

ISG202-SPAR

REPORTING ON JANUARY 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 Mechanism¹. 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 new [System Price Analysis Dashboard](#) is now available on the ELEXON website, and allows customers to model System Prices under post 1 November 2018 scenarios.

This month’s SPAR contains an appendix on System Prices in 2017.

1 SYSTEM PRICES AND LENGTH

This report covers the month of January. 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 January 2018.

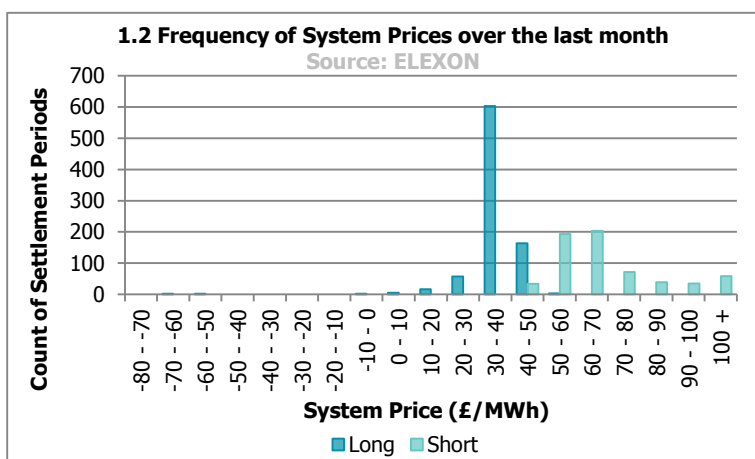
Graph 1.2 shows the distribution of System Prices across Settlement Periods in January 2018 when the market was long and short.

67% of System Prices were between £30/MWh and £60/MWh, regardless of system length. When the system was long, 90% of prices were between £30/MWh and £50/MWh. When the system was short, 62% of prices were between £50/MWh and £70/MWh and 9% of prices were over £100/MWh. 13% of System Prices regardless of length were between £40/MWh and £50/MWh.

System Price (Long)					
Month	Min	Max	Median	Mean	Std Dev
January 2018	-68.43	56.00	37.62	36.04	9.10

System Price (Short)					
Month	Min	Max	Median	Mean	Std Dev
January 2018	42.39	188.45	62.60	70.02	20.35

1.1 System Price summary by month (£/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 57 times in January 2018 (compared to 67 times in December), with these System Prices occurring on 13 different days.

The highest System Price, **£188.45/MWh**, occurred in Settlement Period 35 on 5 January 2018 and was set by an Offer from a CCGT BMU priced at £167/MWh, and a Buy Price Price Adjustment (BPA) of £21.45/MWh.

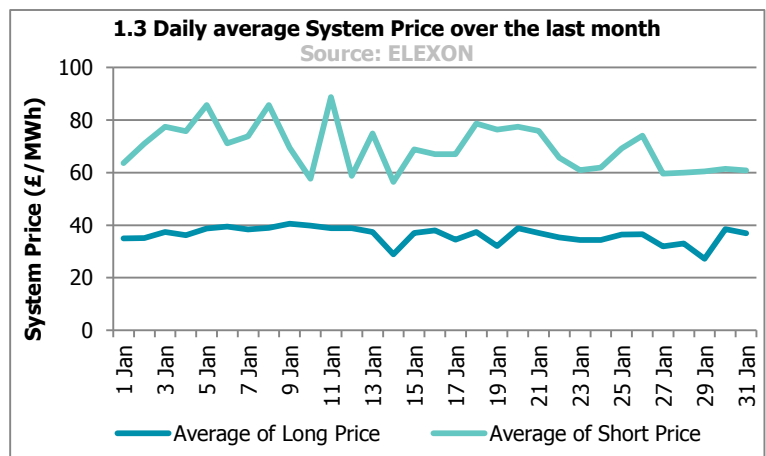
In two Settlement Periods the System Price was £0/MWh in January. These System Prices were set by Bids priced at £0/MWh from Hydro and Pumped Storage BMUs.

There were **six negative System Prices** in January. The lowest System Price of the month was **-£68.43/MWh** occurring in Settlement Period 15 on 14 January 2018. The price was set by a Bid from a Wind BMU.

Graph 1.3 shows daily average System Prices over the last month. In January, the average System Price was £36.04/MWh when the system was long and £70.02/MWh when the system was short.

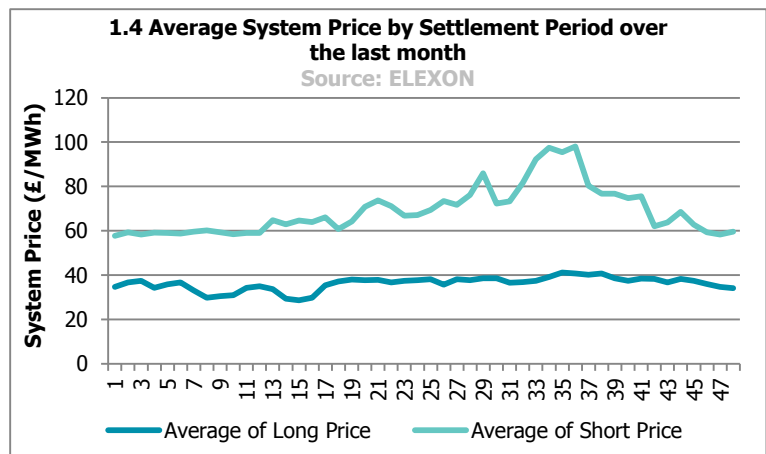
The highest daily average price when the system was short was £88.76/MWh and occurred on 11 January. The system was short for 18 Settlement Periods on this day.

The lowest daily average price when the system was short was £27.20/MWh on 29 January 2018. The system was long in 31 Settlement Periods on this day, with the average reduced by the two negative prices on this day.



Graph 1.4 shows the variation of System Prices across the day. Short prices were highest in Settlement Period 36, with long prices lowest in Settlement Period 15. The lowest average System Prices regardless of market length was seen during Settlement Period 8, when the System Price was, on average, £40.58/MWh.

Long prices show less variance over Settlement Periods, with the prices between £26.64/MWh and £41.10/MWh. Average short Settlement Period prices vary from £57.68/MWh to £98.08/MWh.

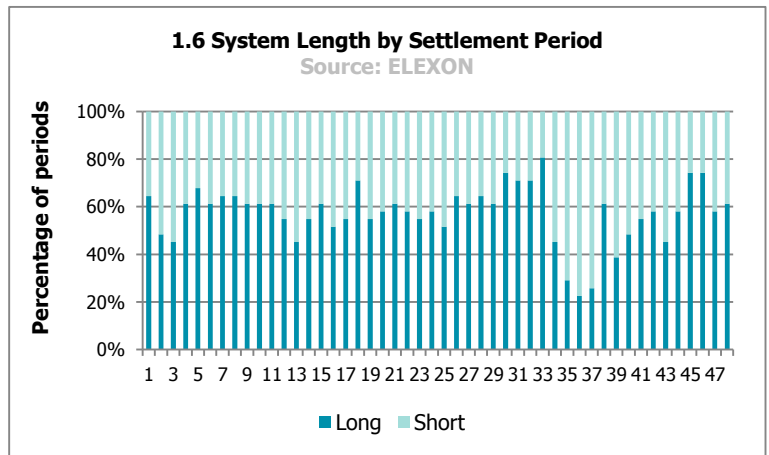
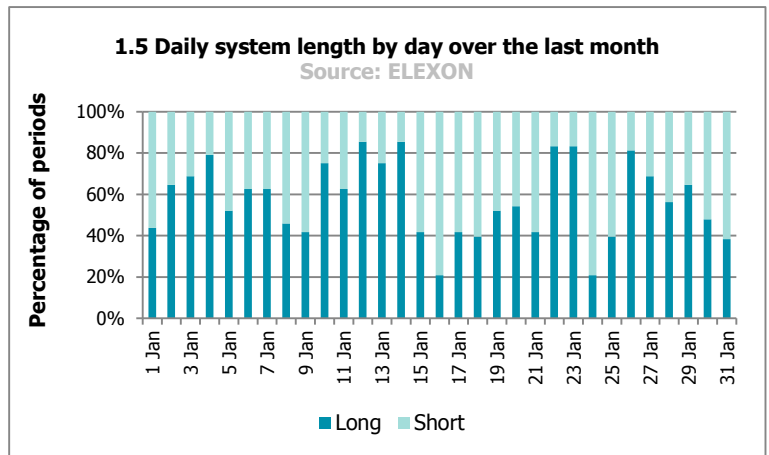


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Graph 1.5 shows system length by day, and **Graph 1.6** shows system length by Settlement Period for January. The system was long for 57% of Settlement Periods in January, compared to 48% in December.

On 16 January and 24 January, the system was short for 79% of Settlement Periods. On 16 January, the average NIV while the system was short on this day was 334MWh. The average System Price on this day regardless of length was £61/MWh. Comparatively, on 24 January, the average NIV while the system was short on this day was 377MWh and the average System Price was £56.18/MWh regardless of length.

Settlement Period 36 was short for 77% of the month.



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2 PARAMETERS

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

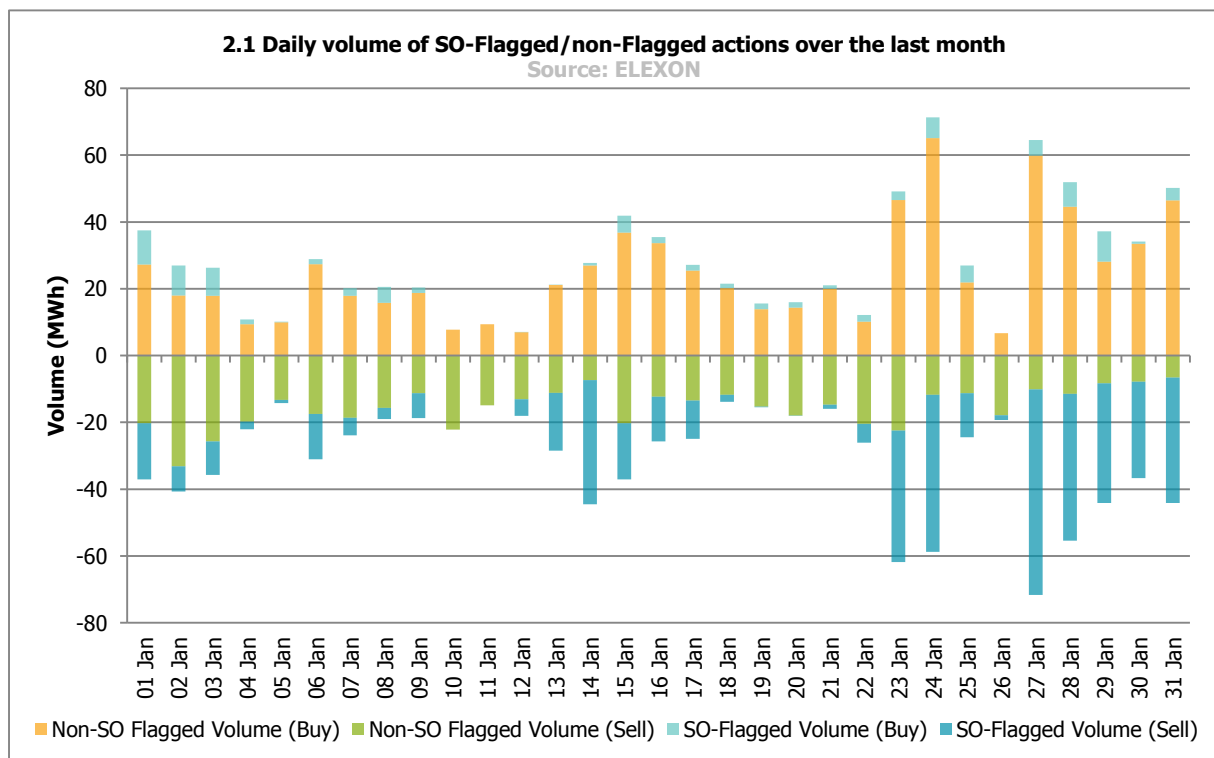
- The impact of Flagging balancing actions;
- The impact of NIV Tagging;
- The impact of PAR Tagging;
- The impact of the Replacement Price; and
- How these mechanisms affect which balancing actions feed into the price.

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 January 2018 as being constraint related. On 27 January, 86% of sell volume was SO-Flagged.



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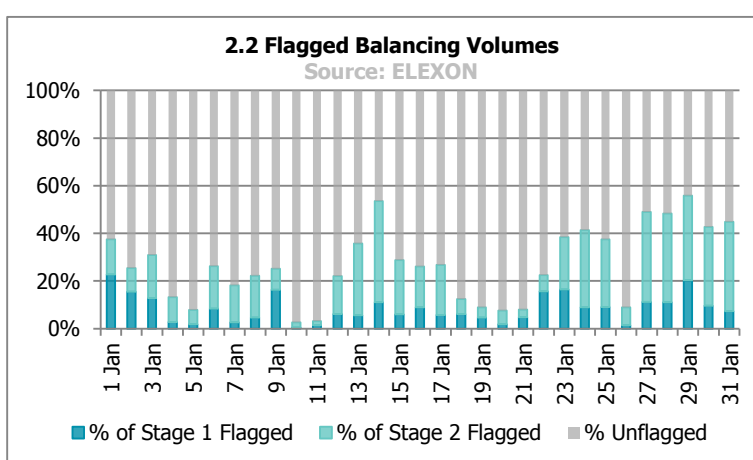
50% of sell balancing actions taken in January had an SO-Flag compared with 49% in December. 46% of SO-Flagged sell actions came from CCGT BMUs, 24% from Balancing Services Adjustment Actions (BSAAs) and 20% from Wind BMUs. The average initial price (i.e. before any re-pricing) of a SO-flagged sell action was -£25.17/MWh.

11% of buy balancing actions taken in January had an SO-Flag, compared to 20% in December. 56% of SO-Flagged buy actions came from BSAAs, and 32% from CCGT BMUs. The average initial price of a SO-Flagged buy action was £66.52/MWh.

Any actions which are less than 15 minutes total duration are CADL Flagged. 2% of buy actions and 1% of sell actions were CADL Flagged in January. The majority of CADL Flagged buy actions (95%) and CADL Flagged sell actions (56%) came from Pumped Storage BMUs, with CCGT BMUs accounting for a further 42% 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-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 balancing actions that were accepted – only a proportion of these will feed through to the final price calculation.



The Replacement Price

If there are Second-Stage Flagged action volumes left in the NIV, these will be repriced by the Replacement Price. In total 51% of sell actions in January were flagged. Of these 13% were assigned a Replacement Price, currently based on the most expensive 1MWh of Unflagged actions.

Sell actions will typically have their prices revised upwards by the Replacement Price for the purposes of calculating the System Price. In January, the average original price of a Second-Stage Flagged repriced sell action was £17.49/MWh and the average Replacement Price for sell actions (when the System was long) was £35.64/MWh.

13% of buy actions were Flagged; of these 0.9% had the Replacement Price applied. The average original price of a buy action with the Replacement Price applied was £96.65/MWh, and the average Replacement Price was £66.11/MWh.

If there are no Unflagged actions remaining in the NIV, the Replacement Price will default to the Market Index Price. This occurred in 40 long and one short Settlement Period (compared to 16 long and 16 short Settlement Periods last month).

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NIV and NIV Tagging

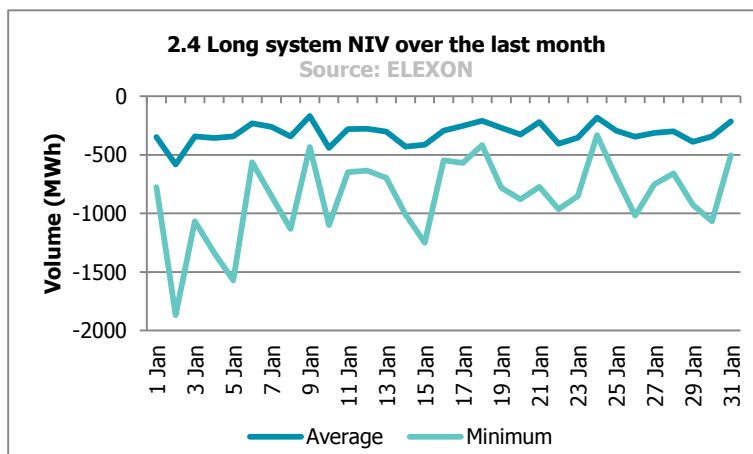
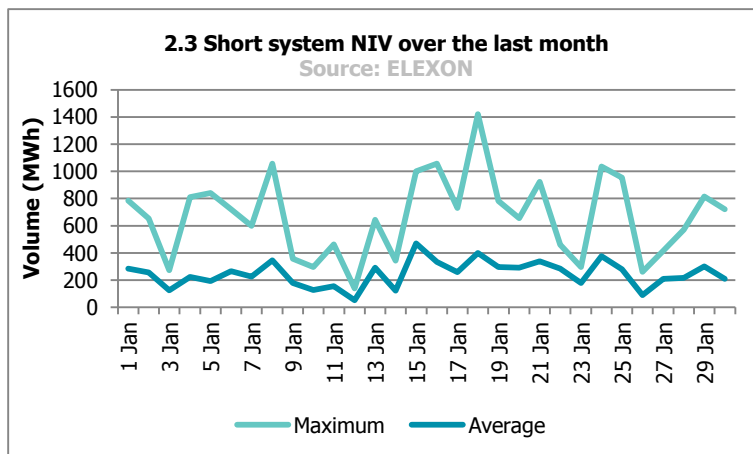
The Net Imbalance Volume (NIV) represents the direction of imbalance of the system – i.e. whether the system is long or short overall. **Graph 2.3** shows the greatest and average NIV when the system was short and **Graph 2.4** shows the greatest and average NIVs when the system was long. Note short 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. It is from these remaining actions that the price is derived.

NIV Tagging has a significant impact in determining which actions feed through to prices. 74% of volume was removed due to NIV tagging in January. 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 minimum long system NIV of the month was -1,869MWh, on 2 January 2018 during Settlement Period 16. There were -2,166MWh of sell actions and 279MWh of buy actions in this Settlement Period. The System Price was £31.22/MWh in this Settlement Period.

The maximum short system NIV of the month (1,421MWh) was seen on 18 January in Settlement Period 13.



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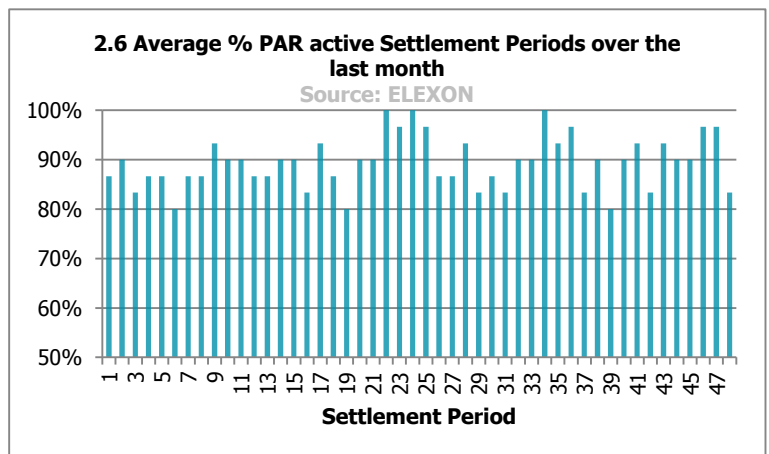
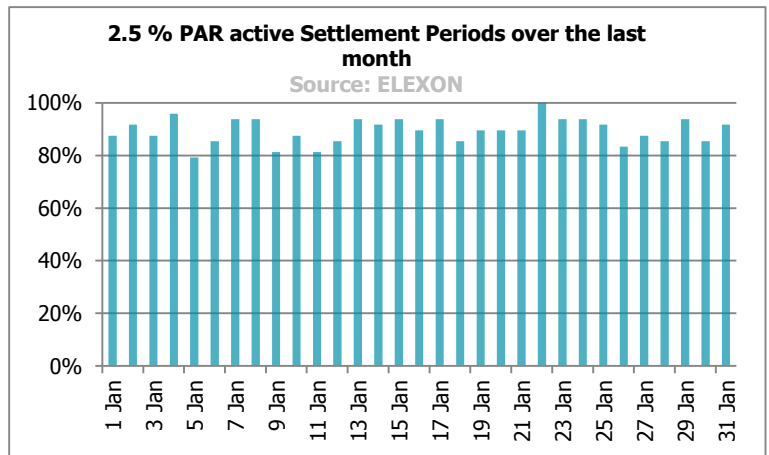
PAR Tagging

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.

The impact of PAR Tagging across the month can be seen in **Graph 2.5**. 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 89% of Settlement Periods in January.

Graph 2.6 shows the proportion of Settlement Periods over the last month when PAR Tagging was active. Settlement Periods 6, 19 and 39 had the lowest active PAR Tagging in January 2018 with 80%, representing the NIV being smaller in this period or the system being more balanced as a whole prior to System Operator balancing activity.

There was PAR Tagging in Settlement Periods 22, 24 and 34 on every day of the month.



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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).

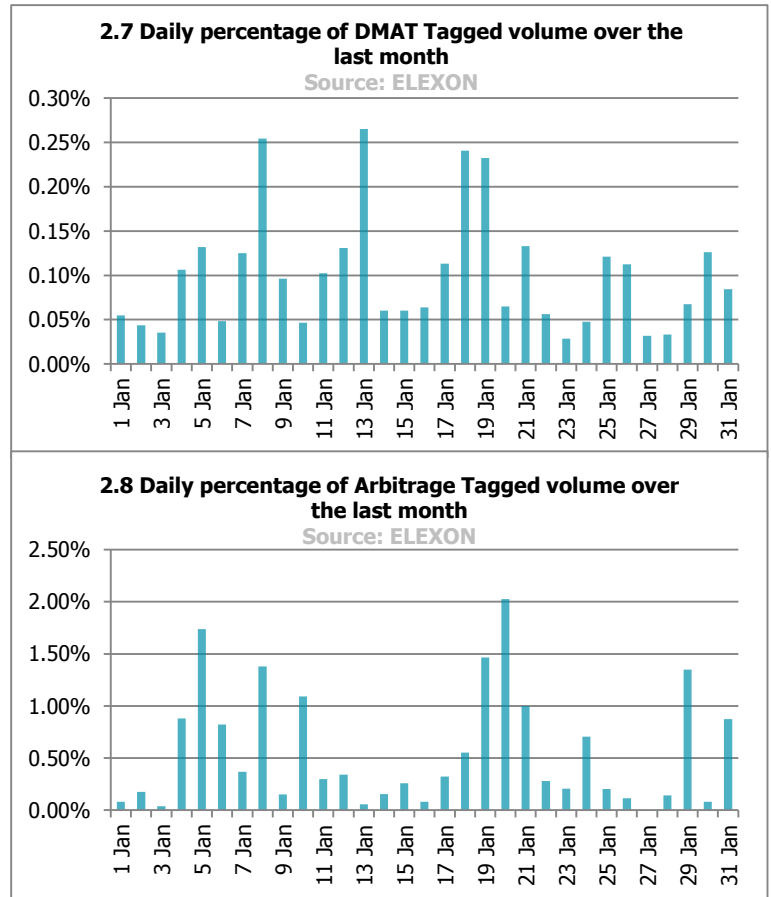
Graph 2.7 shows the volumes of actions which were removed due to DMAT Tagging. 0.08% of total buy and sell volume was removed by DMAT Tagging in January. 41% of DMAT Tagged volume came from CCGT BMUs, whilst 35% came from Balancing Services Adjustment Actions (BSAAs).

Graph 2.8 shows the volumes of actions that were removed due to Arbitrage Tagging. 58% of Arbitrage Tagged volume was from CCGT BMUs, 19% from BSAAs and 13% from Coal BMUs.

In January the average initial price of an

Arbitrage Tagged buy action was £39.46/MWh, and for a sell action was £48.06/MWh. The maximum price of an Arbitrage Tagged sell action was £252.07/MWh, and the lowest priced Arbitrage Tagged buy action was -£53.64/MWh.

On 20 January 2018, 688MWh of actions were Arbitrage Tagged, representing 2% of daily volume. The average price of an Arbitrage Tagged buy action was £42.57/MWh and for a sell action was £50.40/MWh. 0.06% of daily volume was DMAT Tagged on this day.



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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.

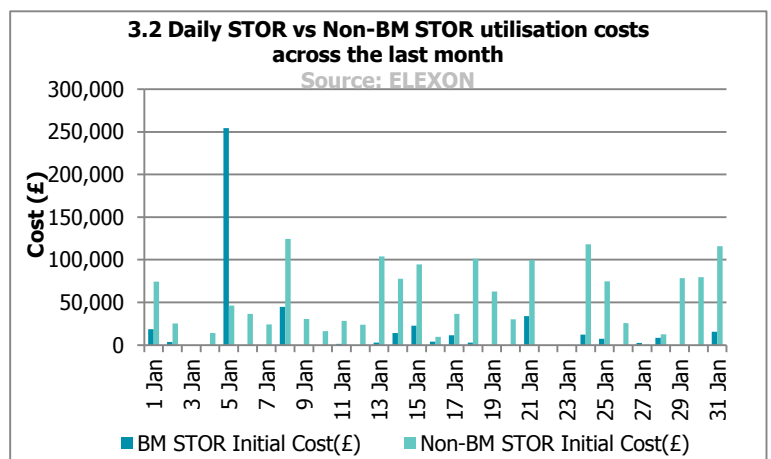
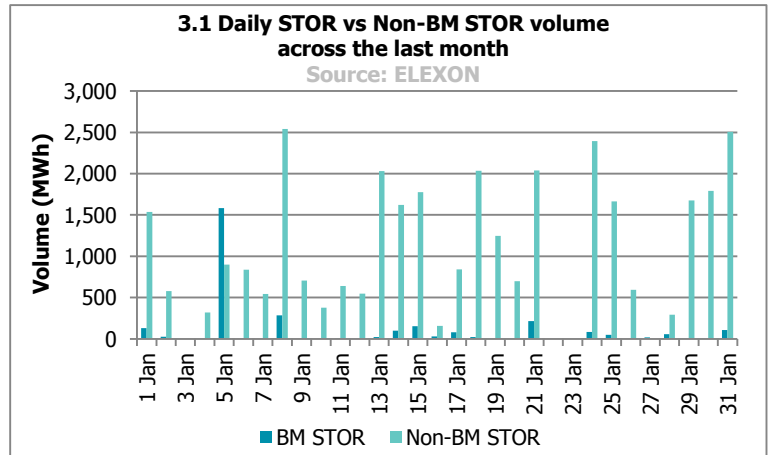
In addition to Bids and Offers available in the Balancing Mechanism, the SO can enter into contracts with providers of balancing capacity to deliver when called upon. These additional sources of power are referred to as reserve, and most of the reserve that the SO procures is called Short Term Operating 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. 92% of the total STOR utilised in January came from outside of the Balancing Mechanism.

The average Utilisation Price for STOR capacity in January was £56.54/MWh (£155.48/MWh for BM STOR and £47.62/MWh for non-BM STOR).

On 5 January the utilisation cost for BM STOR totalled £254,000. 1,538MWh of BM STOR volume was called upon on this day, which represented 53.4% of the BM STOR volume in January.



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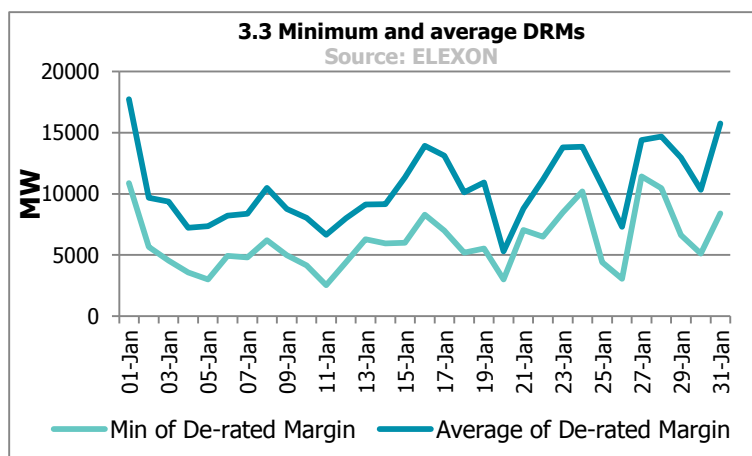
De-Rated Margin, Loss of Load Probability and the Reserve Scarcity Price

There are times when the Utilisation Prices of STOR plants are uplifted using the **Reserve Scarcity Price (RSP)** in order to calculate System Prices. The RSP 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 January 2018.

The System Operator has determined a relationship between each DRM and the LoLP, which will determine the RSP². The minimum DRM in January was 2,543MW on 11 January in Settlement Period 43 (compared to 1,942MW in December).

The RSP 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 RSP in January (see **Table 3.4**).



3.4 Top 5 LoLPs and RSPs

Date	SP	DRM	LoLP	RSP	RSP Used	System Length	System Price
11/01/2018	38	2,543.19	0.0001	0.42	No	Long	45.52
11/01/2018	37	2,646.54	0.0001	0.23	No	Long	42.11
11/01/2018	36	2,869.40	0.0000	0.06	No	Long	43.11
11/01/2018	35	2,899.90	0.0000	0.05	No	Long	47.02
05/01/2018	35	3,015.73	0.0000	0.02	No	Short	188.45

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

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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 RSP, 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:

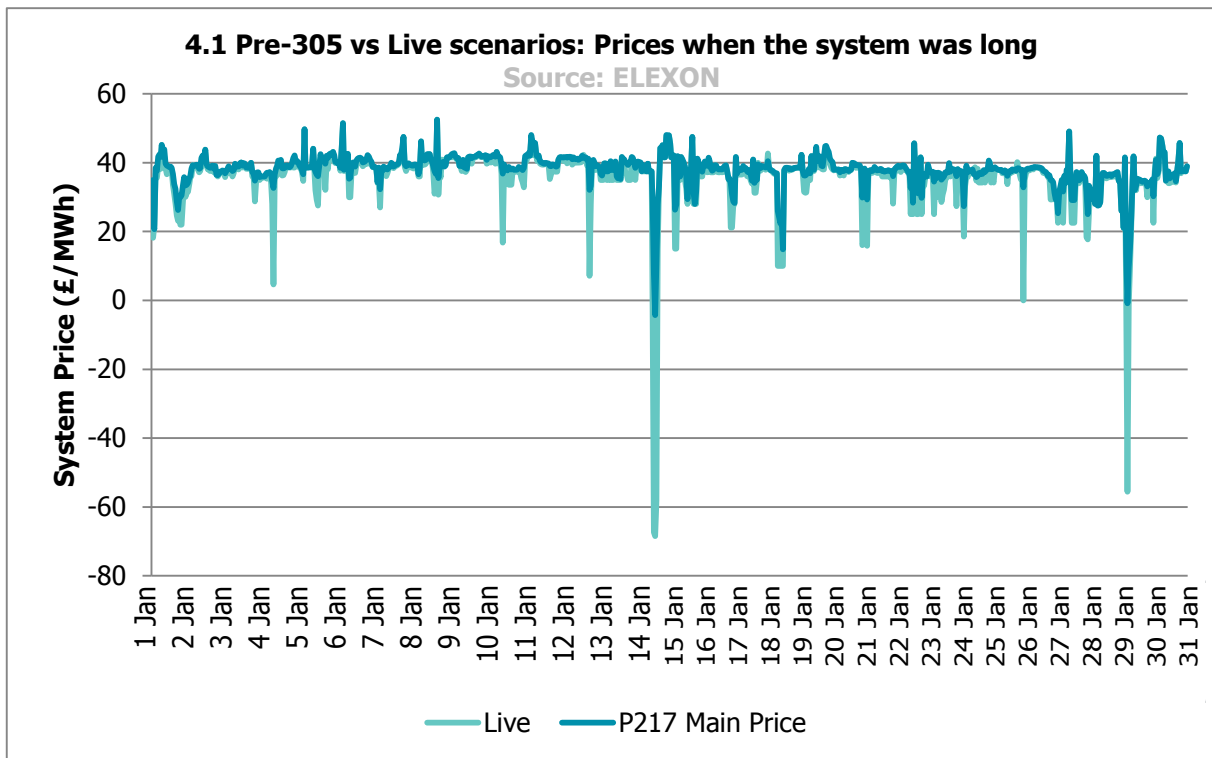
- A reduction in the PAR value to 1MWh (RPAR will remain at 1MWh);
- The introduction of a 'dynamic' LoLP function; and
- An increase in the VoLL to £6,000MWh, which will apply to all instances of VoLL in arrangements, including the RSP function.

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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 £1.88/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 90% of Settlement Periods; in 66% of these periods the change was less than £1/MWh. The biggest price change occurred on the 14 January 2018 in Settlement Period 14, where the live price was £75.20/MWh lower than the System Price would have been under the P217 Scenario. Again this is due to the reduction in PAR.



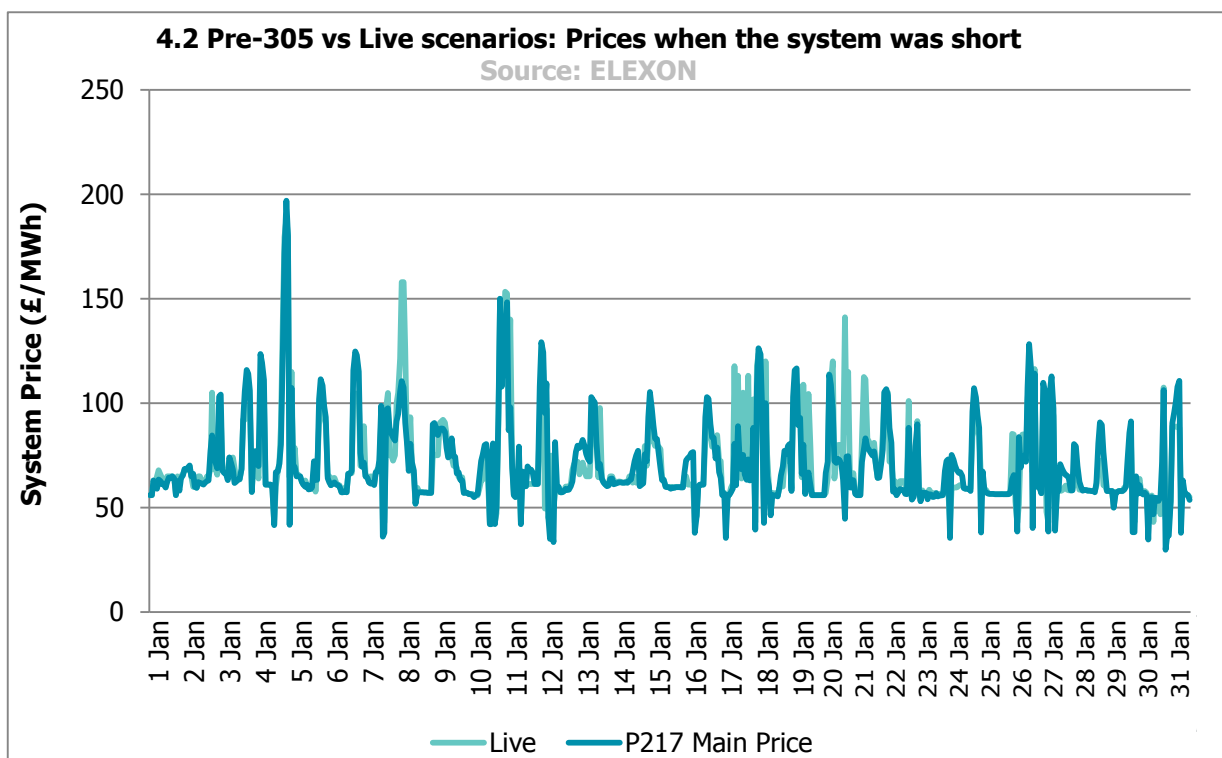
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Graph 4.2 compares live System Prices when the system was short with prices re-calculated using the pre-P305 pricing scenario 'P217' (using the Main Price calculation).

Live prices were on average £0.13/MWh lower when the system was short with 34% of Settlement Periods having Pre-305 prices higher than the live scenario.

The biggest difference in prices when the system was short was £96.55/MWh (20 January 2018 during Settlement Period 36), as a result of the inclusion of non-BM STOR in the pricing calculation. In the P217 scenario, the Main Price would have been £44.65/MWh compared to the live scenario System Price of £141.20/MWh.

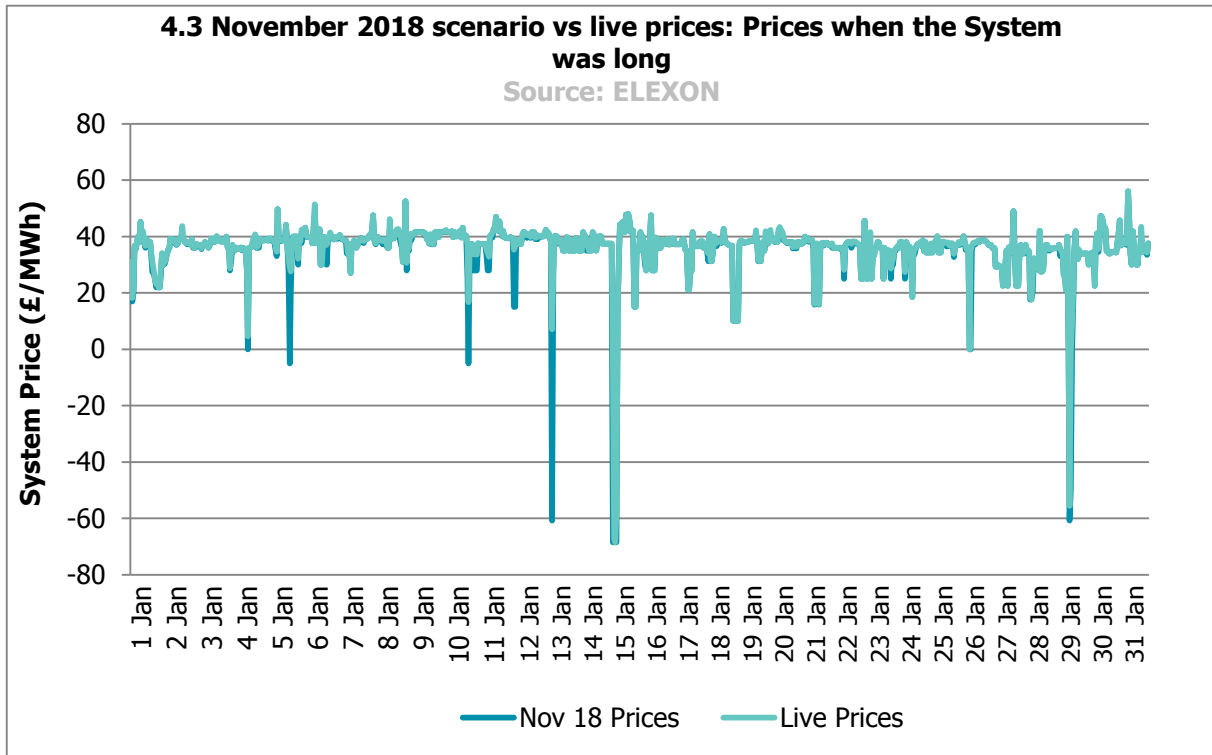
The inclusion of non-BM STOR volumes in the pricing stack changed the system length from long to short in 30 Settlement Periods.



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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.

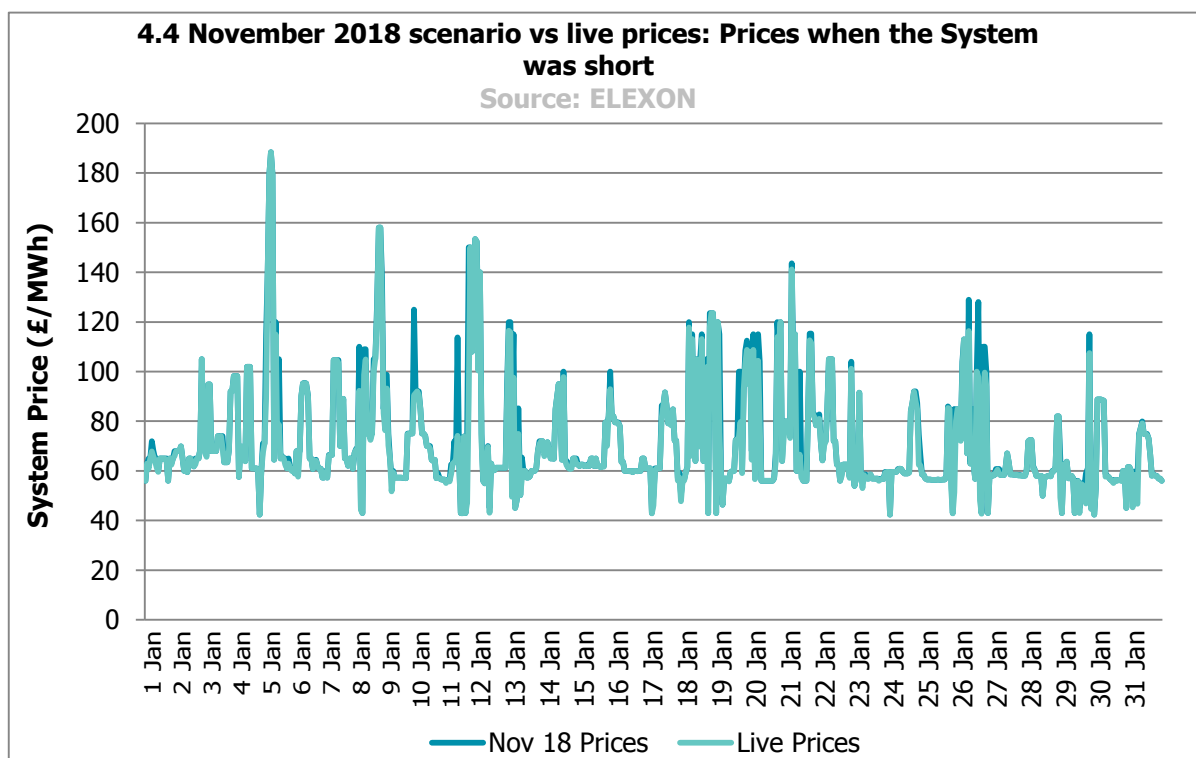


The average price differences across the month are relatively small under the November 2018 scenario, with prices unchanged in prices in 55% of Settlement Periods. System Prices would be £0.76/MWh lower when the system was long and £1.86/MWh higher when the system was short. When the system was long, price changes were less than £1/MWh in 77% of Settlement Periods and greater than £5/MWh in 5% of Settlement Periods. The biggest shift in price was £67.87/MWh (Settlement Period 43 on 12 January 2018), when the price would have been -£60.75/MWh under the November 2018 scenario compared to the current live System Price of £7.12/MWh.

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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 38% of short Settlement Periods under the November 2018 scenario; 24% changed by more than £5/MWh and 15% by more than £10/MWh. The biggest difference in price was £60.23/MWh (Settlement Period 28 on 11 January 2018), when the price would have been £150/MWh under the November 2018 scenario compared to the current live System Price of £89.77/MWh.

Under the November 2018 scenario, there would be 81 Settlement Periods in January 2018 with prices greater than £100/MWh, compared to 57 periods under the current live scenario.



There were no Demand Control actions taken during January 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 RSPs can be seen in **Table 4.5**. The RSP would have re-priced no STOR actions in January.

4.5 Reserve Scarcity Prices with VoLL of £6,000

Date	SP	DRM	LoLP	RSP	RSP Used	System Length	System Price
11/01/2018	38	2,543.19	0.0001	0.84	No	Long	45.52
11/01/2018	37	2,646.54	0.0001	0.47	No	Long	42.11
11/01/2018	36	2,869.40	0.0000	0.12	No	Long	43.11
11/01/2018	35	2,899.90	0.0000	0.10	No	Long	47.02
05/01/2018	35	3,015.73	0.0000	0.05	No	Short	188.45

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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	RSP	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 RSP. The RSP function is based on the prevailing system scarcity, and is calculated as the product of two following values: <ul style="list-style-type: none"> 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.

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APPENDIX 1 – SYSTEM PRICES IN 2017

In this section, one of our Market Analysts, Nick Baker, takes a detailed look at System Prices across 2017.



nick.baker@elexon.co.uk

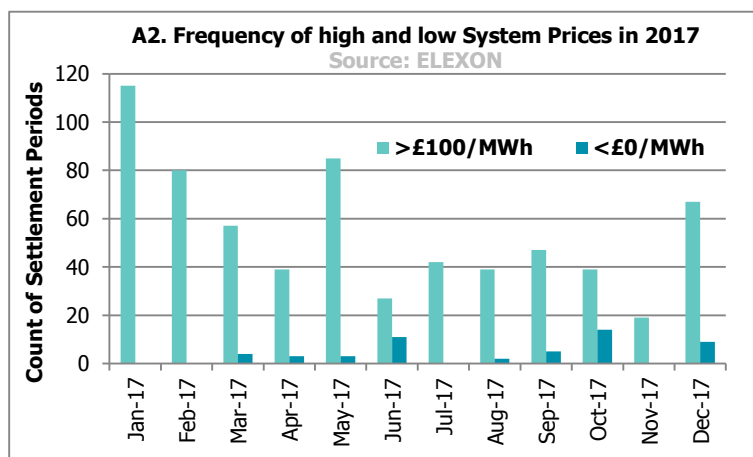
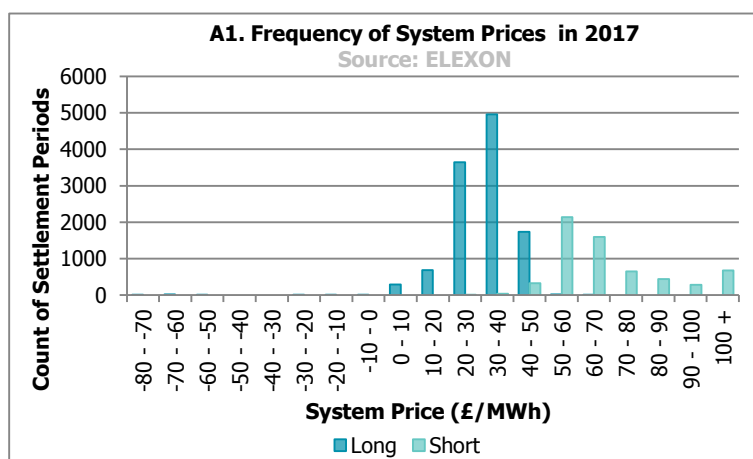
In 2017 the average System Price when the System was long was £30.77/MWh. When the System was short, the average System Price was £71.67/MWh.

Graph A1 shows the frequency of System Prices in 2017. Regardless of system length, in 49% of Settlement Periods, the System Price was between £20/MWh and £40/MWh. When the System was long, 44% of prices were between £30/MWh and £40/MWh. 61% of System Prices were between £50/MWh and £70/MWh when the system was short. When short, 11% of System Prices were greater than £100/MWh.

The frequency of high and low System Prices is given in **Graph A2**. Out of 17,520 Settlement Periods in 2017, 51 had negative System Prices. The average price of the negative System Prices in October was -£37.06/MWh. The lowest System Price of the year was -£73.14/MWh in Settlement Period 18 on 28 May 2017.

There were 656 Settlement Periods in 2017 with a System Price exceeding £100/MWh, 18% of these occurred in January.

The highest System Price of the year was £1,509.80/MWh in Settlement Period 33 on 17 May 2017. There were three prices in the year greater than £1,000/MWh. These occurred between Settlement Periods 32 to 34 on 17 May 2017.



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Graph A3 gives the average System Price by Settlement Period for 2017. The evening peak in short System Prices, reaches a maximum in Settlement Period 33, where the average price was £96.61/MWh. The morning peak in short System Prices occurs during Settlement Period 22, where the average price was £81.29/MWh.

Graph A4 shows the system length by month in 2017. In all months except December, the majority of Settlement Periods were long. 65% of Settlement Periods were long in 2017.

December 2017 had the highest percentage (52%) of short Settlement Periods, whilst March 2017 had the lowest (21%).

