ISG241-SPAR

Issue 64 - Published 13 April 2021

System Price Analysis Report

The System Prices Analysis Report (SPAR) provides a monthly update on price calculations. It is published by the ELEXON Market Operations on the Elexon Website and issued to the Imbalance Settlement Group (ISG) at their monthly meeting.

This report provides data and analysis specific to System Prices and the Balancing Mechanism. It demonstrates the data used to derive the prices. The data is a combination of II and SF Settlement Runs.

Reporting on March 2021

1 System Prices and length

This report covers the month of March. Where available, data uses the latest Settlement Run (in most cases 'II' or 'SF'). In this report, we distinguish between a 'long' and a 'short' market when analysing System Prices, because the price calculation differs between the two scenarios.

When the market is long, System Prices are based predominantly on the System Operator's 'sell' actions such as accepted Bids. When the market is short, System Prices are based predominantly on the System Operator's 'buy' actions.

System Price summary by month (£/MWh)

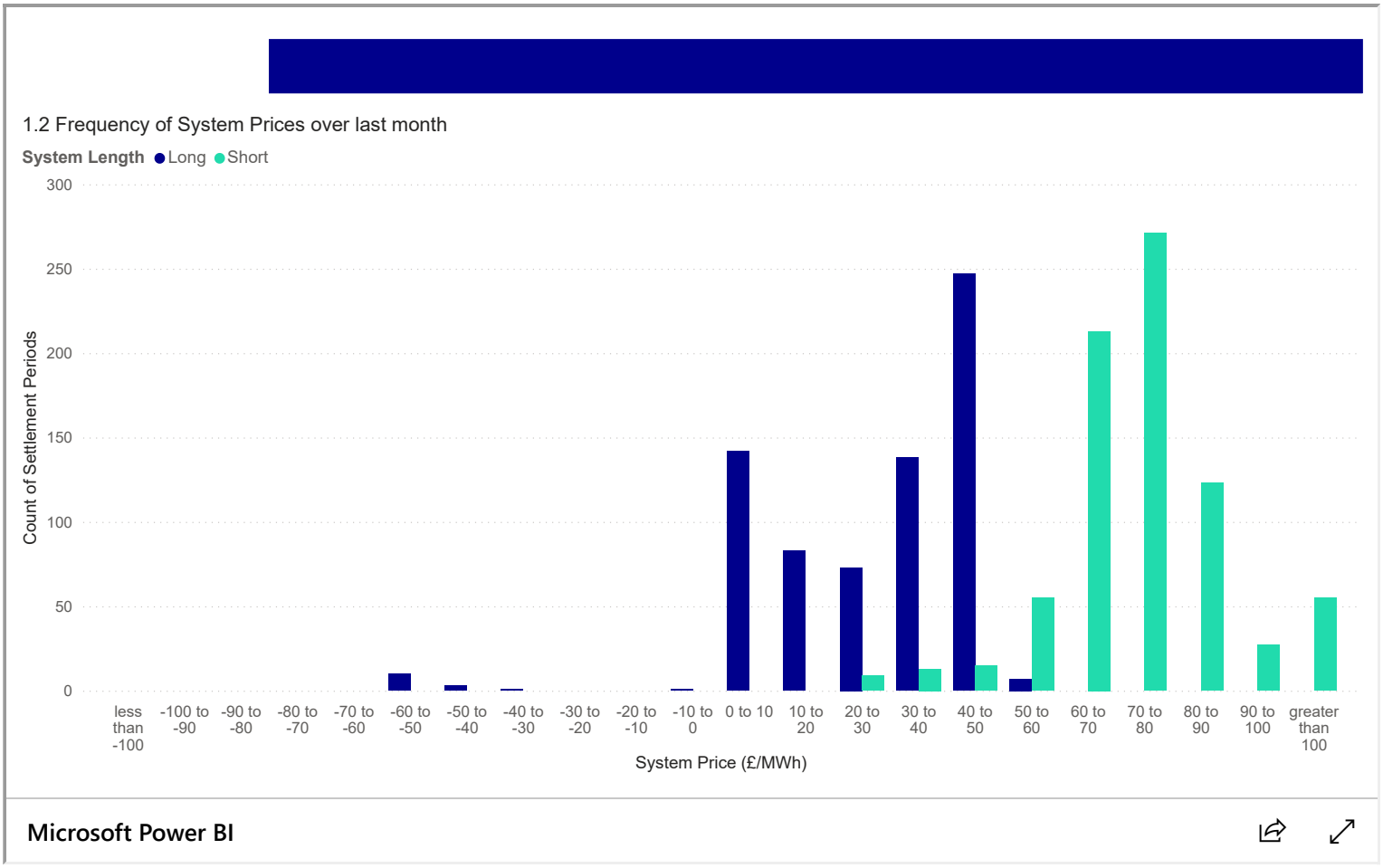
This table gives a summary of System Prices for March, with values shown in £/MWh.

System Length	Min	Max	Median	Mean	Std.Dev
Long	-61.00	53.40	36.08	26.56	19.65
Short	22.98	900.00	73.85	79.85	56.78

Source: Elexon

Frequency of System Prices over last month

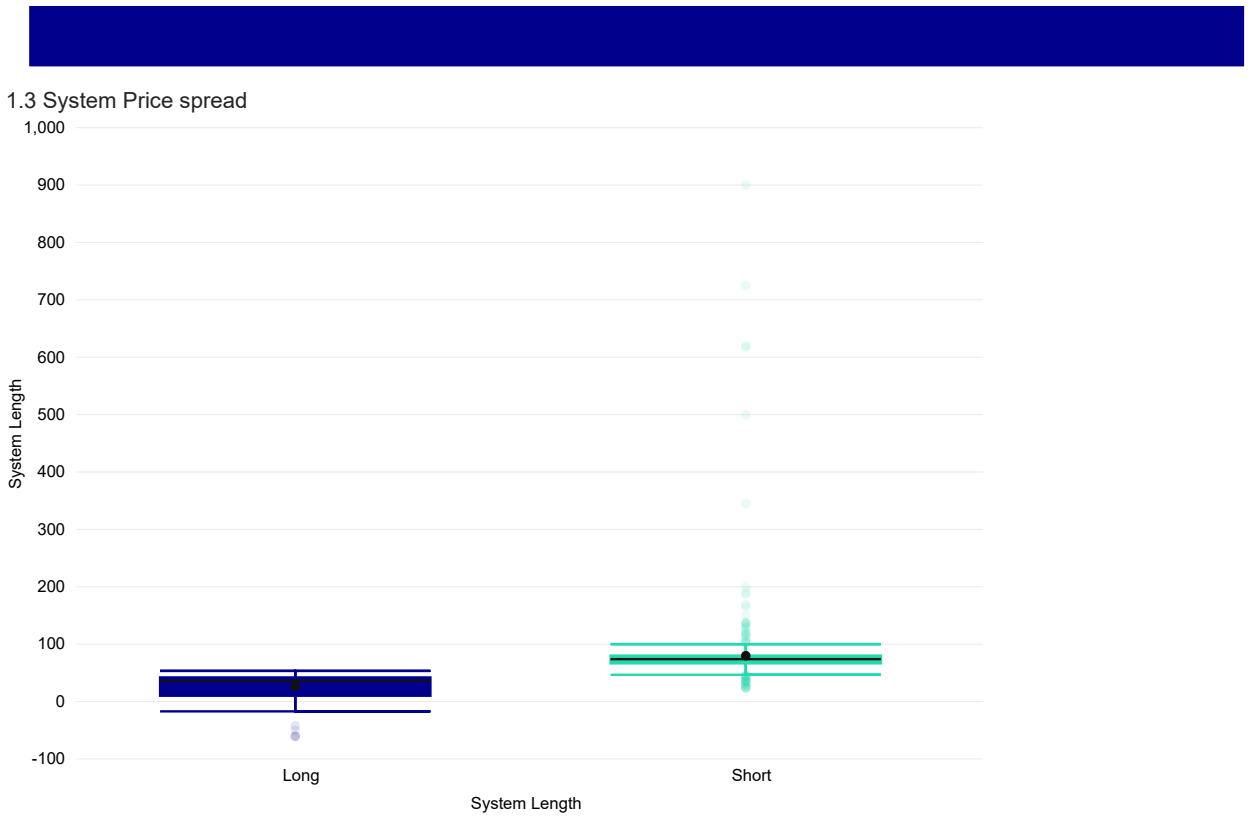
This graph shows the distribution of System Prices across Settlement Periods in March 2021 when the market was long and short. 80% of System Prices were between £8.50/MWh and £85.00/MWh regardless of system length. When the system was long, 80% of prices were between £4.55/MWh and £44.20/MWh. When the system was short, 80% of prices were between £58.00/MWh and £90.00/MWh.



System Prices were £100/MWh or more on 55 occasions in March 2021, compared to 32 times in February. The highest System Price of the month, £900.00/MWh, occurred in Settlement Period 36 on 3 March. The price was set by two Offers from a CCGT BMU priced at £900.00/MWh.

There were 17 Settlement Periods where the System Price was less than £0.00/MWh in March, with the lowest System Price of -£61.00/MWh occurring in Settlement Periods 4 and 46 on 11 March, Settlement Period 44 on 28 March and Settlement Period 31 on 29 March. Settlement Period 31 on 29 March was a peak period whereas the three other Settlement Periods were off-peak.

System Price spread The graph below displays the spread of System Prices in March 2021 as a box plot diagram, split between a short and long system.



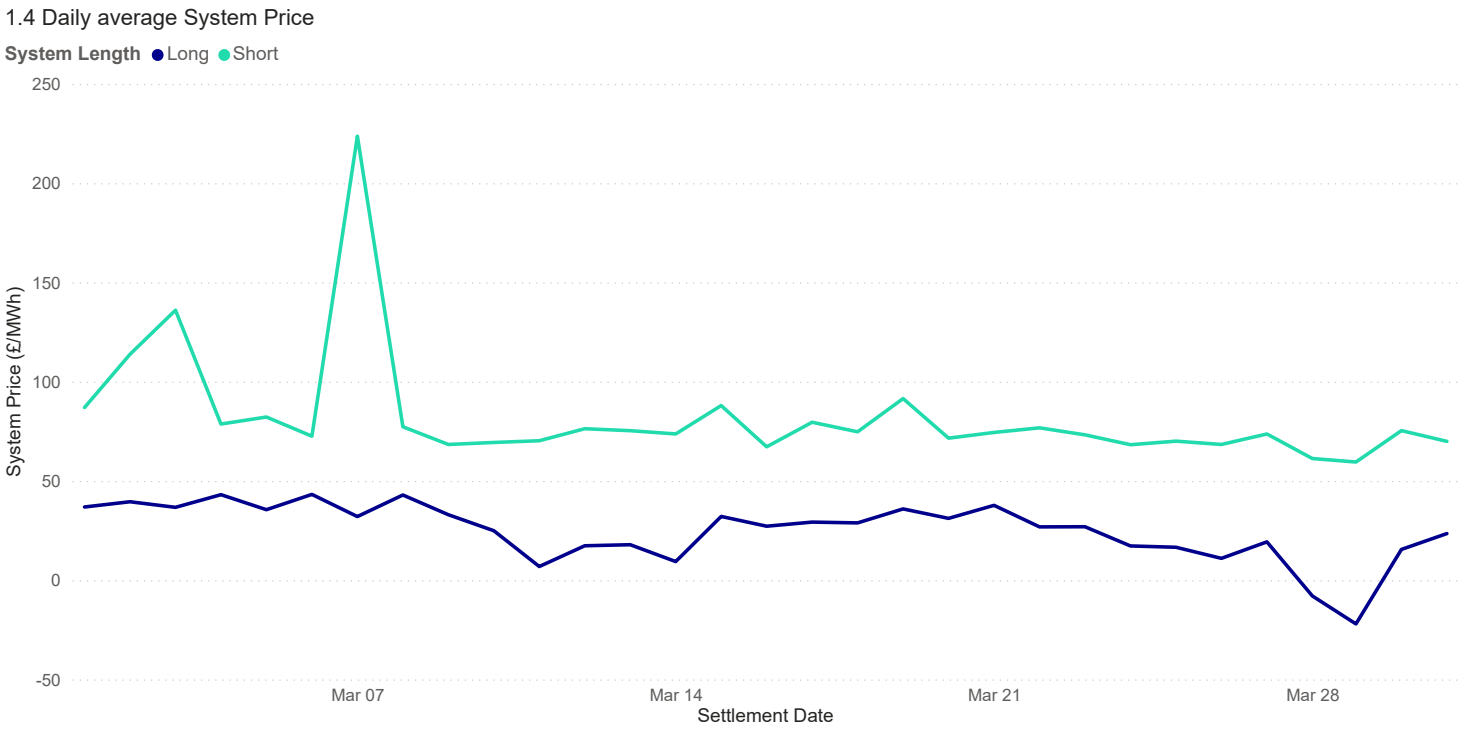
Microsoft Power BI

The middle line in each box represents the median System Price of the month, which is £73.85/MWh for short Settlement Periods and £36.08/MWh for long Settlement Periods. Each box edge represents the lower and upper quartiles (25th and 75th percentile respectively), with the Interquartile Range (difference between the Upper and Lower quartiles) being £13.50/MWh for short System Prices and £31.90/MWh for long System Prices.

Outliers are shown on the graph as circles, and have been defined as being greater than 1.5 times the Interquartile Range (IQR) away from the Upper and Lower quartiles. Under this definition, 14 long and 77 short System Prices in March were outliers. Of the 14 long outliers, all were less than the lower outlier boundary. The prices of Long outliers ranged from -£61.00/MWh (the lowest System Price of the month) to -£42.00/MWh. The highest System Price of the month, £900.00/MWh, was over 12 times the median short System Price for the month.

Daily average System Price

The graph below shows daily average System Prices over the last month.

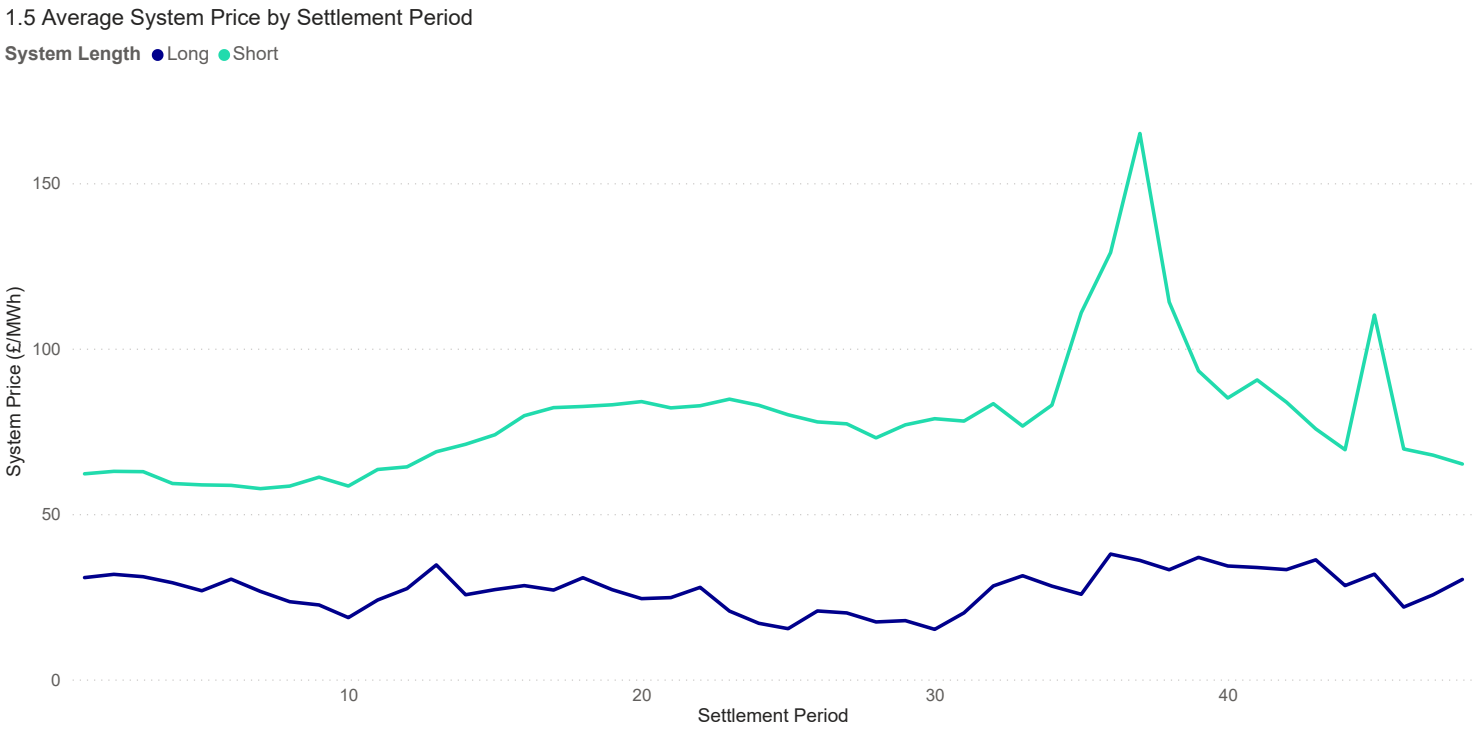


Microsoft Power BI

In March, the average System Price was £26.56/MWh when the system was long and £79.85/MWh when the system was short. The highest daily average price when the system was short was £223.68/MWh, and occurred on 7 March; the system was short for 12 Settlement Periods on this day. The lowest daily average price when the system was long was -£21.99/MWh on 29 March. The system was long for 18 Settlement Periods on this day.

Average System Price by Settlement Period

The graph below shows the variation of average System Prices across the day.

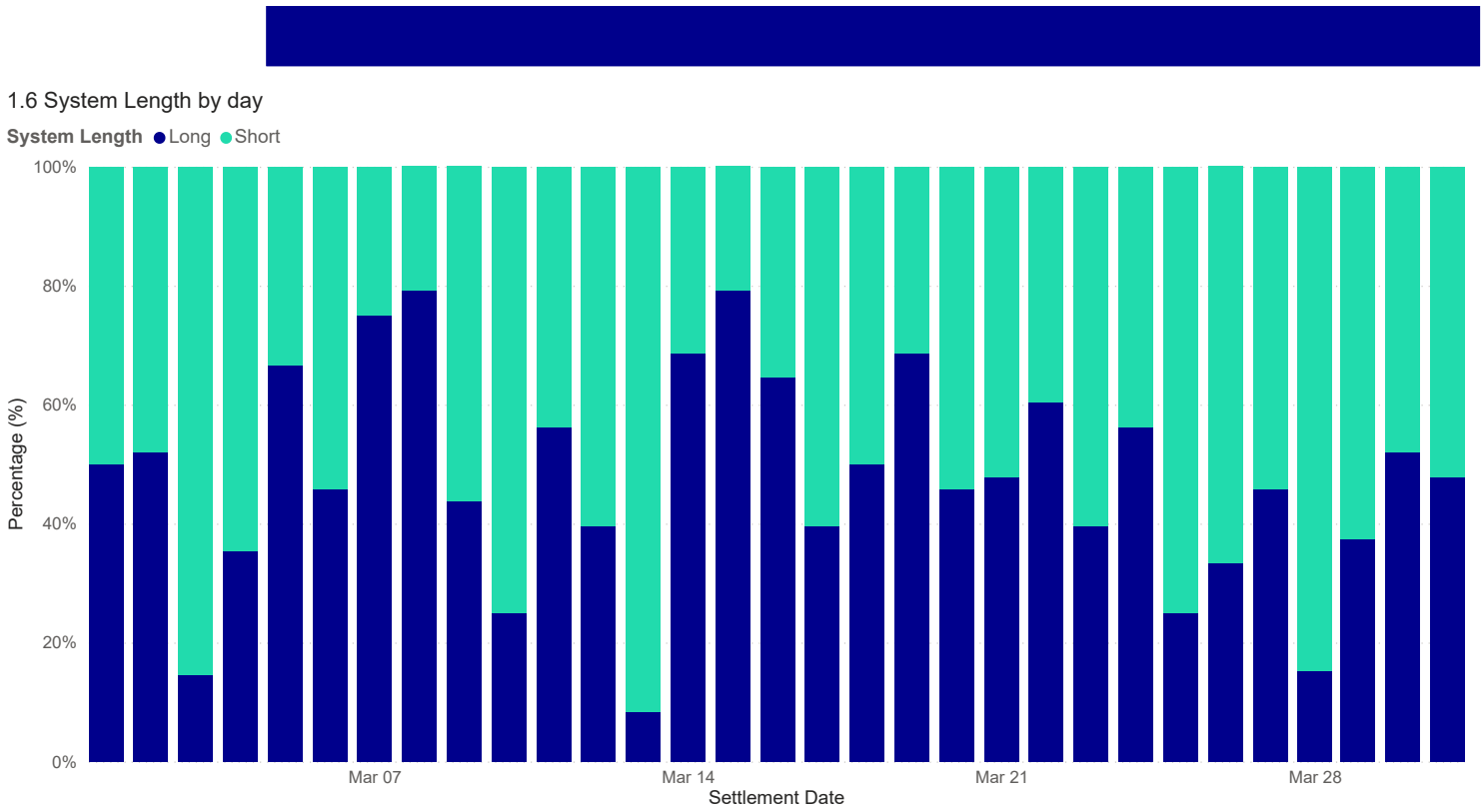


Microsoft Power BI

Short prices were highest in Settlement Period 37, with long prices lowest in Settlement Period 30. The lowest average System Price, regardless of market length, occurred during Settlement Period 10, when the System Price was £35.39/MWh. The daily average long Settlement Period System Prices ranged between £15.16/MWh and £37.91/MWh. Average short Settlement Period prices varied from £57.69/MWh to £165.03/MWh.

Daily System Length

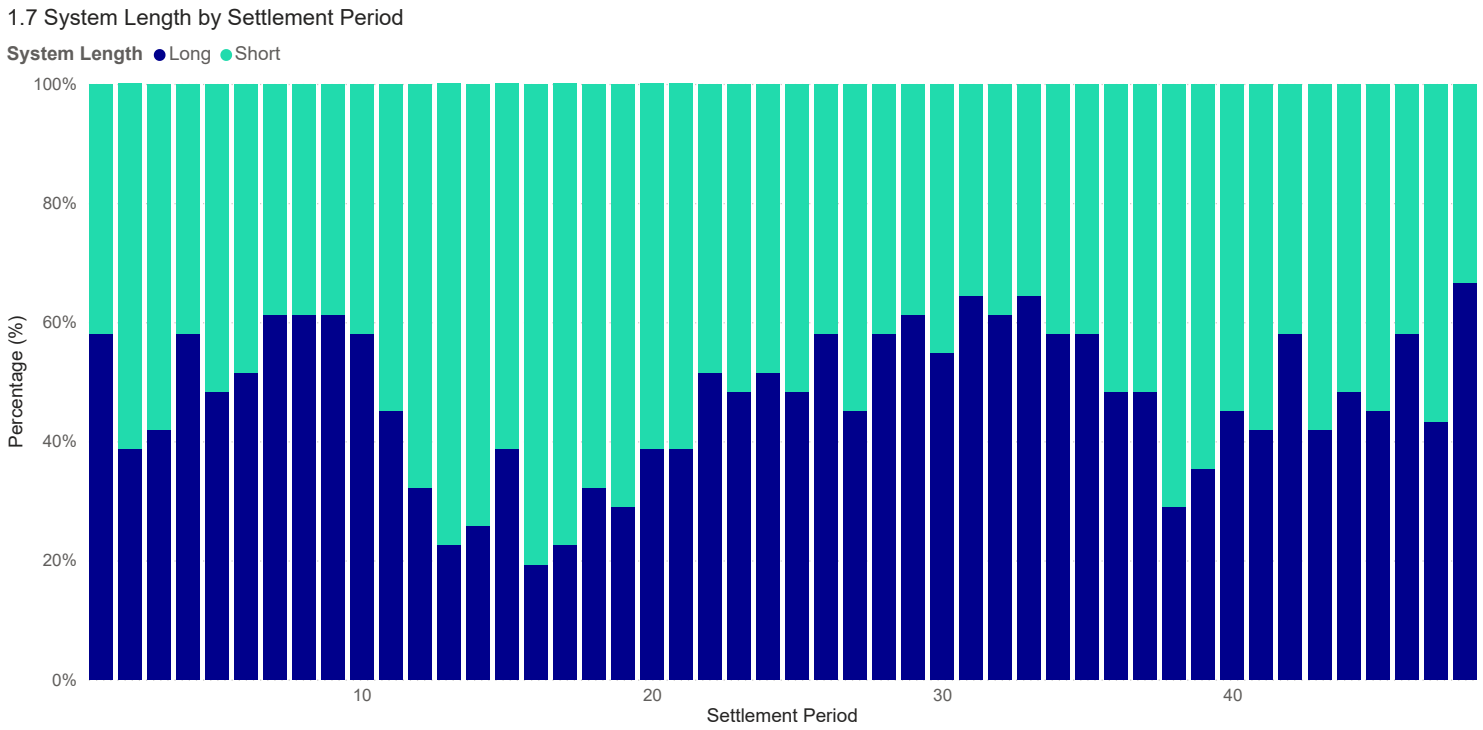
This graph shows system length by day.



Microsoft Power BI

System Length by Settlement Period

This graph shows system length by Settlement Period for March.



Microsoft Power BI

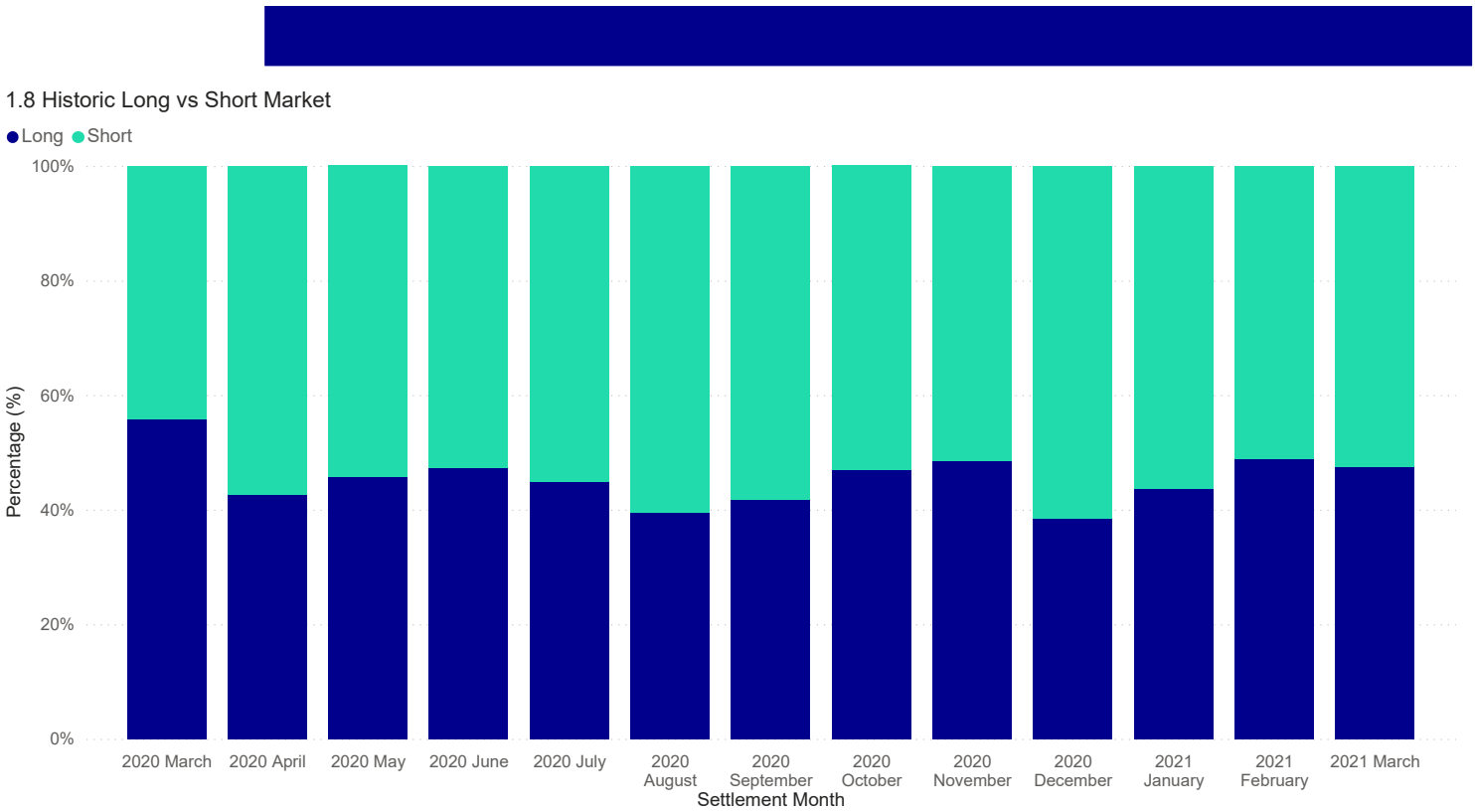
The system was long for 47% of Settlement Periods in March.

On 13 March, the system was short for 44 of 48 Settlement Periods. The long Settlement Periods on this day had an average NIV of -81MWh. The daily average NIV on this day was 394MWh.

Settlement Period 48 had the highest percentage of long Settlement Periods (67%) in March 2021. Due to the clock change day on 28 March, there were Settlement Periods 47 and 48 occurred 30 times whereas all other Settlement Periods occurred 31 times.

Historic long vs short market

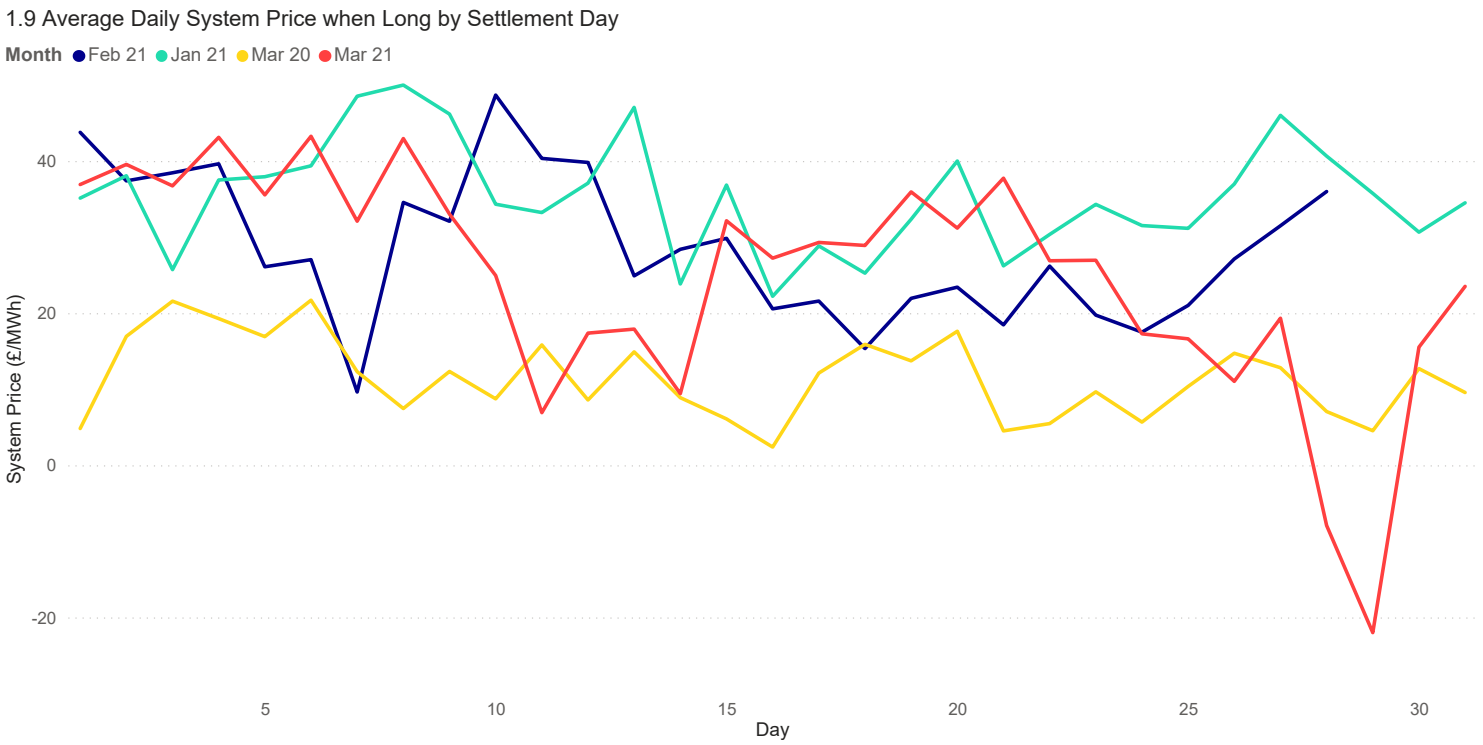
This graph shows the percentage of long and short Settlement Periods over the past year. March 2021 had 47% of long Settlement Periods, compared to 45% per month over the previous 12 months.



Microsoft Power BI

Average Daily System Price when Long by Settlement Day

The graph below displays the daily average System Prices in March 2021 when the system was long compared to the two previous months and the same month last year.

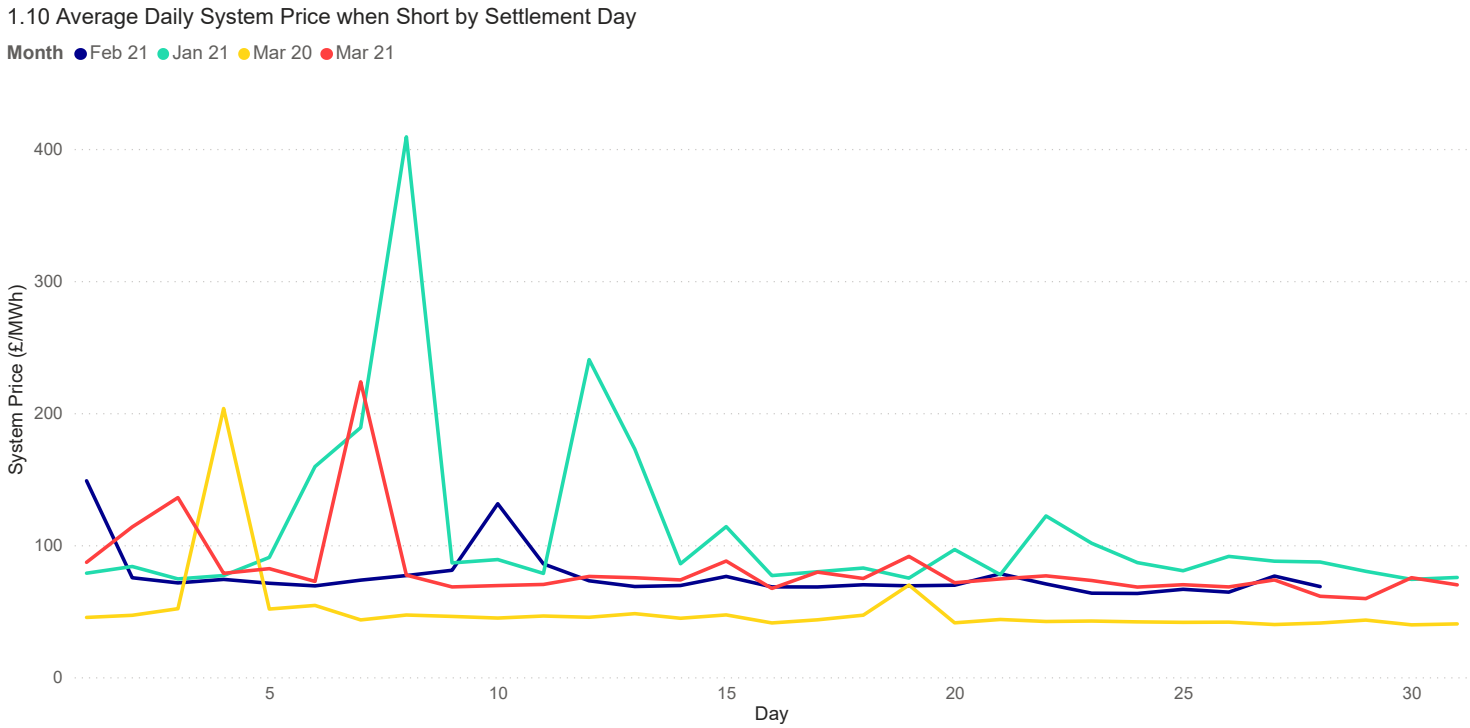


Microsoft Power BI

During March 2021, daily average long System Prices were £13.36/MWh higher in March 2021 than the same month in 2020.

Average Daily System Price when Short by Settlement Day

This graph looks at System Prices from the same months as the previous graph, but when the System was short.

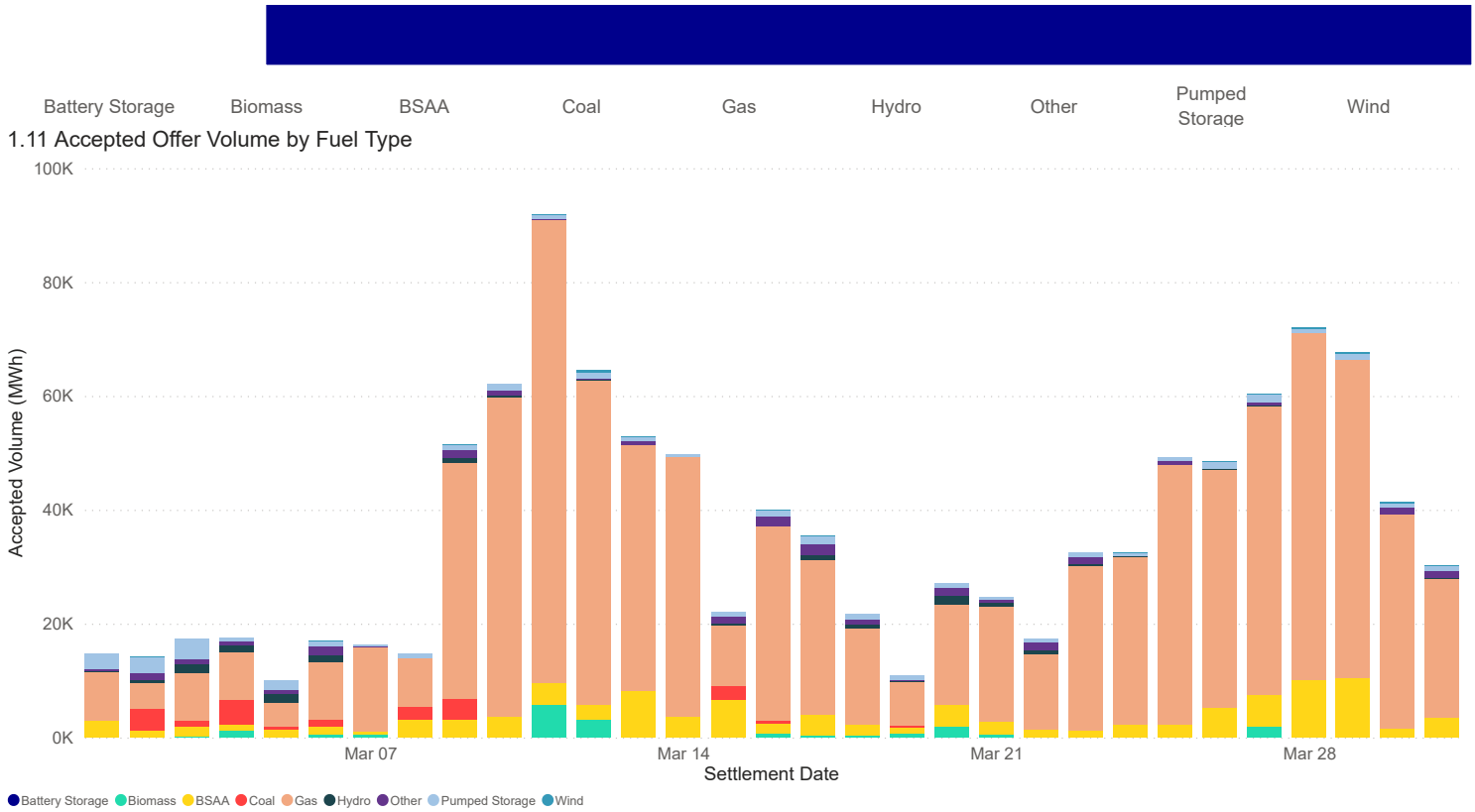


Microsoft Power BI

Short daily average System Prices were £31.65/MWh higher in March 2021 than the same month last year. On the 1 February, the daily average System Price of £148.76/MWh was £104.11/MWh higher than the same date last year.

Accepted Volumes Accepted Offer Volume by Fuel Type

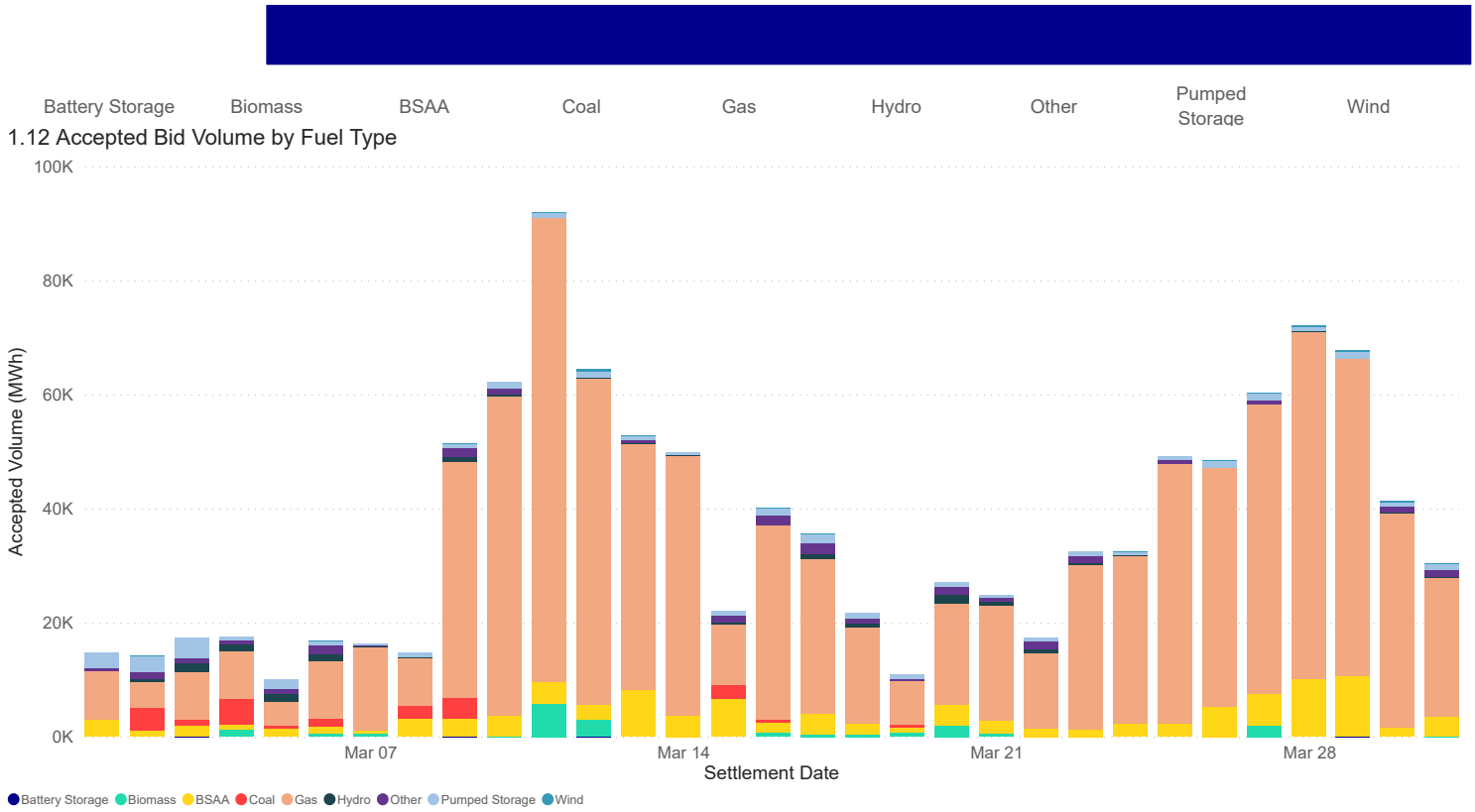
This graph displays the Offer volumes of fuel types that participated in the Balancing Mechanism during March 2021. Offers are balancing actions taken to increase the level of energy on the System. This report now contains balancing volumes from Balancing Services Adjustment Actions (BSAAs). BSAAs include, but are not limited to, balancing actions such as system-to-system services, Short Term Operating Reserve actions taken outside the Balancing mechanism and forward contracted energy products.



Microsoft Power BI

Accepted Bid Volume by Fuel Type

This graph displays the Bid volumes of fuel types that participated in the Balancing Mechanism during March 2021. Bids are balancing actions taken to decrease the level of energy on the System.



Microsoft Power BI

During March, 81% of Offer volume came from Gas BMUs in March.

43% of Bid volume came from Gas BMUs with a further 25% from Wind BMUs. On 11 March 75% of Bid volume was from Wind, the highest of the month.

2 Parameters

In this section, we consider a number of different parameters on the price. We consider:

- The impact of Flagging balancing actions;
- The impact of the Replacement Price;
- The impact of NIV Tagging;
- The impact of PAR Tagging;
- The impact of DMAT and Arbitrage Tagging; and
- How these mechanisms affect which balancing actions feed into the price.

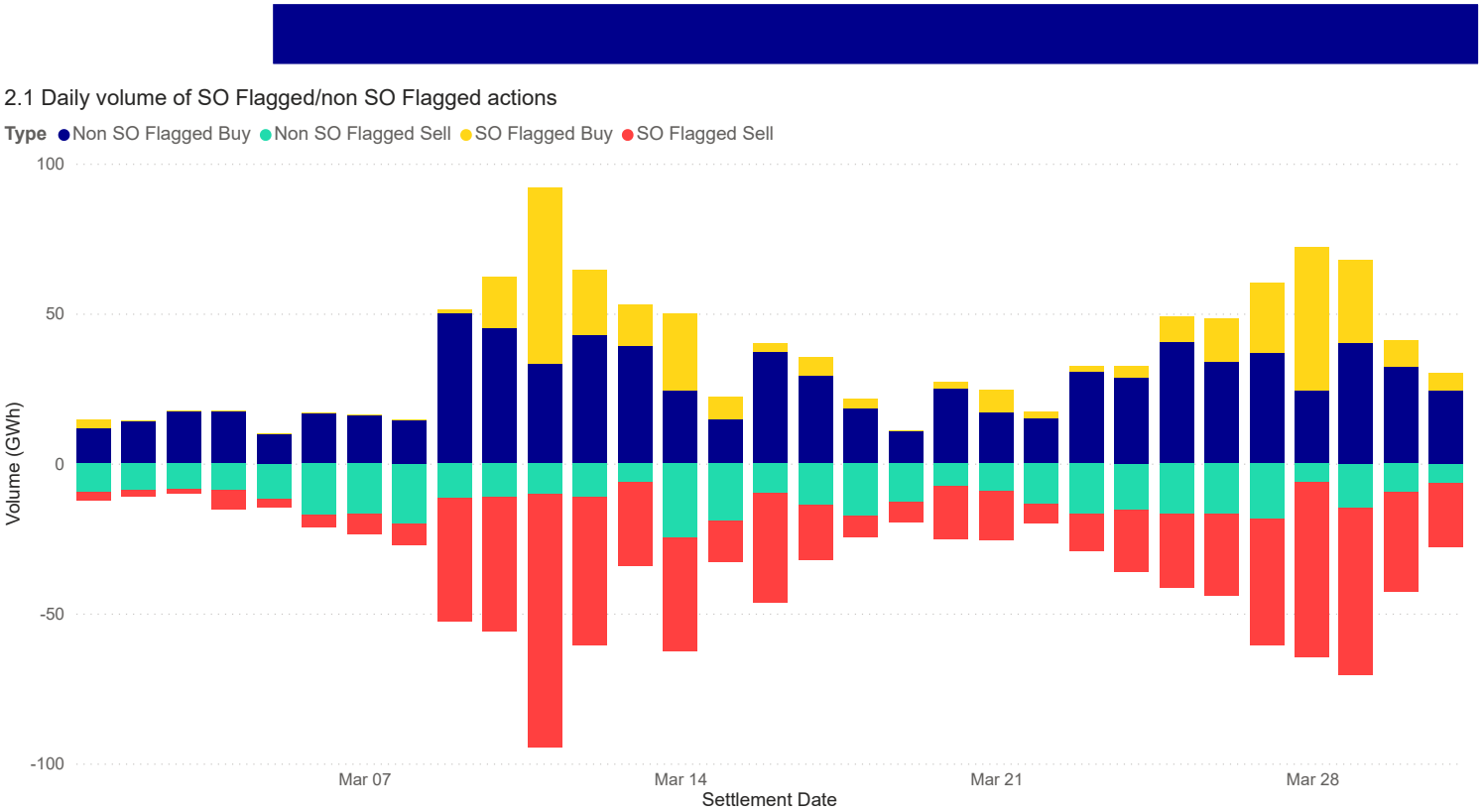
Flagging

The Imbalance Price calculation aims to distinguish between ‘energy’ and ‘system’ balancing actions. Energy balancing actions are those related to the overall energy imbalance on the system (the ‘Net Imbalance Volume’). It is these ‘energy’ balancing actions which the Imbalance Price should reflect. System balancing actions relate to non-energy, system management actions (e.g. locational constraints).

Some actions are ‘Flagged’. This means that they have been identified as potentially being ‘system related’, but rather than removing them completely from the price calculation (i.e. Tagging them) they may be re-priced, depending on their position in relation to the rest of the stack (a process called Classification). The System Operator (SO) flags actions when they are taken to resolve a locational constraint on the transmission network (SO-Flagging), or to correct short-term increases or decreases in generation/demand (Continuous Acceptance Duration Limit (CADL) Flagging).

Daily volume of SO-Flagged/non-Flagged actions

This graph shows the volumes of Buy and Sell actions in March 2021 that have been Flagged by the SO as being constraint related. On 28 March, 91% of Sell volume was SO-Flagged.



Microsoft Power BI

65% of Sell balancing action volume taken in March had an SO-Flag, compared with 78% the previous month. 24% of SO-Flagged Sell actions came from CCGT BMUs, 33% came from Balancing Service Adjustment Actions (BSAAs) and 37% from Wind BMUs. The average initial price (i.e. before any re-pricing) of a SO-Flagged Sell action was -£43.23/MWh.

28% of Buy balancing action volume taken in March had an SO-Flag, compared to 15% in February. 82% of SO-Flagged Buy actions came from CCGT BMUs and 17% from BSAAs. The average initial price of a SO-Flagged Buy action was £77.26/MWh.

Any actions with a total duration of less than the CADL are flagged. The CADL is currently set at 10 minutes.

0.5% of Buy action volume and 0.4% of Sell action volume were CADL Flagged in March. The majority of CADL Flagged Buy actions (97%), and CADL Flagged Sell actions (66%) came from Pumped Storage BMUs, with CCGT BMUs accounting for a further 11% of CADL Flagged Sell Actions.

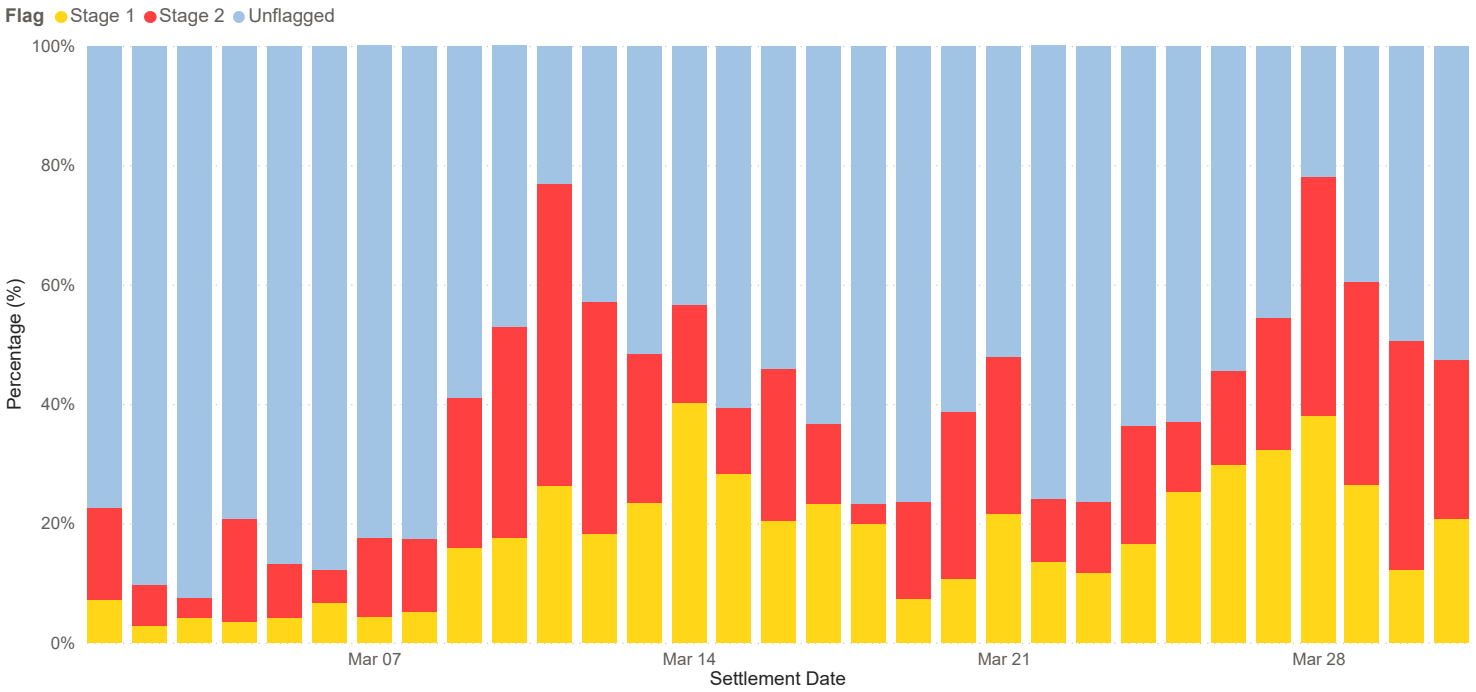
SO-Flagged and CADL Flagged actions are known as ‘First-Stage Flagged’. First-Stage Flagged actions may become ‘Second-Stage Flagged’ depending on their price in relation to other Unflagged actions. If a First-Stage Flagged balancing action has a more expensive price than the most expensive First-Staged Unflagged balancing action, it becomes Second-Stage Flagged. This means it is considered a system balancing action and becomes unpriced.

Flagged Balancing Volumes

This graph shows First and Second-Stage Flagged action volumes as a proportion of all actions taken on the system. Note these are all the accepted balancing actions – only a proportion of these will feed through to the final price calculation.

In March, 38% of balancing volume received a First-Stage Flag with 55% of this volume going on to receive a Second-Stage Flag. On the 28 March, 78% of balancing volume was flagged; with 51% of this volume receiving a Second Stage Flag.

2.2 Flagged volume percentage

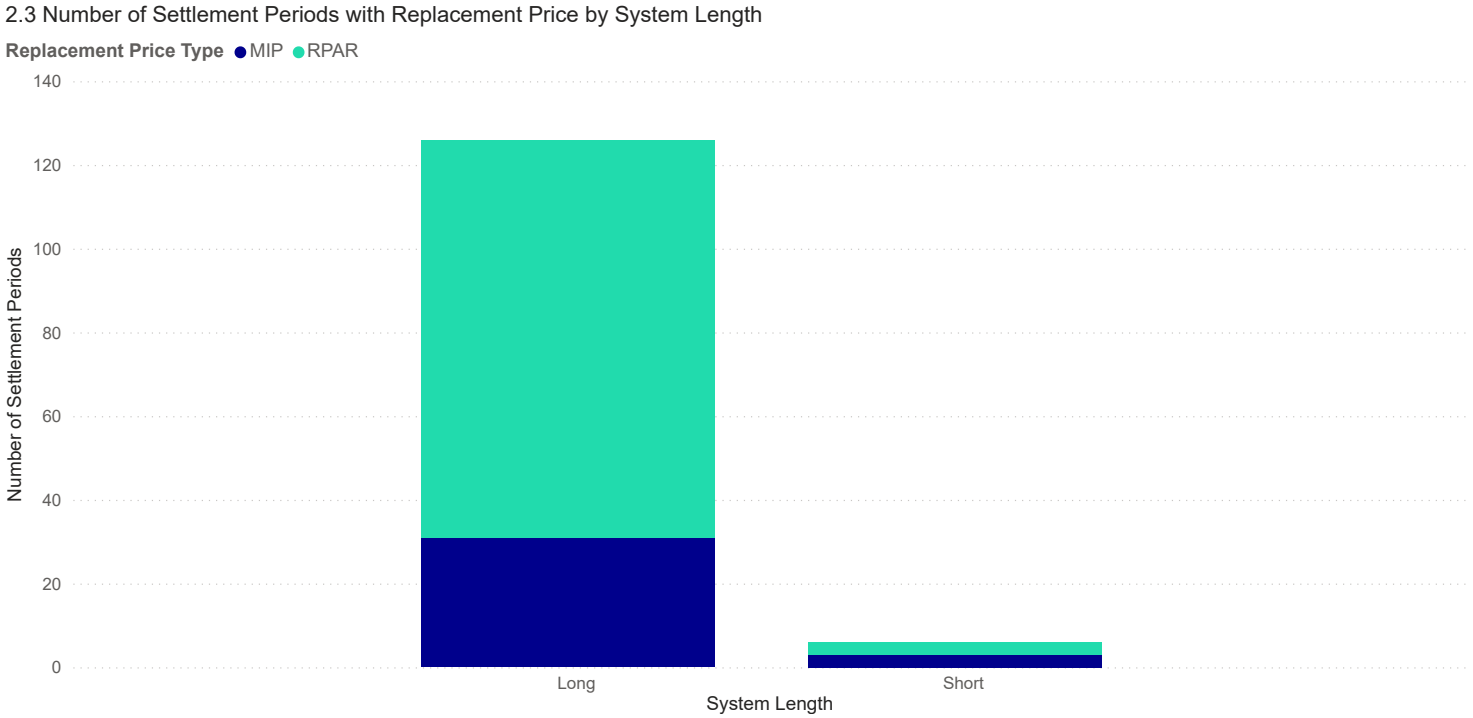


Microsoft Power BI

The Replacement Price

Any Second-Stage Flagged action volumes left in the NIV will be repriced using the Replacement Price. The Replacement Price is either based on the Replacement Price Average Reference (RPAR currently based on the most expensive 1MWh of Unflagged actions), or if no Unflagged actions remain after NIV Tagging, the Market Index Price (MIP). In March, 98 (7%) Settlement Periods had a Replacement Price based on the RPAR and 34 (2%) Settlement Periods had a Replacement Price based on the MIP. However, the majority of Settlement Periods (91%) did not have a Replacement Price.

Number of Settlement Periods with Replacement Price by System Length displays the count of Settlement Periods which had a Replacement Price applied, split by the system length and if the Replacement Price was based on RPAR or the MIP.



Microsoft Power BI

Average Price and Replacement Price by System Length

This table displays the average original and Replacement Price of Second-Stage Flagged actions

System Length	Original Price	Replacement Price
Long	-7.21	18.52
Short	75.79	62.68

Source: Elexon

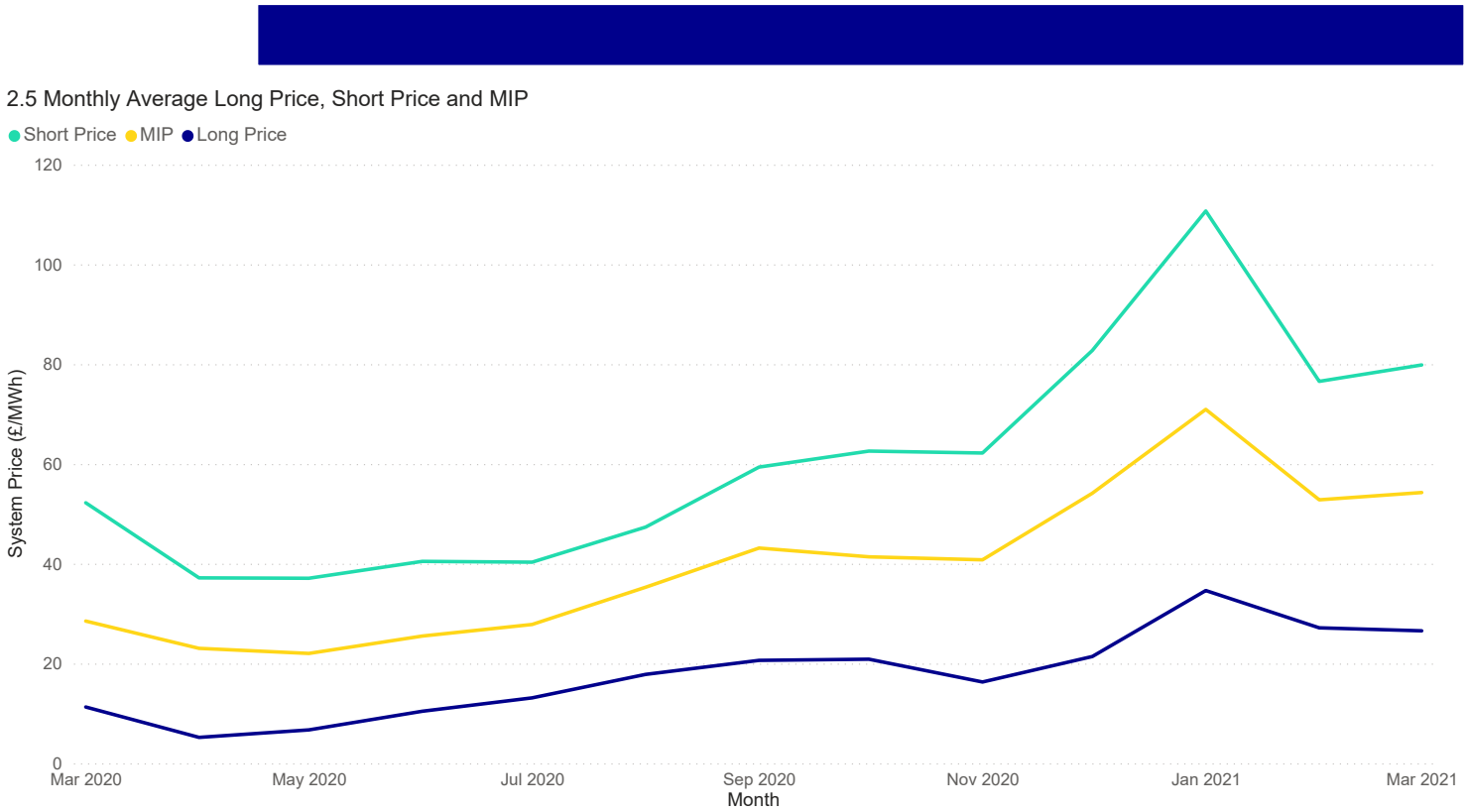
Sell actions will typically have their prices revised upwards by the Replacement Price for the purposes of calculating the System Price. In total, 65% of Sell volume in March was Flagged. Of this Flagged Sell volume, 4% was assigned a Replacement Price. The average original price of a Second-Stage Flagged repriced Sell action was -£7.21/MWh and the average Replacement Price for Sell actions (when the System was long) was £18.52/MWh.

28% of Buy volume were Flagged; 0.3% of this volume had the Replacement Price applied.The average original price of a Second-Stage Flagged repriced Buy action was £75.79/MWh and the average Replacement Price for Buy actions (when the System was long) was £62.68/MWh.

If there are no Unflagged actions remaining in the NIV, the Replacement Price will default to the MIP. This occurred in 31 long and three short Settlement Periods in March, compared to 84 long Settlement Periods the previous month.

Monthly Average Long Price, Short Price and MIP

This graph compares the monthly average MIP to the monthly average long and short System Prices for the past 13 months. The monthly average long price decreased by -£0.60/MWh to £26.56/MWh, the short price increased by £3.29/MWh to £79.85/MWh and the MIP increased by £1.46/MWh to £54.28/MWh in March 2021 compared to the previous month.



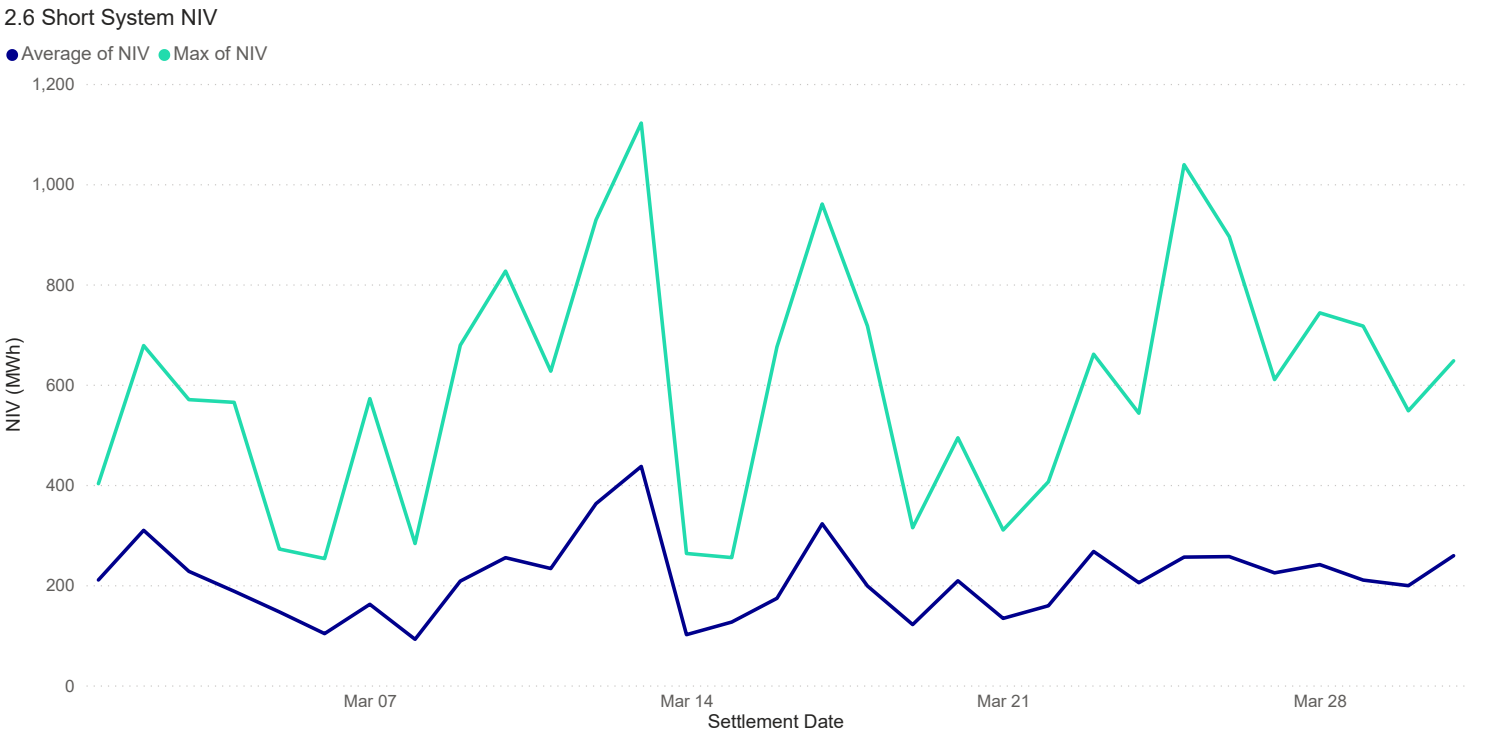
Microsoft Power BI

NIV and NIV Tagging

The Net Imbalance Volume (NIV) represents the direction of imbalance of the system – i.e. whether the system is long or short overall.

Short system NIV

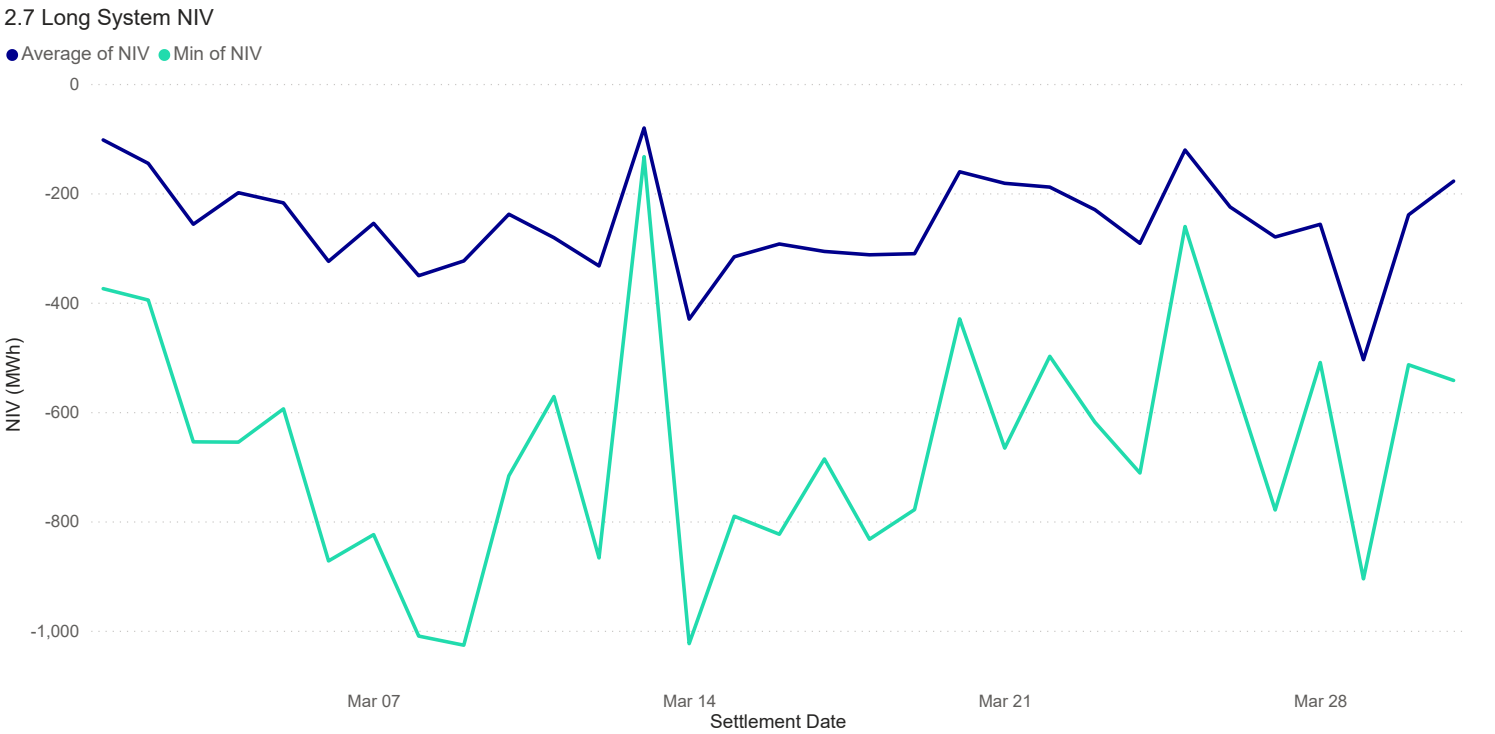
This graph shows the greatest and average NIV when the system was short.



Microsoft Power BI

Long system NIV

This graph shows the minimum and average NIVs when the system was long. Note short NIVs are depicted as positive volumes and long NIVs are depicted as negative volumes.



Microsoft Power BI

In almost all Settlement Periods, the System Operator will need to take balancing actions in both directions (Buys and Sells) to balance the system. However, for the purposes of calculating an Imbalance Price there can only be imbalance in one direction (the Net Imbalance). 'NIV Tagging' is the process which subtracts the smaller stack of balancing actions from the larger one to determine the Net Imbalance. The price is then derived from these remaining actions.

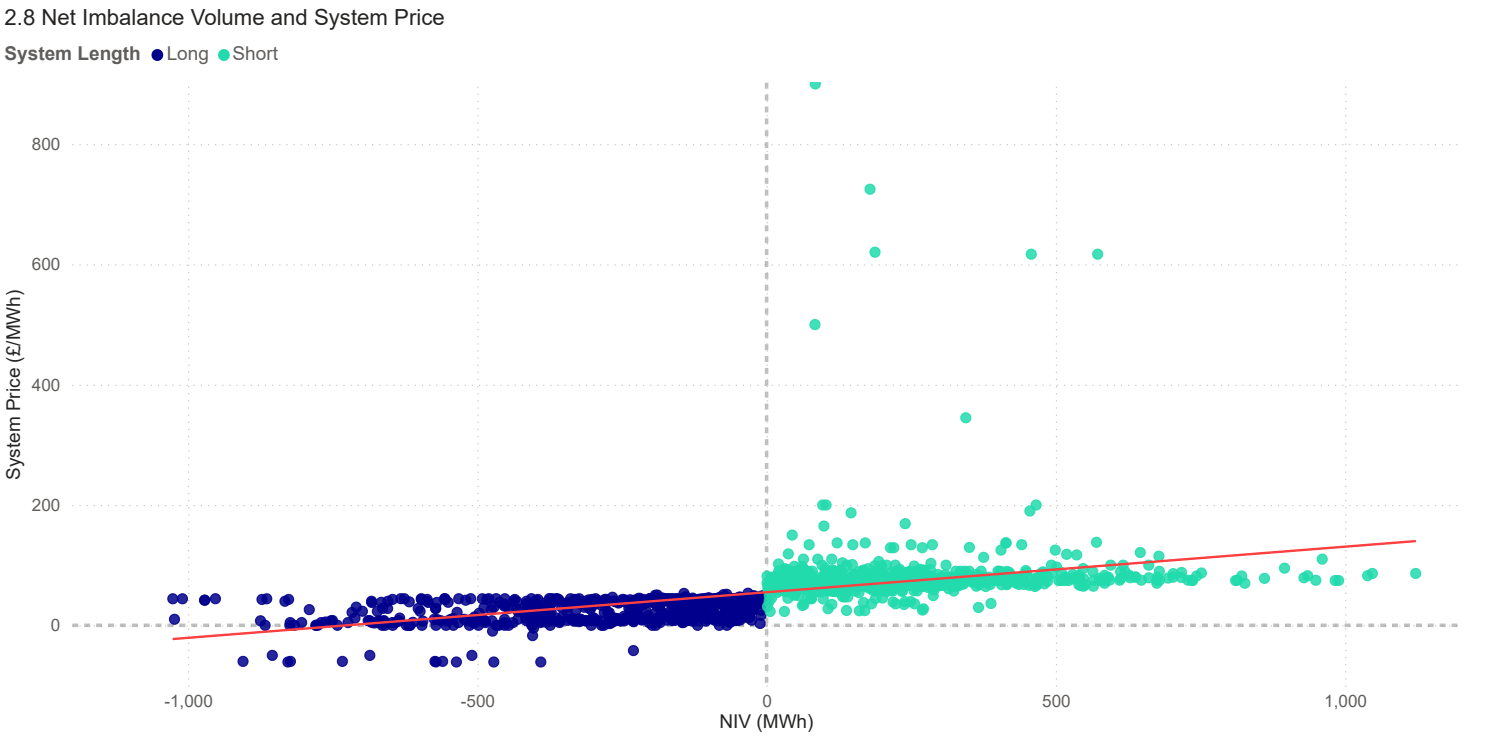
NIV Tagging has a significant impact in determining which actions feed through to prices. In March, 83% of volume was removed due to NIV tagging. The most expensive actions are NIV Tagged first; hence NIV Tagging has a dampening effect on prices when there are balancing actions in both directions.

The maximum short system NIV of the month (1,122MWh) was seen in Settlement Period 38 on 13 March, where the System Price was £86.20/MWh.

The minimum long system NIV of the month was -1,026MWh, in Settlement Period 22 on 9 March, where the System Price was £44.10/MWh.

Net Imbalance Volume and System Price

This graph displays a scatter graph of Net Imbalance Volume and System Prices. The dashed lines display a 0MWh NIV and a £0.00/MWh System Price, the red line is a trendline with the expected System Price from a particular NIV based on the month's data.



Microsoft Power BI

There were 705 long Settlement Periods in March, 38 of which occurred on 8 March, 15 March. The average NIV on this day was -229MWh, with the lowest NIV (-1,010MWh) occurring in Settlement Period 31. All five System Prices exceeding £500.00/MWh had a short NIV, however, only two of these Settlement PEriods had a short NIV greater than the average short NIV in March (231MWh). You can read more about the increase in System Prices over £500.00/MWh in Elexon's BSC Insight: Unprecedented Price Spikes in 2021 (https://www.elexon.co.uk/article/bsc-insight-unprecedented-price-spikes-in-2021).

PAR Tagging

PAR Tagging is the final step of the Imbalance Price calculation. It takes a volume-weighted average of the most expensive 1MWh of actions left in the stack. The value of PAR is set at 1MWh.

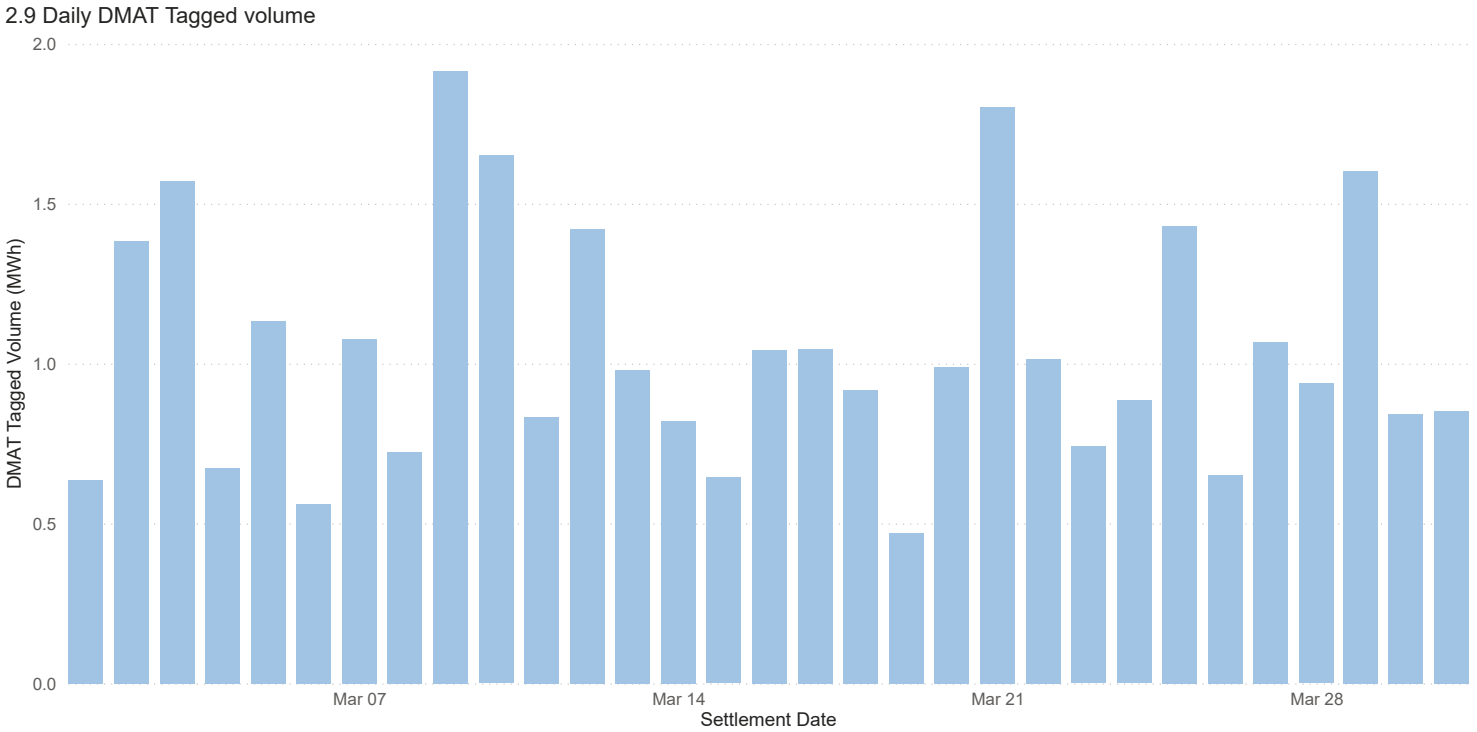
PAR Tagging is active in almost all Settlement Periods, the only periods not affected by the new parameter have a NIV of less than 1MWh.

During March, there were 4 Settlement Periods where PAR Tagging was inactive. The average NIV in these Settlement Periods was 0.08MWh. Settlement Period 41 on 26 March had the lowest absolute NIV (-0.28MWh), and therefore was the most balanced Settlement Period of the month.

DMAT and Arbitrage Tagged Volumes

Some actions are always removed from the price calculation (before NIV Tagging). These are actions which are less than the De Minimis Acceptance Threshold (DMAT) Tagging or Buy actions which are either the same price or lower than the price of Sell actions (Arbitrage Tagging). The DMAT is set at 0.1MWh.

Daily Volume of DMAT Tagged volume This graph shows the volumes of actions removed due to DMAT Tagging.

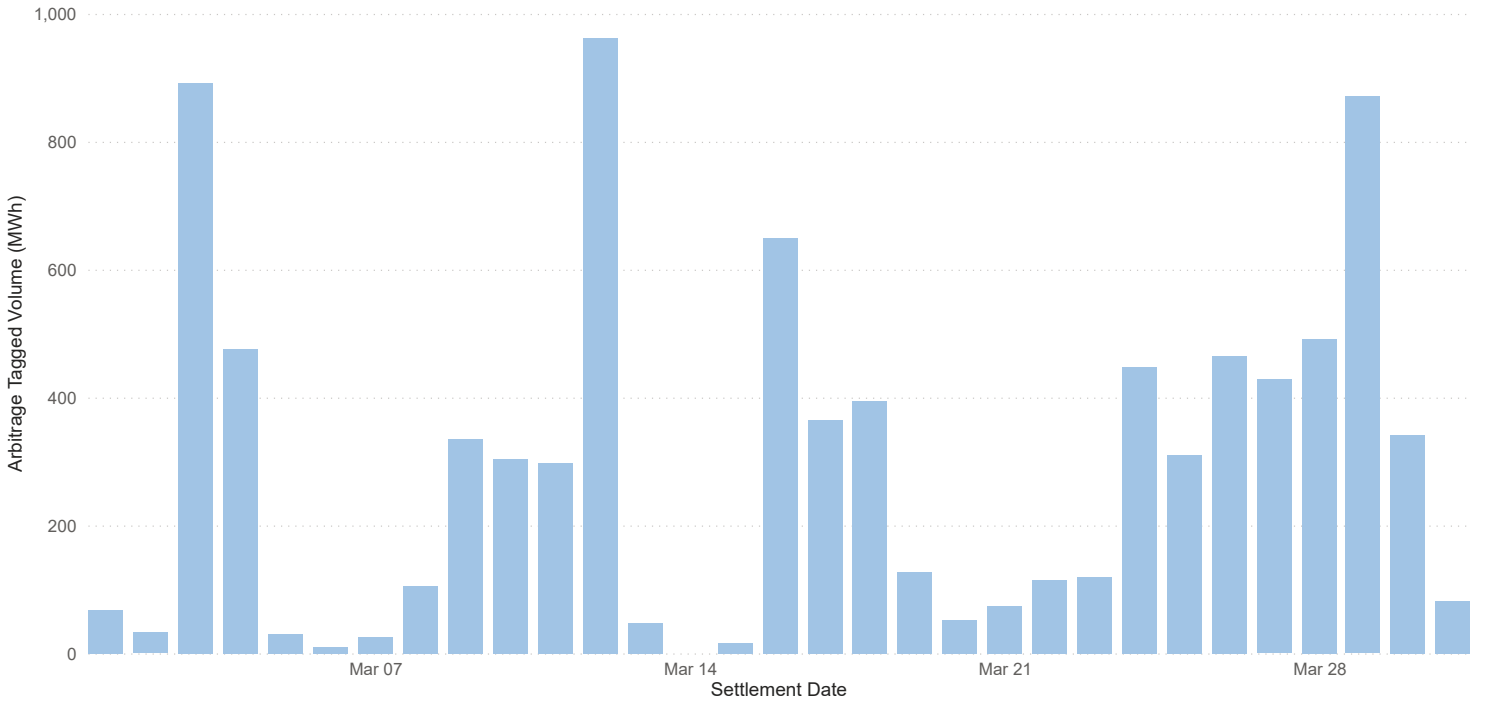


32.3MWh of total Buy and Sell volume was removed by DMAT Tagging in March, compared to 29.4MWh the previous month. 47% of the DMAT Tagged volume came from CCGT BMUs, 22% from other BMUs and 6% from Gas BMUs.

Daily volume of Arbitrage Tagged volume

This graph shows the volumes of actions that were removed due to Arbitrage Tagging.

2.10 Daily Arbitrage Tagged volume



Microsoft Power BI

8,939MWh of total Buy and Sell volume was removed by Arbitrage Tagging in March. 48% of the Arbitrage Tagged came from CCGT BMUs, 26% from BSAAs and 15% from Wind BMUs.

In March, the average initial price of an Arbitrage Tagged Buy action was £46.86/MWh, and for a Sell action was £46.70/MWh. The maximum initial price of an Arbitrage Tagged Sell action was £311.39/MWh, and the lowest priced Arbitrage Tagged Buy action was -£48.57/MWh.

On 12 March, 962MWh of actions were Arbitrage Tagged, representing 0.8% of the daily volume of balancing actions. The average price of an Arbitrage Tagged Buy action was £20.47/MWh, and for a Sell action was £41.19/MWh on this day. 38% of the Abitrage Tagged Volume came from Wind BMUs, 33% from BSAAs and 15% from CCGT BMUs.

3 Balancing Services

Short Term Operating Reserve (STOR) costs and volumes

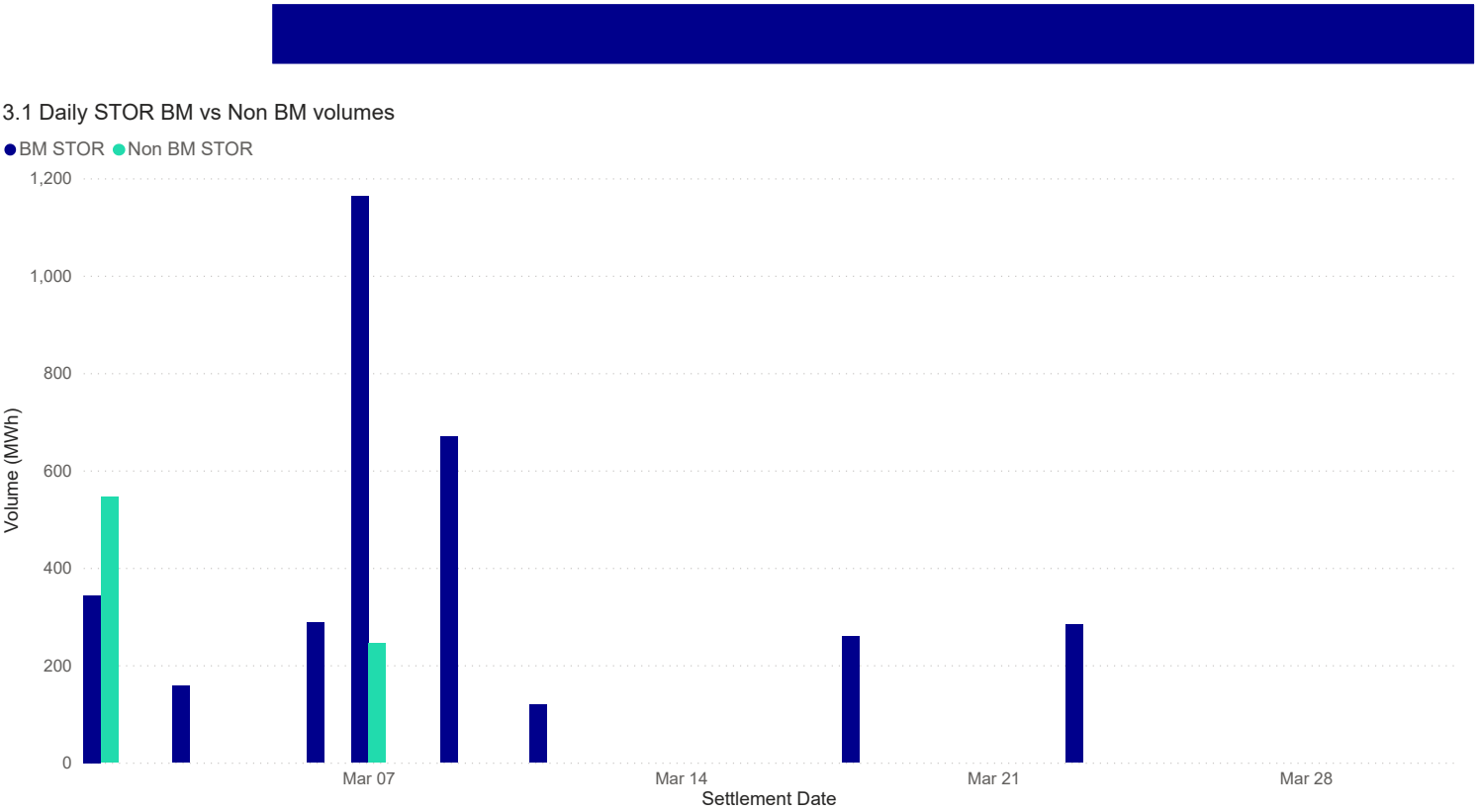
This section covers the balancing services that the System Operator (SO) takes outside the Balancing Mechanism that can affect the price.

In addition to Bids and Offers available in the Balancing Mechanism, the SO can enter into contracts with providers of balancing capacity to deliver when called upon. These additional sources of power are referred to as reserve, and most of the reserve that the SO procures is called Short Term Operating Reserve (STOR).

Under STOR contracts, availability payments are made to the balancing service provider in return for capacity being made available to the SO during specific times (STOR Availability Windows). When STOR is called upon, the SO pays for it at a pre-agreed price (its Utilisation Price). Some STOR is dispatched in the Balancing Mechanism (BM STOR) while some is dispatched separately (Non-BM STOR).

Daily STOR vs Non-BM STOR volume

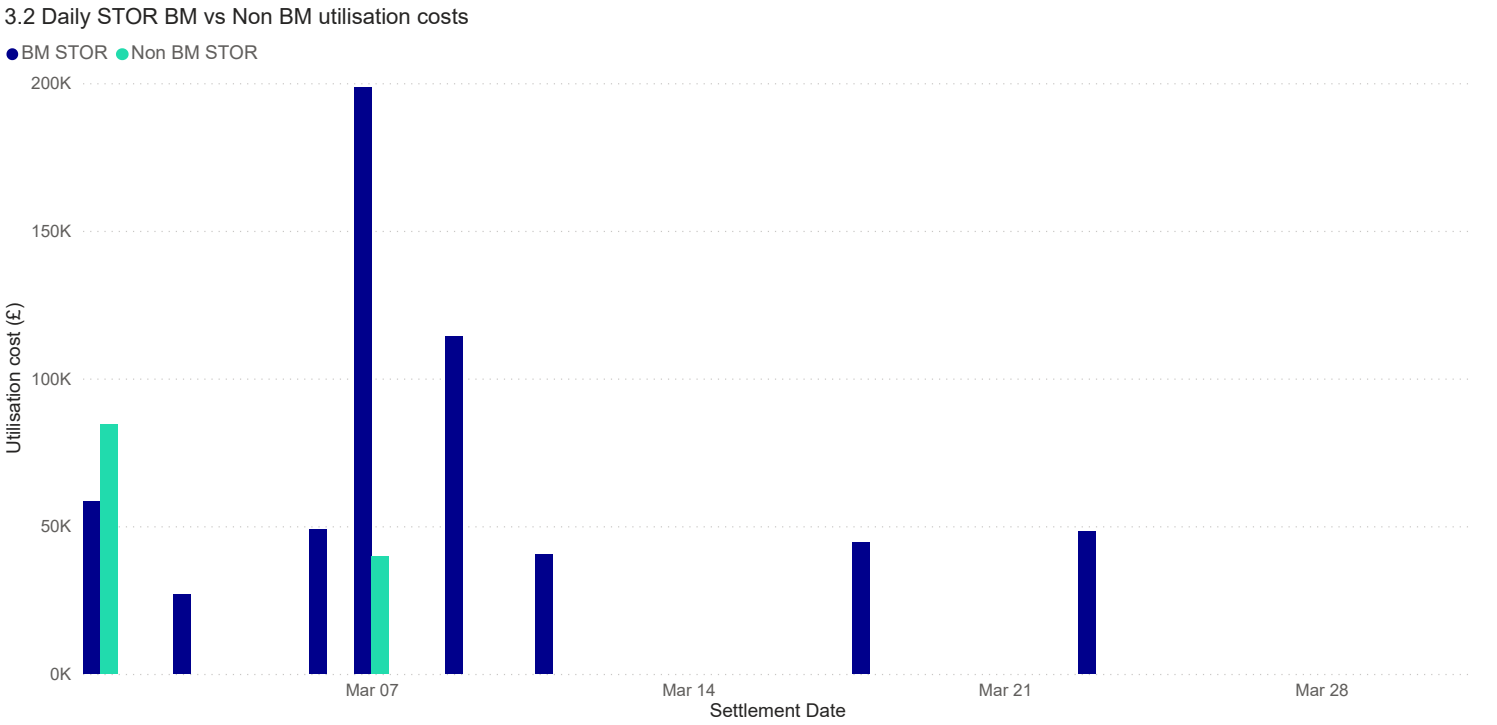
This graph gives STOR volumes that were called upon during the month split into BM STOR and non-BM STOR. 19% of the total STOR volume utilised in March came from outside of the Balancing Mechanism.



Microsoft Power BI

Daily STOR vs Non-BM STOR utilisation costs

This graph shows the utilisation costs of this capacity. The average Utilisation Price for STOR capacity in March was £172.86/MWh; £176.66/MWh for BM STOR and £157.04/MWh for non-BM STOR.



Microsoft Power BI

On 7 March the largest amount was spent on STOR volume for the month (£238,167), of which 83% of the cost was BM STOR and 17% was non-BM STOR. The utilised BM STOR volume on this day was 1,163MWh, compared to the average of 106MWh across the month.

De-Rated Margin, Loss of Load Probability and the Reserve Scarcity Price

There are times when the Utilisation Prices of STOR plants are uplifted using the **Reserve Scarcity Price (RSVP)** in order to calculate System Prices. The RSVP is designed to respond to capacity margins, so rises as the system gets tighter (the gap between available and required generation narrows). It is a function of **De-Rated Margin (DRM)** at Gate Closure, the likelihood that this will be insufficient to meet demand (the **Loss of Load Probability**, LoLP) and the **Value of Lost Load** (VoLL, set at £6,000/MWh from 1 November 2018).

Minimum and average DRMs This graph shows the daily minimum and average Gate Closure DRMs for March 2021.

Microsoft Power BI

The System Operator has determined a dynamic relationship between each DRM and the LoLP, which will determine the RSVP.

The minimum DRM in March was 474MW on 6 March in Settlement Period 37 (compared to 511MW in February). This DRM corresponded to a LoLP of 0.244 and a RSVP of £1,461.01/MWh (see **Top 5 LoLPs and RSVPs**).

The RSVP re-prices STOR actions in the Imbalance Price calculation if it is higher than the original Utilisation Price. In total there were three Settlement Periods where a total of 27 actions were repriced with the RSVP during March.

Top 5 LoLPs and RSVPs

Settlement Date	Settlement Period	DRM (MW)	LoLP	RSVP (£/MWh)	RSVP Used	System Price (£/MWh)	System Length
06/03/2021	37	474	0.243	1,461.01	Yes	43.10	Long
06/03/2021	38	950	0.097	579.88	No	43.00	Long
06/03/2021	36	1,078	0.061	368.44	Yes	43.00	Long
07/03/2021	37	1,250	0.049	295.16	Yes	616.98	Short
06/03/2021	35	1,741	0.008	46.12	No	43.00	Long

Source: Elexon