

ISG237-SPAR

Issue 61 - Published 22 December 2020

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.

This month, the SPAR contains pricing graphs from the Trading Operations Report (TOR) (<https://www.elexon.co.uk/data/key-data-reports/trading-operations-report/>). In the January edition of the SPAR, these graphs will no longer feature in the TOR and all monthly reporting on System Prices will be contained within the SPAR.

Reporting on November 2020

1 System Prices and length

This report covers the month of November. 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 November, with values shown in £/MWh.

System Length	Min	Max	Median	Mean	Std.Dev
Long	-63.93	46.47	18.20	16.31	16.42
Short	8.05	240.77	59.95	62.20	17.02

Source: Elexon

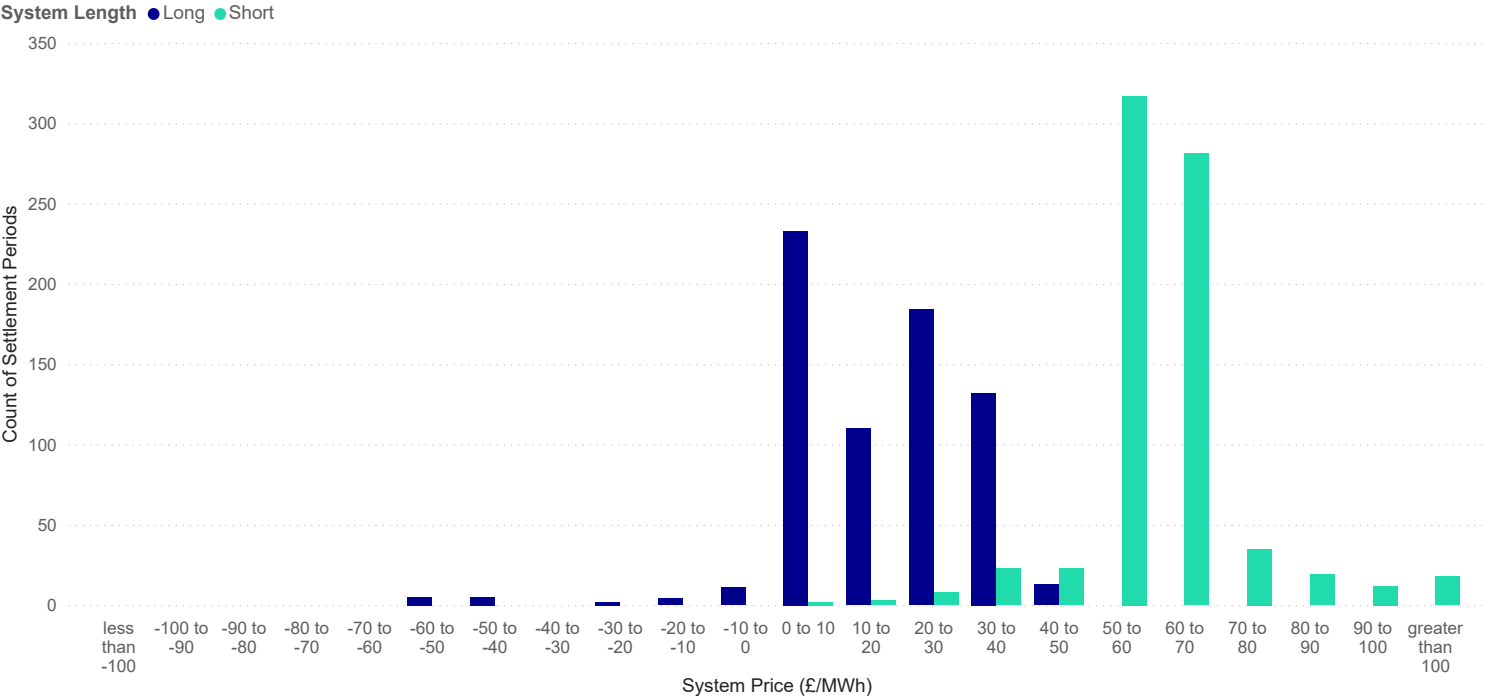
Frequency of System Prices over last month

This graph shows the distribution of System Prices across Settlement Periods in November 2020 when the market was long and short.

80% of System Prices were between £5.00/MWh and £66.99/MWh regardless of system length. When the system was long, 80% of prices were between £1.71/MWh and £35.00/MWh. When the system was short, 80% of prices were between £52.45/MWh and £72.00/MWh.



1.2 Frequency of System Prices over last month



Microsoft Power BI



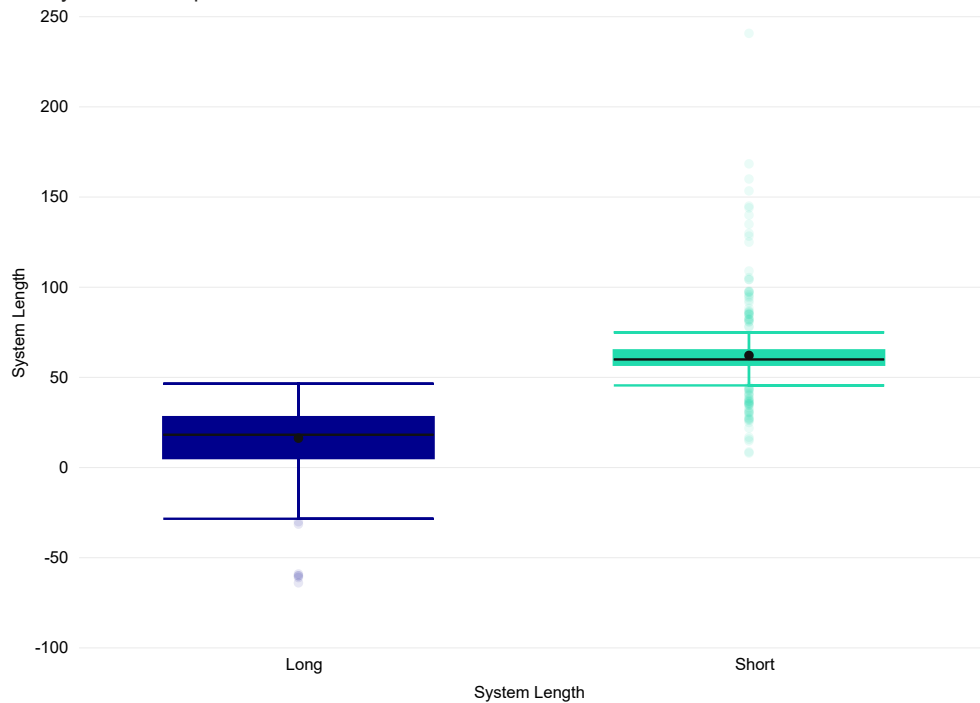
System Prices were £100/MWh or more on 18 occasions in November 2020, compared to 12 times in October. The highest System Price of the month, £240.77/MWh, occurred in Settlement Period 35 on 9 November. This price was set by Offers from three Short Term Operating Reserve (STOR) providers. During this Settlement Period, the Reserve Scarcity Price (RSP) was applied to STOR flagged actions. The Reserve Scarcity Price is the product of the Loss of Load Probability (LoLP) and the Value of Lost Load (VoLL). In this Settlement Period, the LoLP was 0.0354 and the VoLL is a defined parameter with a value of £6,000/MWh. The RSP, and therefore the price of STOR actions with a price less than the RSP, was £212.36/MWh in the System Price calculation for this Settlement Period. This price then had the addition of a Buy Price Price Adjuster (BPA) of £28.41/MWh to create the System Price of £240.77/MWh

There were 50 Settlement Periods where the System Price was less than £0/MWh in November, with the lowest System Price of -£63.93/MWh occurring in Settlement Period 10 on 16 November. This was set by three Bids from three different Wind BMUs in the South Scotland GSP all priced at -£63.93/MWh.

System Price spread

The graph below displays the spread of System Prices in November 2020 as a box plot diagram, split between a short and long system.

1.3 System Price spread



Microsoft Power BI



The middle line in each box represents the median System Price of the month, which is £59.95/MWh for short Settlement Periods and £18.20/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 £8.00/MWh for short System Prices and £22.72/MWh for long System Prices.

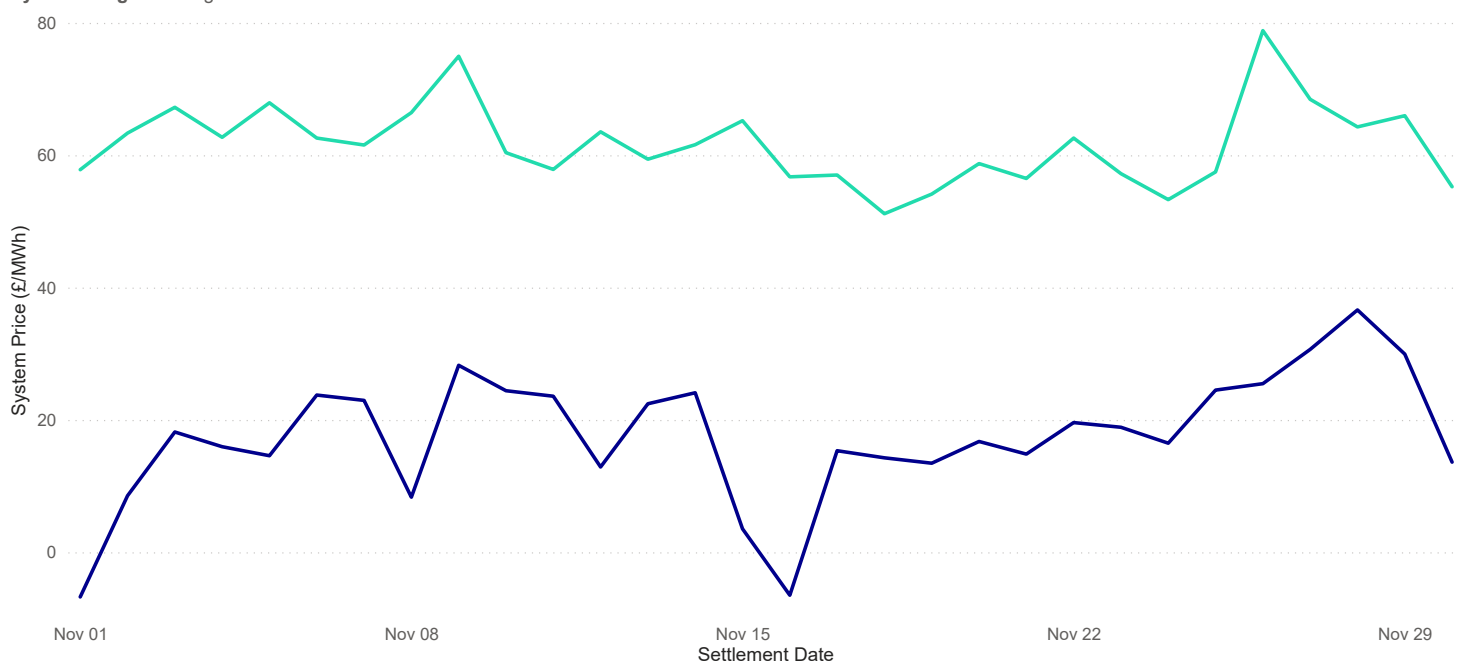
Outliers are shown on the graph as circles, and have been defined as being greater than 1.5 times the Interquartile Range (IQR) away from the Upper and Lower quartiles. Under this definition, 12 long and 97 short System Prices in November were outliers. Of the 12 long outliers, all were less than the lower outlier boundary. The prices of Long outliers ranged from -£63.93/MWh (the lowest System Price of the month) to -£30.00/MWh. The highest System Price of the month, £240.77/MWh, was over 4 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.

1.4 Daily average System Price

System Length ● Long ● Short



Microsoft Power BI



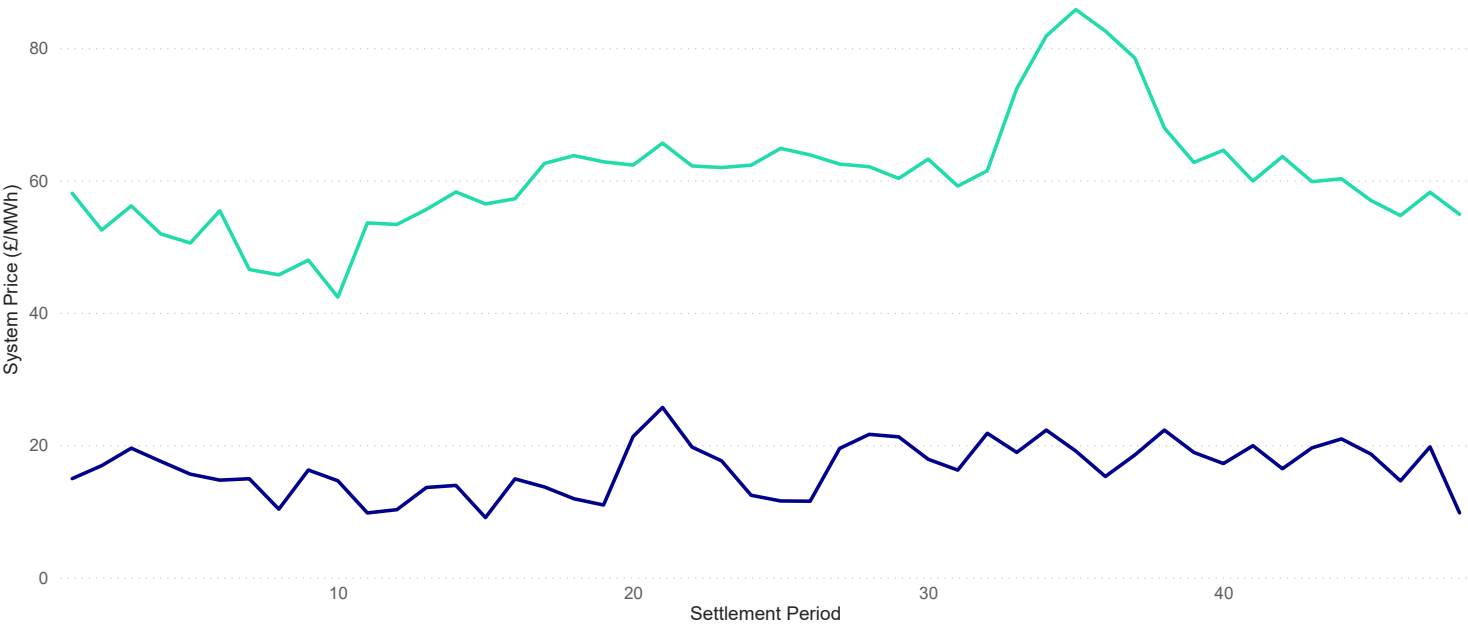
In November, the average System Price was £16.31/MWh when the system was long and £62.20/MWh when the system was short. The highest daily average price when the system was short was £78.84/MWh, and occurred on 26 November; the system was short for 26 Settlement Periods on this day. The lowest daily average price when the system was long was -£6.74/MWh on 1 November. The system was long for 37 Settlement Periods on this day.

Average System Price by Settlement Period

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

1.5 Average System Price by Settlement Period

System Length ● Long ● Short



Microsoft Power BI



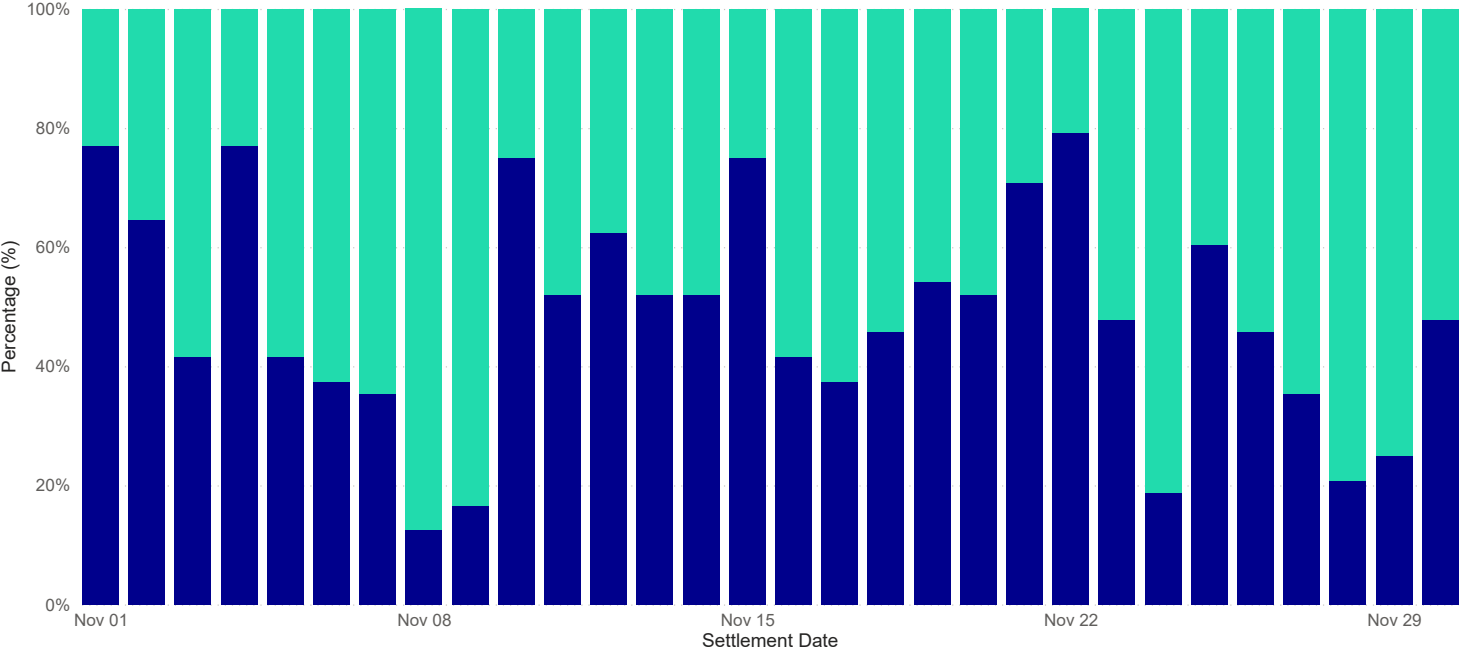
Short prices were highest in Settlement Period 35, with long prices lowest in Settlement Period 15. The lowest average System Price, regardless of market length, occurred during Settlement Period 8, when the System Price was £20.95/MWh. The daily average long Settlement Period System Prices ranged between £9.06/MWh and £25.70/MWh. Average short Settlement Period prices varied from £42.37/MWh to £85.82/MWh.

Daily System Length

This graph shows system length by day.

1.6 System Length by day

System Length ● Long ● Short



Microsoft Power BI

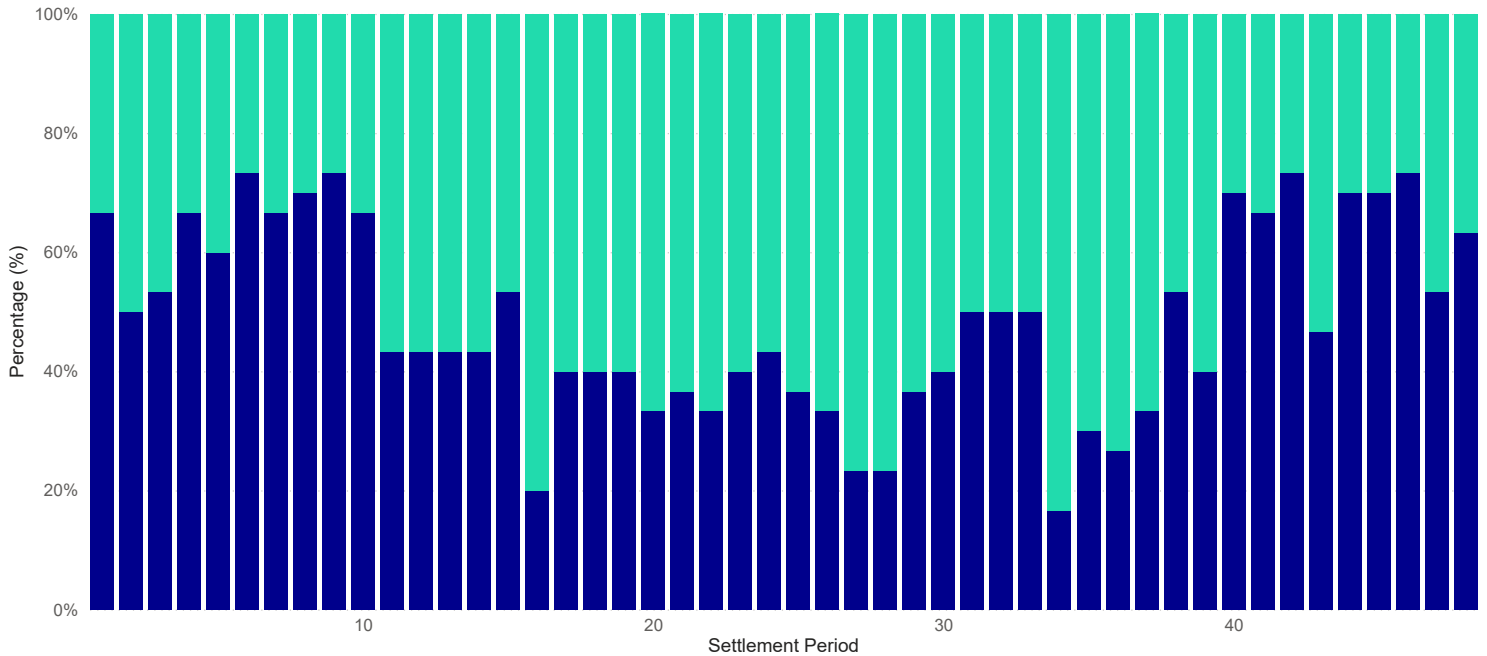


System Length by Settlement Period

This graph shows system length by Settlement Period for November. The system was long for 49% of Settlement Periods in November.

1.7 System Length by Settlement Period

System Length ● Long ● Short



Microsoft Power BI



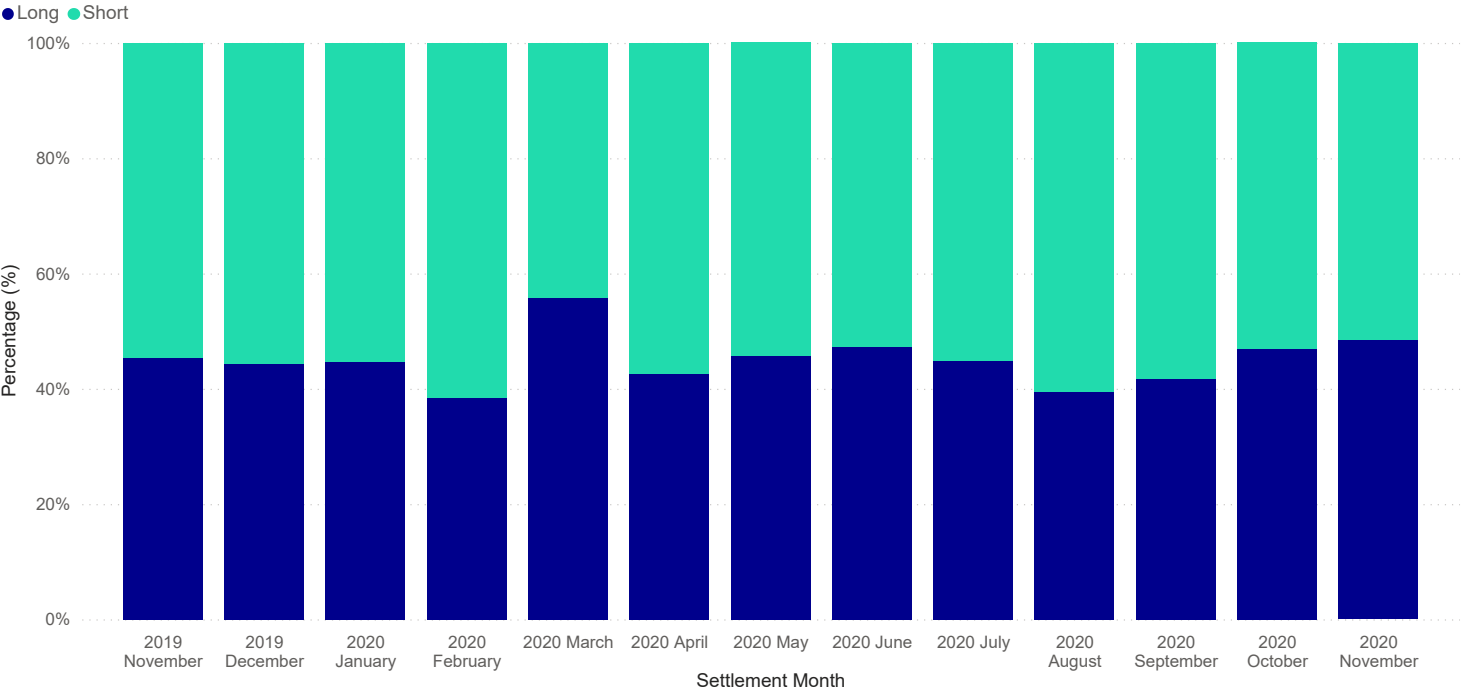
On 8 November, the system was short for 42 of 48 Settlement Periods. The long Settlement Periods on this day had an average NIV of -375MWh. The daily average NIV on this day was 311MWh.

Settlement Period 34 had the highest number of short Settlement Periods, with 83% of them being long this month.

Historic Long vs Short Market

This graph shows the percentage of long and short Settlement Periods back to 2010. Compared to the last 12 months, November 2020 had the fourth lowest monthly percentage of long Settlement Periods (42%).

1.8 Historic Long vs Short Market



Microsoft Power BI

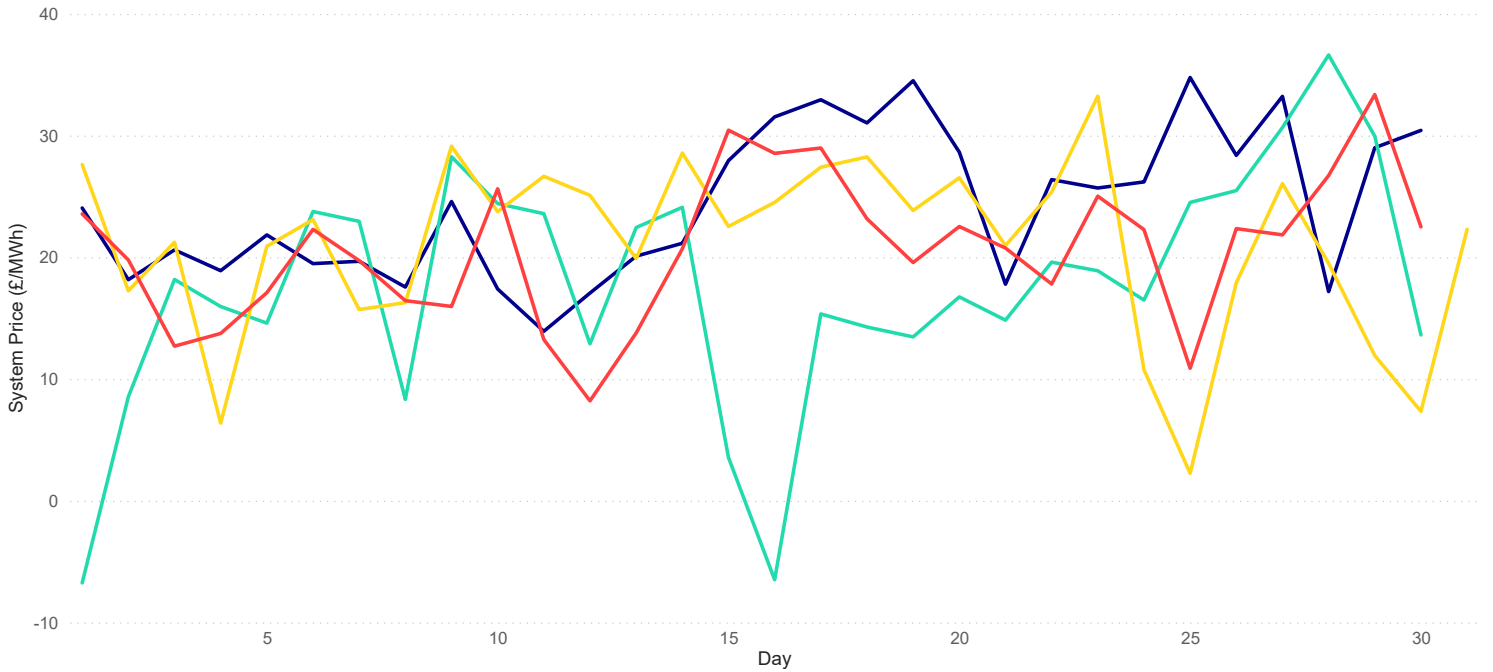


Average Daily System Price when Long by Settlement Day

The graph below displays the daily average System Prices in November 2020 when the system was long compared to the two previous months and the same month last year.

1.9 Average Daily System Price when Long by Settlement Day

Month ● Nov 19 ● Nov 20 ● Oct 20 ● Sep 20



Microsoft Power BI



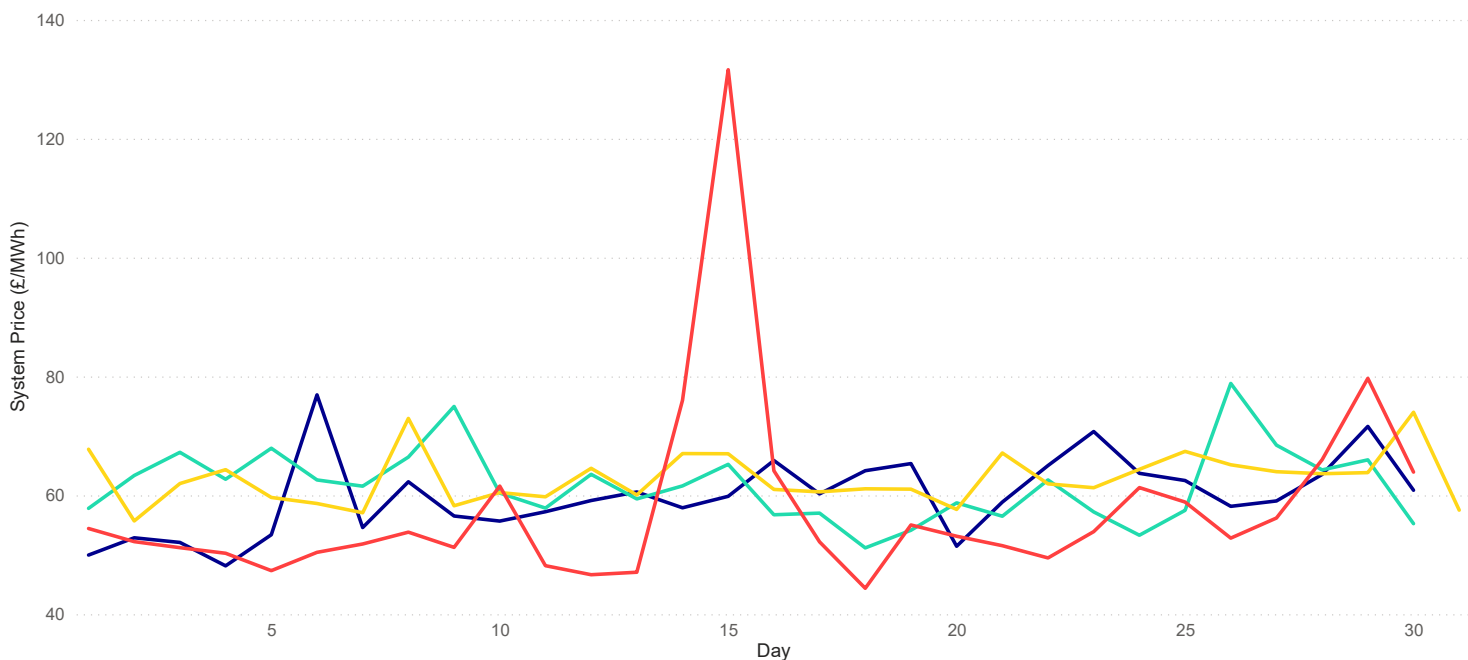
During November 2020, the daily average long System Price was negative on 1 and 16 November. Daily average System Prices were £6.71/MWh lower in November 2020 than the same month in 2019. On the 16 November, the daily average System Price of -£6.48/MWh was £38.02/MWh less than the 16 November in 2019.

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.

1.10 Average Daily System Price when Short by Settlement Day

Month ● Nov 19 ● Nov 20 ● Oct 20 ● Sep 20



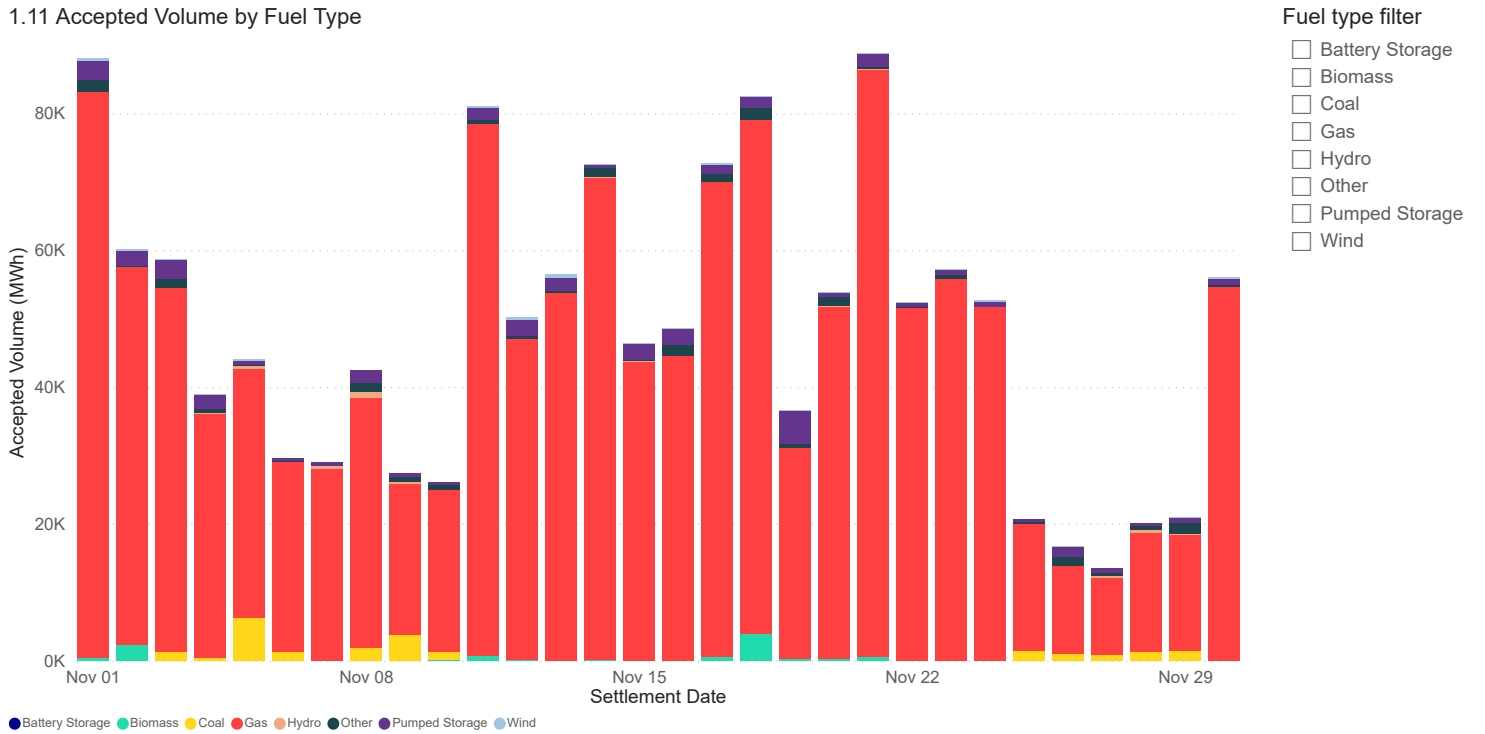
Microsoft Power BI



Short daily average System Prices were £1.73/MWh higher in November 2020 than the same month last year. On the 26 November, the daily average System Price of £78.84/MWh was £20.68/MWh higher than the 26 November in 2019.

Accepted Offer Volume by Fuel Type and **Accepted Bid Volume by Fuel Type** display the fuel types that participated in the Balancing Mechanism during November 2020 split between Offers (balancing actions taken to increase the level of energy on the System) and Bids (balancing actions taken to decrease the level of energy on the System). These graphs do not include volume from Balancing Services Adjustment Actions (BSAAs).

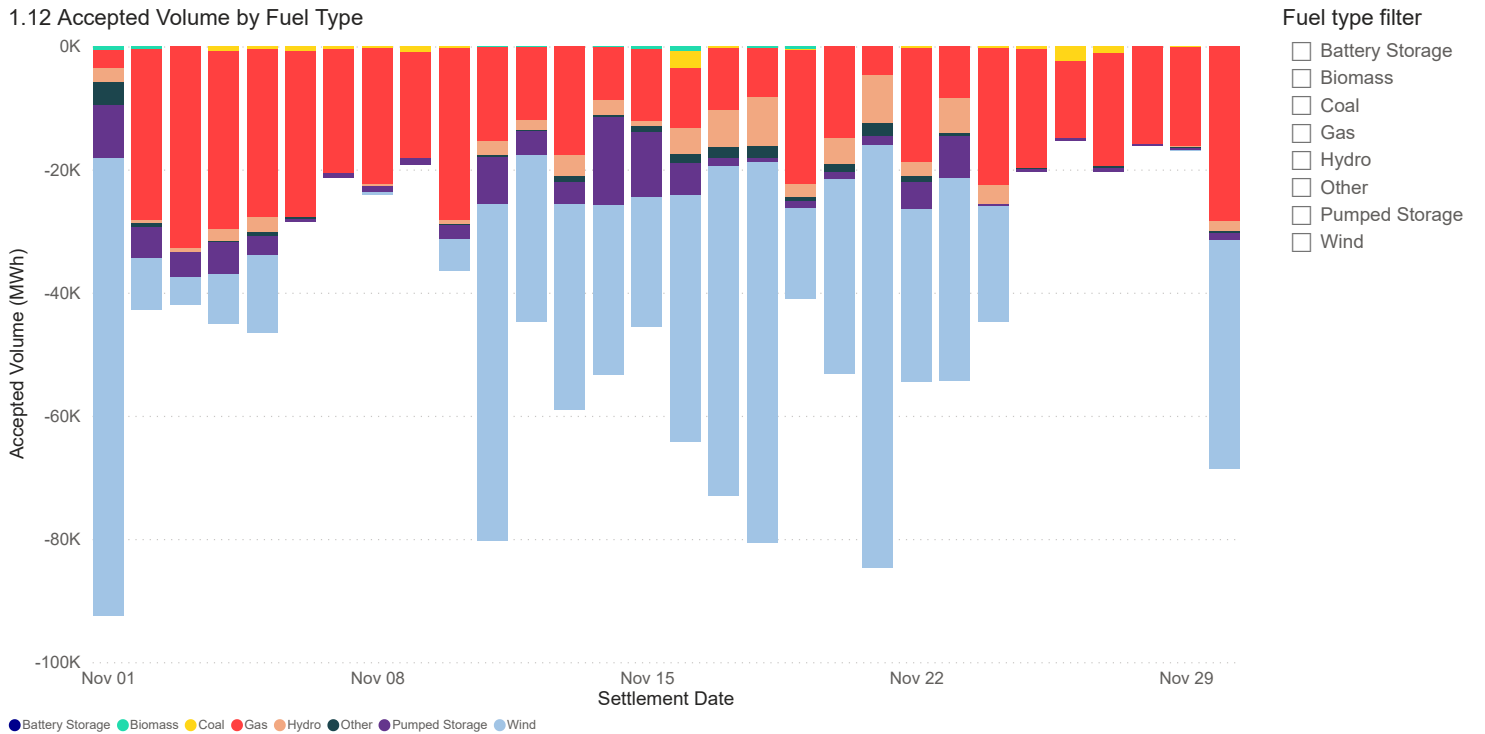
1.11 Accepted Volume by Fuel Type



Microsoft Power BI



1.12 Accepted Volume by Fuel Type



Microsoft Power BI



During November 2020, 48% of Bid volume came from Wind BMUs with a further 38% from Gas BMUs. 93% of Offer volume came from CCGT BMUs in November 2020.

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).

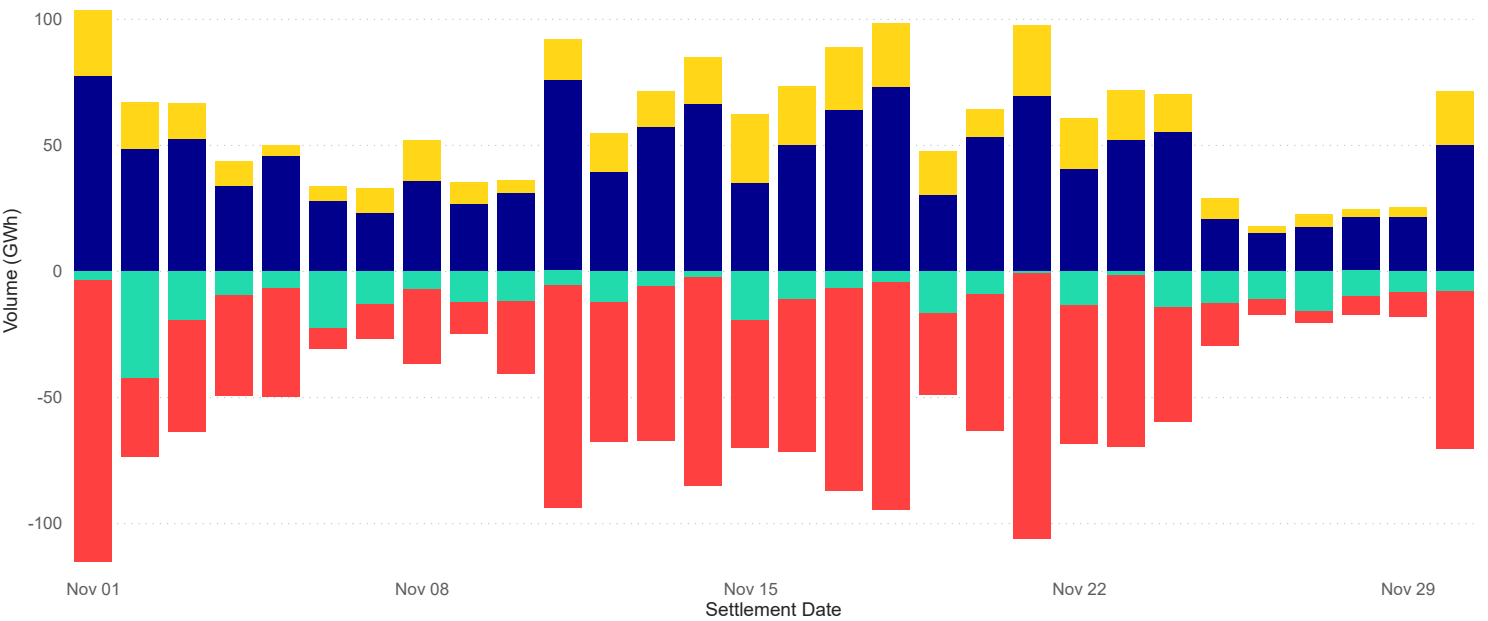
Daily volume of SO-Flagged/non-Flagged actions

This graph shows the volumes of Buy and Sell actions in November 2020 that have been Flagged by the SO as being constraint related. On 21 November, 99% of Sell volume was SO-Flagged.



2.1 Daily volume of SO Flagged/non SO Flagged actions

Type ● Non SO Flagged Buy ● Non SO Flagged Sell ● SO Flagged Buy ● SO Flagged Sell



80% of Sell balancing action volume taken in November had an SO-Flag, compared with 70% the previous month. 47% of SO-Flagged Sell actions came from Wind BMUs, 23% came from Balancing Service Adjustment Actions (BSAAs) and 19% from CCGT BMUs. The average initial price (i.e. before any re-pricing) of a SO-Flagged Sell action was -£52.74/MWh.

25% of Buy balancing action volume taken in November had an SO-Flag, compared to 27% in October. 50% of SO-Flagged Buy actions came from BSAAs and 48% from CCGT BMUs. The average initial price of a SO-Flagged Buy action was £63.12/MWh.

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

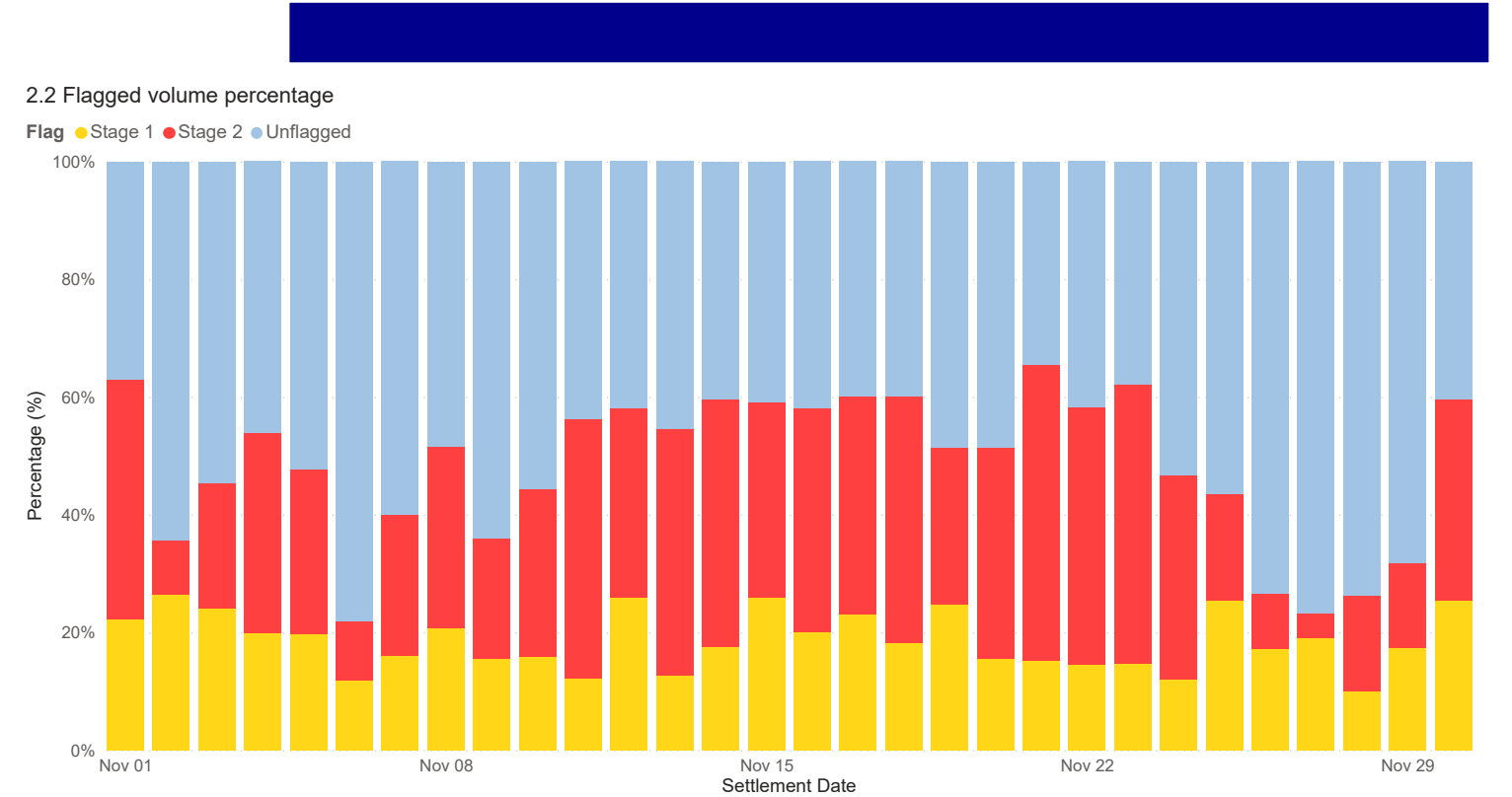
0.3% of Buy action volume and 0.2% of Sell action volume were CADL Flagged in November. The majority of CADL Flagged Buy actions (97%), and CADL Flagged Sell actions (83%) came from Pumped Storage BMUs, with CCGT BMUs accounting for a further 14% of CADL Flagged Sell Actions.

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 November, an average of 48% of balancing actions received a First-Stage Flag with an average of 59% of this volume going on to receive a Second-Stage Flag. On the 21 November, 66% of balancing volume was flagged; with 77% of this volume receiving a Second Stage Flag.



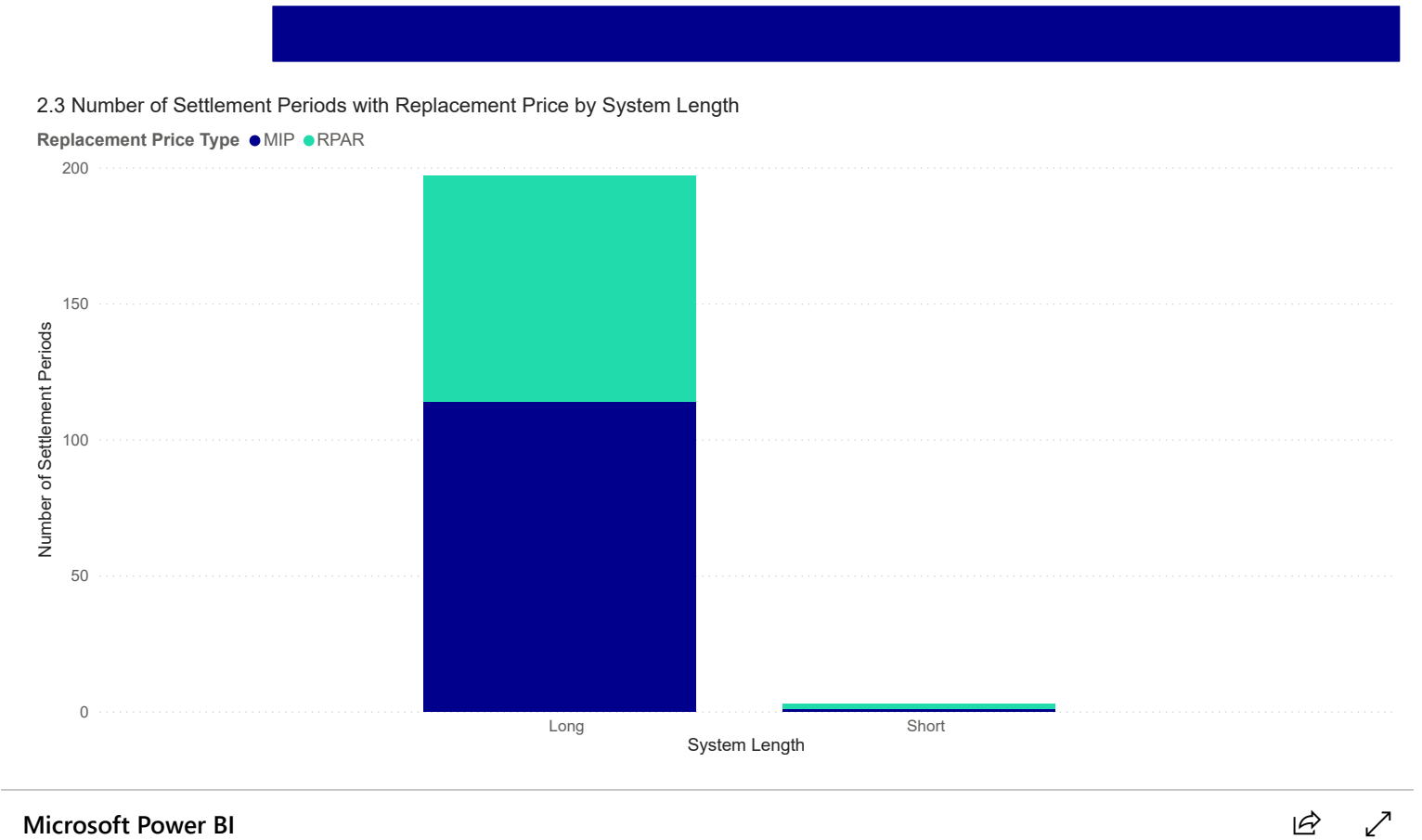
The Replacement Price

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 November, 85 (6%) Settlement

Periods had a Replacement Price based on the RPAR and 115 (8%) Settlement Periods had a Replacement Price based on the MIP. However, the majority of Settlement Periods (86%) did not have a Replacement Price.

Number of Settlement Periods with Replacement Price by System Length

This graph 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.



Average Price and Replacement Price by System Length

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

System Length	Replacement Price	Original Price
Long	14.30	-4.91
Short	43.28	56.67

Source: Elexon

Source: ELEXON

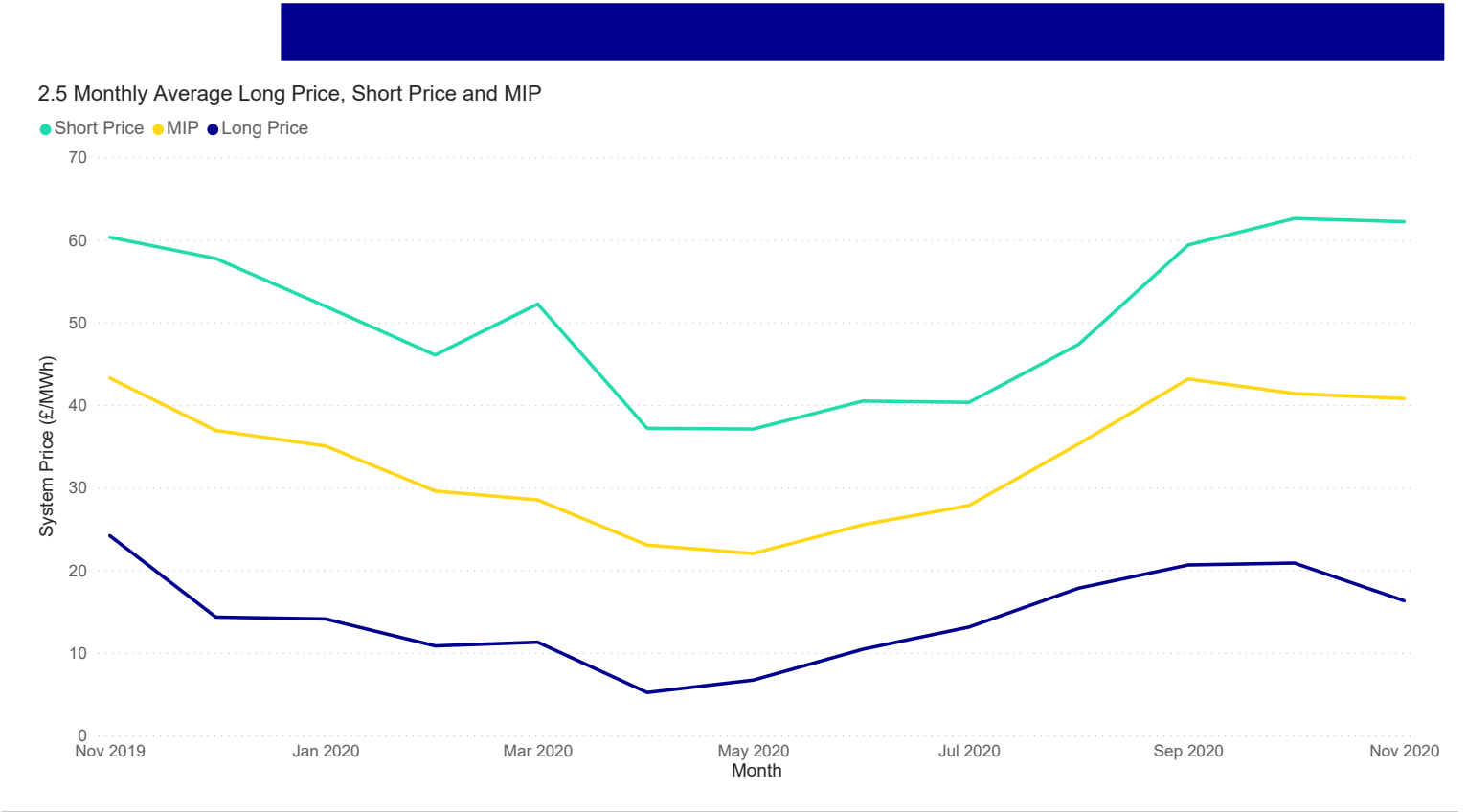
Sell actions will typically have their prices revised upwards by the Replacement Price for the purposes of calculating the System Price. In total, 81% of Sell volume in November was Flagged. Of this Flagged Sell volume, 4% was assigned a Replacement Price. The average original price of a Second-Stage Flagged repriced Sell action was -£4.91/MWh and the average Replacement Price for Sell actions (when the System was long) was £14.30/MWh.

25% of Buy volume were Flagged; 0.1% of this volume had the Replacement Price applied. This is the first time all monthly Buy action volume 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 114 long and one short Settlement Period in November, compared to 73 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. All three average prices dropped from last month. The monthly average long price dropped by £4.57/MWh to £16.31/MWh, the short price by £0.39/MWh to £62.20/MWh and the MIP by £0.60/MWh to £40.79/MWh.



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.

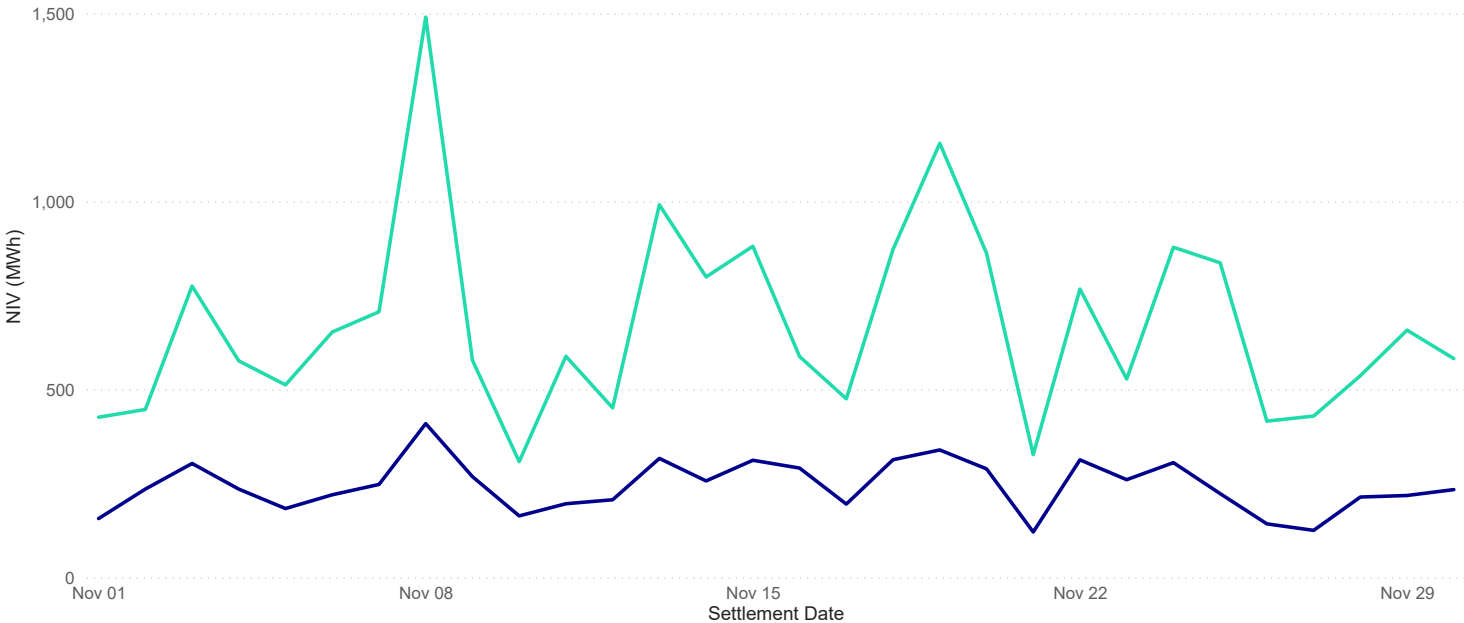
Short system NIV

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



2.6 Short System NIV

● Average of NIV ● Max of NIV



Microsoft Power BI



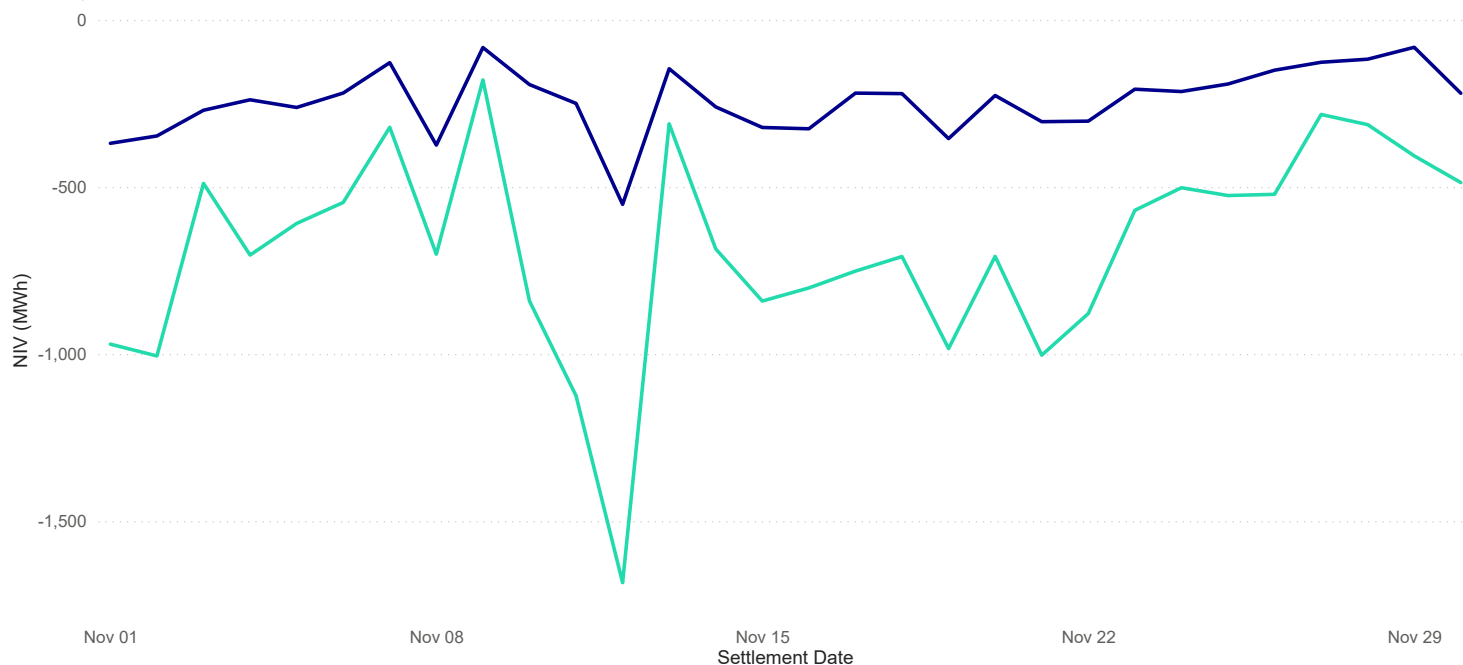
Long system NIV

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.



2.7 Long System NIV

● Average of NIV ● Min of 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 November, 89% 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 (1,490MWh) was seen in Settlement Period 35 on 8 November, where the System Price was £104.28/MWh.

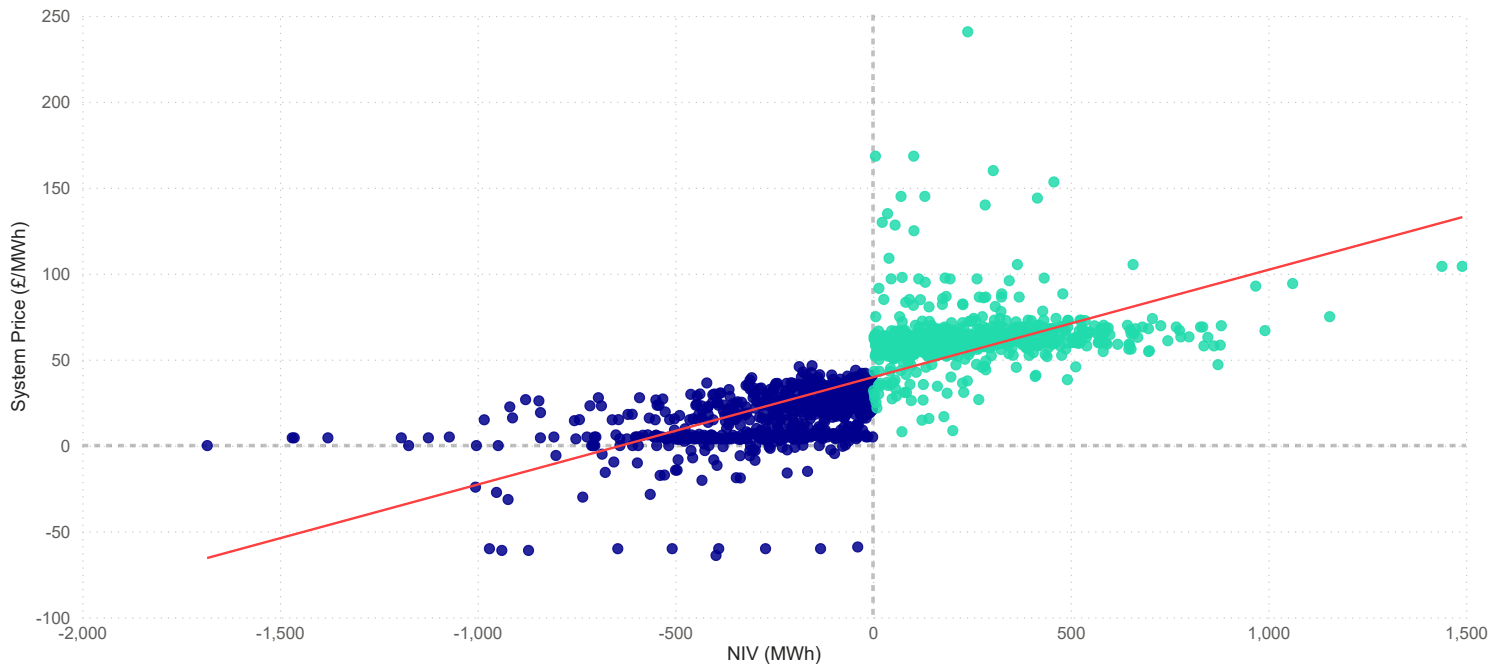
The minimum long system NIV of the month was -1,684MWh, in Settlement Period 8 on 12 November, where the System Price was £0.00/MWh.

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.

2.8 Net Imbalance Volume and System Price

System Length ● Long ● Short



Microsoft Power BI



There were 699 long Settlement Periods in November, 38 of which occurred on 22 November. The average NIV on this day was -175MWh, with the lowest NIV (-879MWh) occurring in Settlement Period 17. The most expensive Settlement Period, with a System Price of £240.77/MWh, had a short NIV of 240MWh.

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 November, there were two Settlement Periods where PAR Tagging was inactive. The average NIV in these Settlement Periods was -0.46MWh. Settlement Period 15 on 9 November had the lowest absolute NIV (-0.1MWh), and therefore was the most balanced Settlement Period of the month.

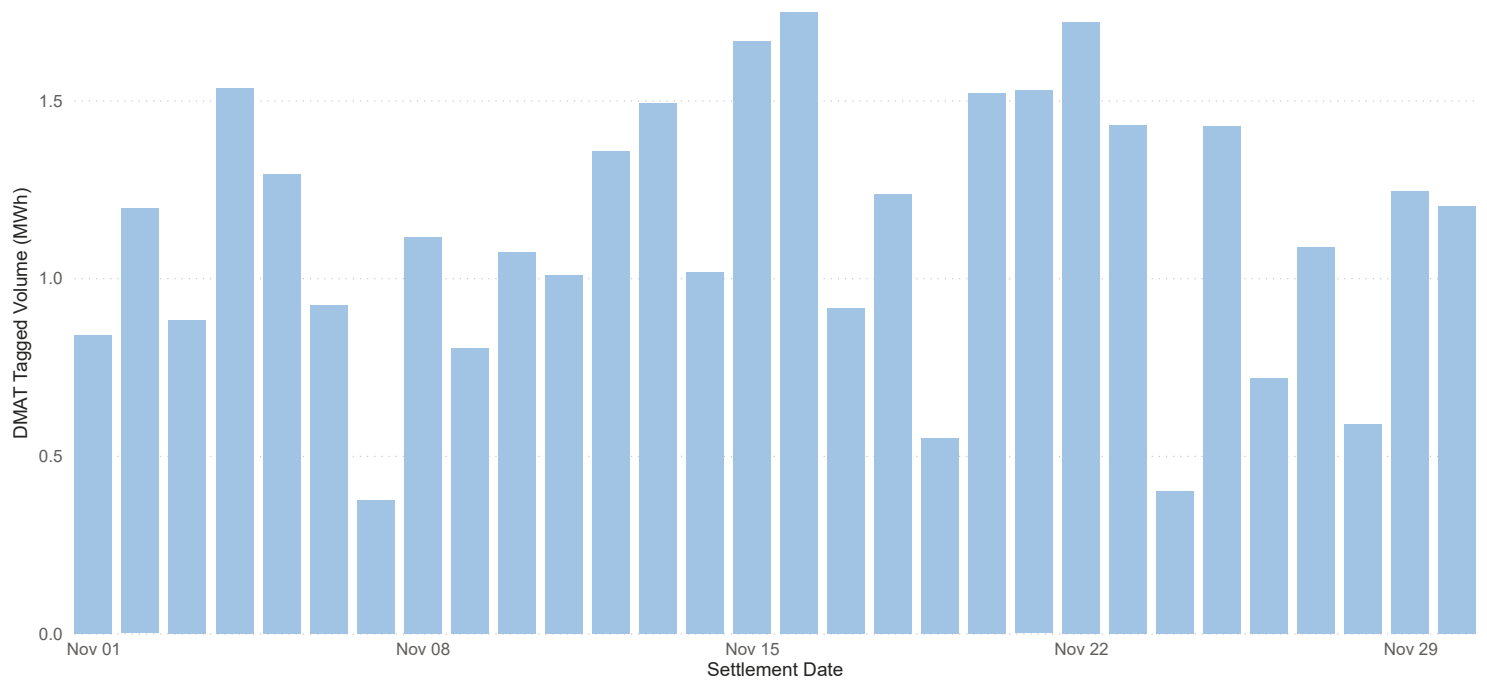
DMAT and Arbitrage Tagged Volumes

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.

2.9 Daily DMAT Tagged volume



Microsoft Power BI

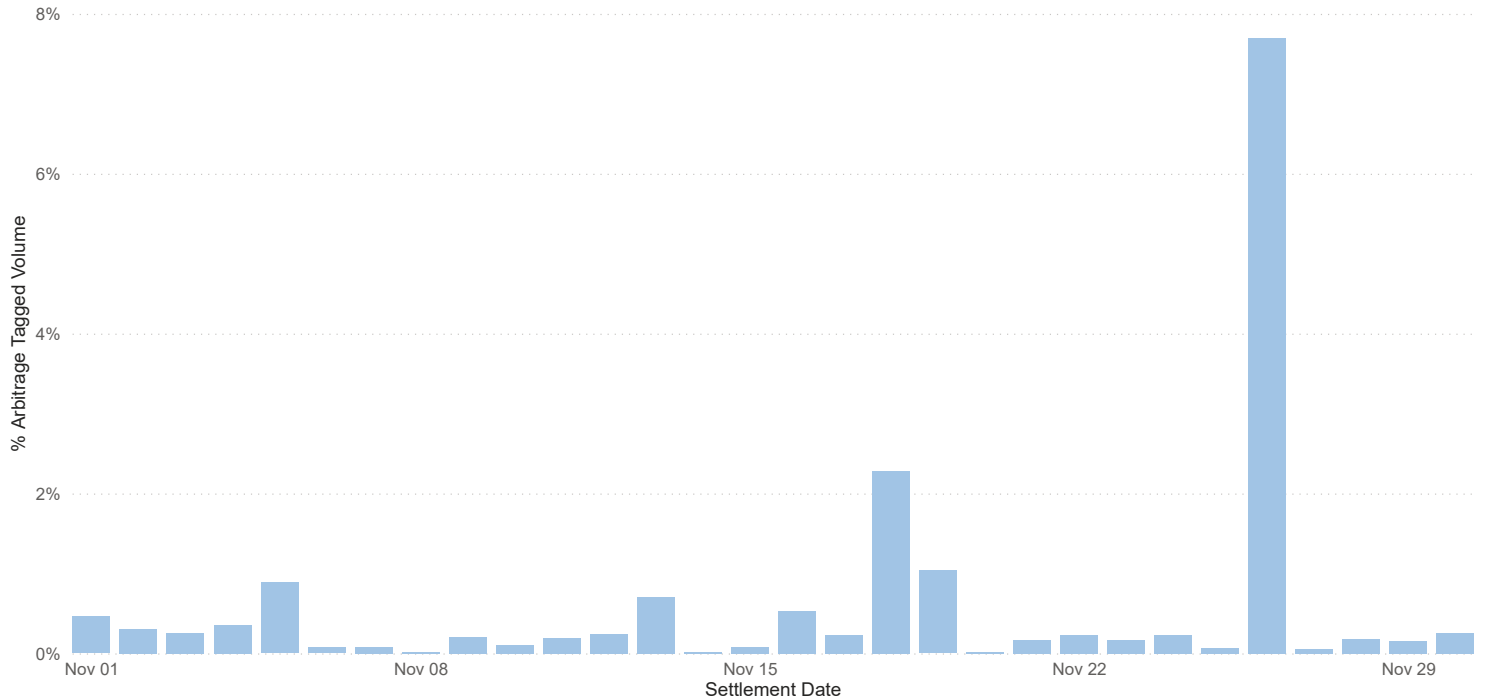


34MWh of total Buy and Sell volume was removed by DMAT Tagging in November, compared to 32MWh the previous month. 64% of the DMAT Tagged volume came from CCGT BMUs, 13% from other BMUs and 9% from Wind BMUs.

Daily percentage of Arbitrage Tagged volume

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

2.10 Daily percentage of Arbitrage Tagged volume



Microsoft Power BI



0.5% of total Buy and Sell volume was removed by Arbitrage Tagging in November. 54% of the Arbitrage Tagged came from BSAAs, 27% from CCGT BMUs and 14% from Wind BMUs.

In November, the average initial price of an Arbitrage Tagged Buy action was £25.92/MWh, and for a Sell action was £36.07/MWh. The maximum initial price of an Arbitrage Tagged Sell action was £323.47/MWh, and the lowest priced Arbitrage Tagged Buy action was -£154.11/MWh.

On 26 November, 2,701MWh of actions were Arbitrage Tagged, representing 7.7% of the daily volume of balancing actions. The average price of an Arbitrage Tagged Buy action was £63.75/MWh, and for a Sell action was £119.32/MWh on this day. 45% of the Arbitrage Tagged Volume came from BSAAs and 43% 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).

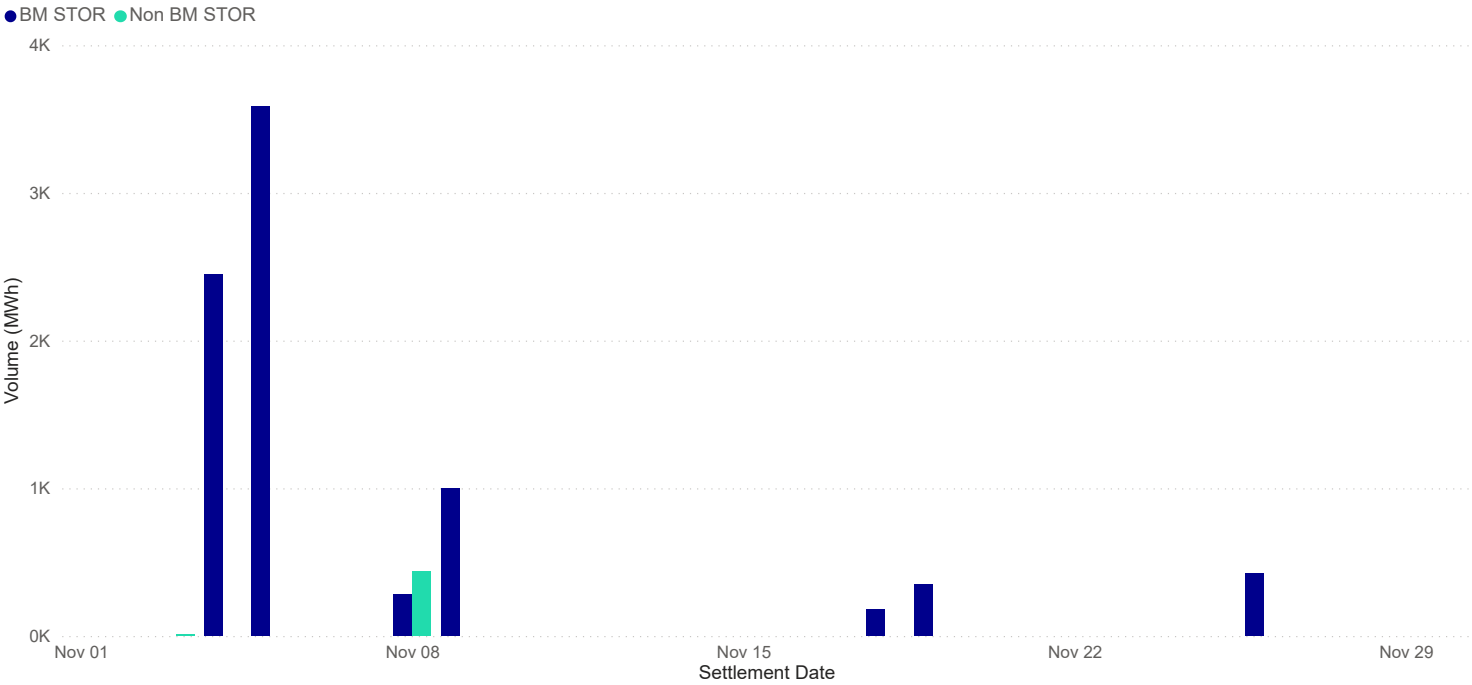
Under STOR contracts, availability payments are made to the balancing service provider in return for capacity being made available to the SO during specific times (STOR Availability Windows). When STOR is called upon, the SO pays for it at a pre-agreed price (its Utilisation Price). Some STOR is dispatched 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. 5% of the total STOR volume utilised in November came from outside of the Balancing Mechanism.



3.1 Daily STOR BM vs Non BM volumes

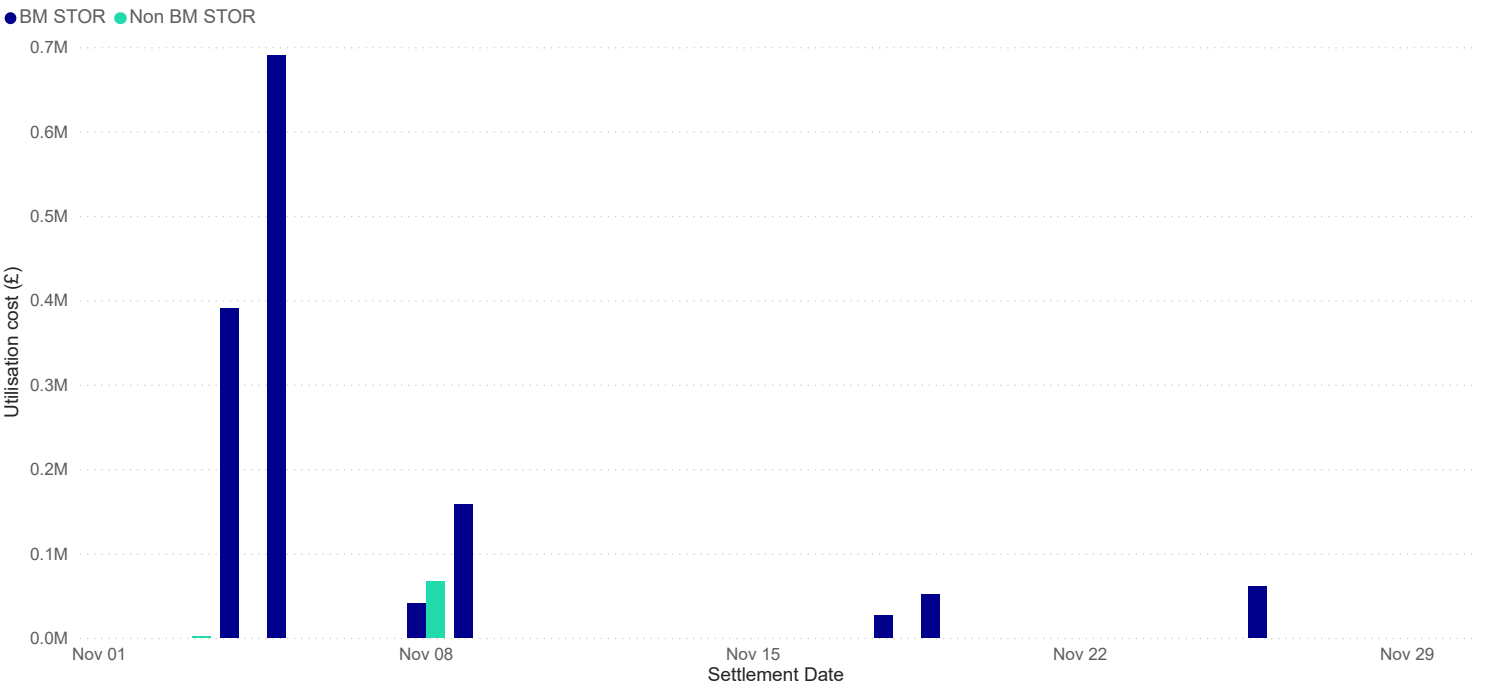


Daily STOR vs Non-BM STOR utilisation costs

This graph shows the utilisation costs of this capacity. The average Utilisation Price for STOR capacity in November was £170.59/MWh; £171.50/MWh for BM STOR and £153.41/MWh for non-BM STOR.



3.2 Daily STOR BM vs Non BM utilisation costs



Microsoft Power BI



On 5 November the largest amount was spent on STOR volume for the month (£690,252), all of the cost was BM STOR. The utilised BM STOR volume on this day was 3,585MWh, compared to the average of 276MWh 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).

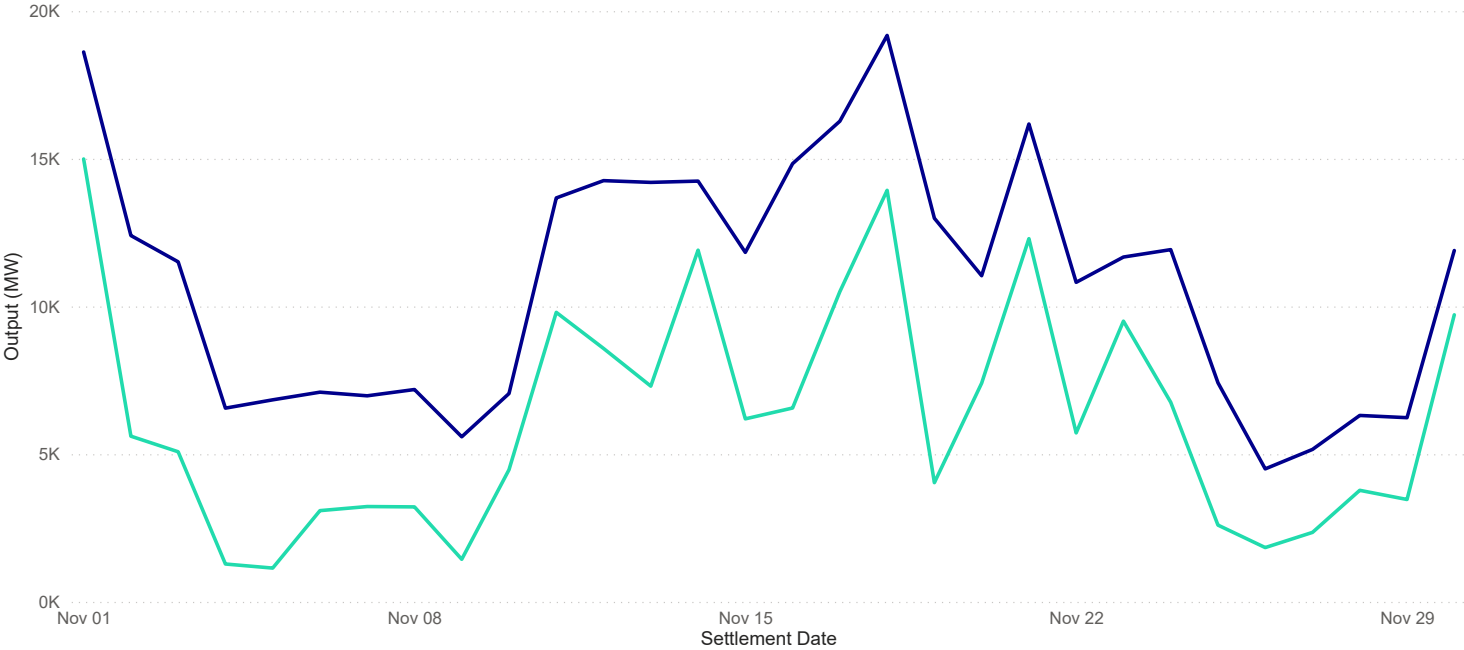
Minimum and average DRMs

This graph shows the daily minimum and average Gate Closure DRMs for November 2020.



3.3 Minimum and average DRMs

● Average of DRM ● Min of DRM



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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 November was 1.145GW on 5 November 2020 in Settlement Period 36 (compared to 1.809 in October). This DRM corresponded to a LoLP of 0.066 and RSVP of £396.14/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 four Settlement Periods where a total of 30 actions were repriced with the RSVP during November. The RSVP only set the System Price in Settlement Period 35 on 9 November. In all other Settlement Periods where the RSVP was applied to balancing actions, the repriced actions were NIV tagged from the System Price calculation.

Top 5 LoLPs and RSVPs

Settlement Date	Settlement Period	DRM (MW)	LoLP	RSVP (£/MWh)	RSVP Used	System Price (£/MWh)	System Length
05/11/2020	36	1,145	0.066	396.14	Yes	145.00	Short
05/11/2020	37	1,156	0.0641	384.84	Yes	22.00	Long
04/11/2020	35	1,283	0.049	296.62	Yes	3.85	Long
09/11/2020	35	1,443	0.035	212.36	Yes	240.77	Short
04/11/2020	36	1,615	0.022	129.24	No	0.00	Long

Source: Elexon