ISG191-SPAR

REPORTING ON JANUARY 2017

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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.

In addition to the SPAR, a post-implementation review will be published for changes under Modification P305 'Electricity Balancing Significant Code Review Developments'.

A one year post-P305 review has also been published this month looking back to the start of P305, you can download the review from the ELEXON website.

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 will be based predominantly on the System Operator's 'sell' actions such as Accepted Bids. When the market is short, System Prices will instead be based predominantly on the System Operator's 'buy' actions. **Table 1.1** gives a summary of System Prices for January 2017.

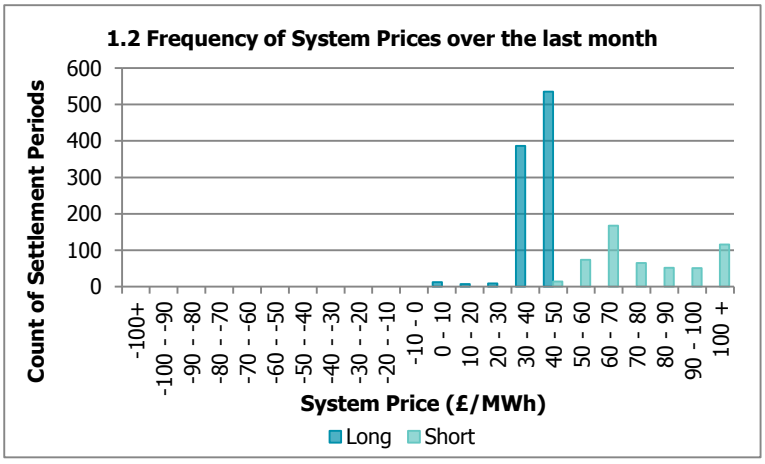
	System Price (Long)				
Month	**Min**	**Max**	**Median**	**Mean**	**Std Dev**
January 2017	0.00	46.97	40.20	39.09	5.60

	System Price (Short)				
Month	**Min**	**Max**	**Median**	**Mean**	**Std Dev**
January 2017	44.50	292.55	72.39	84.32	33.80

1.1 System Price summary by month (£/MWh)

Graph 1.2 shows the distribution of System Prices across Settlement Periods in the last month when the market was long and short. System Prices were between £20/MWh and £50/MWh in 63% of Settlement Periods (in both directions).

When the System was long, 97% of prices were between £30/MWh and £50/MWh. When the System was short, 57% prices were between £50/MWh and £80/MWh with 22% of prices 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/

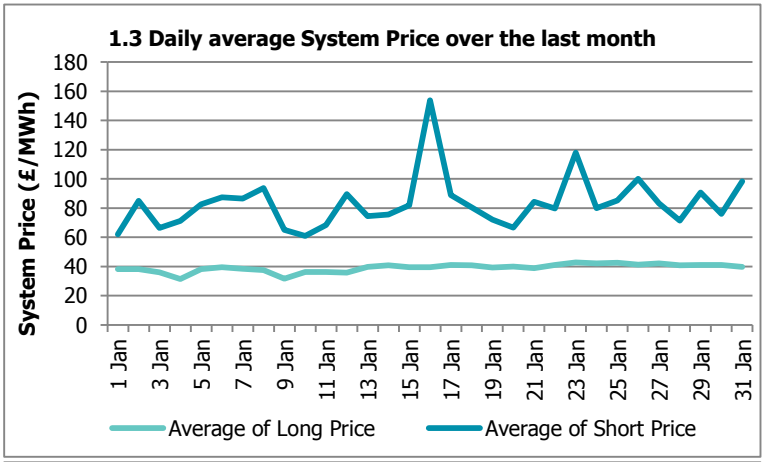
SYSTEM PRICE ANALYSIS REPORT

The lowest System Price when the system was short (£44.50/MWh) occured at Settlement Period 31 on 22 January 2017.

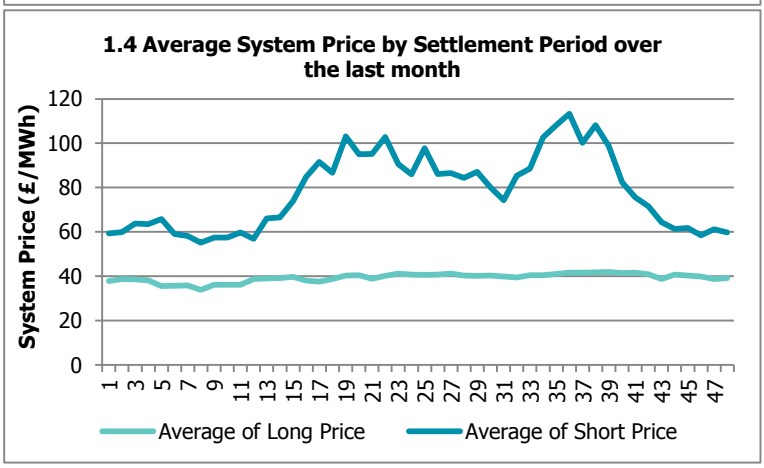
There were no Settlement Periods with **negative System Prices** in January 2017 (compared to nine the previous month and eight in January 2016). The lowest System Price was -£0/MWh, which occurred at Settlement Period 5 on 19 January 2017 and Settlement Period 8 on 21 January 2017, these prices were set by zero priced Bids from a CCGT BMU. System Prices **exceeded £100/MWh** 116 times in January (compared to 78 times in December), these high prices were seen in 7.8% of Settlement Periods, regardless of length. The **highest System Price** was £292.55/MWh and occurred at Settlement Period 34 on 16 January 2017. The price was set by a Balancing Services Adjustment Action (BSAA) priced at £133/MWh combined with a Buy Price Price Adjuster (BPA) of £159.55/MWh.

Graph 1.3 shows daily average System Prices over the last month. In January, the average System Price when the system was long was £39.09/MWh and short was £84.32/MWh.

The highest daily average price when the system was short was £153.84/MWh and occurred on the 16 January. On this day the system was short for 13 Settlement Periods. The Maximum System Price on the day was £292.55/MWh, and this lead to the high short daily average price.



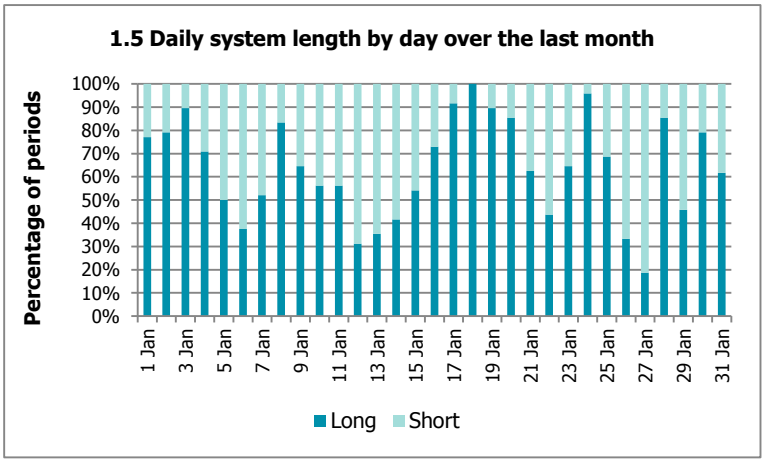
Graph 1.4 shows the variation of System Prices across the day. Short prices were highest in Settlement Period 36 and long prices lowest in Settlement Period 8. Long prices show little variance over settlement periods, with the price typically around £40/MWh. In contrast, short prices have a distinctive morning and evening peak.

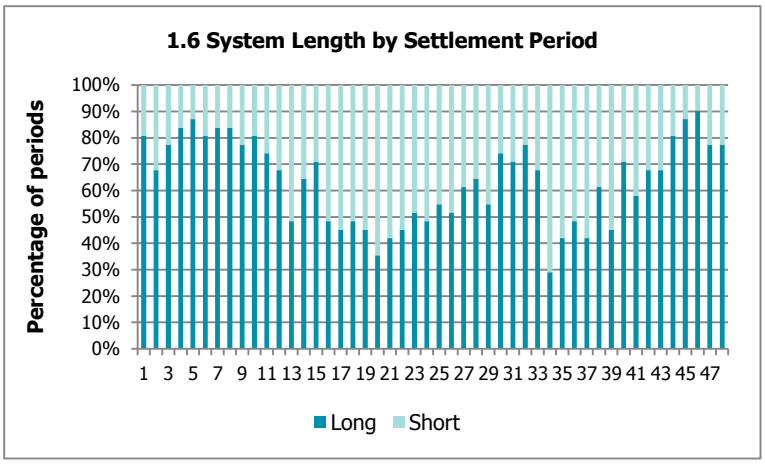


Graph 1.5 shows system length by day, and **Graph 1.6** shows system length by Settlement Period for January. The system was long for 64% of Settlement Periods in January, lower than the 75% seen in December.

On 18 January 2017, the System was long for all Settlement Periods. In contrast, the 27 January was short for 39 Settlement Periods, with an average NIV when the system was short of 201MWh.

Settlement Period 34 was short for 71% of the month, making it the shortest Settlement Period in January 2017.





2 PARAMETERS

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

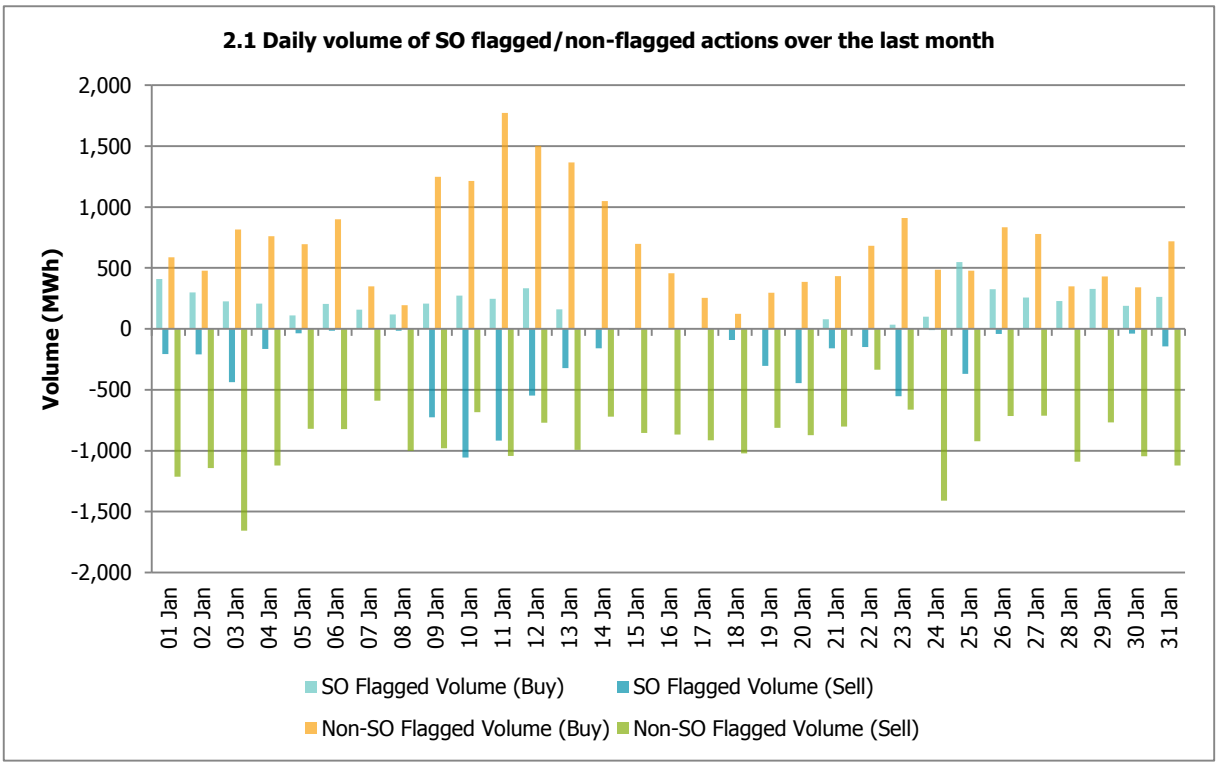
- The impact of flagging balancing actions;
- The impact of NIV tagging;
- The impact of PAR tagging;
- The impact of the Replacement Price; and
- How these mechanisms affect which balancing actions feed into the price.

Flagging

The Imbalance Price calculation aims to distinguish between 'energy' and 'system' balancing actions. Energy balancing actions are those which are 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 are actions which 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). Actions are flagged by the System Operator when they are taken to resolve a locational constraint on the transmission network (SO-flagging), or when they are taken 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 2016 as being constraint related.

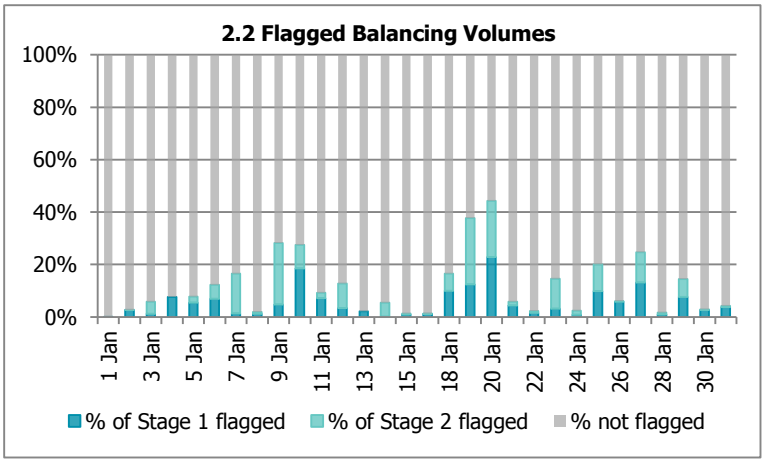


20% of sell balancing actions taken in January had an SO-flag. 31% of SO-flagged sell actions came from Wind BMUs, 29% from CCGT BMUs and 21% of actions came from actions taken outside the balancing mechanism (Balancing Service Adjustment Actions, BSAAs). The average initial price (i.e. before any re-pricing) of a SO-flagged sell action was -£17.52/MWh.

20% of buy balancing actions taken in January had an SO-flag. 61% of SO-flagged buy actions came from BSAAs, 24% CCGT BMUs, 14% from Coal BMUs and. The average initial price of a SO-flagged buy action was £89.09/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 (96%), and 45% of sell actions came from Pumped Storage BMUs.

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 un-flagged actions. If a first stage flagged balancing action has a more expensive price than the most expensive first stage un-flagged balancing action it becomes second stage flagged. This means that 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. On 19 January 25% of actions were second stage flagged, and these actions were all Bids. The average initial price of a second stage flagged action on this day was £34.29/MWh, with an average replacement price of £40.09/MWh.

The Replacement Price

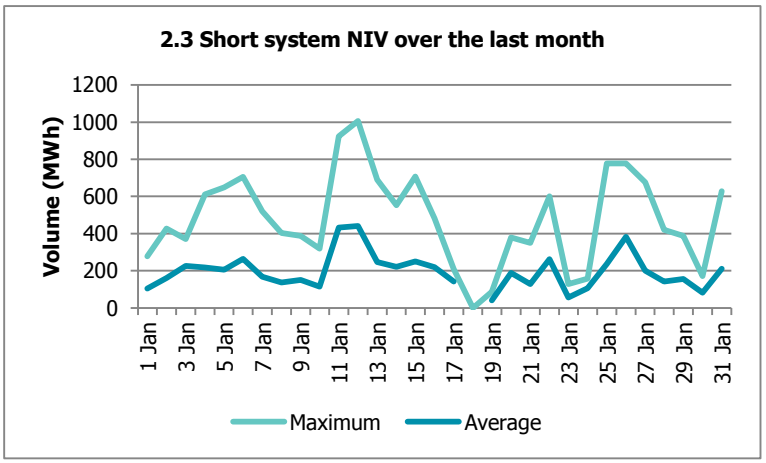
If there are 'second stage' flagged action volumes left in the NIV, these will be unpriced, as was the case for 1% of Buy and 2% of Sell actions in January. Unpriced actions are assigned a Replacement Price, currently based on the most expensive 1MWh of un-flagged actions.

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 sell action was £10.45/MWh, and the average Replacement Price for sell actions (when the System was long) was £34.38/MWh.

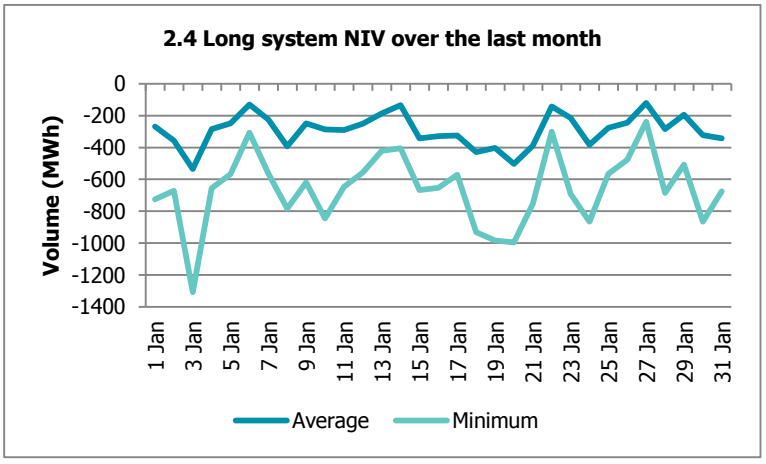
For Buy actions the opposite is true, as they will typically have their prices revised downwards by the Replacement Price when calculating the System Price. In January, the average original price of a second stage flagged buy action was £135.05/MWh, and the average Replacement Price for buy actions (when the System was short) was £83.60/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. **Graph 2.3** shows the greatest and average NIV when the system was short and **Graph 2.4** shows 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. 67% of volume was removed due to NIV tagging in January. Because the most expensive actions are NIV tagged first, NIV tagging has a dampening effect on prices when there are balancing actions in both directions.

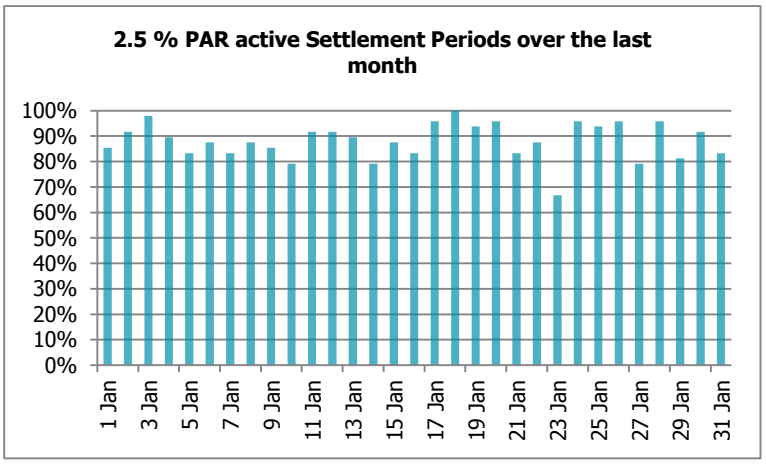
On 18 January, the system was long in every Settlement Period, hence there is no average short system NIV on this day.

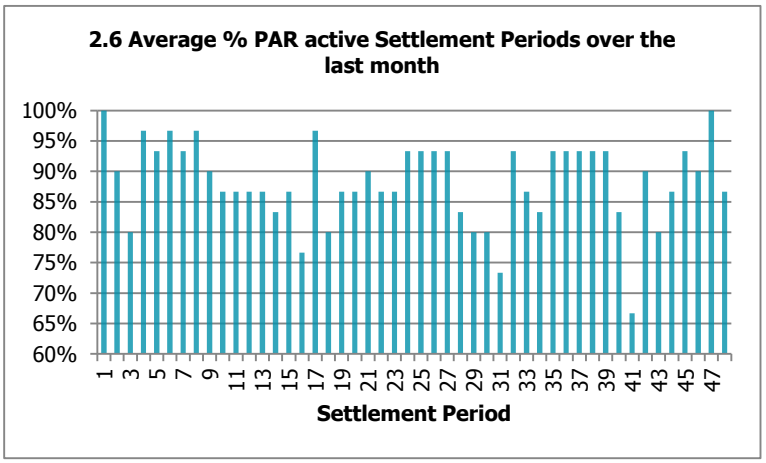
PAR tagging

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 price calculation stack. PAR tagging was active in all Settlement Periods on 18 January 2017.

Graph 2.6 shows the proportion of Settlement Periods over the last month when PAR tagging was active. In January, Settlement Periods 1 and 47 were PAR active on all days.





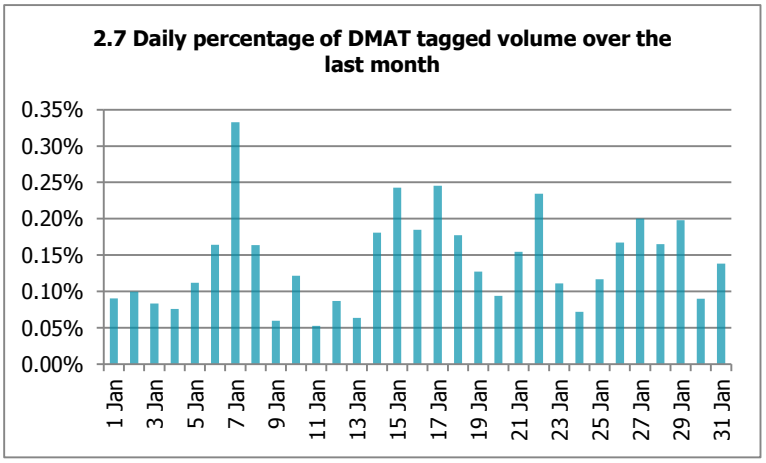
DMAT and Arbitrage Tagged Volumes

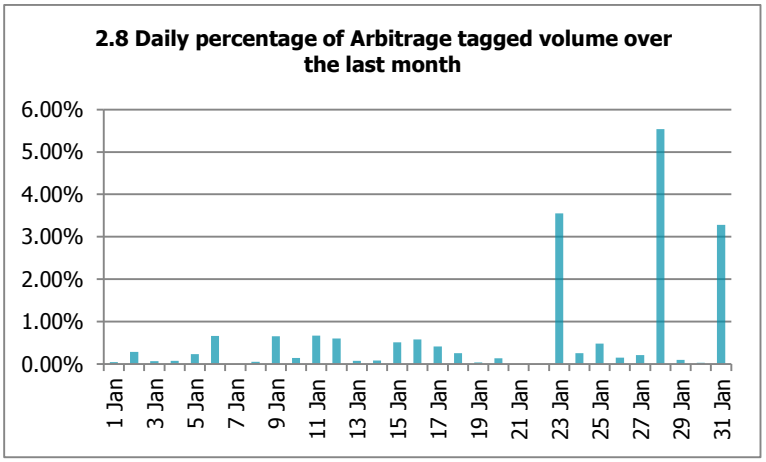
Some actions are always removed from the price calculation (before NIV tagging). These are actions which are less than 1MWh (De Minimis Acceptance Threshold (DMAT) tagging) or buy actions which are either the same price or lower than the price of sell actions (Arbitrage tagging).

Graph 2.7 shows the volumes of actions which were removed due to DMAT tagging. 44% of DMAT tagged volume came from CCGT BMUs and 27% from Balancing Services Adjustment Actions (BSAAs).

Graph 2.8 shows the volumes of actions that were removed due to Arbitrage tagging. The daily percentage is below 1% on all days except three in January 2017. 38% of Arbitrage tagged volume was from BSAAs and 36% from CCGT BMUs.

The average initial price of an Arbitrage tagged Buy action is £54.41/MWh, average price for a sell action is £57.05/MWh.





3 BALANCING SERVICES

Short Term Operating Reserve (STOR) costs and volumes

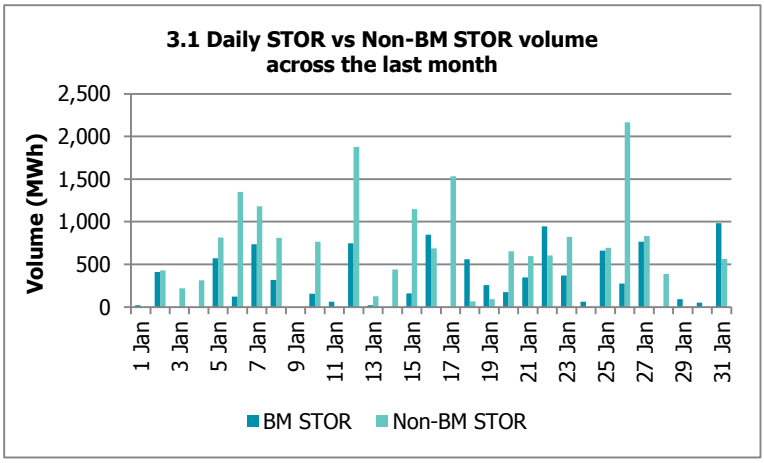
This section covers the balancing services that the System Operator takes outside the Balancing Mechanism that can have an impact on the price.

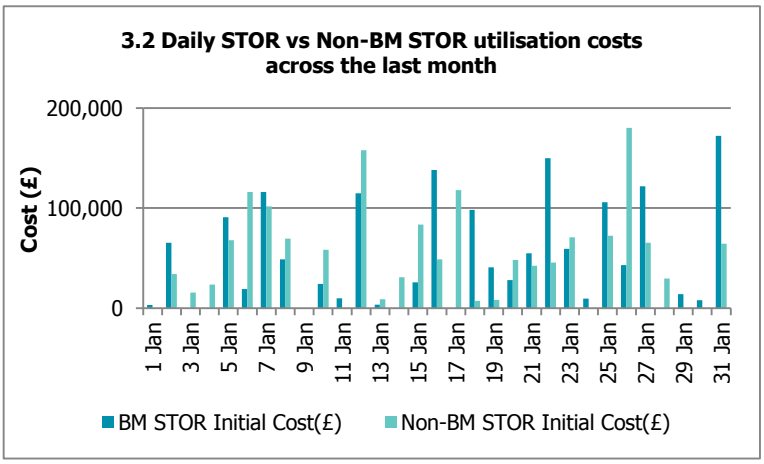
In addition to Bids and Offers available in the Balancing Mechanism, the SO can enter into contracts with providers of balancing capacity to deliver when called upon. These additional sources of power are referred to as reserve, and most of the reserve that the SO procures is called Short Term Operating 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 sets out STOR that were called upon during the month – split into volumes as BM STOR and non-BM STOR. **Graph 3.2** shows the utilisation costs of this capacity. 66% of the total STOR utilised in January came from outside of the Balancing Mechanism.

The average Utilisation Price for STOR capacity in January was £84.38/MWh (for BM STOR it was £148.33/MWh, and for non-BM STOR it was £78.15/MWh). The lowest STOR Utilisation Price was £62.99/MWh and the highest STOR Utilisation Price was £395/MWh.

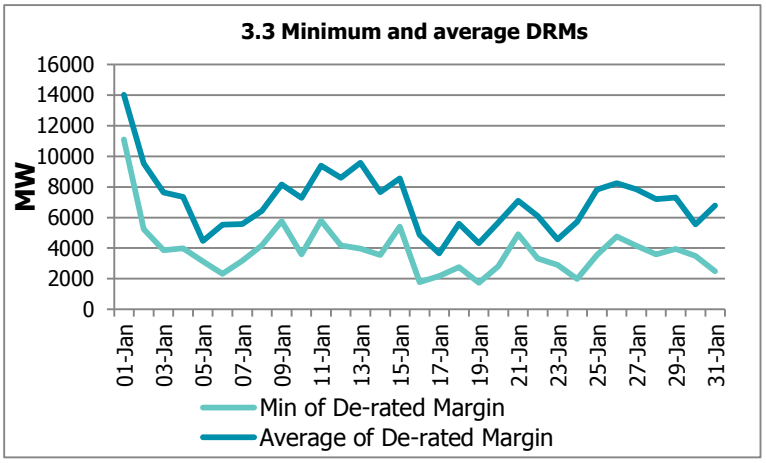




De-rated margin, loss of load probability and the Reserve Scarcity Price

There are times when the Utilisation prices of STOR plants are uplifted using the **Reserve Scarcity Price (RSP)** in order to calculate imbalance prices. The RSP is designed to respond to capacity margins so that it 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 2017.



The System Operator has determined a relationship between each DRM and the LoLP which will determine the RSP[2]. The minimum DRM in January was 1,732MW (January minimum 1,600MW) on 19 January Settlement Period 37.

The RSP is used to re-price 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
19/01/2017	37	1,732.19	0.0067	**20.03**	No	Long	42.87
16/01/2017	37	1,784.51	0.0054	**16.16**	No	Long	44.14
19/01/2017	35	1,842.44	0.0043	**12.75**	No	Long	40.96
19/01/2017	36	1,887.03	0.0035	**10.54**	No	Long	42.78
19/01/2017	34	1,895.09	0.0034	**10.18**	No	Short	96.55

[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 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.

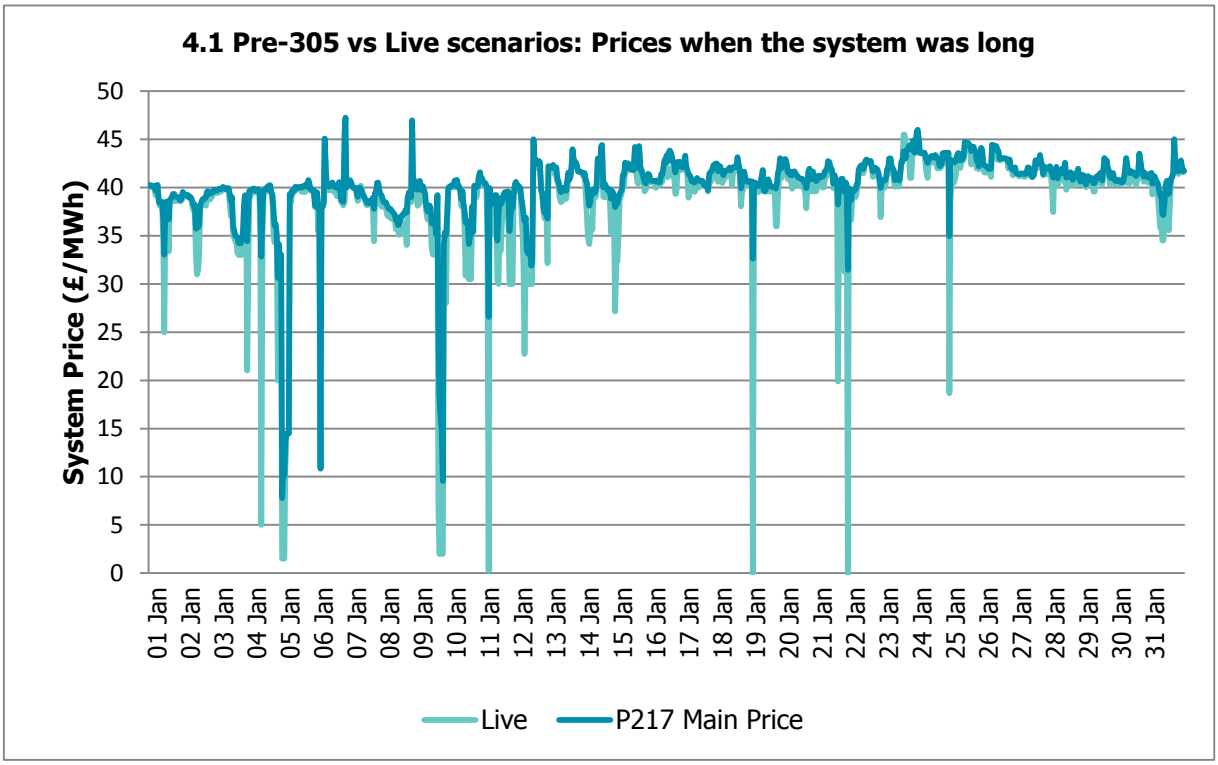
We also consider the **November 2018 Scenario**, which captures the effect of changes to the imbalance price parameters that are due to come in on 1 November 2018. These are:

- 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.

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 (for comparison we use the Main Price calculation). On average, live prices were £1.07/MWh lower when the system was long compared to the pre-P305 calculation. This is expected, in particular because of the reduction of PAR from 500MWh to 50MWh to make prices 'more marginal'. This change reduces the dampening effect of a large PAR.

When the system was long, prices were different in 91% of Settlement Periods; in 83% of these periods the change was less than £1/MWh. The biggest price change occurred on the 19 January 2017 Settlement Period 5, where the live price was £32.61/MWh lower than the System Price would have been under the P217 Scenario. This price change is a result of the reduction in PAR.

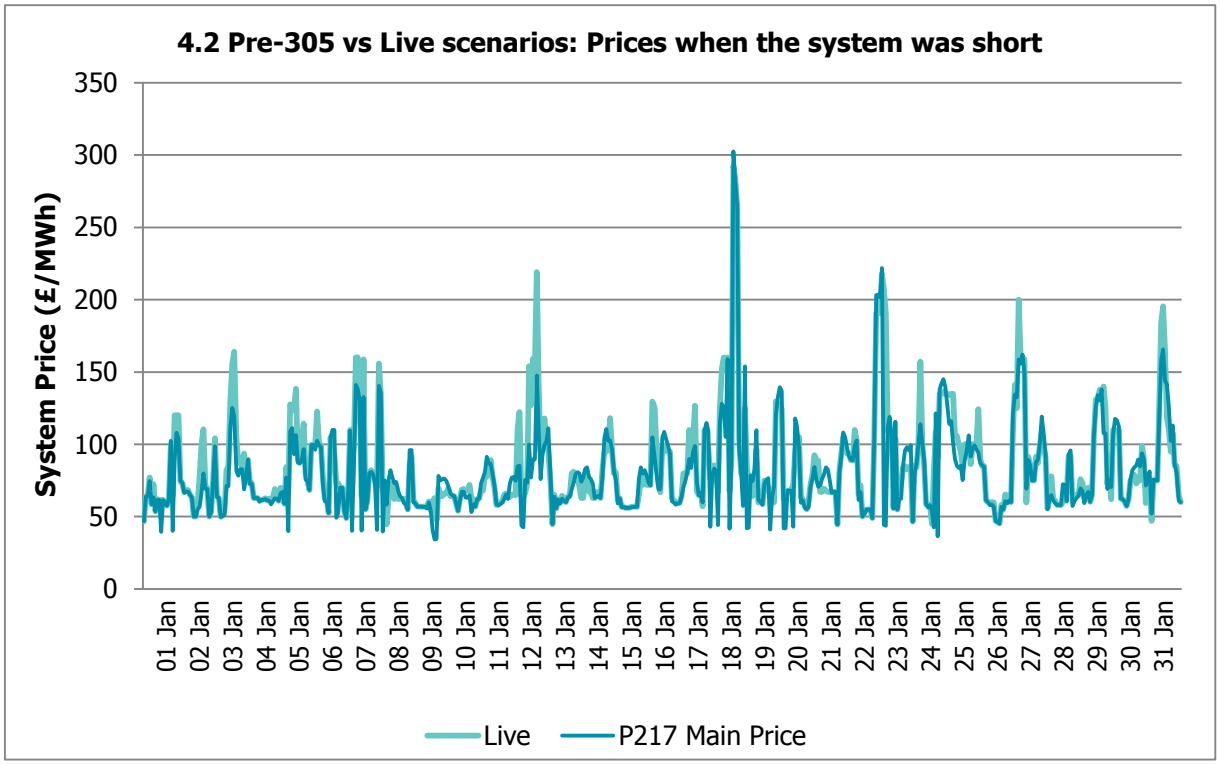


Graph 4.2 compares live System Prices when the system was short with prices re-calculated using the pre-P305 pricing scenario (using the Main Price calculation).

Live prices were on average £3.77/MWh higher when the system was short, and 28% of short Settlement Periods had price changes greater than £10/MWh.

The biggest difference in prices when the system was short was £162.89/MWh, which happened on 23 January 2017 at Settlement Period 20. The change in prices was a result of the addition of Non-BM STOR volumes changing the system direction. In the P217 scenario the system was long and the Main Price was £44.41, whereas in the live scenario the system was short and the System Price was £207.30/MWh.

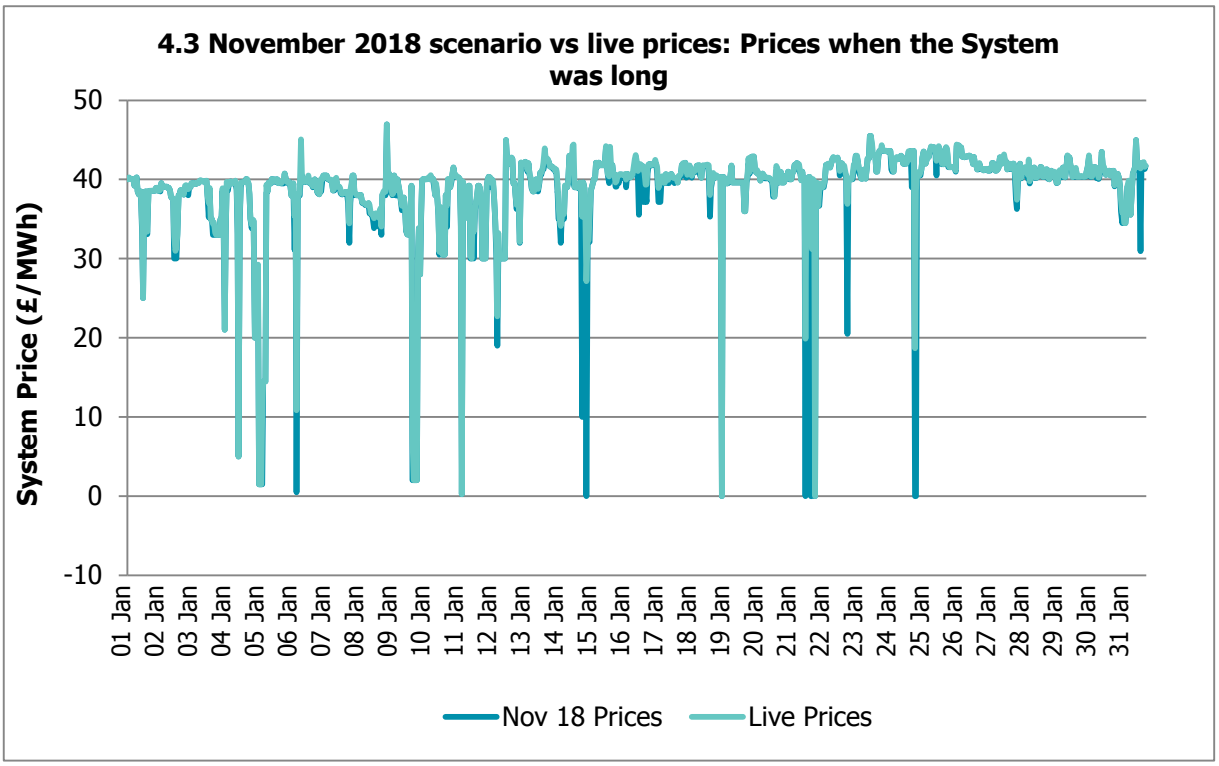
The inclusion of non-BM STOR volumes in the pricing stack changed the system length from long to short in 25 Settlement Periods.



November 2018 Price Calculation

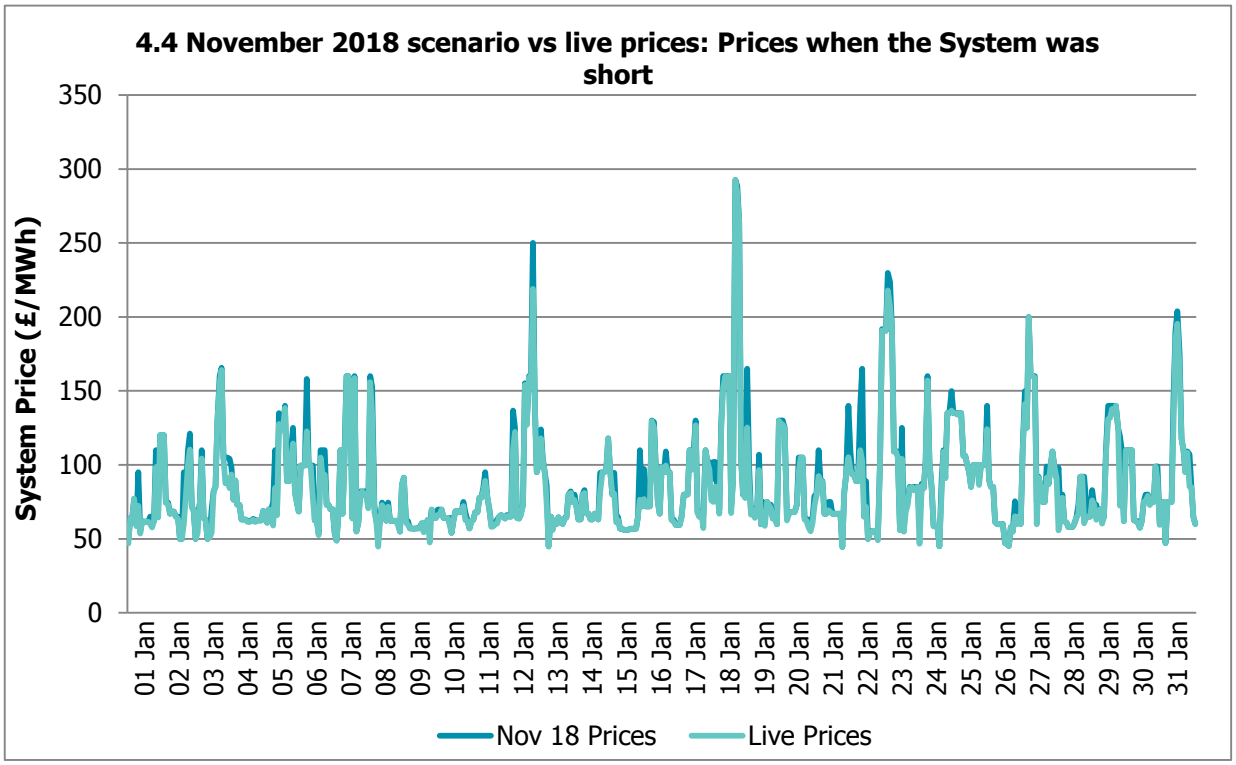
The average price differences across the month are relatively small under the November 2018 scenario. System Prices would be £0.51/MWh lower when the system was long and £3.16/MWh higher when the system was short. There was no change in prices in 48% of Settlement Periods. Note that under the November 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 re-calculated using the November 2018 scenario when the system was long. The magnitude of the changes seen when the system was long was less than those when the system was short. When the system was long, price changes were less than £1/MWh in 86% of Settlement Periods and greater than £5/MWh in only 3% of Settlement Period. The biggest shift in price was -£38.60/MWh (Settlement Period 22 on 24 January 2015) when the price would have been £0MWh under the November 2018 scenario, compared to the current live System Price of £38.60/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 44% of short Settlement Periods under the November 2018 scenario. Of those, 41% changed by more than £5/MWh and 21% by more than £22/MWh. The biggest difference in price was £62.37/MWh (Settlement Period 42 on 22 January 2017), which would be £165/MWh under the November 2018 scenario compared to the live price of £102.63/MWh. This change is a result of the planned reduction in PAR.

Under the November 2018 scenario, there would be 137 Settlement Periods in January 2017 with prices greater than or equal to £100/MWh, compared to 116 periods under the current live scenario.



There were no Demand Control actions taken during January 2017. 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
19/01/2017	37	1,732.19	0.0067	**40.05**	No	Long	42.87
16/01/2017	37	1,784.51	0.0054	**32.32**	No	Long	44.14
19/01/2017	35	1,842.44	0.0043	**25.51**	No	Long	40.96
19/01/2017	36	1,887.03	0.0035	**21.07**	No	Long	42.78
19/01/2017	34	1,895.09	0.0034	**20.36**	No	Short	96.55

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 Price		The Market 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: · the Loss of Lost Load (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 via Standard Settlement Runs.

6 APPENDIX 1

Annualised System Price and Length Graphs for 2016

In 2016 the average System Price across all Settlement Periods was £40.03/MWh, with a standard deviation of £46.61/MWh.

This was the first full year of System Prices under the BSC Modification P305 pricing calculation.

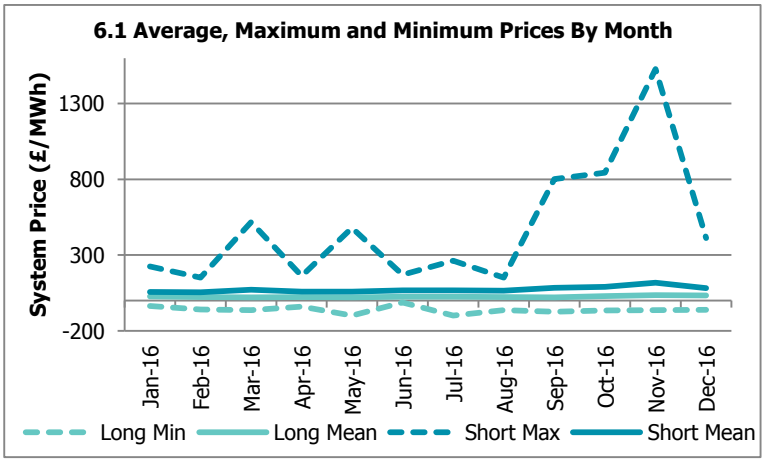
Graph 6.1 shows the average, maximum and minimum System Prices when the system was long and short. November 2016 is notable for having the highest System Price of the year (£1,528/MWh, Settlement Period 28 on 8 November) and the highest average short System Price (£117/MWh).

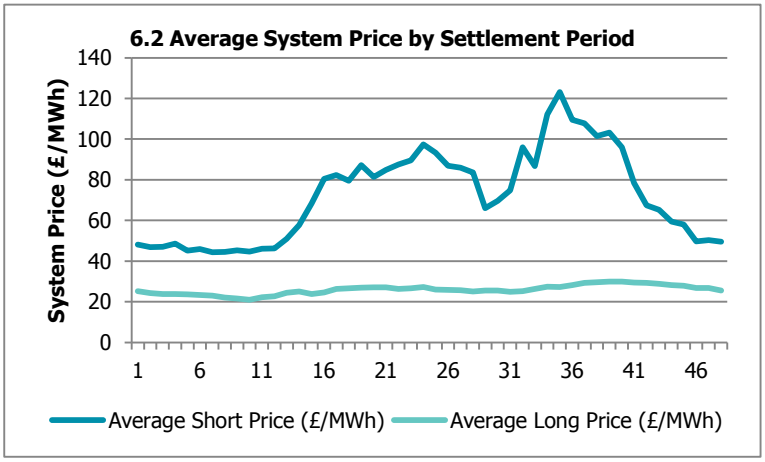
The lowest System price occurred on 19 May 2016, when the System Price was -£100/MWh in Settlement Period 22. September had the lowest long prices average at £21/MWh.

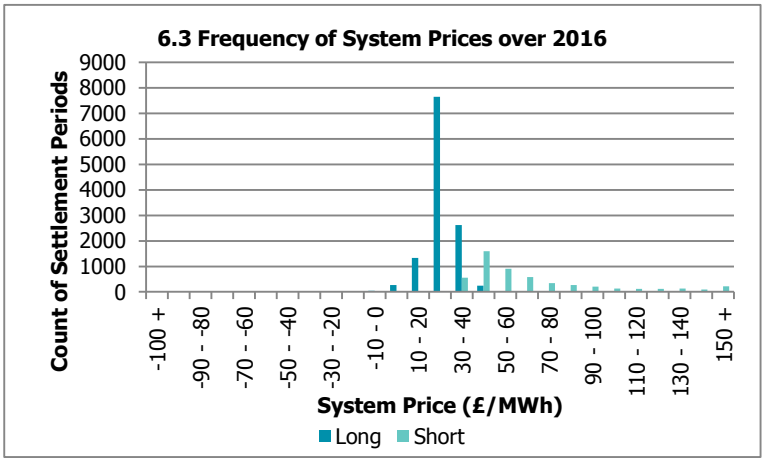
Graph 6.2 gives the average System Price by Settlement Period for 2016. The evening peak in short System Prices, reaches a maximum in Settlement Period 35, where the average price was £123/MWh. The morning peak in short System Prices occurs during Settlement Period 24, where the average price was £97/MWh.

The average System Price when the System is long remains between £20/MWh and £30/MWh across the day, falling as low as £20/MWh in Settlement Period 10.

Graph 6.3 gives the frequency of System Prices in 2016. In 62% of Settlement Periods, the price was between £20/MWh and £40/MWh.







The frequency of high and low System Prices are given in **graph 6.4.**

There were 129 Settlement Periods with negative Prices in 2016, with 34 occurring in March. The average price of the negative System Prices in March was -£22/MWh.

4% of System Prices when the market was short were over £100/MWh in 2016, with 41% of these occurring in the autumn (September to November).

Graph 6.5 shows the system length by month in 2016. In all months, the majority of Settlement Periods were long, with over 70% of Settlement Periods long in 2016.

January 2016 had the highest percentage (41%) of Short Settlement Periods, whilst May 2016 had the lowest (22%).

Graph 6.6 gives the System length by Settlement Period. Settlement Periods 4 and 43 have the greatest percentage (40%) of short periods, whilst Settlement Period 46 has the smallest (14%).

In 2016, during Settlement Period 35, the System Price when the market is short is on average £123/MWh. For this Settlement Period the System is short on 33% of days. When the System is long the average System Price was £27/MWh.