ISG236-SPAR

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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 October 2020

1 System Prices and length

This report covers the month of October. 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. **Table 1.1** gives a summary of System Prices for October, with values shown in £/MWh.

1.1 System Price summary by month (£/MWh)

System Length	Min	Max	Median	Mean	Std.Dev
Long	-63.93	54.91	24.27	20.87	12.57
Short	30.00	200.00	61.49	62.47	12.58

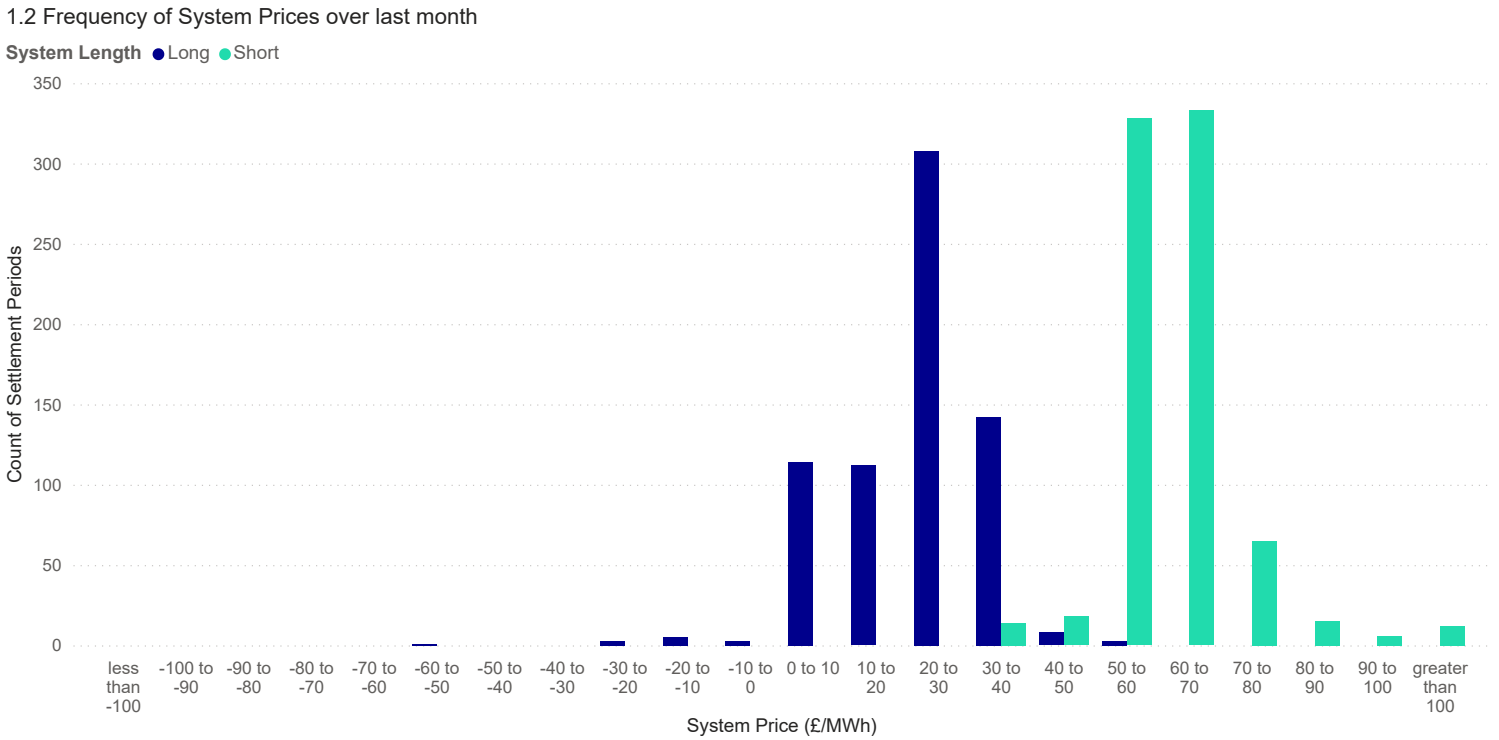
Source: Elexon

Graph 1.2 shows the distribution of System Prices across Settlement Periods in October 2020 when the market was long and short. 80% of System Prices were between £12.70/MWh and £67.52/MWh regardless of system length. When the system was long, 80% of prices were between £3.90/MWh and £32.56/MWh. When the system was short, 80% of prices were between £53.50/MWh and £72.50/MWh.

System Prices were £100/MWh or more on 12 occasions in October 2020, compared to 31 times in September. The highest System Price of the month, £200.00/MWh, occurred in Settlement Period 39 on 8 October. The price was set by Offers from four Embedded OCGT BM Units and one Transmission System connected OCGT BM Unit all priced at £200.00/MWh. This is the ninth highest System Price of 2020.

There were 25 Settlement Periods where the System Price was less than £0/MWh in October, with the lowest System Price of -£63.93/MWh occurring in Settlement Period 44 on 29 October. The price was set by Bids from five different Wind BMUs all priced at -£63.93/MWh.

1.2 Frequency of System Prices over last month



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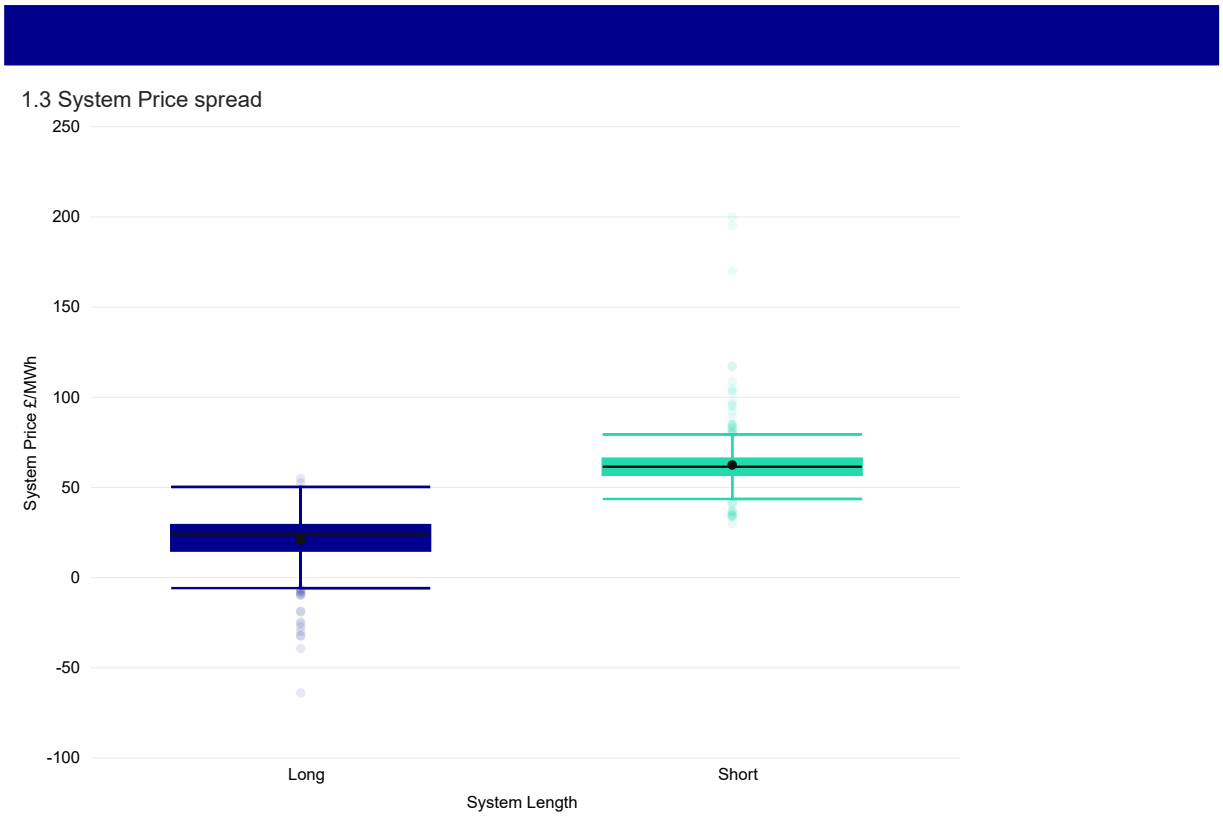
Graph 1.3 displays the spread of System Prices in October 2020 as a box plot diagram, split between a short and long system. The middle line in each box represents the median System Price of the month, which is £61.49/MWh for short Settlement Periods and £24.27/MWh for long Settlement Periods. Each box edge represents the lower and upper quartiles (25th and 75th percentile respectively), with the Interquartile Range (difference between the Upper and Lower quartiles) being £9.00/MWh for short System Prices and £14.18/MWh for long System Prices.

1.3 System Price spread



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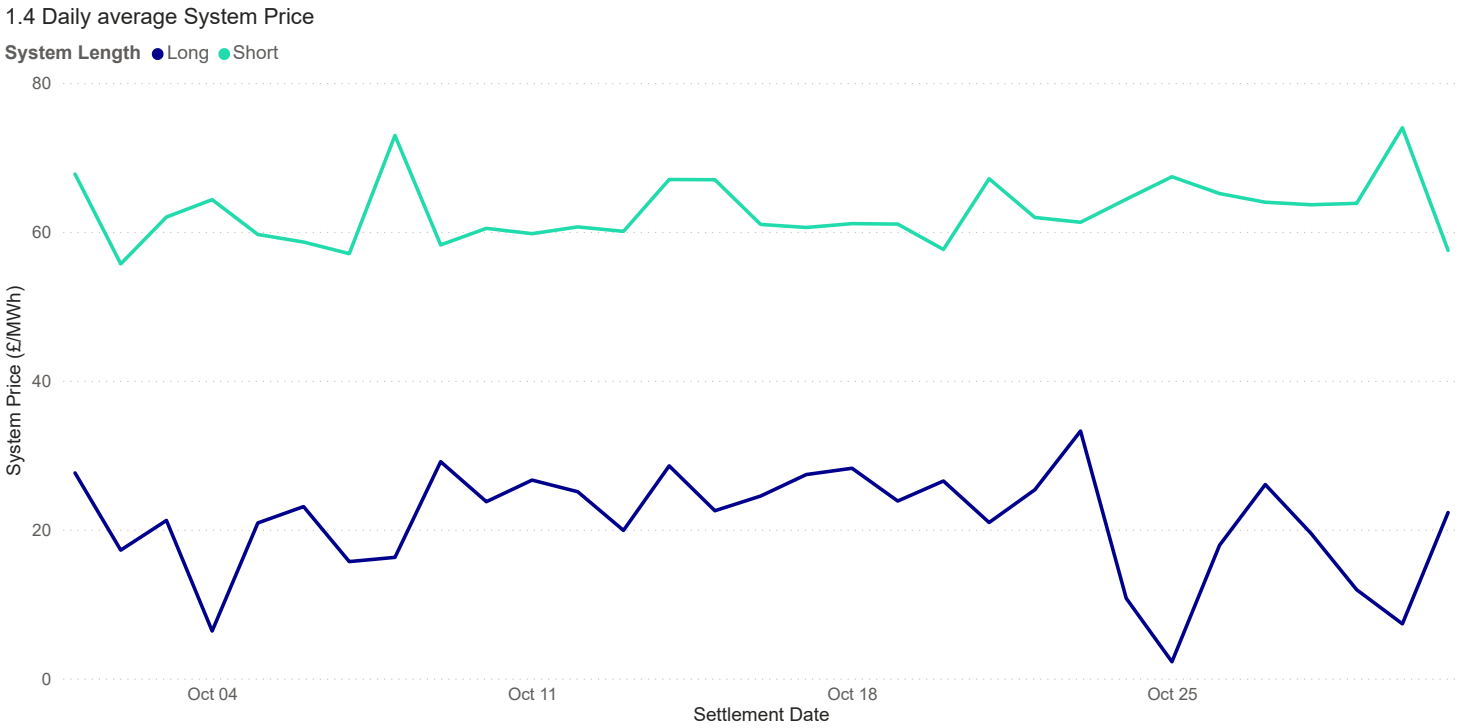
Outliers are shown on the graph as circles, and have been defined as being greater than 1.5 times the Interquartile Range (IQR) away from the Upper and Lower quartiles. Under this definition, 21 long and 51 short System Prices in October were outliers. Of the 21 long outliers, 19 were less than the lower outlier boundary. The prices of Long outliers ranged from -£63.93/MWh (the lowest System Price of the month) to £54.91/MWh. The highest System Price of the month, £200.00/MWh, was 3.25 times the median short System Price for the month.

Graph 1.4 shows daily average System Prices over the last month. In October, the average System Price was £20.87/MWh when the system was long and £62.47/MWh when the system was short. The highest daily average price when the system was short was £73.99/MWh, and occurred on 30 October; the system was short for 24 Settlement Periods on this day. The lowest daily average price when the system was long was £2.26/MWh on 25 October. The system was long for 34 Settlement Periods on this day.

1.4 Daily average System Price



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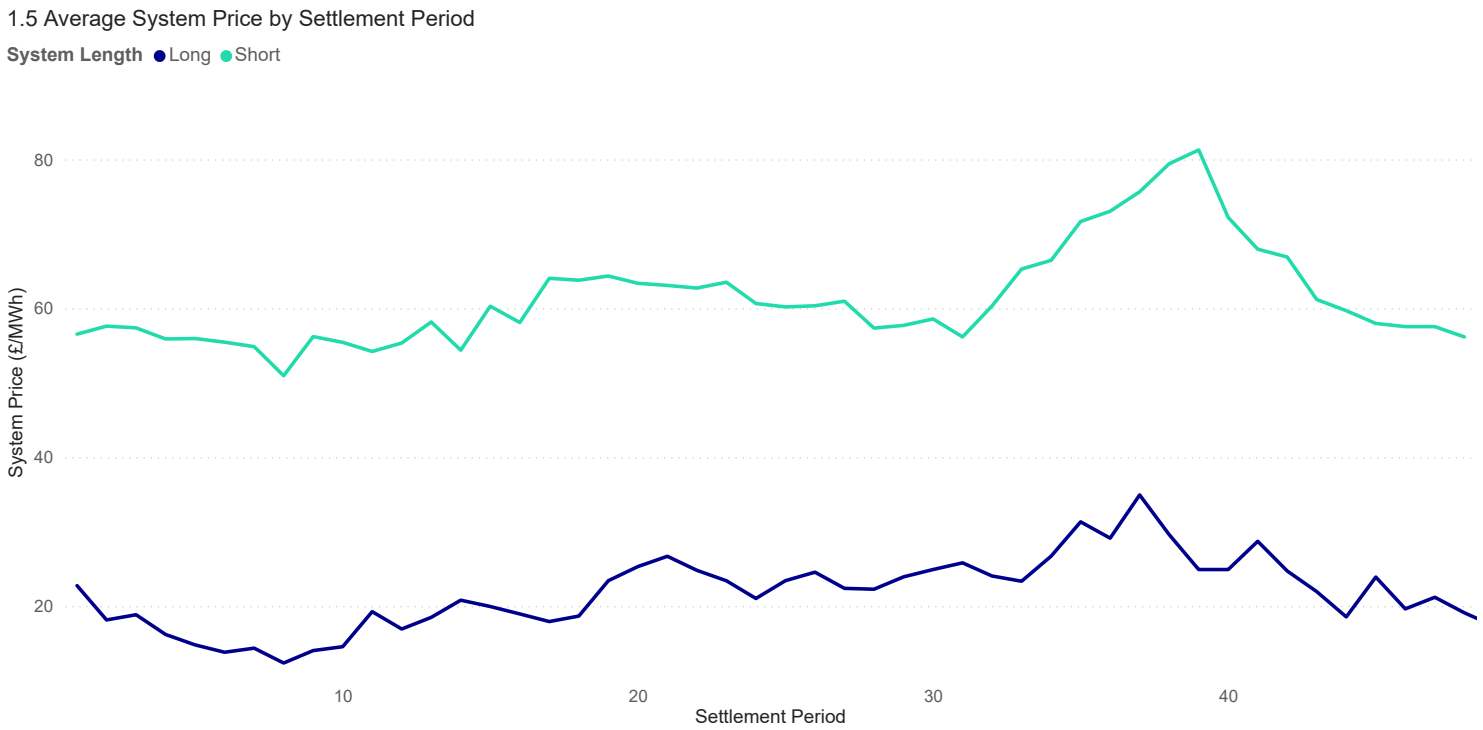
Graph 1.5 shows the variation of average System Prices across the day. Short prices were highest in Settlement Period 39, with long prices lowest in Settlement Period 8. The lowest average System Price, regardless of market length, occurred during Settlement Period 50, when the System Price was £14.71/MWh. The daily average long Settlement Period System Prices ranged between £12.36/MWh and £34.94/MWh. Average short Settlement Period prices varied from £50.95/MWh to £81.28/MWh.

1.5 Average System Price by Settlement Period



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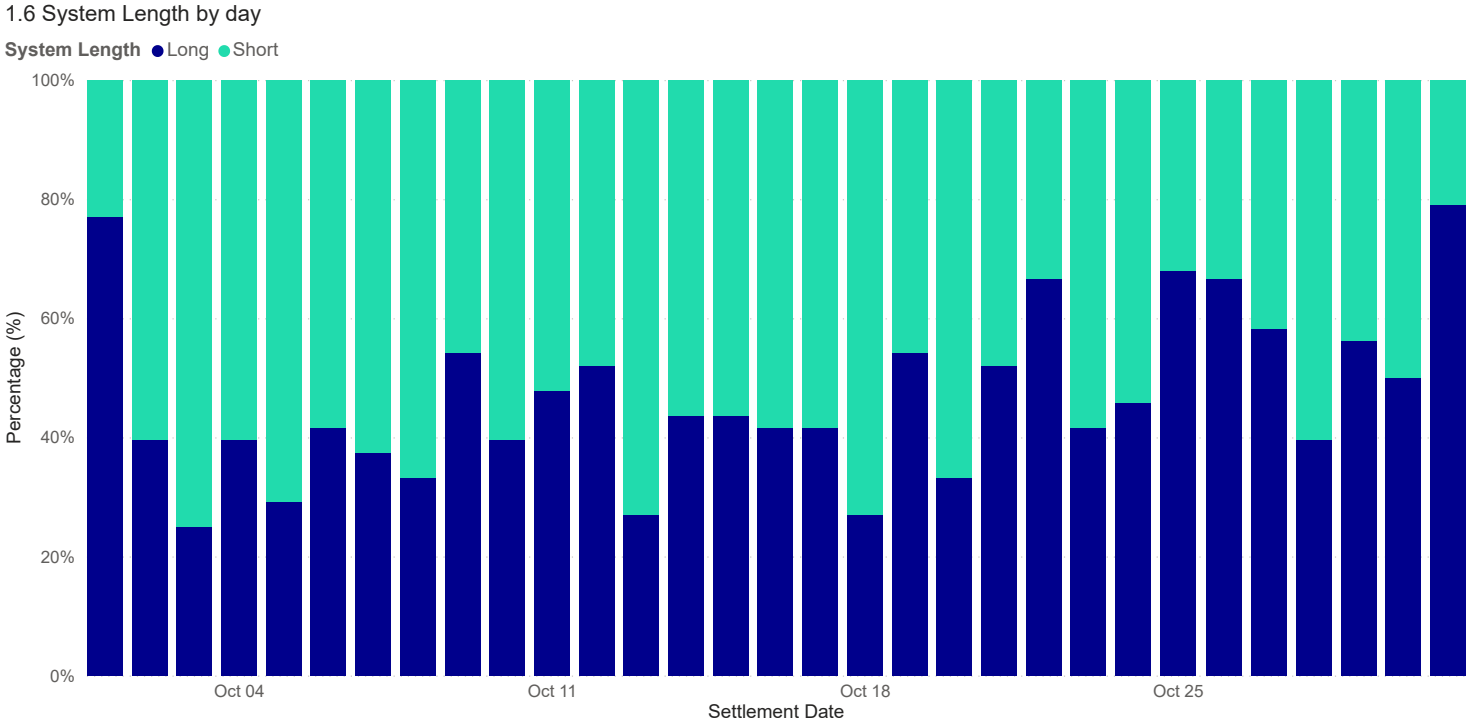
Graph 1.6 shows system length by day, and **Graph 1.7** shows system length by Settlement Period for October. The system was long for 47% of Settlement Periods in October.

1.6 Daily system length



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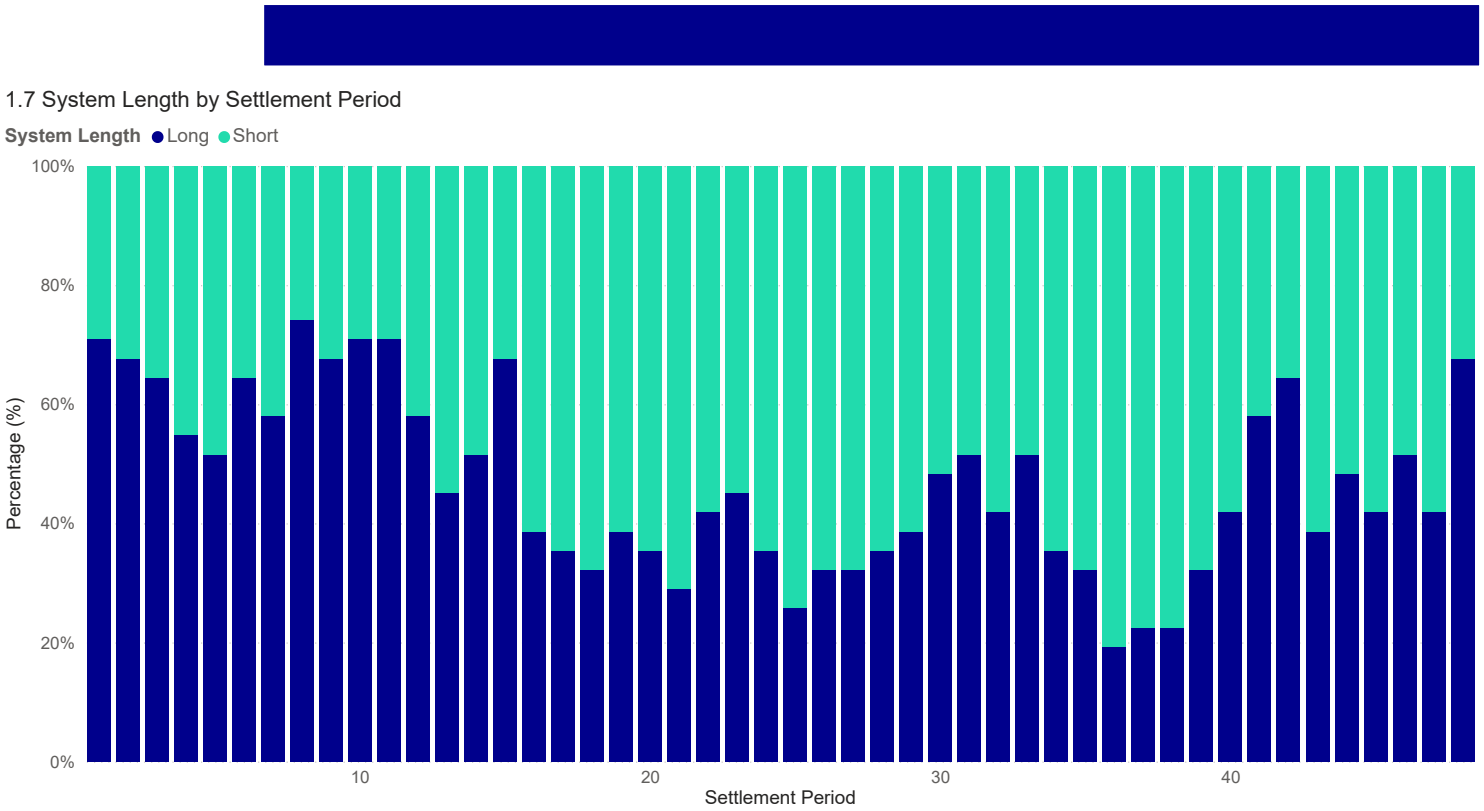
1.7 System Length by Settlement Period



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On 3 October, the system was short for 36 of FALSE Settlement Periods. The long Settlement Periods on this day had an average NIV of -238MWh. The daily average NIV on this day was 362MWh.

Settlement Period 8 had the highest number of long Settlement Periods, with 74% of them being long this 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.

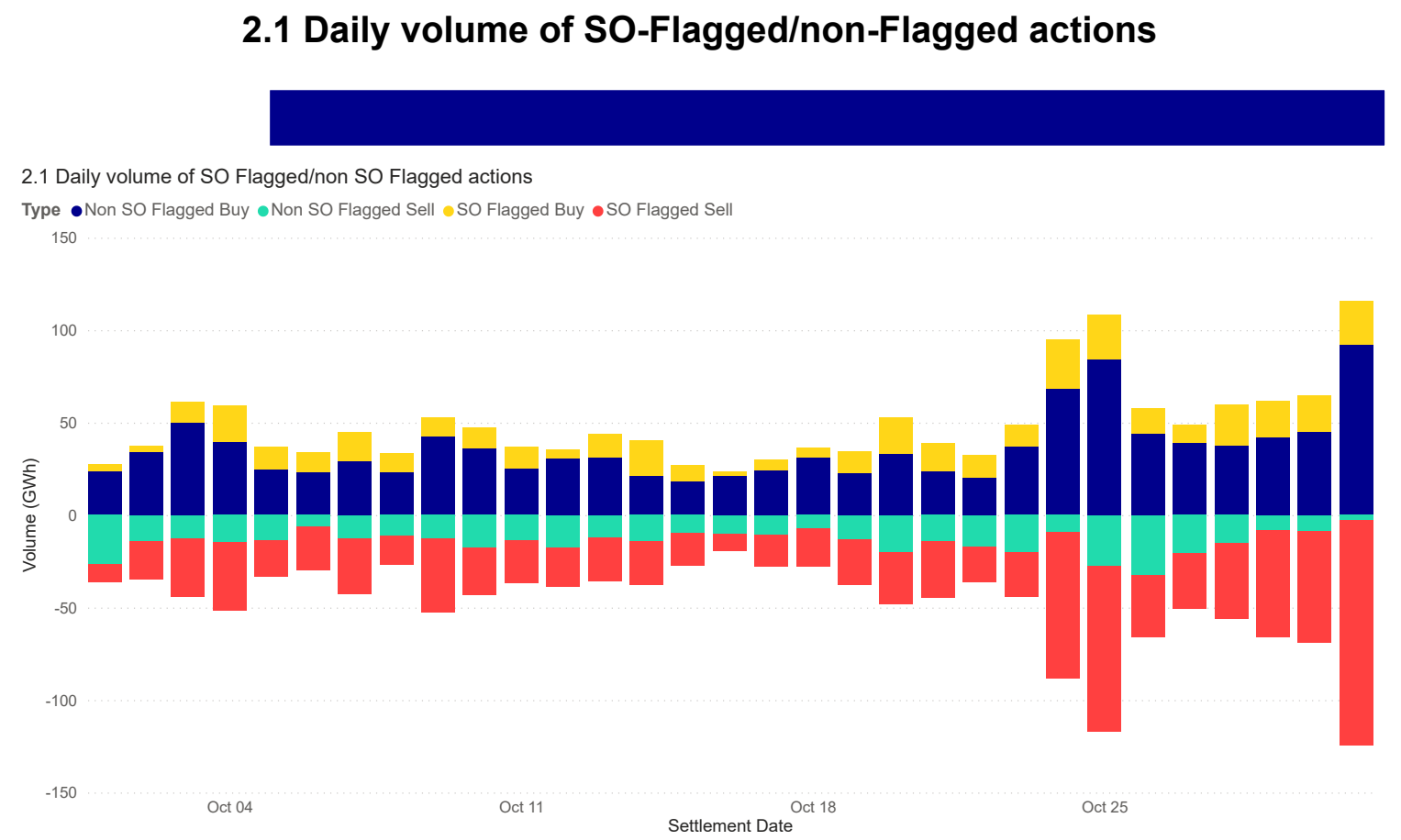
Flagging

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).

Graph 2.1 shows the volumes of Buy and Sell actions in October 2020 that have been Flagged by the SO as being constraint related. On 31 October, 98% of Sell volume was SO-Flagged.



70% of Sell balancing action volume taken in October had an SO-Flag, compared with 73% the previous month. 38% of SO-Flagged Sell actions came from Balancing Service Adjustment Actions (BSAAs), 28% from Wind BMUs and 25% came from CCGT BMUs. The average initial price (i.e. before any re-pricing) of a SO-Flagged Sell action was -£41.05/MWh.

27% of Buy balancing action volume taken in October had an SO-Flag, compared to 30% in September. 54% of SO-Flagged Buy actions came from CCGT BMUs and 43% from BSAAs. The average initial price of a SO-Flagged Buy action was £66.80/MWh.

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

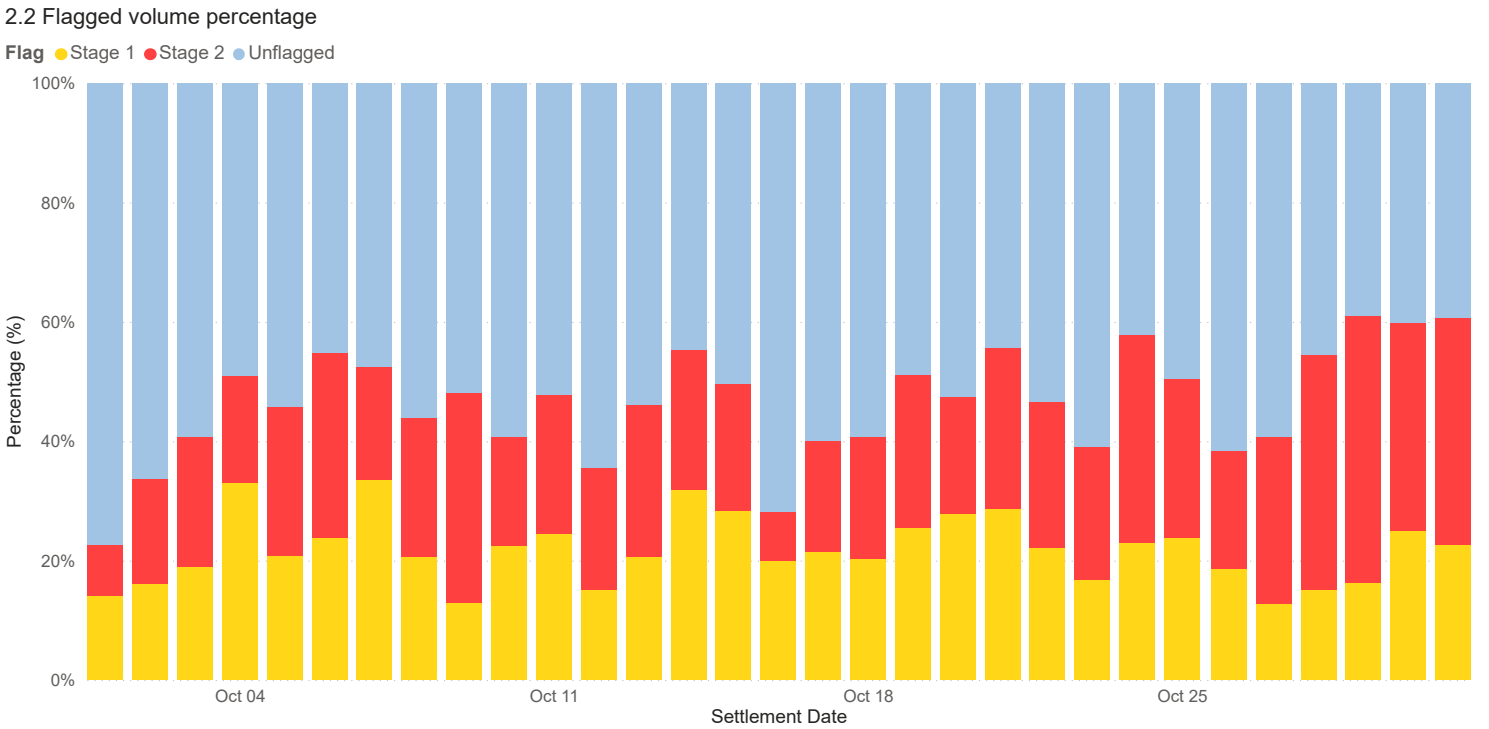
0.4% of Buy action volume and 0.3% of Sell action volume were CADL Flagged in October. The majority of CADL Flagged Buy actions (95%), and CADL Flagged Sell actions (81%) came from Pumped Storage BMUs, with CCGT BMUs accounting for a further 12% of CADL Flagged Sell Actions.

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.

Graph 2.2 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 October, an average of 46% of balancing actions received a First-Stage Flag with an average of 52% of this volume going on to receive a Second-Stage Flag. On the 29 October, 61% of balancing volume was flagged; with 73% of this volume receiving a Second Stage Flag.

2.2 Flagged Balancing Volumes



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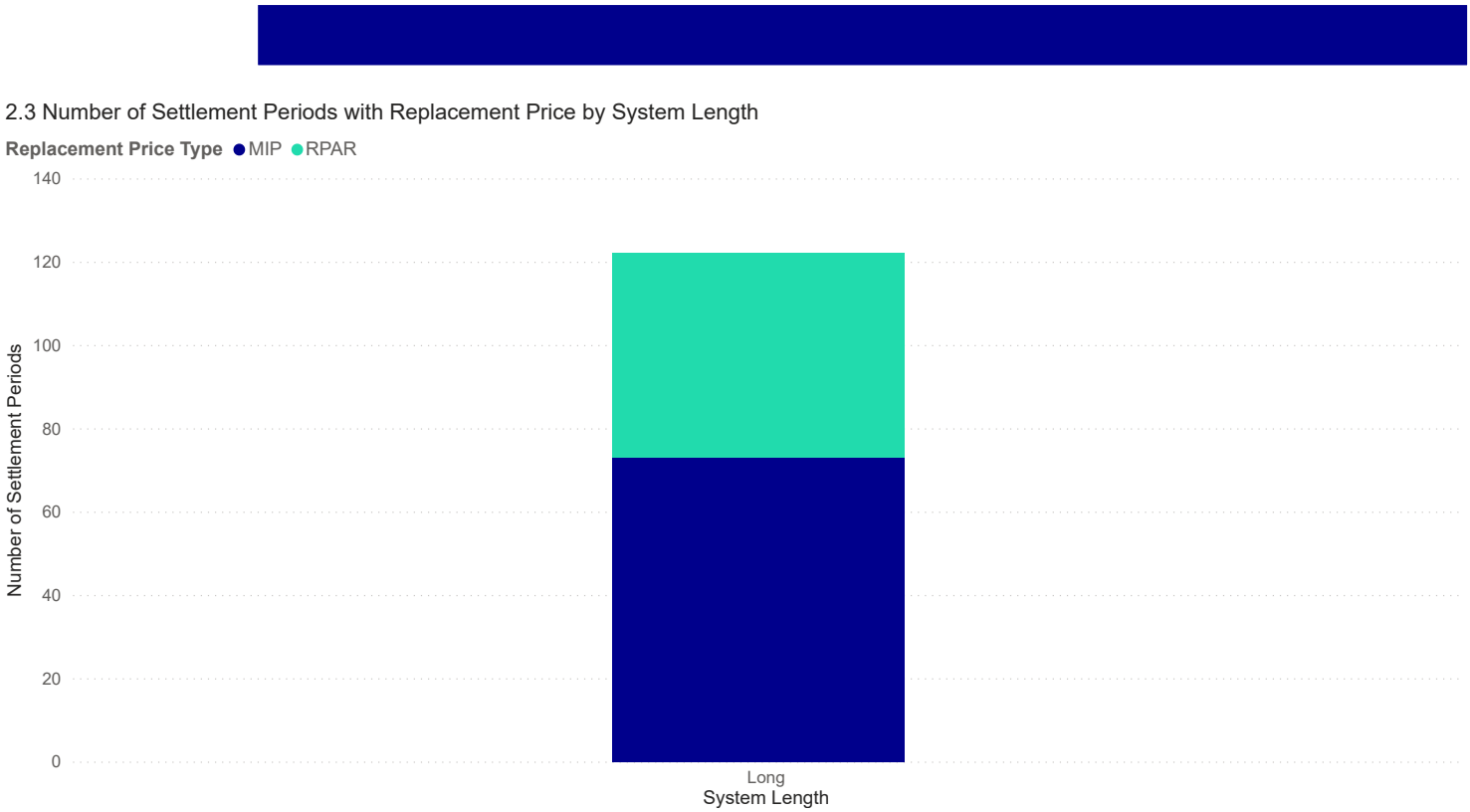
The Replacement Price

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 October, 49 (3%) Settlement Periods had a Replacement Price based on the RPAR and 73 (5%) Settlement Periods had a Replacement Price based on the MIP. However, the majority of Settlement Periods (92%) did not have a Replacement Price.

Graph 2.3 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. **Graph 2.4** displays the average original and Replacement Price of Second-Stage Flagged actions.

2.3 Number of Settlement Periods with Replacement Price by System Length



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2.4 Average Price and Replacement Price by System Length

System Length	Original Price	Replacement Price
Long	-7.79	11.42

Source: Elexon

Source: ELEXON

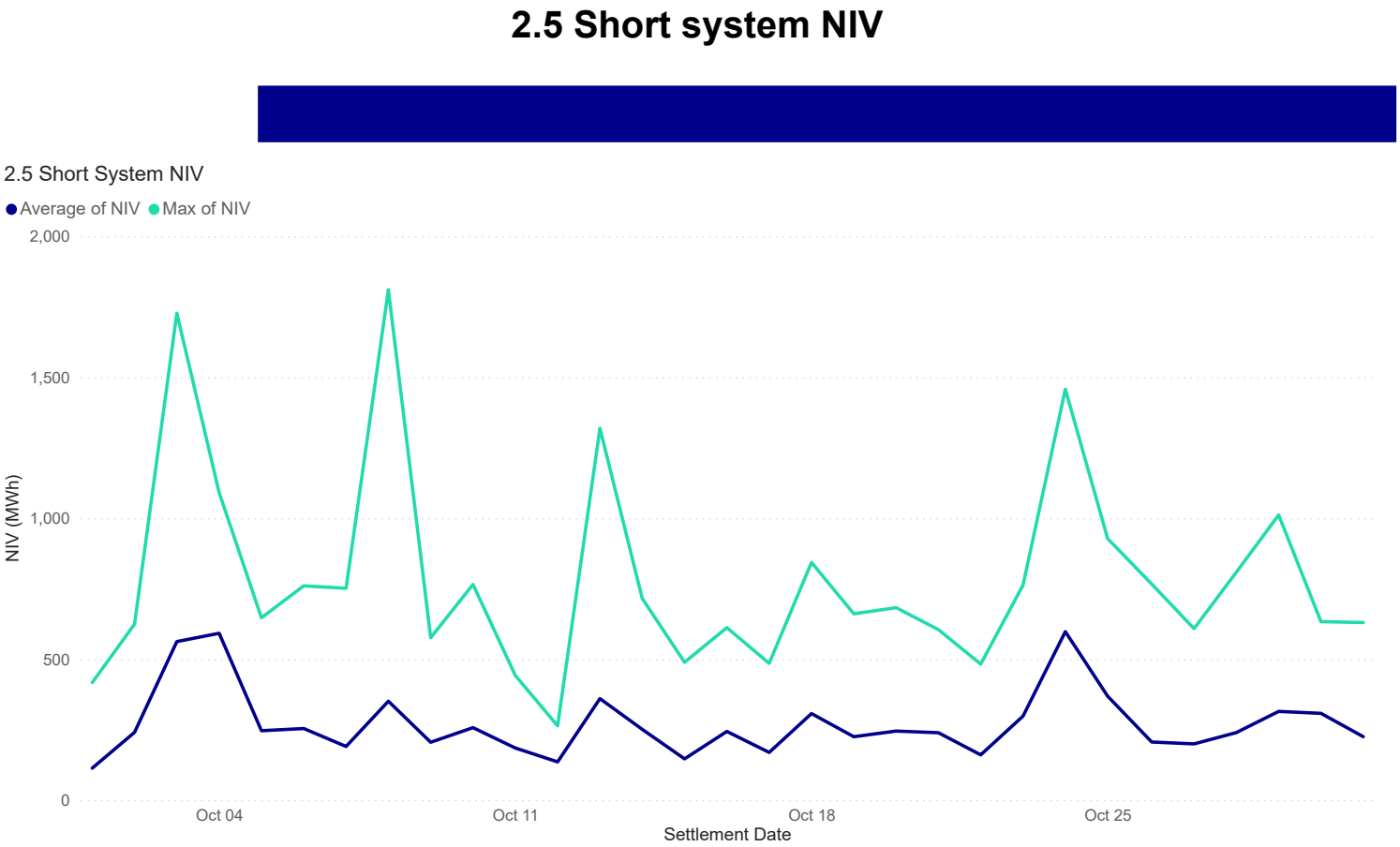
Sell actions will typically have their prices revised upwards by the Replacement Price for the purposes of calculating the System Price. In total, 71% of Sell volume in October was Flagged. Of this Flagged Sell volume, 4% was assigned a Replacement Price. The average original price of a Second-Stage Flagged repriced Sell action was -£7.79/MWh and the average Replacement Price for Sell actions (when the System was long) was £11.42/MWh.

27% of Buy volume were Flagged; none of this volume had the Replacement Price applied. This is the first time all Buy action volume during a month has not received a Replacement Price.

If there are no Unflagged actions remaining in the NIV, the Replacement Price will default to the MIP. This occurred in 73 long and no short Settlement Periods in October, compared to 21 long and six short Settlement Periods the previous month.

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. **Graph 2.5** shows the greatest and average NIV when the system was short, and **Graph 2.6** shows the greatest and average NIVs when the system was long. Note short NIVs are depicted as positive volumes and long NIVs are depicted as negative volumes.



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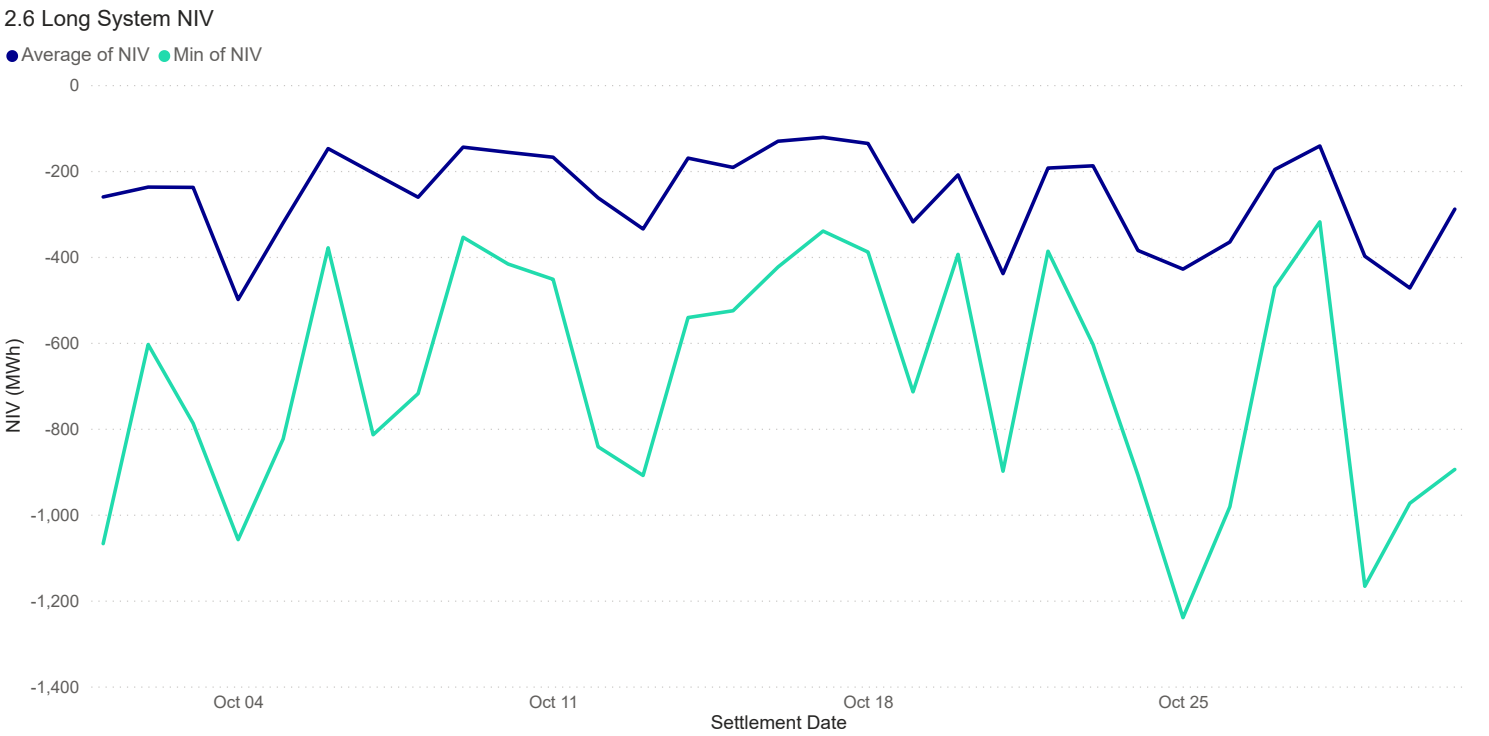
2.6 Long system NIV



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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 October, 86% 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.

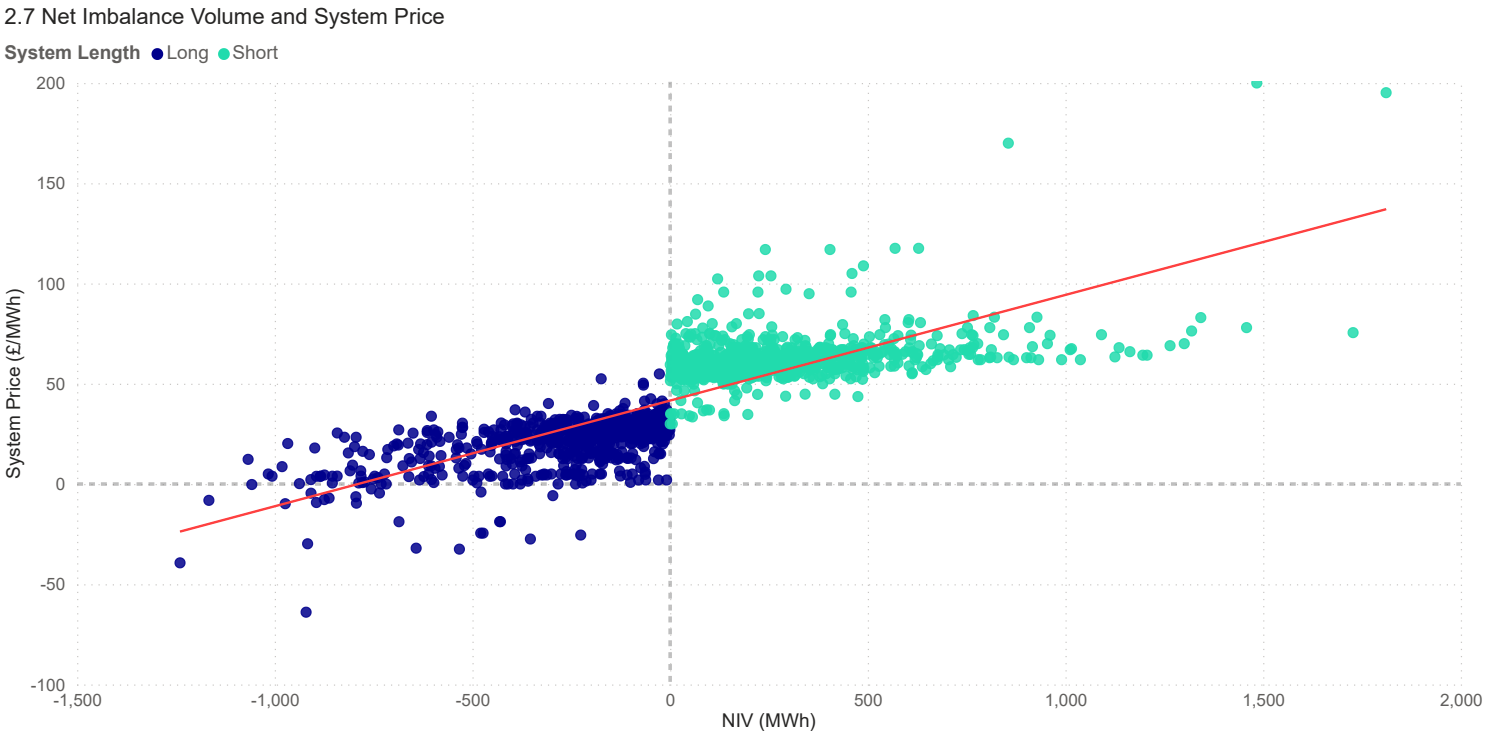
The maximum short system NIV of the month (1,811MWh) was seen in Settlement Period 38 on 8 October, where the second highest System Price of the month occurred (£195.17/MWh).

The minimum long system NIV of the month was -1,240MWh, in Settlement Period 6 on 25 October, where the System Price was -£39.32/MWh.

Graph 2.7 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. There were 699 long Settlement Periods in October, 38 of which occurred on 31 October. The average NIV on this day was -182MWh, with the lowest NIV (-895MWh) occurring in Settlement Period 33.

Settlement Period 39 on 8 October had a Net Imbalance Volume (NIV) of 1,484MWh, the third highest NIV in October 2020 and the ninth highest of 2020.

2.7 Net Imbalance Volume and System Price



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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.

Following the change of PAR, 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.

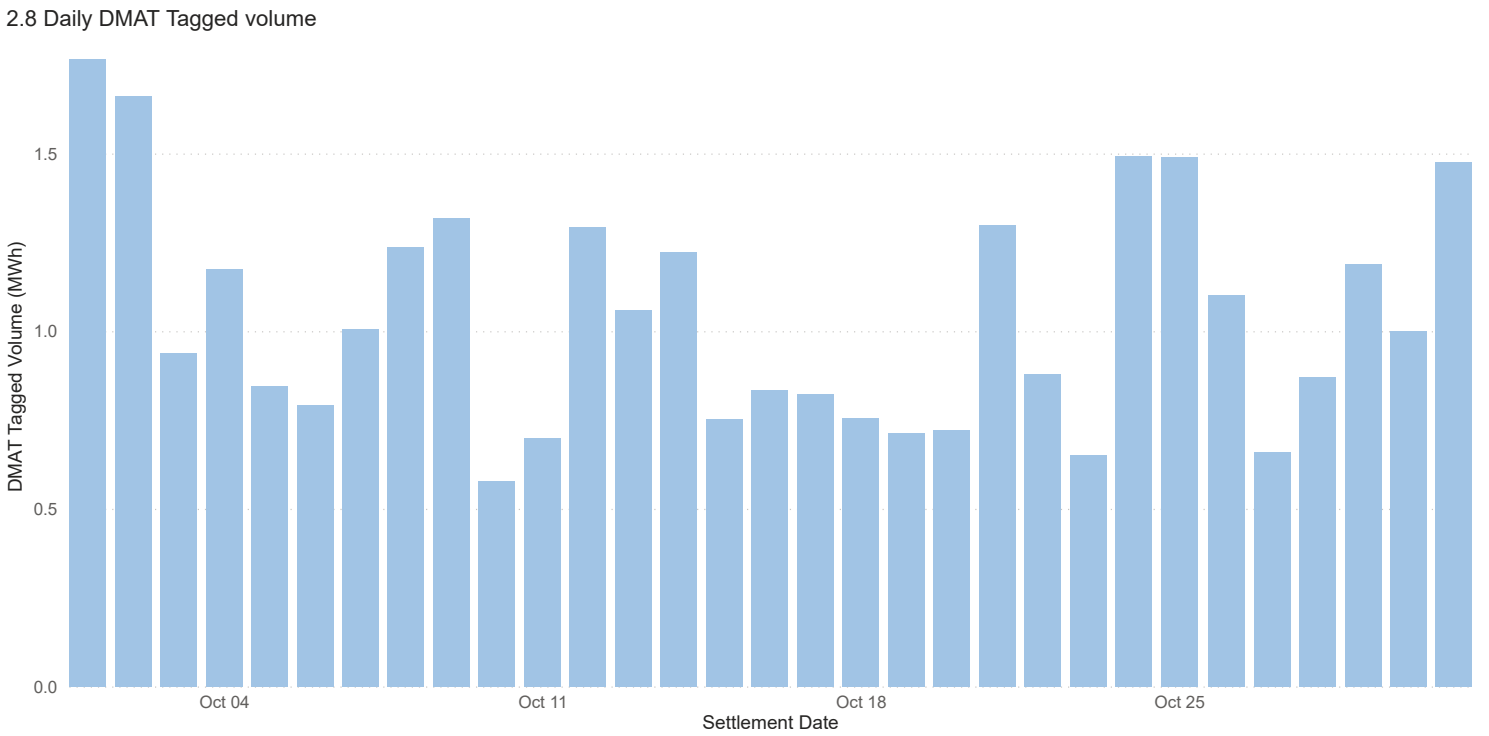
During October, there were 27, 5, 8, 46, 25, 26 Settlement Periods where PAR Tagging was inactive. The average NIV in these Settlement Periods was -0.21MWh. Settlement Period 8 on 6 October had the lowest absolute NIV (0.13MWh), and therefore was the most balanced Settlement Period of the month.

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.

Graph 2.8 shows the volumes of actions removed due to DMAT Tagging. 0.0011% of total Buy and Sell volume was removed by DMAT Tagging in October, compared to 0.0012% the previous month. 66% of the DMAT Tagged volume came from CCGT BMUs, 10% from Other BMUs and 8% from Gas BMUs.

2.8 Daily Total of DMAT Tagged volume



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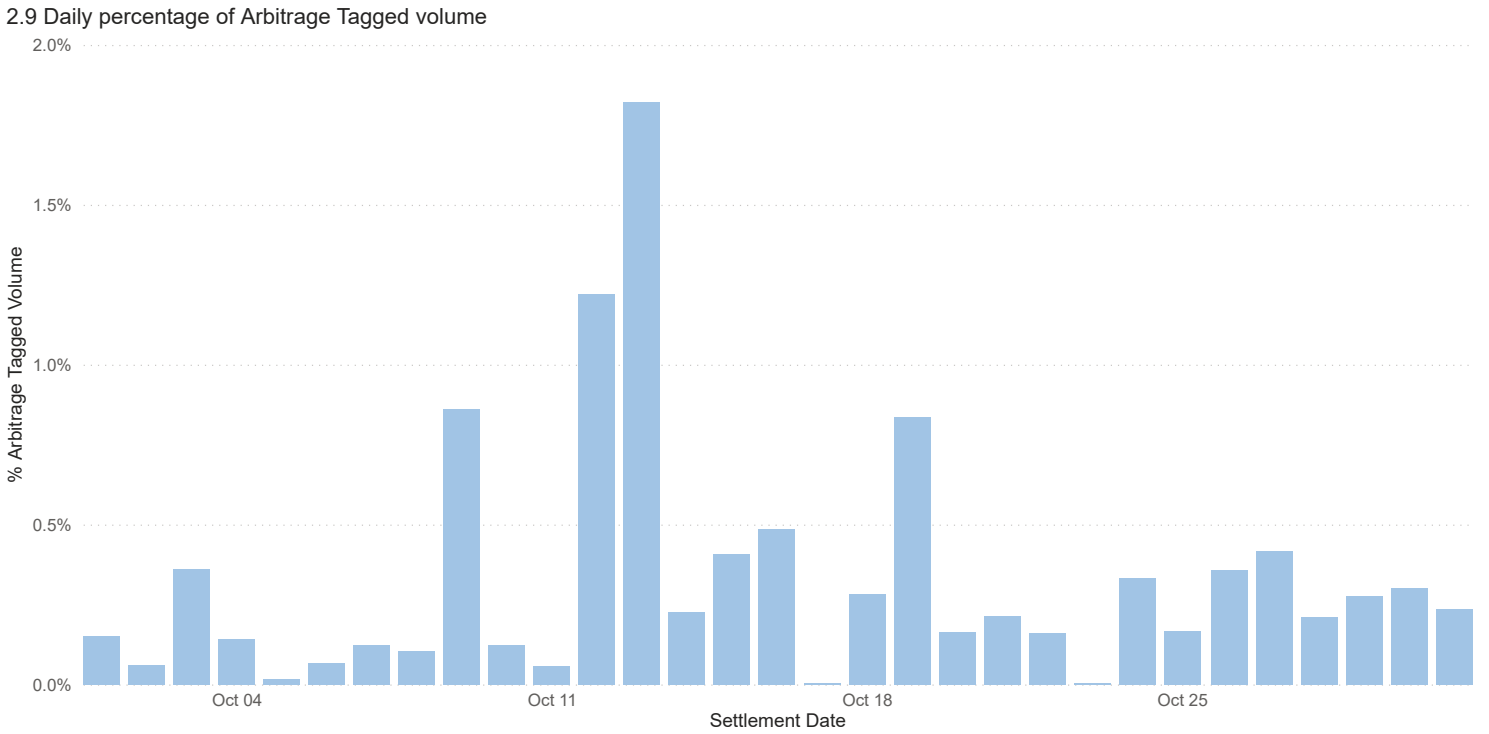
Graph 2.9 shows the volumes of actions that were removed due to Arbitrage Tagging. 0.3% of total Buy and Sell volume was removed by Arbitrage Tagging in October. 41% of the Arbitrage Tagged came from CCGT BMUs, 31% from BSAAs and 14% from Wind BMUs.

2.9 Daily percentage of Arbitrage Tagged volume



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In October, the average initial price of an Arbitrage Tagged Buy action was £23.89/MWh, and for a Sell action was £35.08/MWh. The maximum initial price of an Arbitrage Tagged Sell action was £261.89/MWh, and the lowest priced Arbitrage Tagged Buy action was -£81.88/MWh.

On 13 October, 1,452MWh of actions were Arbitrage Tagged, representing 2% of the daily volume of balancing actions. The average price of an Arbitrage Tagged Buy action was £28.29/MWh, and for a Sell action was £27.43/MWh on this day. 52% of the Abitrage Tagged Volume came from CCGT BMUs and 47% from BSAAs.

3 Balancing Services

Short Term Operating Reserve (STOR) costs and volumes

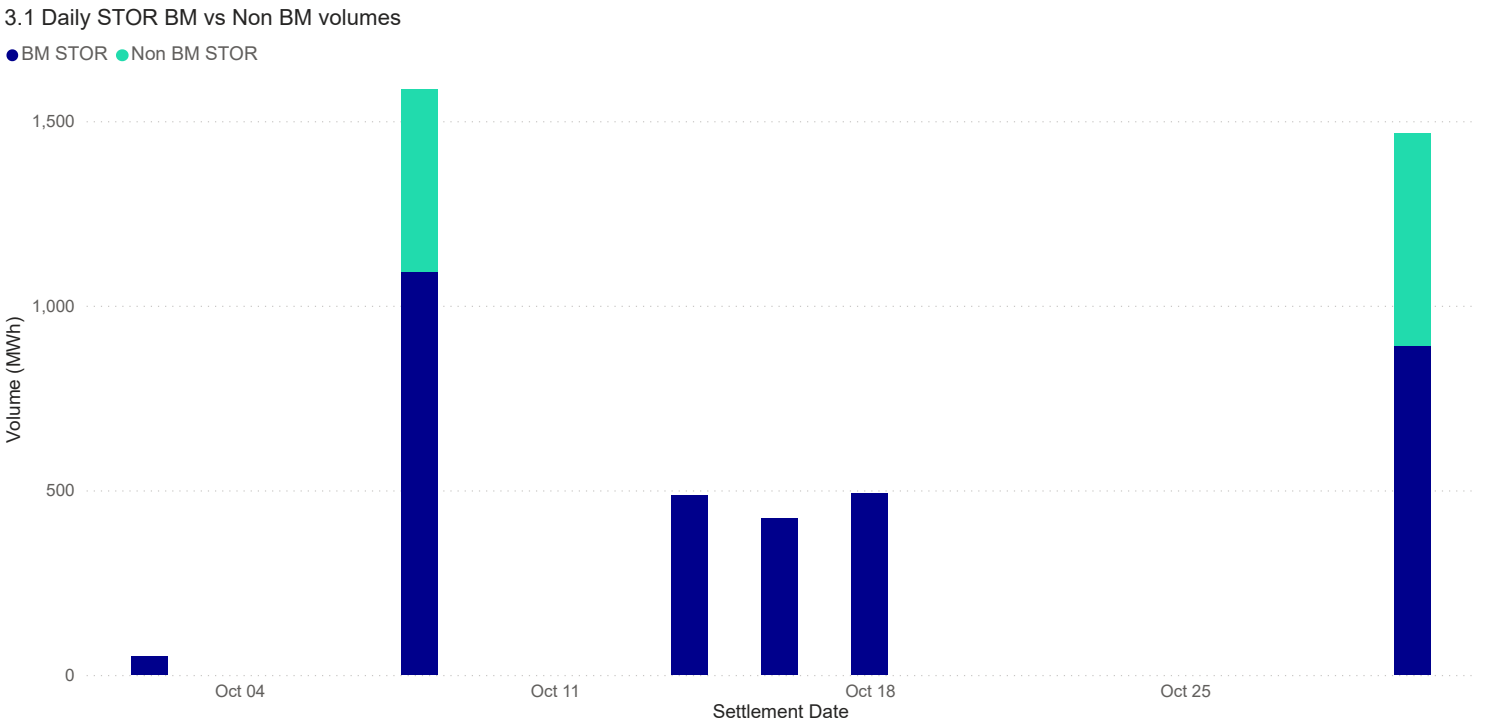
This section covers the balancing services that the System Operator (SO) takes outside the Balancing Mechanism that can affect the price.

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).

Graph 3.1 gives STOR volumes that were called upon during the month split into BM STOR and non-BM STOR. 24% of the total STOR volume utilised in October came from outside of the Balancing Mechanism.

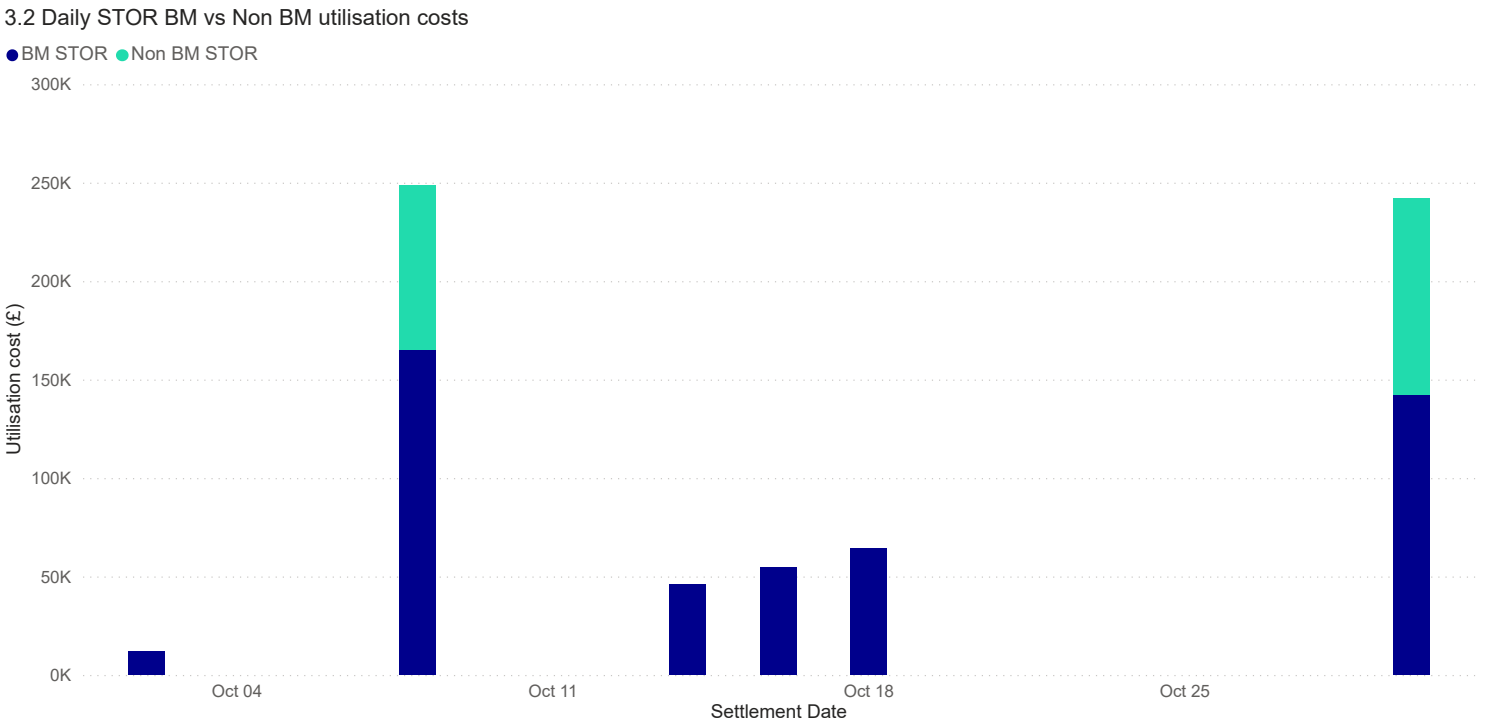
3.1 Daily STOR vs Non-BM STOR volume



Microsoft Power BI

Graph 3.2 shows the utilisation costs of this capacity. The average Utilisation Price for STOR capacity in October was £148.28/MWh; £140.95 for BM STOR and £171.81 for non-BM STOR.

3.2 Daily STOR vs Non-BM STOR utilisation costs



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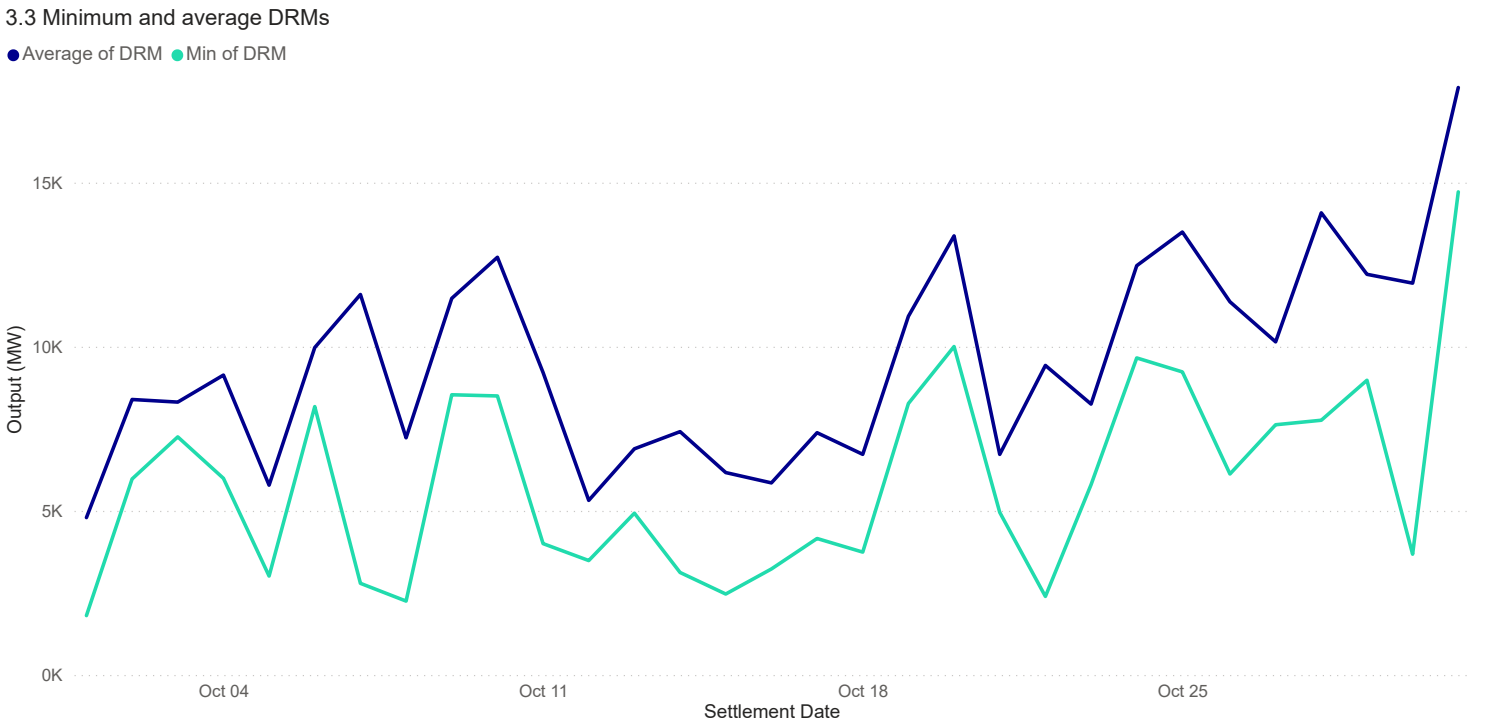
On 8 October the largest amount was spent on STOR volume for the month (£248,685), of which 66% of the cost was BM STOR and STAT 34% was non-BM STOR. The utilised BM STOR volume on this day was 1,094MWh, compared to the average of 109MWh across the month.

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).

Graph 3.3 shows the daily minimum and average Gate Closure DRMs for October 2020.

3.3 Minimum and average DRMs



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

The minimum DRM in October was 1.809GW on 1 October 2020 in Settlement Period 39, (compared to 0.193GW in September). This DRM corresponded to a LoLP of 0.007 and RSVP of £42.97.MWh (see **Table 3.4**).

The RSVP re-prices STOR actions in the Imbalance Price calculation if it is higher than the original Utilisation Price. No actions were repriced with the RSVP during October.

3.4 Top 5 LoLPs and RSVPs

Settlement Date	Settlement Period	DRM (MW)	LoLP	RSVP (£/MWh)	RSVP Used	System Price (£/MWh)	System Length
01/10/2020	39	1,809	0.0071614	42.97	No	84.90	Short
01/10/2020	38	2,097	0.0024641	14.78	No	35.15	Long
08/10/2020	39	2,252	0.0043270	25.96	No	200.00	Short
22/10/2020	39	2,394	0.0035349	21.21	No	32.15	Long
15/10/2020	38	2,467	0.0031446	18.87	No	108.81	Short

Source: Elexon