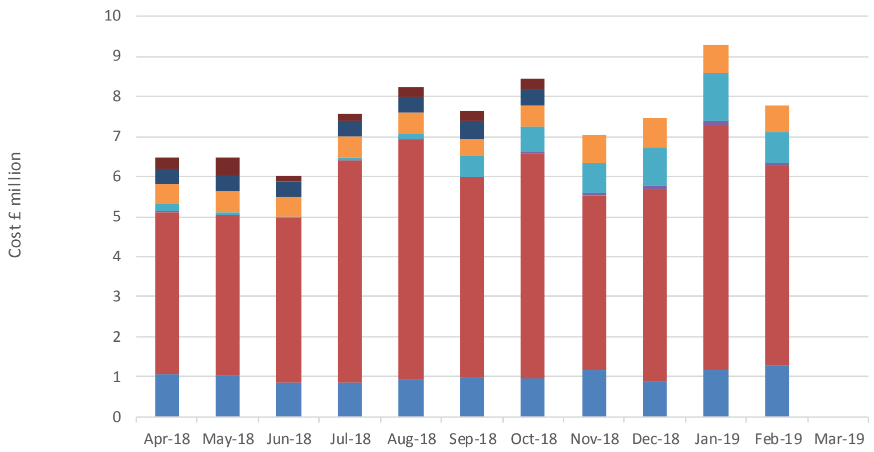
We procure Optional Spin Gen (for Hydro Pump Storage only) via bilateral agreements, and the services are called upon through requests from the National Grid Electricity Control centre, but not through the BM.

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 providers the Capped Bid-Offer price for use of the service through the BM, or the Firm Fast Reserve Energy Fee for non-BM providers.

Fast Reserve Volume and Expenditure

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)	0.28	0.46	0.14	0.18	0.26	0.24	0.29	0.00	0.00	0.00	0.00	
NBM Firm Fast Reserve Avail + Nom (Tendered)	0.37	0.39	0.37	0.39	0.39	0.47	0.39	0.00	0.00	0.00	0.00	
BM Firm Fast Reserve (Tendered)	0.50	0.51	0.50	0.51	0.51	0.40	0.52	0.70	0.72	0.71	0.66	
NBM Optional Fast Reserve Utilisation (Commercial)	0.16	0.06	0.02	0.05	0.12	0.53	0.66	0.74	0.95	1.17	0.77	
NBM Optional Fast Reserve Availability (Commercial)	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.06	0.11	0.14	0.07	
BM Optional Fast Reserve (Commercial)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Hydro Spin Gen No LF (Commercial)	4.05	4.00	4.10	5.56	6.00	4.98	5.63	4.38	4.77	6.11	4.98	
BM - Fast Reserves	1.08	1.03	0.87	0.84	0.94	0.99	0.96	1.16	0.89	1.16	1.29	

Figure 31

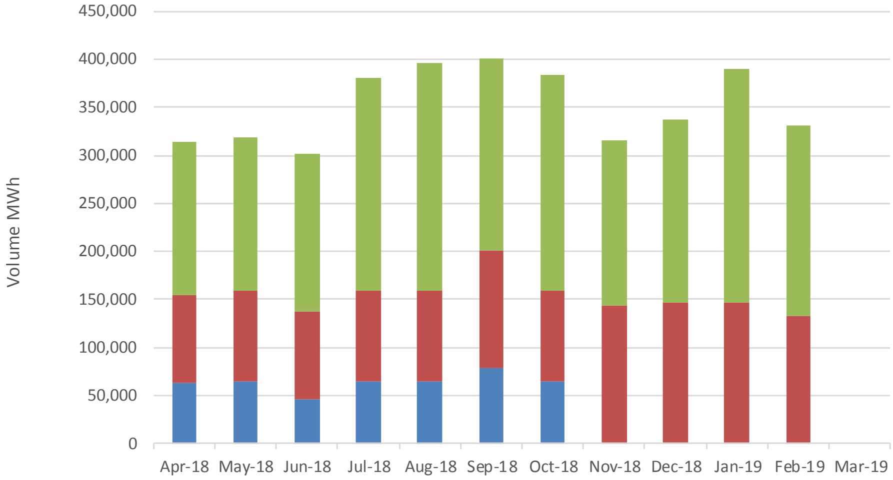
The total amount we paid for Fast Reserve in the month was:

- £7.77 million.

That cost breaks down into

- £6.92 million to BM providers
- £0.84 million to non BM providers

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	159,528	164,255	221,512	237,260	200,064	224,154	172,820	190,133	243,345	197,601	
AS - BM Firm Fast Reserve availability (Tendered)	90,720	93,780	91,080	93,960	93,960	121,800	94,140	142,780	146,650	147,310	133,160	
AS - NBM Firm Fast Reserve availability + nomination (Tendered)	63,000	65,100	46,620	65,100	65,100	78,552	65,100	-	-	-	-	

Figure 32

Response

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, then Frequency Response Services.

Paying for Response

We procure Firm Frequency Response through a competitive monthly tendering process. Additional response, where required, is also procured through the Mandatory Frequency Response Market in the balance mechanism. Only Balancing Mechanism Units are able to offer mandatory response.

We have five types of payments made to Firm Frequency Response suppliers:

- Availability payments in £/hr – for the hours for which a provider has tendered to make the service available for.
- Nomination payments in £/hr – a holding fee for each hour used within Firm Frequency Response nominated windows.
- Window initiation payments in £/window – for each Firm Frequency Response 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.
    - As per CUSC section 4.1.3.9A for BMU Providers.

N.B. Utilisation volumes will be determined in accordance with system frequency and the characteristic of the response service.

Response Volume and Expenditure

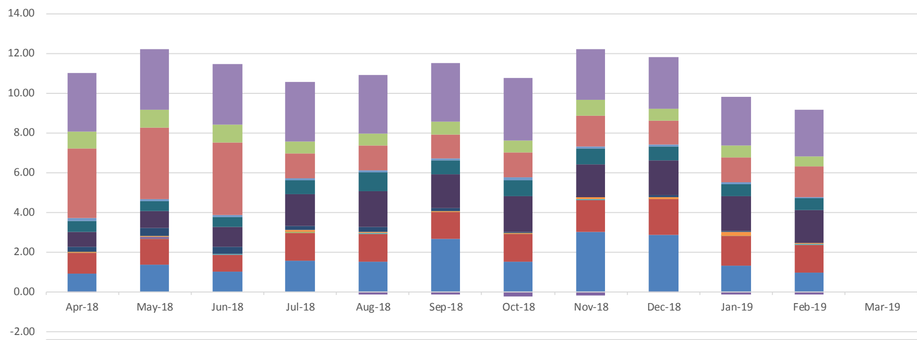
The total amount we paid for Response in the month was:

- £9.05 million.

The Response holding volume in the month was:

- Primary: 440,723 MWh
- Secondary: 374,906 MWh
- High: 323,073 MWh

Response Service costs, in pounds sterling (£m)

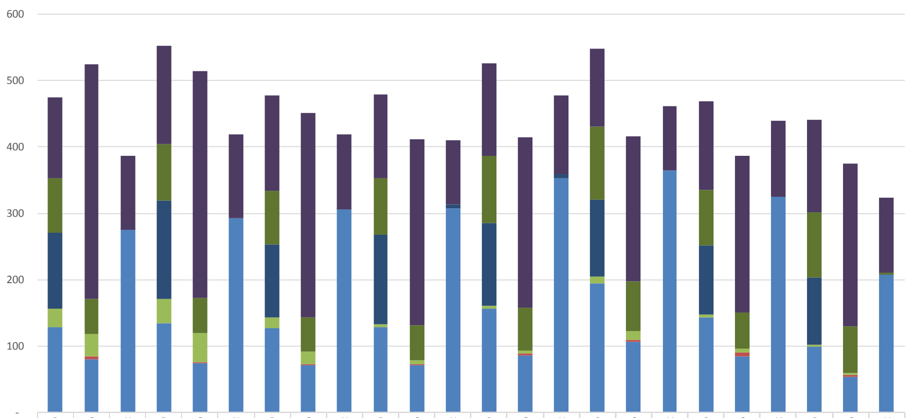


	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
NBM FFR (Tendered)	2.96	3.07	3.07	2.99	2.95	3.00	3.12	2.55	2.63	2.48	2.35	
BM FFR Response Energy (Tendered)	0.84	0.89	0.90	0.57	0.60	0.62	0.62	0.79	0.57	0.59	0.54	
BM FFR (Tendered)	3.54	3.61	3.62	1.25	1.24	1.21	1.25	1.57	1.24	1.25	1.52	
NBM Other Response (Commercial)	0.11	0.11	0.11	0.11	0.12	0.12	0.12	0.10	0.08	0.08	0.08	
BM Other Response (Commercial)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
NBM Demand Side Response (Commerical)	0.55	0.49	0.50	0.71	0.94	0.67	0.84	0.78	0.70	0.62	0.61	
NBM Enhanced Frequency Response (Commercial)	0.77	0.84	1.01	1.59	1.77	1.72	1.79	1.64	1.76	1.76	1.61	
Interconnector Response (Commercial)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
BM Enhanced Frequency Response (Commercial)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Hydro Pump deload	0.23	0.41	0.32	0.22	0.28	0.13	0.04	0.04	0.09	0.04	0.02	
Hydro Spin Gen with LF	0.05	0.06	0.04	0.08	0.05	0.04	0.05	0.09	0.08	0.17	0.06	
BM Generator Response Energy (Commercial)	0.02	0.01	0.02	0.03	0.01	0.01	0.01	0.04	0.02	0.02	0.02	
BM Generator Response Energy (Mandatory)	-0.02	0.05	0.01	0.00	-0.13	-0.15	-0.23	-0.19	-0.06	-0.14	-0.12	
BM Generator Response (Commercial)	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.01	0.00	
BM Generator Response (Mandatory)	1.02	1.32	0.85	1.42	1.40	1.35	1.38	1.59	1.79	1.47	1.40	
BM - Response	0.93	1.36	1.01	1.54	1.53	2.66	1.52	3.01	2.88	1.33	0.97	

Figure 33

Figure 34 shows the dynamic and static response holding volumes in GWh, for primary, secondary and high response types (P, S, and H on the chart).

Response Service volume; primary, secondary and high, in Gigawatt hours (GWh)



	Jul-18			Aug-18			Sep-18			Oct-18			Nov-18			Dec-18			Jan-19			Feb-19		
	P	S	H	P	S	H	P	S	H	P	S	H	P	S	H	P	S	H	P	S	H	P	S	H
NBM FFR (Tendered)	122	353	112	149	342	127	143	309	113	126	280	97	140	257	119	118	218	97	133	237	115	139	246	112
BM FFR (Tendered)	82	53	-	84	53	-	81	51	-	85	53	-	101	64	-	110	76	-	84	53	0	98	70	4
BM Other Response (Commercial)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NBM Demand Side Response (Commerical)	114	-	0	149	-	-	110	-	0	135	-	6	125	-	5	116	-	-	104	-	-	101	-	0
NBM Enhanced Frequency Response (Commercial)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interconnector Response (Commercial)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BM Enhanced Frequency Response (Commercial)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydro Pump deload	28	34	-	36	44	-	16	19	-	4	5	-	4	5	-	10	13	-	5	6	-	3	3	-
Hydro Spin Gen with LF	-	3	-	-	2	-	-	1	-	-	2	-	-	3	-	-	3	-	-	7	-	-	2	-
BM Generator Response (Mandatory)	128	81	275	135	74	293	127	71	306	129	72	308	156	85	354	194	106	365	143	84	325	100	54	207

Figure 34

Reactive Power (Voltage Control)

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 **www.nationalgrideso.com**. Look under Balancing services, then Reactive power services.

Paying for Reactive Power

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, obligatory reactive power, market information.

Reactive Power Volume and Expenditure

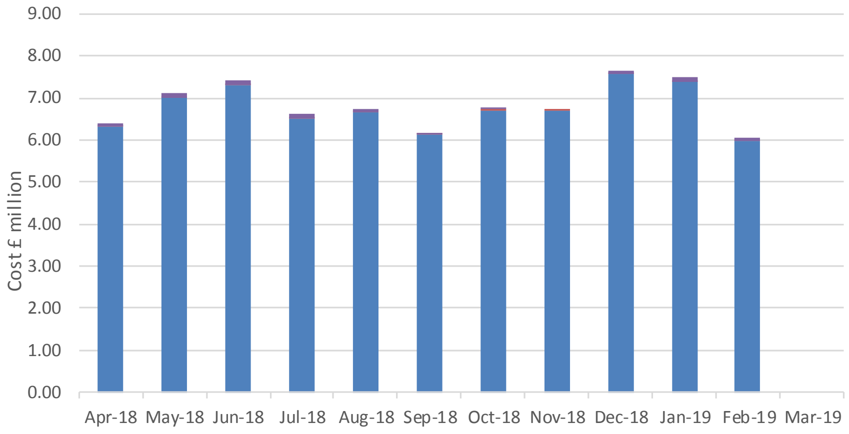
The total amount we paid for Reactive Service in the month was:

- £6.07 million

The total volume of reactive power used in the month was:

- 1,757,793 MVArh

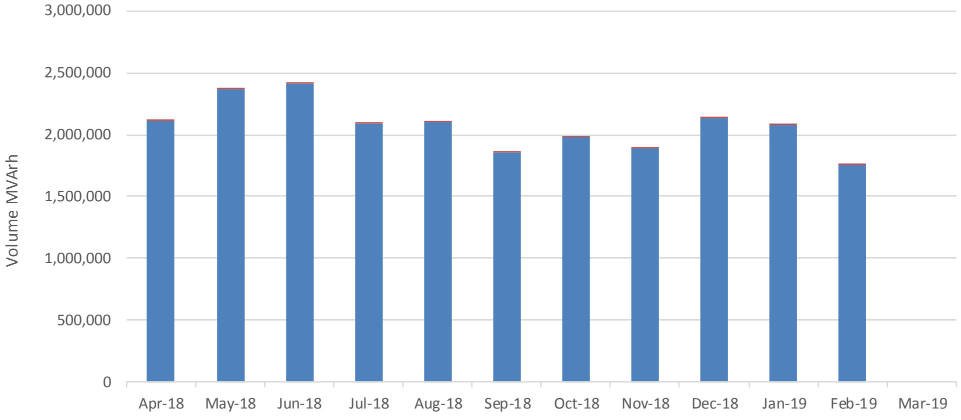
Costs of Reactive Power, in pounds sterling (£ million)



	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
AS-BM Syncronous Compensation (Commerical)	0.06	0.12	0.09	0.10	0.09	0.00	0.01	0.00	0.07	0.09	0.09	
AS-BM Reactive Utilisation (Commercial)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
AS-BM Utilisation (Mandatory - SVA)	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
AS-BM Default Utilisation (Mandatory - CVA)	6.32	7.00	7.31	6.50	6.66	6.13	6.72	6.69	7.56	7.38	5.97	

Figure 35

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	0	0	0	0	0	0	0	0	0	0	
BM Utilisation (Mandatory - SVA)	0	0	0	0	0	0	0	0	0	0	0	
BM Reactive Utilisation (Commercial)	2,489	2,280	1,517	1,809	2,376	3,251	3,392	3,135	1,378	2,745	1,515	
BM Default Utilisation (Mandatory - CVA)	2,115,438	2,364,237	2,412,139	2,087,881	2,105,064	1,855,790	1,976,160	1,885,022	2,130,646	2,078,434	1,756,278	

Figure 36

Black Start

Definition

Black start is the procedure we use to restore power in the event of a total or partial shutdown of the national electricity transmission system. 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 other 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 www.nationalgrideso.com. Look under Balancing services, then System security.

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 in the energy market
- capital contributions – the cost of setting up black start capability
- other payments – for example, for testing

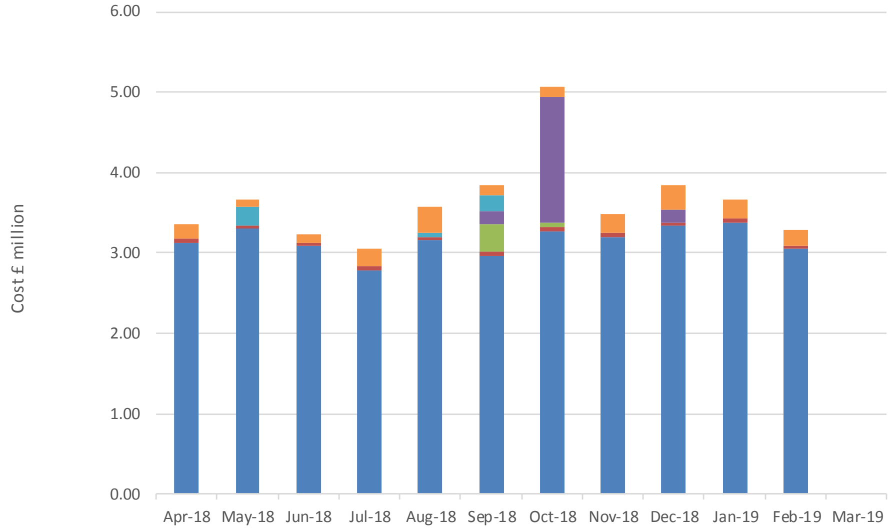
Black Start Volume and Expenditure

Figure 37 shows the amount we spent on Black Start, in pounds sterling (£ million).

The amount we spent on Black Start contracts in the month was:

- £3.30 million

Black Start service 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 (Commerical)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
BM Black Start Warming (Commercial)	0.19	0.10	0.10	0.22	0.32	0.12	0.13	0.24	0.30	0.24	0.20	
BM Black Start Feasibility (Commercial)	0.00	0.22	0.00	0.00	0.05	0.19	0.00	0.00	0.00	0.00	0.00	
BM Black Start Capital Contributions (Commerical)	0.00	0.00	0.00	0.00	0.00	0.17	1.57	0.00	0.16	0.00	0.00	
BM Black Start Test (Commerical)	0.00	0.00	0.00	0.00	0.00	0.34	0.05	0.00	0.00	0.00	0.00	
Interconnector Black Start Availability (Commercial)	0.04	0.03	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
BM Black Start Availability (Commercial)	3.13	3.31	3.08	2.79	3.15	2.97	3.27	3.20	3.33	3.38	3.05	

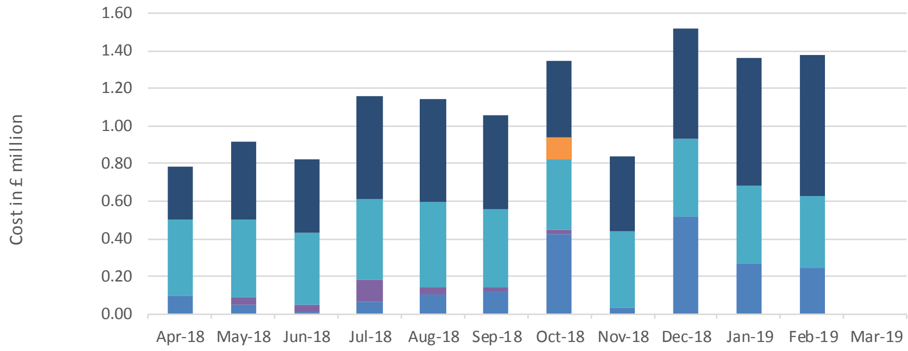
Figure 37

Other Costs

The costs reported in this sections account for:

- BM actions, which are not easily accounted for in the previously reported categories
- Other general costs; trading option fees, bank charges, sterling adjustments
- Non-Delivery and Reconciliation

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
Hydro Optional Spin Pump (Commercial)	0.29	0.42	0.39	0.55	0.55	0.50	0.40	0.40	0.59	0.68	0.75	
Hydro Rapid Start And GT Fast Start Utilisation (Commercial)	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	
BM GT Fast Start Availability (Commerial)	0.41	0.42	0.39	0.43	0.46	0.41	0.38	0.40	0.41	0.41	0.38	
NBM Demand Turn Up (Commerical)	0.00	0.03	0.04	0.11	0.04	0.03	0.03	0.00	0.00	0.00	0.00	
BM Power Potential (Commercial)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
BM Demand Turn Up (Commercial)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
BM Warming (Commercial)	0.09	0.05	0.01	0.07	0.10	0.12	0.42	0.03	0.52	0.27	0.25	

4

Other Information

Wind Generation

New Wind Generation

This table will only include new wind generation when its settlement metering is greater than 1MWh.

BMU ID	Month First Metered	Connection Area	Max Metered MW

Table 5

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.

Payments to Wind Powered Generation

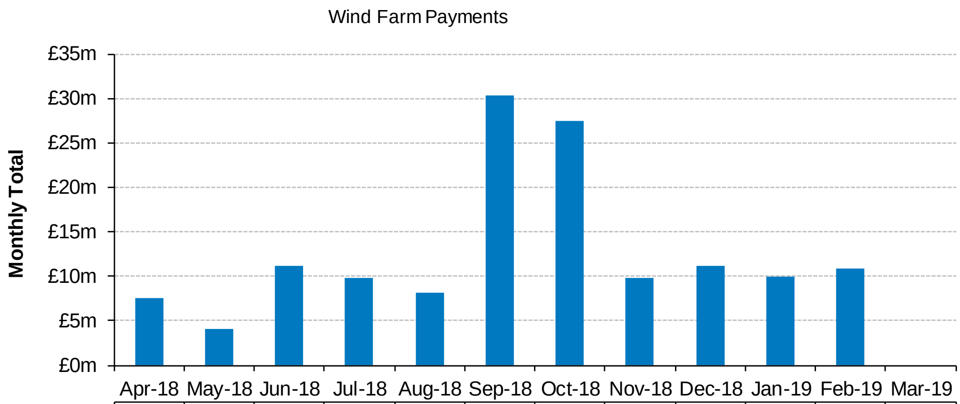
The table below shows the payments made to wind powered generation since the 2010/11 financial year. There were no payments to wind powered generation prior to this. All payments to wind powered generation are included regardless of the reason that this cost was incurred.

£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	140.7

Table 6

Monthly Breakdown of Wind Farm Payments

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



	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	£7.6m	£4.1m	£11.2m	£9.9m	£8.2m	£30.3m	£27.5m	£9.9m	£11.2m	£10.0m	£10.9m	£0.0m

Figure 38

Further Information

You'll find more detail about balancing services on our web site at **www.nationalgrideso.com**.

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 Balancing Data, then System balancing reports.
- Monthly BSUoS Report – Outturn and Forecast information about the monthly BSUoS charge resulting from balancing the system. Find the report on our web site under Balancing data, then Forecast volumes and costs.
- Procurement Guidelines Report – information about the balancing services that we're going to procure. Find the report on our web site under Balancing services, C16 Statements, and then Latest Statements.
- Balancing Principles Statement – information about balancing mechanism bid and offer acceptances. Find it under Balancing services, C16 Statements, then Latest Statements.

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.

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