ISG206-SPAR
REPORTING ON MAY 2018

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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 Analysis Team to the Imbalance Settlement Group (ISG) and on the ELEXON Website ahead of the monthly ISG meeting.

This report provides data and analysis specific to System Prices and the Balancing Mechanism[1]. It demonstrates out-turn prices and the data used to derive the prices. The data is a combination of II and SF Settlement Runs.

The System Price Analysis Dashboard is available on the ELEXON website, and allows customers to model and compare System Prices under post 1 November 2018 scenario.

This month's SPAR contains an appendix on tagging of energy balancing volumes.

1 SYSTEM PRICES AND LENGTH

This report covers the month of May. 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 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 May 2018, with values shown in £/MWh.

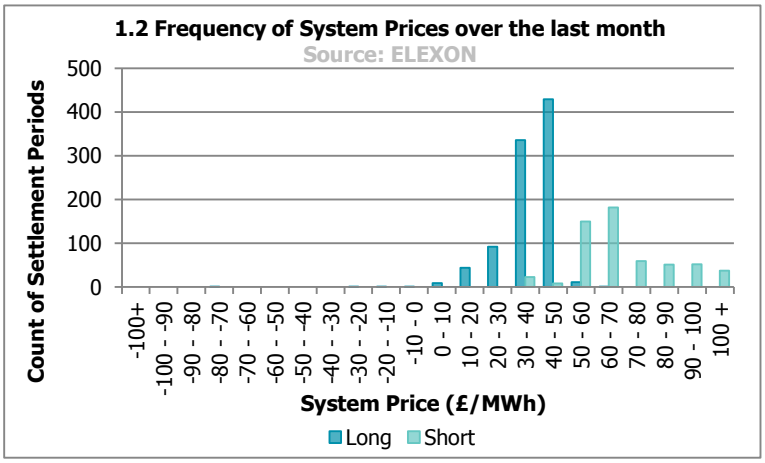
	System Price (Long)				
Month	**Min**	**Max**	**Median**	**Mean**	**Std Dev**
May 2018	-71.33	61.85	39.50	36.80	9.55

	System Price (Short)				
Month	**Min**	**Max**	**Median**	**Mean**	**Std Dev**
May 2018	34.95	158.00	62.50	70.45	19.27

1.1 System Price summary by month (£/MWh)

Graph 1.2 shows the distribution of System Prices across Settlement Periods in May 2018 when the market was long and short.

64% of System Prices were between £30/MWh and £60/MWh, regardless of system length. When the system was long, 83% of prices were between £30/MWh and £50/MWh. When the system was short, 59% of prices were between £50/MWh and £70/MWh and 7% of prices were over £100/MWh.



[1] For further detail of the Imbalance Price calculation, see our imbalance pricing guidance: https://www.elexon.co.uk/reference/credit-pricing/imbalance-pricing/

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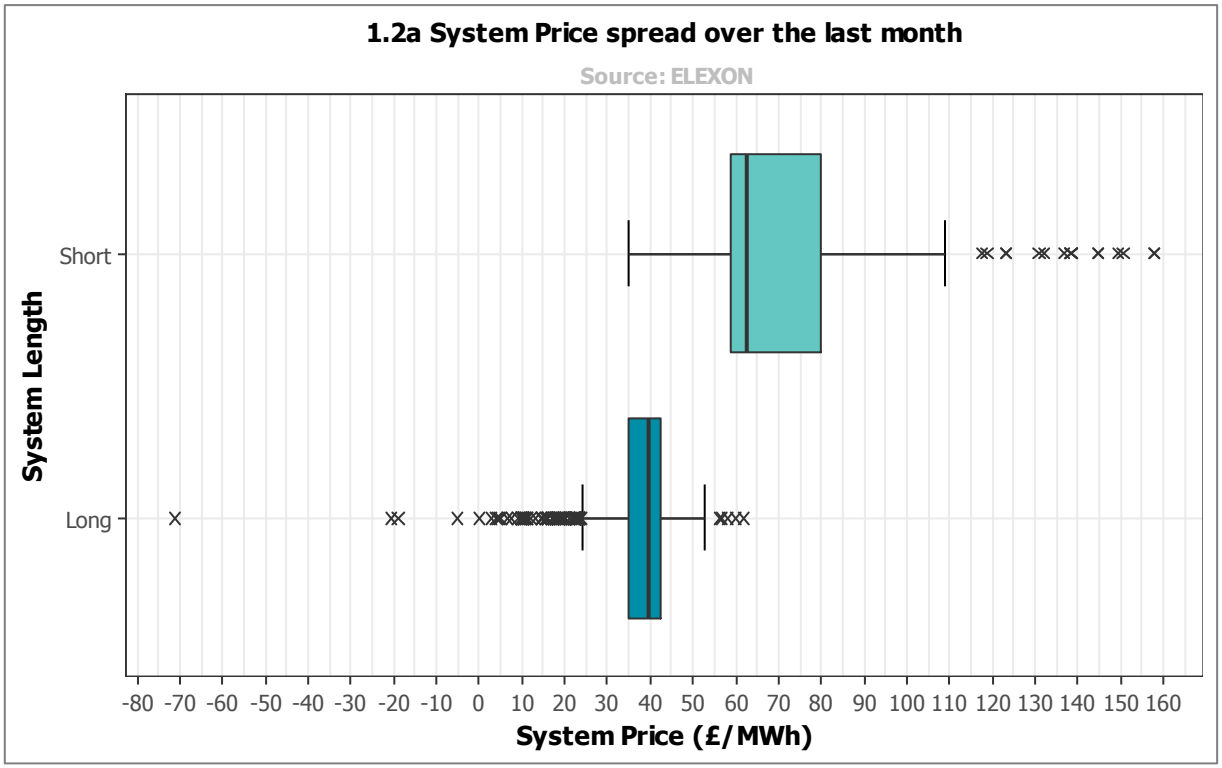
System Prices exceeded £100/MWh 37 times in May 2018 (compared to 49 times in April). The highest System Price, £158/MWh, occurred in Settlement Periods 42 and 43 on 20 May 2018. These prices were set by an Offer from a Gas BMU priced at £158/MWh.

The lowest System Price of the month was -£71.33/MWh. This occurred in Settlement Period 17 on 4 May 2018, and was set by negatively priced Bids from four Wind BMUs and a Balancing Services Adjustment Action (BSAA).

Graph 1.2a shows the spread of System Prices in May 2018 displayed as a box plot diagram, and split between a short and long system. The middle line in each box represents the median System Price of the month, which is £62.50/MWh for short Settlement Periods and £39.50/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 £20.99/MWh for short System Prices and £7.40/MWh for long System Prices.

Outliers are shown on the graph as crosses, and have been defined as being greater than 1.5 x the Interquartile Range away from the Upper and Lower quartiles. Under this definition, 16 of 562 short System Prices (3%) for May were outliers - with a System Price greater than £109/MWh. The graph also shows how these high short System Prices are distributed up to the maximum short System Price for the month of £158/MWh.

For long System Prices, the majority of prices fall within a narrow band; 83% of prices are between £30/MWh and £50/MWh. The lowest long System Price of the month, -£73.3/MWh, is much lower than other long System Prices in May.



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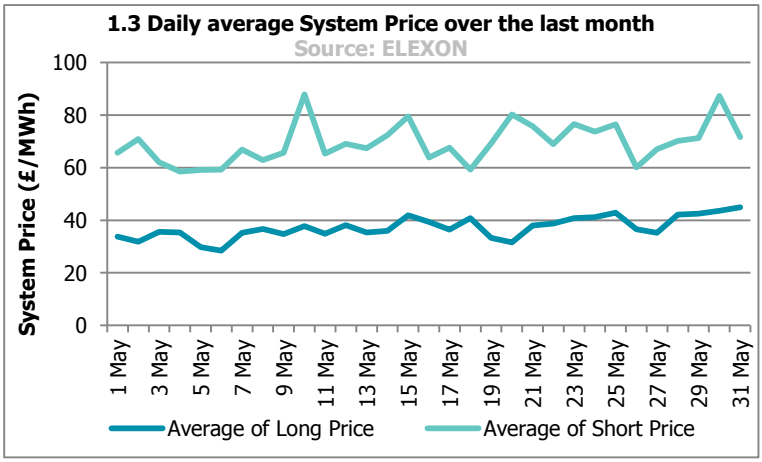
Graph 1.3 shows daily average System Prices over the last month. In May, the average System Price was £36.80/MWh when the system was long and £70.45MWh when the system was short.

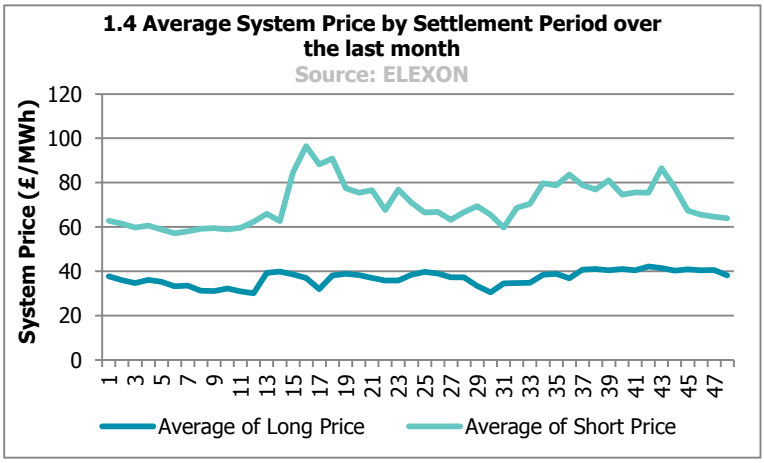
The highest daily average price when the system was short was £87.89/MWh, and occurred on 10 May. The system was short for two Settlement Periods on this day.

The lowest daily average price when the system was long was £28.35/MWh on 6 May 2018. The system was long in 40 Settlement Periods on this day.

Graph 1.4 shows the variation of System Prices across the day. Short prices were highest in Settlement Period 16, with long prices lowest in Settlement Period 12. The lowest average System Prices, regardless of market length, occurred during Settlement Period 11, when the System Price was £39.25/MWh.

Average long Settlement Period System Prices ranged between £30.05/MWh and £42.16/MWh. Average short Settlement Period prices varied more, from £57.16/MWh to £96.42/MWh.





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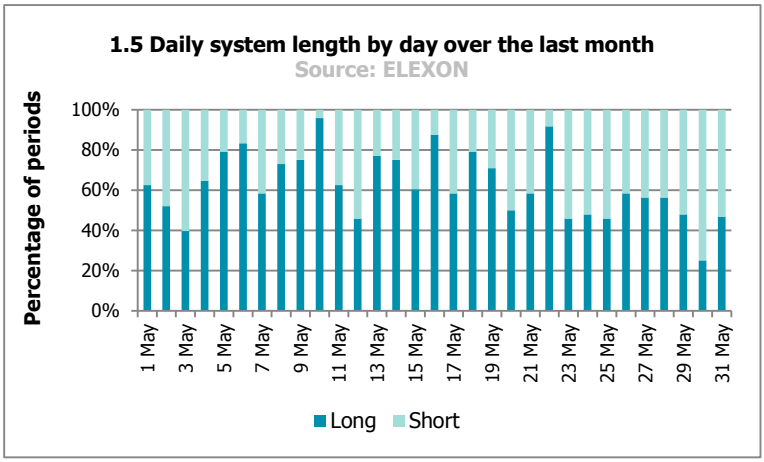
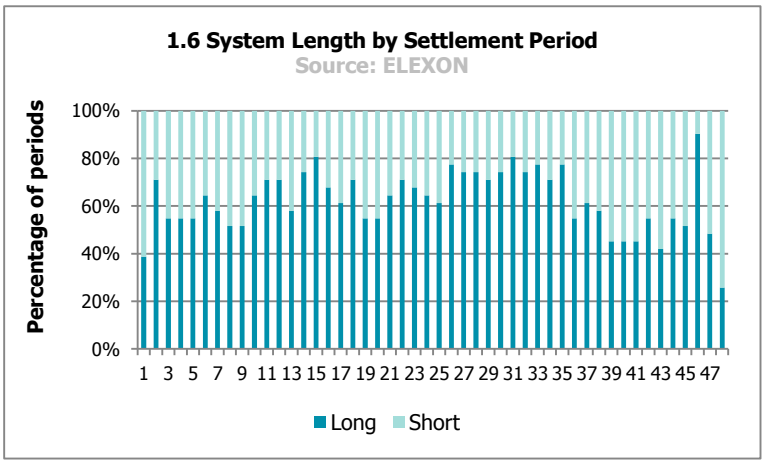
Graph 1.5 shows system length by day, and **Graph 1.6** shows system length by Settlement Period for May. The system was long for 62% of Settlement Periods in May, compared to 61% in April.

On 30 May, the system was short for 75% of Settlement Periods. The average NIV when the system was short on this day was 275MWh, while the average System Price in a short Settlement Period was £87.26/MWh. In contrast, on 10 May the system was long in 96% of Settlement Periods.

Settlement Period 48 was short for 74% of the month, whilst Settlement Period 46 was short for 10% of the month.





2 PARAMETERS

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

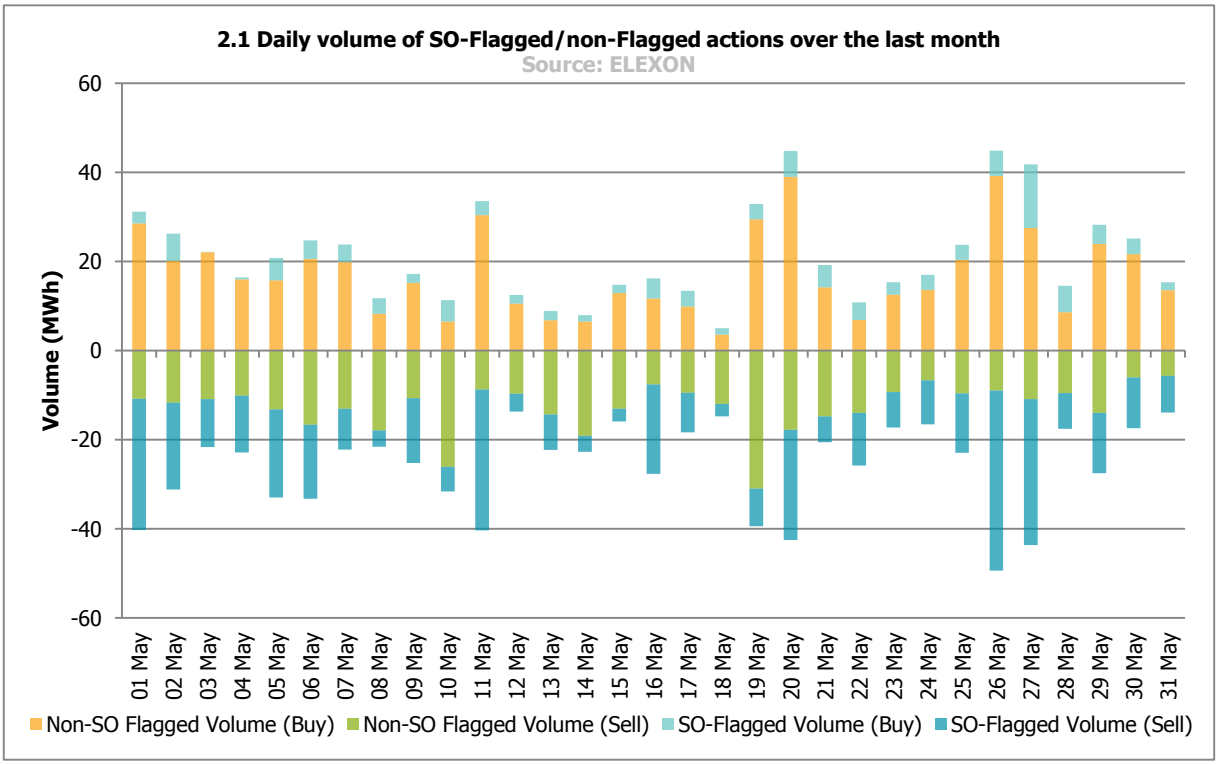
- The impact of Flagging balancing actions;
- The impact of NIV Tagging;
- The impact of PAR Tagging;
- The impact of the Replacement Price; and
- How these mechanisms affect which balancing actions feed into the price.

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 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 (CADL Flagging).

Graph 2.1 shows the volumes of buy and sell actions that have been Flagged by the SO in May 2018 as being constraint related. On 26 May, 82% of sell volume was SO-Flagged.



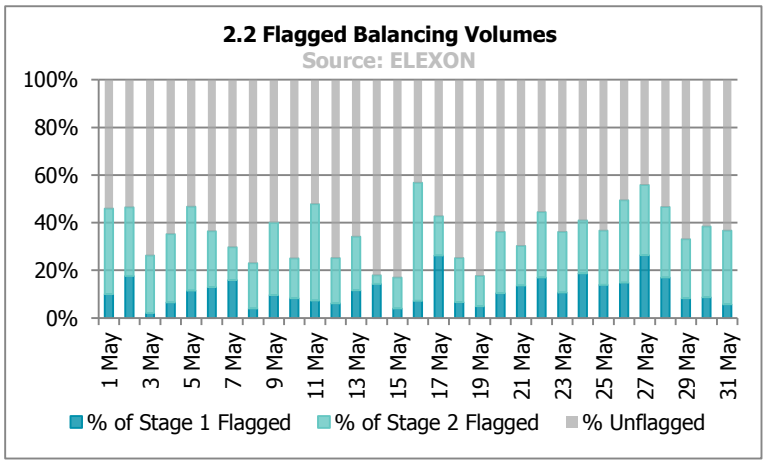
51% of sell balancing actions taken in May had an SO-Flag compared with 49% in April. 52% of SO-Flagged sell actions came from Balancing Services Adjustment Actions (BSAAs), 32% from CCGT BMUs and 12% from Wind BMUs. The average initial price (i.e. before any re-pricing) of a SO-flagged sell action was -£19/MWh.

18% of buy balancing actions taken in May had an SO-Flag, compared to 18% in April. 64% of SO-Flagged buy actions came from BSAAs and 32% from CCGT BMUs. The average initial price of a SO-Flagged buy action was £74.09/MWh.

Any actions with a total duration of less than 15 minutes are CADL Flagged. 2% of buy actions and 1% of sell actions were CADL Flagged in May. The majority of CADL Flagged buy actions (91%) came from Pumped Storage BMUs. 67% of CADL Flagged sell actions came from CCGT BMUs, with Pumped Storage BMUs accounting for a further 31%.

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-Stage 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.



The Replacement Price

Any Second-Stage Flagged action volumes left in the NIV will be repriced using the Replacement Price. In total, 52% of sell actions in May were flagged. Of these, 16% were assigned a 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 May, 327 Settlement Periods had a Replacement Price based on the RPAR and 43 Settlement Periods had a Replacement Price based on the MIP. However the majority of Settlement Periods (75%) did not have a Replacement Price.

Sell actions will typically have their prices revised upwards by the Replacement Price for the purposes of calculating the System Price. In May, the average original price of a Second-Stage Flagged repriced sell action was £10.06/MWh and the average Replacement Price for sell actions (when the System was long) was £38.02/MWh.

19% of buy actions were Flagged; of these 1% had the Replacement Price applied. Buy actions will typically have their prices revised downwards by the Replacement Price. The average original price of a buy action with the Replacement Price applied was £102.43/MWh, and the average Replacement Price was £81.59/MWh.

If there are no Unflagged actions remaining in the NIV, the Replacement Price will default to the Market Index Price. This occurred in 43 long Settlement Periods in May, compared to 31 long Settlement Periods last month.

NIV and NIV Tagging

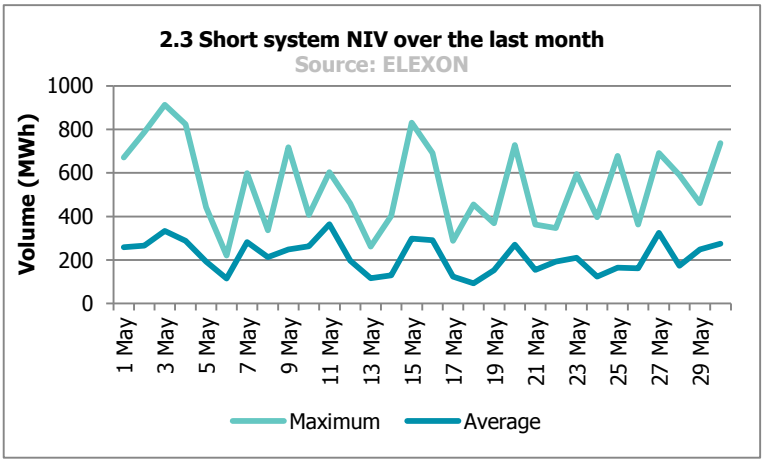
The Net Imbalance Volume (NIV) represents the direction of imbalance of the system – i.e. whether the system is long or short overall. **Graph 2.3** shows the greatest and average NIV when the system was short, and **Graph 2.4** shows the greatest and average NIVs when the system was long. Note short NIVs are depicted as positive volumes and long NIVs are depicted as negative volumes.

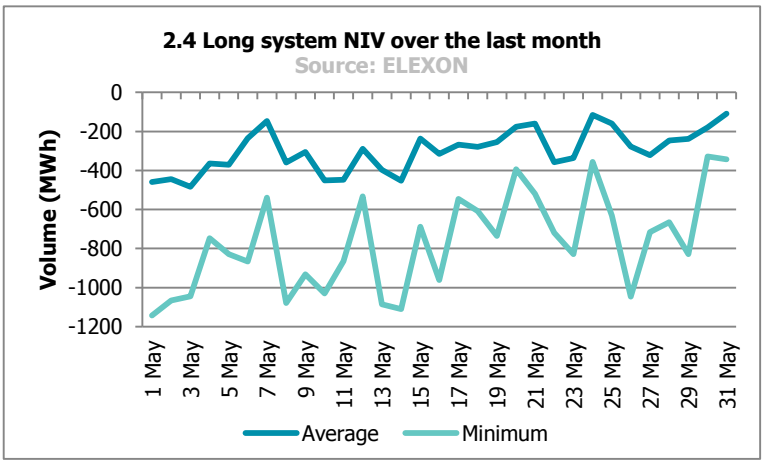
In almost all Settlement Periods, the System Operator will need to take balancing actions in both directions (buys and sells) to balance the system. However, for the purposes of calculating an Imbalance Price there can only be one imbalance in one direction (the Net Imbalance). 'NIV Tagging' is the process 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 May, 68% 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 (913MWh) was seen on 3 May in Settlement Period 34. The System Price was £89.01/MWh in this Settlement Period.

The minimum long system NIV of the month was -1,142MWh, on 1 May 2018 during Settlement Period 22 when the System Price was £22.50/MWh.





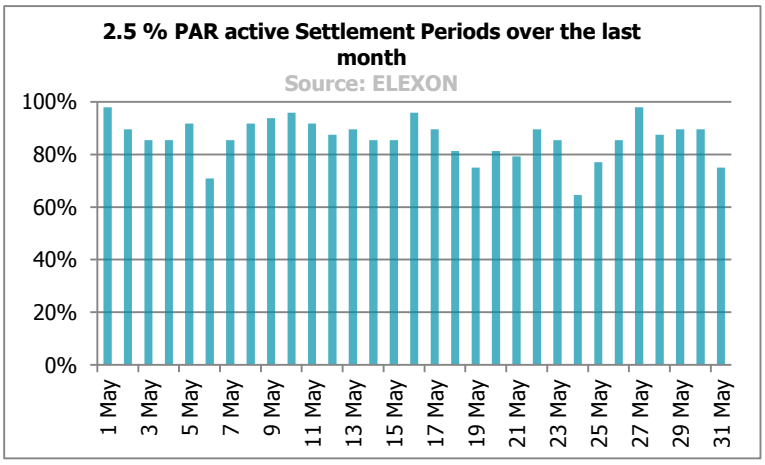
PAR Tagging

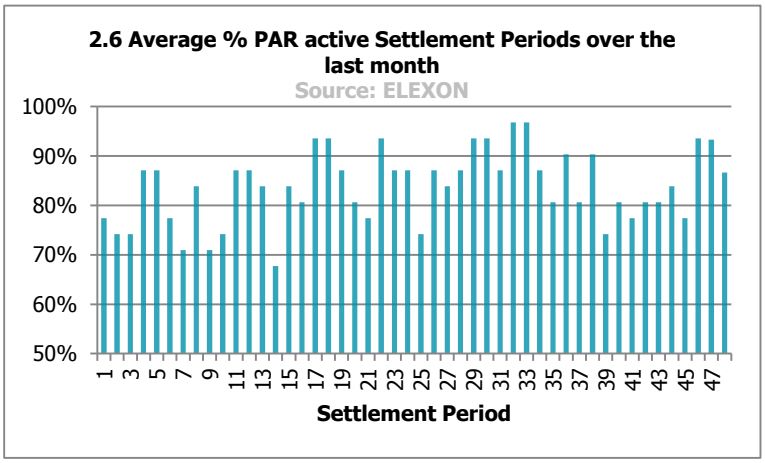
PAR is the final step of the Imbalance Price calculation. It takes a volume weighted average of the most expensive 50MWh of actions left in the stack. PAR is currently set to 50MWh, but is due to decrease to 1MWh on 1 November 2018.

Graph 2.5 shows the impact of PAR Tagging across the month. PAR Tagging is active when there are more than 50MWh of actions left in the NIV following the previous steps of Imbalance Price calculation. Only the most expensive 50MWh are used in the calculation, so any volumes greater than 50MWh are 'PAR Tagged' and removed from the Imbalance Price calculation stack. PAR was active for 86% of Settlement Periods in May.

Graph 2.6 shows the proportion of Settlement Periods over the last month when PAR Tagging was active. Settlement Period 14 had the lowest active PAR Tagging in May 2018 with 68%, representing the NIV being smaller in this period or the system being more balanced as a whole prior to System Operator balancing activity.

No Settlement Periods had PAR Tagging active every day during May.





DMAT and Arbitrage Tagged Volumes

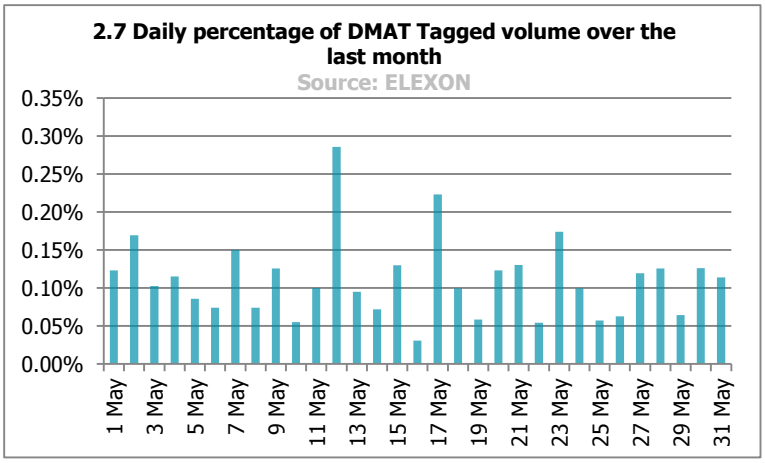
Some actions are always removed from the price calculation (before NIV Tagging). These are actions which are less than 1MWh (De Minimis Acceptance Threshold (DMAT) Tagging) or buy actions which are either the same price or lower than the price of sell actions (Arbitrage Tagging). More information on Arbitrage Tagging is given in this month's appendix.

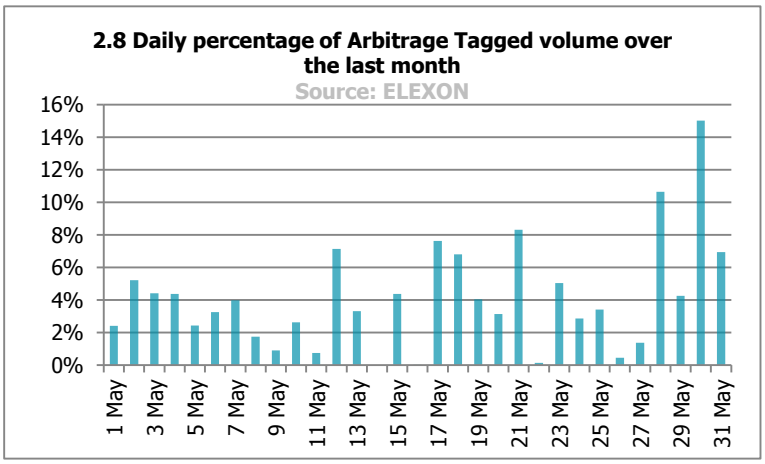
Graph 2.7 shows the volumes of actions removed due to DMAT Tagging. 0.11% of total buy and sell volume was removed by DMAT Tagging in May. 50% of DMAT Tagged volume came from Balancing Services Adjustment Actions (BSAAs), whilst 34% came from CCGT BMUs.

Graph 2.8 shows the volumes of actions that were removed due to Arbitrage Tagging. 49% of Arbitrage Tagged volume was from BSAAs, with 46% from CCGT BMUs.

In May, the average initial price of an Arbitrage Tagged buy action was £37.84/MWh, and for a sell action was £42.91/MWh. The maximum price of an Arbitrage Tagged sell action was £122.15/MWh, and the lowest priced Arbitrage Tagged buy action was £0/MWh.

On 30 May 2018, 6,394MWh of actions were Arbitrage Tagged, representing 15.03% of daily volume. The average price of an Arbitrage Tagged buy action was £38.97/MWh, and for a sell action was £44.29/MWh. 0.13% of daily volume was DMAT Tagged on this day.





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).

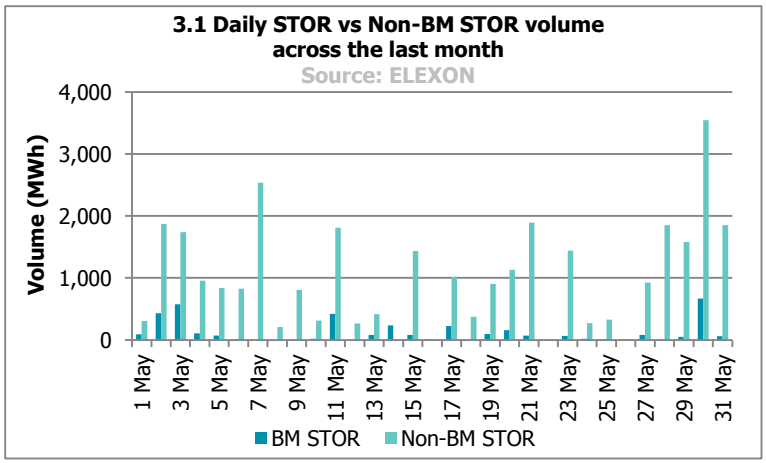
Under STOR contracts, availability payments are made to the balancing service provider in return for capacity being made available to the SO during specific times (STOR Availability Windows). When STOR is called upon, the SO pays for it at a pre-agreed price (its Utilisation Price). Some STOR is dispatched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

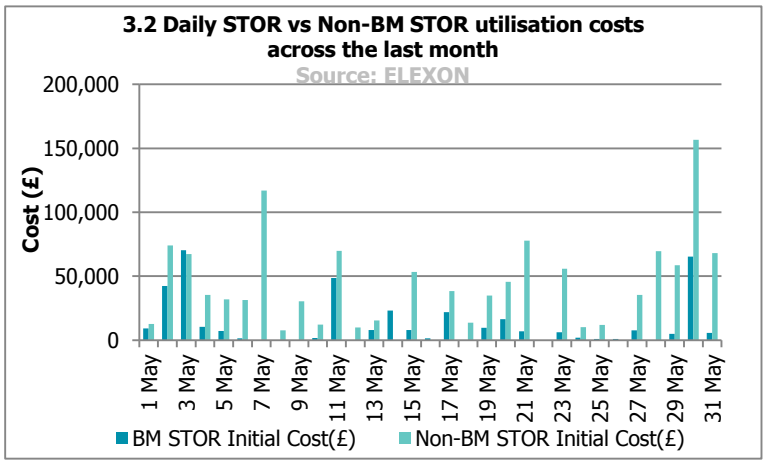
Graph 3.1 gives STOR volumes that were called upon during the month – split into BM STOR and non-BM STOR. **Graph 3.2** shows the utilisation costs of this capacity. 90% of the total STOR utilised in May came from outside of the Balancing Mechanism.

The average Utilisation Price for STOR capacity in May was £46.24/MWh (£104.13/MWh for BM STOR and £39.53/MWh for non-BM STOR).

On 30 May, 665MWh of BM STOR volume was called at an utilisation cost of £65,170. This represented 18% of the total BM STOR volume in May. On the same day, 3,546MWh of Non-BM STOR was called upon at an utilisation cost of £156,626.

In total, 4,211MWh of BM and non-BM STOR volume was called on 30 May, at a combined utilisation costs of £221,796.





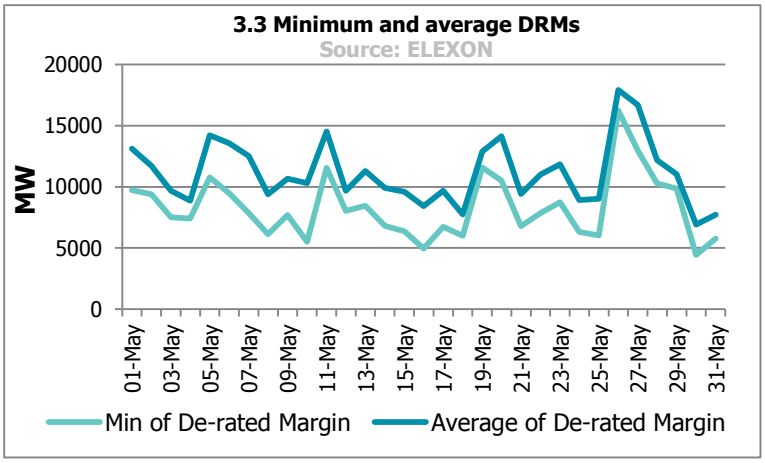
De-Rated Margin, Loss of Load Probability and the Reserve Scarcity Price

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, currently set at £3,000/MWh).

Graph 3.3 shows the daily minimum and average Gate Closure DRMs for May 2018.

The System Operator has determined a relationship between each DRM and the LoLP[2], which will determine the RSVP. The minimum DRM in May was 4,433MW on 30 May in Settlement Period 37 (compared to 3,142MW in April).

The RSVP re-prices STOR actions in the Imbalance Price calculation if it is higher than the original Utilisation Price. No STOR actions were re-priced using the RSVP in May (see **Table 3.4**).



3.4 Top 5 LoLPs and RSVPs

Date	SP	DRM	LoLP	RSVP	RSVP Used	System Length	System Price
30/05/2018	37	4,432.75	0.0000	**0.00**	No	Short	149.61
30/05/2018	38	4,904.20	0.0000	**0.00**	No	Short	104.16
16/05/2018	37	4,969.75	0.0000	**0.00**	No	Long	42.01
16/05/2018	38	5,074.02	0.0000	**0.00**	No	Long	42.25
30/05/2018	36	5,131.13	0.0000	**0.00**	No	Short	150.59

[2] The System Operators methodology for LoLP is set out in the LoLP Methodology statement: https://www.elexon.co.uk/wp-content/uploads/2015/10/Loss_of_Load_Probability_Calculation_Statement_v1.0.pdf

4 P305 - SPECIFIC ANALYSIS

This section compares live prices with two different pricing scenarios. First we consider what prices would look like with the **pre-P305 price calculation** to highlight the impact of P305. Before the implementation of P305, the price calculation had:

- A PAR of 500MWh, and an RPAR of 100MWh;
- No non-BM STOR volumes or prices included in the price stack;
- No RSVP, and instead a Buy Price Adjuster (BPA) that recovers STOR availability fees; and
- No Demand Control, Demand Side Balancing Reserve (DSBR), or Supplementary Balancing Reserve (SBR) actions priced at VoLL.

We also consider the **November 2018 Scenario**, which captures the effect of changes to the Imbalance Price parameters that are due to come in on 1 November 2018. These are:

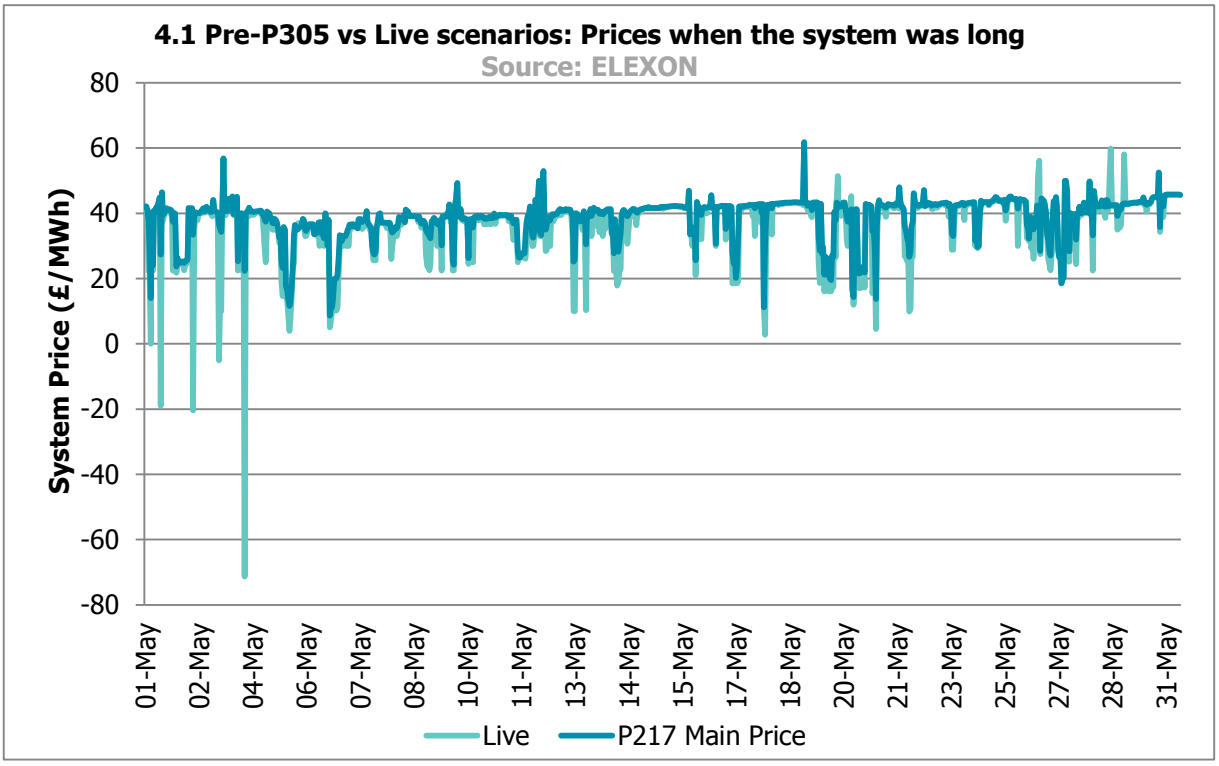
- A reduction in the PAR value to 1MWh (RPAR will remain at 1MWh);
- The introduction of a 'dynamic' LoLP function[3]; and
- An increase in the VoLL to £6,000MWh, which will apply to all instances of VoLL in arrangements, including the RSVP function.

[3] From 1 May 2018 the Transmission Company will calculate Indicative LoLP values using the Dynamic Method, whilst it continues to calculate Final LoLP values using the Static Method. Indicative LoLP values using the Dynamic Method will be published on the ELEXON Portal.

Pre-P305 Price Calculation

Graph 4.1 compares live System Prices when the system was long with prices re-calculated using the pre-P305 pricing scenario 'P217' (for comparison we use the Main Price calculation). On average, live prices were £1.90/MWh lower when the system was long compared to the pre-P305 calculation. This is expected as the reduction of PAR from 500MWh to 50MWh aims to make prices 'more marginal', by reducing the dampening effect of a large PAR.

When the system was long, prices were different in 83% of Settlement Periods; in 75% of these periods, the change was less than £1/MWh. The biggest price change occurred on the 4 May 2018 in Settlement Period 17, where the live price was £93.69/MWh lower than the System Price would have been under the P217 Scenario. This difference was due to the reduction in PAR.

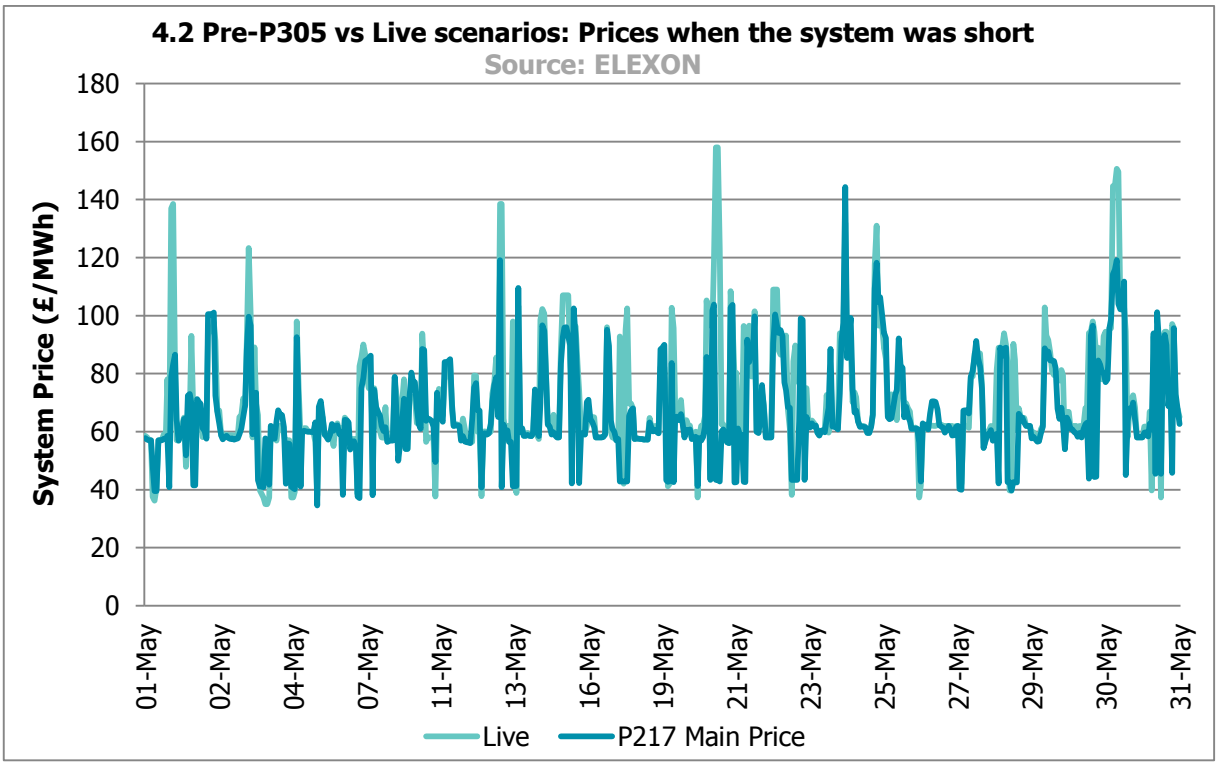


Graph 4.2 compares live System Prices when the system was short with prices re-calculated using the pre-P305 pricing scenario 'P217' (using the Main Price calculation).

Live prices were on average £4.19/MWh higher when the system was short. In May 59% of Settlement Periods had live System Prices higher than the Pre-P305 scenario, 29% lower and 12% with no change.

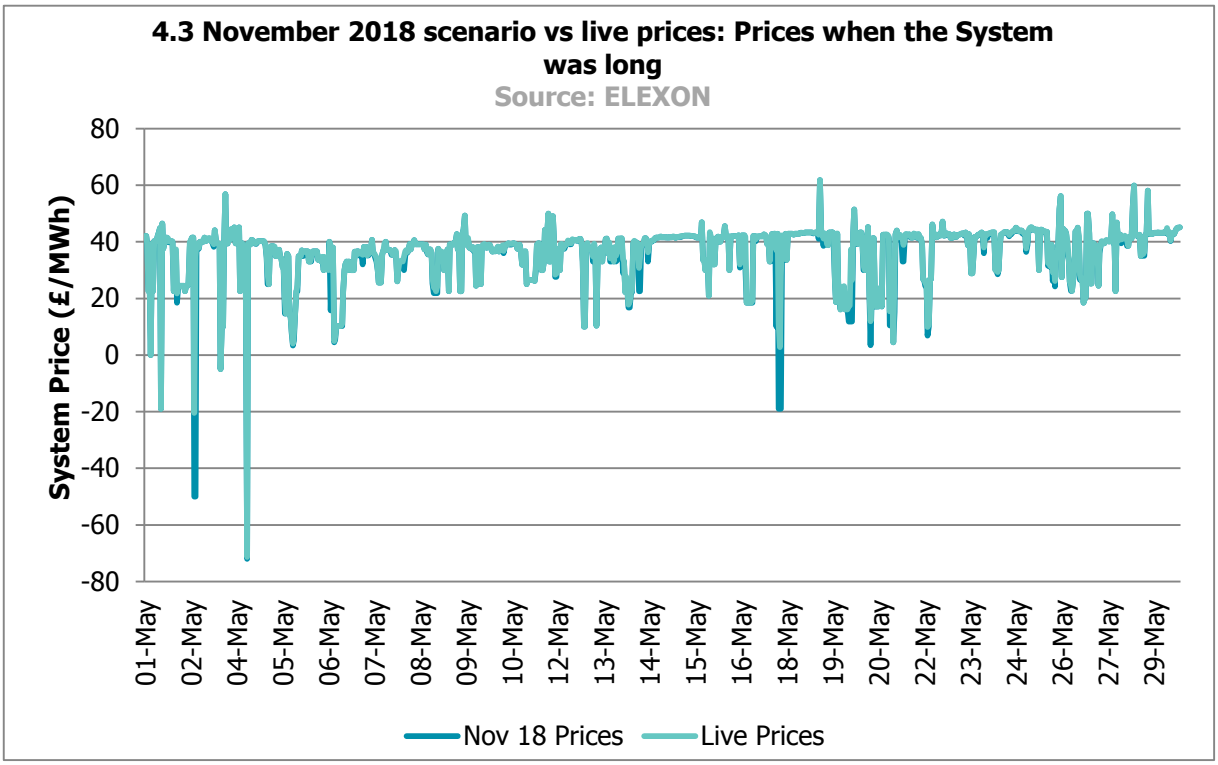
The biggest difference in prices when the system was short was £114.69/MWh (20 May 2018 during Settlement Period 42 and 43), as a result of the inclusion of non-BM STOR in the pricing calculation. In the P217 scenario, the Main Price would have been £43.31/MWh and the system long in both Settlement Periods compared to the live scenario System Prices of £158/MWh and the system short.

The inclusion of non-BM STOR volumes in the pricing stack changed the system length from long to short in 74 Settlement Periods.



November 2018 Price Calculation

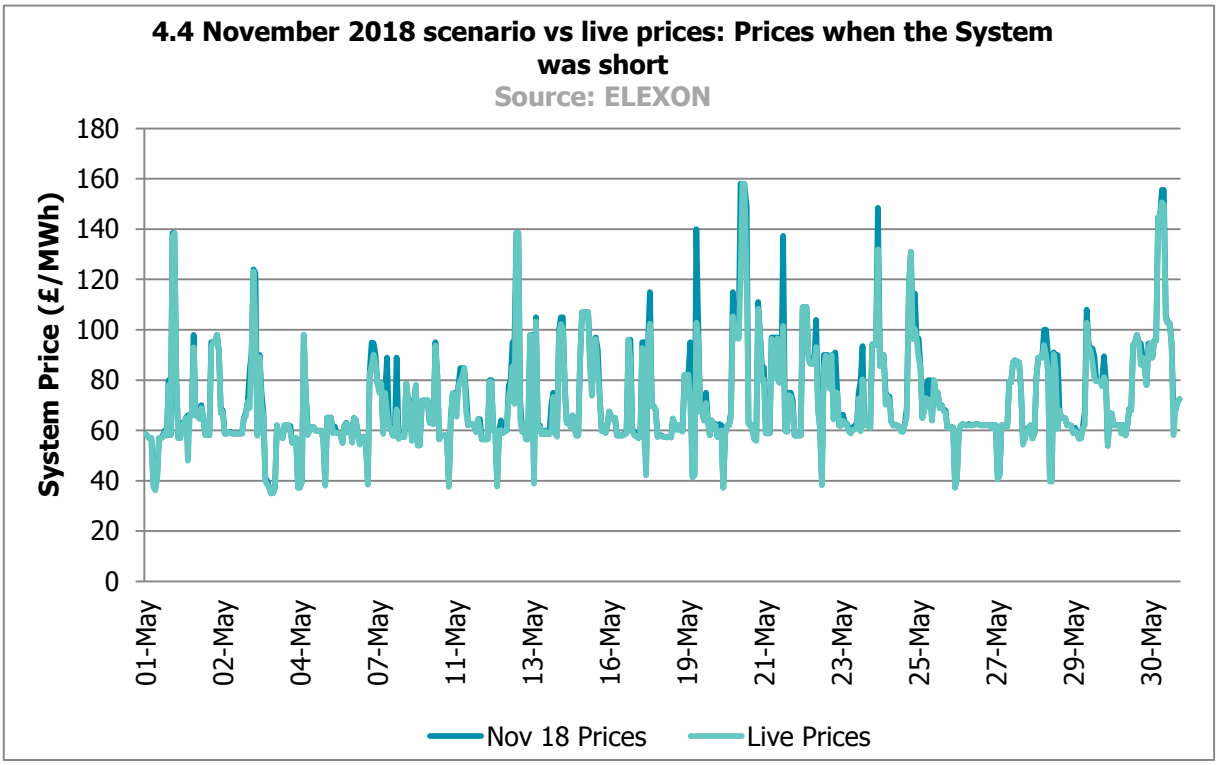
Under the November 2018 scenario, when the system is long prices would be the same or lower, and when the system is short prices would be the same or higher. **Graph 4.3** compares live System Prices with prices recalculated using the November 2018 scenario when the system was long.



The average price differences across the month are relatively small under the November 2018 scenario. Prices were different in 48% of Settlement Periods, with 8% of these changes greater than £1/MWh. System Prices would be £0.72/MWh lower when the system was long, and £1.87/MWh higher when the system was short. When the system was long and System Prices changed, price changes were less than £1/MWh in 74% of Settlement Periods and greater than £5/MWh in 7% of Settlement Periods. The biggest shift in price was -£84.87/MWh (Settlement Period 31 on 2 May 2018), when the price would have been -£50/MWh under the November 2018 scenario compared to the current live System Price of £34.87/MWh.

Graph 4.4 compares live System Prices with prices re-calculated using the November 2018 scenario when the system was short. Prices would be higher in 48% of short Settlement Periods under the November 2018 scenario; 23% changed by more than £5/MWh and 10% by more than £10/MWh. The biggest difference in price was £39.26/MWh (Settlement Period 41 on 20 May), when the price would have been £158/MWh under the November 2018 scenario compared to the current live System Price of £118.74/MWh.

Under the November 2018 scenario there would be 38 Settlement Periods in May 2018 with prices greater than £100/MWh, compared to 37 periods under the current live scenario.



There were no Demand Control actions taken during May 2018. Under the November 2018 scenario, these action types would be priced at a VoLL of £6,000/MWh rather than the current £3,000/MWh. Although this scenario does not capture the impact that a move to a dynamic LoLP methodology will have, the impact of the change in VoLL on the RSVPs can be seen in **Table 4.5.** The RSVP would have re-priced no STOR actions in May.

4.5 Reserve Scarcity Prices with VoLL of £6,000

Date	SP	DRM	LoLP	RSVP	RSVP Used	System Length	System Price
30/05/2018	37	4,432.75	0.0000	**0.00**	No	Short	149.61
30/05/2018	38	4,904.20	0.0000	**0.00**	No	Short	104.16
16/05/2018	37	4,969.75	0.0000	**0.00**	No	Long	42.01
16/05/2018	38	5,074.02	0.0000	**0.00**	No	Long	42.25
30/05/2018	36	5,131.13	0.0000	**0.00**	No	Short	150.59

5 GLOSSARY

Term	Abbrev.	Definition
Bid		A proposed volume band and price within which the registrant of a BM Unit is willing to reduce generation or increase consumption (i.e. a rate below their FPN).
Bid/Offer Acceptance	**BOA**	A Bid or Offer within a given Settlement Period that was Accepted by the SO. BOAs are used in the Imbalance Price calculation process e.g. to calculate NIV or the System Price.
Offer		A proposed volume band and price within which the registrant of a BM Unit is willing to increase generation or reduce consumption (i.e. a rate above their FPN).
System Price		A price (in £/MWh) calculated by BSC Central Systems that is applied to imbalance volumes of BSC Parties. It is a core component of the balancing and settlement of electricity in GB and is calculated for every Settlement Period. It is subject to change via Standard Settlement Runs.
Replacement Price		A price (in £/MWh) calculated by BSC Central Systems that is applied to volumes that are not priced during the imbalance pricing process (detailed in BSC Section T) It is calculated for every Settlement Period, and is subject to change via Standard Settlement Runs.
Utilisation Price		The price (in £/MWh) sent by the SO in respect of the utilisation of a STOR Action which: (i) in relation to a BM STOR Action shall be the Offer Price; and (ii) in relation to a Non-BM STOR Action shall be the Balancing Services Adjustment Cost.
Market Index Price	**MIP**	The Market Index Price reflects the price of wholesale electricity in the short-term market (in £/MWh). You can find an explanation of how it is calculated and used in the Market Index Definition Statement (MIDS).
Reserve Scarcity Price	**RSVP**	Both accepted BM and non-BM STOR Actions are included in the calculation of System Prices as individual actions, with a price which is the greater of the Utilisation Price for that action or the RSVP. The RSVP function is based on the prevailing system scarcity, and is calculated as the product of two following values: · the Loss of Load Probability (LoLP), which will be calculated by the SO at Gate Closure for each Settlement Period; and · the Value of Lost Load (VoLL), a defined parameter currently set to £3,000/MWh.
Replacement Price Average Reference	**RPAR**	The RPAR volume is a set volume of the most expensive priced actions remaining at the end of the System Price calculation, and is currently 1MWh. The volume-weighted average of these actions, known as the Replacement Price, is used to provide a price for any remaining unpriced actions prior to PAR Tagging.
Long		In reference to market length, this means that the volume of Accepted Bids exceeds that of Accepted Offers.
Short		In reference to market length, this means that the volume of Accepted Offers exceeds that of Accepted Bid.
Net Imbalance Volume	**NIV**	The imbalance volume (in MWh) of the total system for a given Settlement Period. It is derived by netting buy and sell Actions in the Balancing Mechanism. Where NIV is positive, this means that the system is short and would normally result in the SO accepting Offers to increase generation/decrease consumption. Where NIV is negative, the system is long and the SO would normally accept Bids to reduce generation/ increase consumption. It is subject to change between Standard Settlement Runs.

SYSTEM PRICE ANALYSIS REPORT

APPENDIX 1 – HOW TAGGING CHANGES THE SYSTEM PRICE

In this section one of our Market Analysts, Emma Tribe, takes a detailed look at how tagging effects System Price calculation. By removing volumes from the top or bottom of the pricing stack the System Price decreases or increases.

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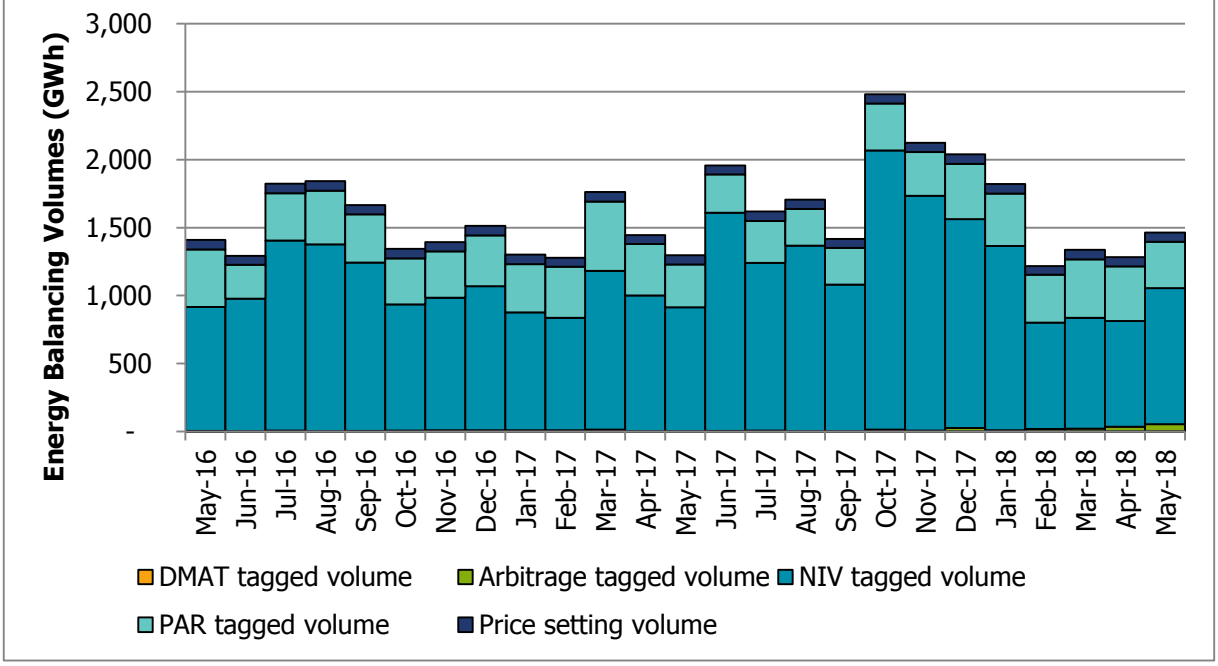
Between May 2016 and May 2018 95.7% of Balancing Volume was removed from the System Price Calculation by Tagging. There are four tagging operations to remove balancing volume from the System Price calculation;

- De-Minimis Acceptance Threshold (DMAT) tagging,
- Arbitrage Tagging,
- Net Imbalance Volume (NIV) Tagging, and
- Price Average Reference (PAR) Tagging.

After all of these tagging operations were taken in May 2018, 4.3% of Energy Balancing Volume remained. In each Settlement Period a volume weighted average of the remaining actions are taken to calculate the Imbalance Price. While the 95.7% of Balancing Volumes was not used to directly set the System Price, the removed volume did influence the System Price. By removing these volumes from the top or bottom of the pricing stack the final weighted average is made higher or lower.

A.1 Energy Balancing Volumes by Tagging operation
Source: ELEXON



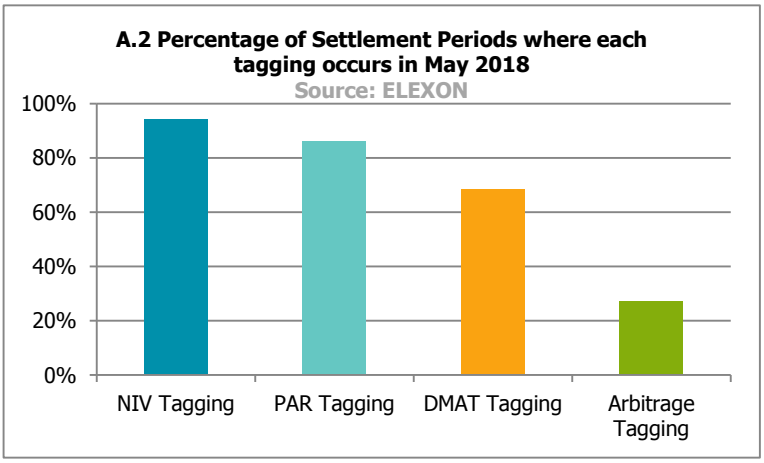
Graph A.1 shows that in every month NIV tagging removes the majority of balancing volume. Over the two years NIV tagging removed 72.7% of Balancing Volume. In October 2017 82.8% of balancing volume was removed by NIV tagging, this is the highest percentage in a month. There is a monthly standard deviation of 6.3% in the percentage removed by NIV tagging; a greater percentage is removed when a greater volume of actions are taken.

During the two years, PAR tagging removed 22.3% of the total Balancing Volume. PAR tagging is the final tagging operation, carried out after the pricing stack has already been NIV, Arbitrage and DMAT tagged. PAR tagging removed 83.8% of the remaining volume after all other tagging operations had already removed volume.

Arbitrage removed a total of 0.6% of Balancing Volume over the two years. The monthly percentage removed by Arbitrage tagging has increased from 0.3% in May 2016 to 3.6% in May 2018. DMAT tagging removed a total of 0.1% of Balancing Volume. The volume of balancing actions removed by DMAT and Arbitrage tagging is much smaller than by NIV and PAR.

Tagging in May 2018

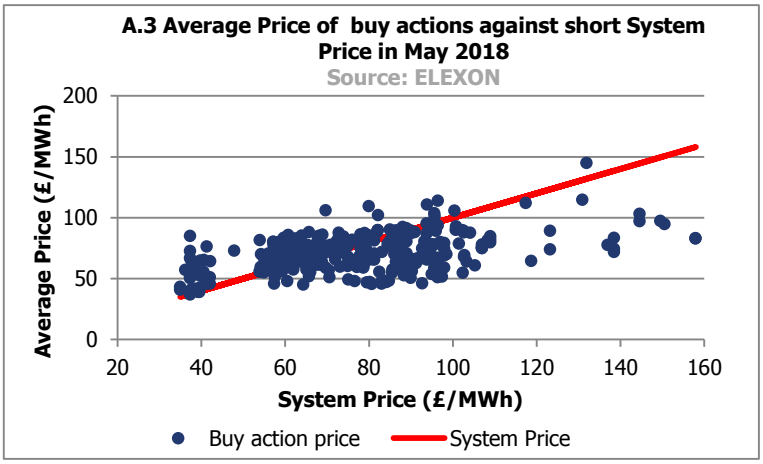
Graph A.2 shows the percentage of Settlement Periods in May 2018 that each of the tagging operations occur in. No tagging operation occurs in every Settlement Period. Volumes are NIV tagged in 94.2% of Settlement Periods; NIV tagging is not used in Settlement Periods where balancing actions are only taken in one direction.



Arbitrage tagging occurred in 27.1% of Settlement Periods. In the majority of Settlement Periods the price of buy actions have been greater than the price of sell actions.

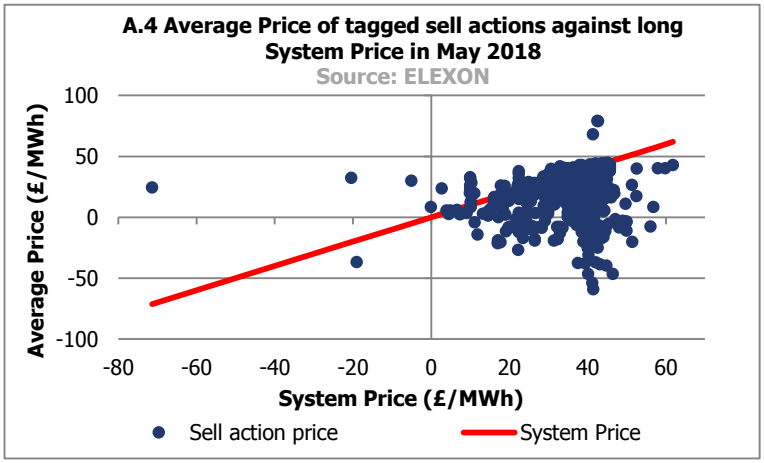
The purpose of these tagging operations is to make the weighted average price:

- more marginal (PAR Tagging),
- representative of cost to resolve the net energy imbalance (NIV Tagging and Arbitrage Tagging), or
- remove price distortions caused by errors (DMAT tagging).



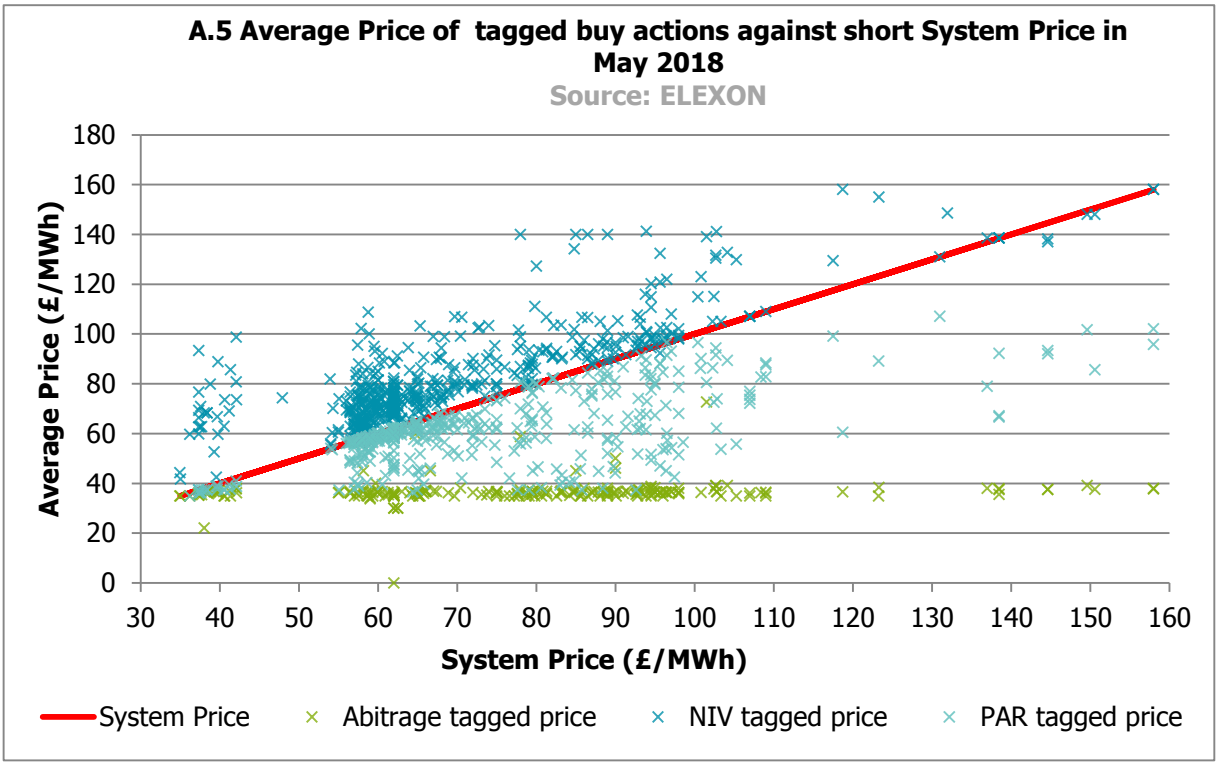
Graph A.3 and **Graph A.4** compare the average weighted price of buy or sell actions against long or short System Prices in May 2018.

In 63% of Settlement Periods the weighted average price of buy actions is greater than short System Prices. When the System Price is less than £80/MWh, the majority (79.9%) of average buy action prices are greater than the System Price. However, when the System Price is greater than £80/MWh, the majority (87.1%) of average buy action prices are less than the System Price.



The weighted average price of sell actions is less than the System Price in 79.9% of long Settlement Periods. This means that the System Price is less expensive than the weighted average price in these Settlement Periods.

Graph A.5 shows the weighted average price of tagged buy actions compared to the System Price, when the market is short, for NIV, PAR and Arbitrage tagging. DMAT tagging was not included as DMAT tagged actions can come from anywhere in the stack.

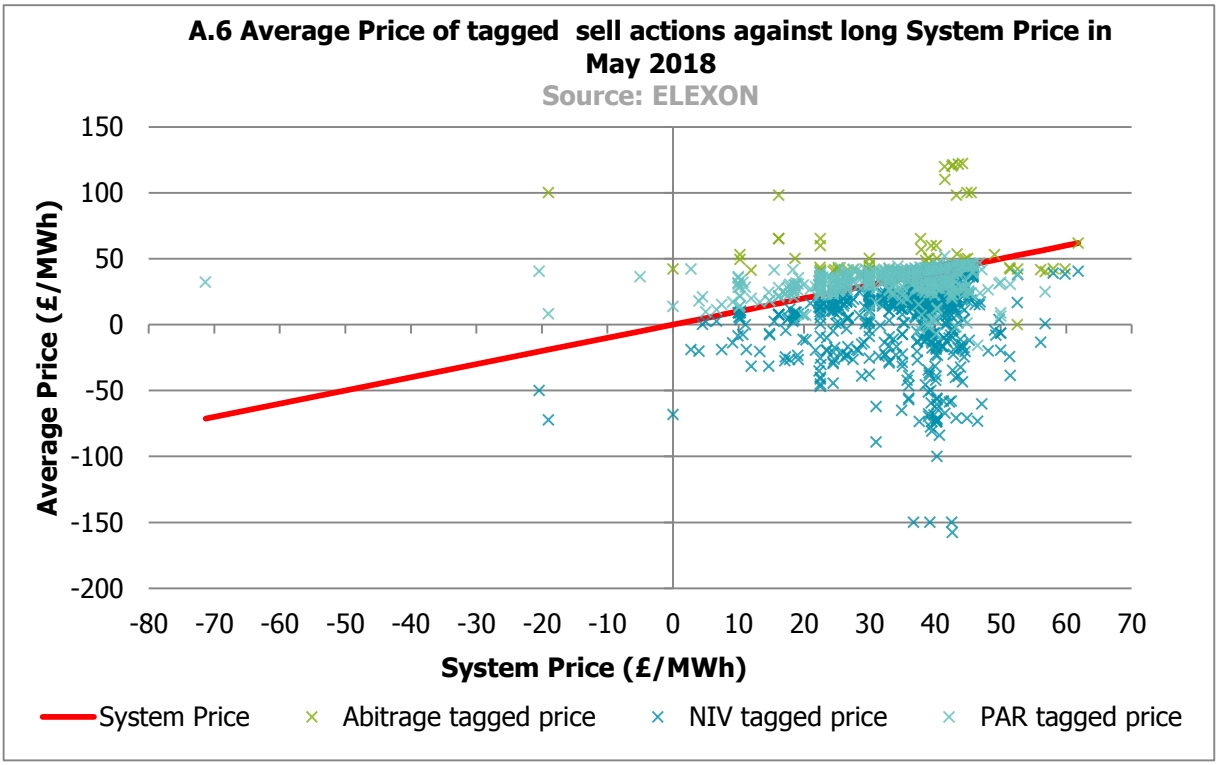


NIV tagging removes the most expensive volumes from the stack, hence the weighted average price of NIV tagged actions is greater than the System Price in 99.1% of Settlement Periods. The System Price can be greater than the weighted average price of NIV tagged actions when a Buy Price Price Adjuster (BPA) has been applied. The weighted average price of NIV tagged actions is greater than the System Price by an average of £12.62/MWh.

PAR tagging and Arbitrage tagging remove the least expensive actions. In all Settlement Periods the weighted average price of Arbitrage tagged actions are less or equal to the System Price. The average Arbitrage tagged action is £36.77/MWh.

The weighted average price of PAR tagged actions are less than or equal to the System Price in 99.6% of Settlement Periods. The weighted average price of PAR tagged actions can be greater than the System Price when second stage flagged actions have been repriced by the Replacement Price.

Graph A.6 shows the weighted average price of tagged sell actions compared to the System Price, when the market is long, for NIV, PAR and Arbitrage tagging. A clear difference between this graph and **graph A.5** is that the distribution of long prices is much narrower than for short prices (as shown in **graph 1.2a**).



NIV tagged weighted averages are less than or equal to the System Price in all Settlement Periods, as the Sell Price Price Adjuster (SPA) has not been applied.

PAR tagged weighted averages are less than the System Price in 24.7% of Settlement Periods, and Arbitrage tagged weighted averages are less than the System Price in 6.3% of Settlement Periods. This occurs when the Replacement Price has been used to reprice Second Stage Flagged actions.

Tagging operations increase or decrease the final weighted average price by changing what volumes remain in the calculation. In contrast, flagging can change the final weighted average by repricing actions. The Replacement Price was used in 5% of Short Settlement Periods and 37% of Long Settlement Periods. Hence, there are more Settlement Periods where the weighted averages of PAR and Arbitrage tagged actions are more expensive than the System Price.