ISG196-SPAR
REPORTING ON JUNE 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 12 month post-P305 review has also been published looking back to the start of P305, which can be downloaded from the ELEXON website.

1 SYSTEM PRICES AND LENGTH

This report covers the month of June. Where available, data uses the latest Settlement Run (in most cases 'II' or 'SF').

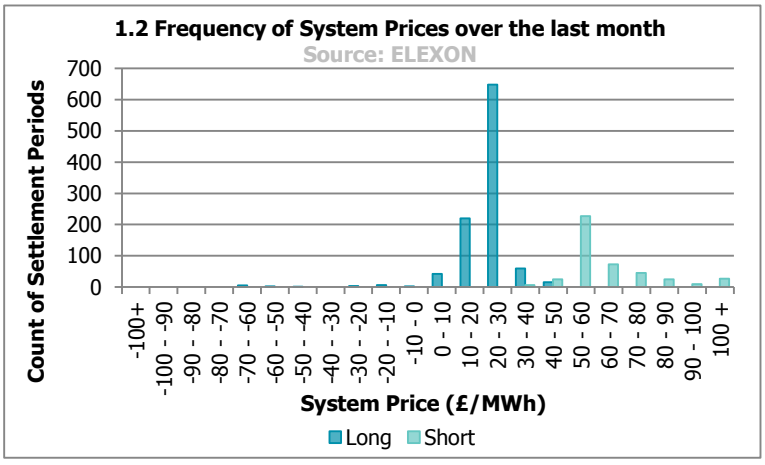
In this report we distinguish between a 'long' and a 'short' market when analysing System Prices because the price calculation differs between two scenarios. When the market is long, System Prices will be based predominantly on the System Operator's 'sell' actions such as Accepted Bids. When the market 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 June 2017.

	System Price (Long)				
Month	**Min**	**Max**	**Median**	**Mean**	**Std Dev**
June 2017	-69.10	47.49	25.01	22.79	11.22

	System Price (Short)				
Month	**Min**	**Max**	**Median**	**Mean**	**Std Dev**
June 2017	33.37	380.04	57.39	66.01	29.34

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.



In June 2017 45% of System Prices were between £20/MWh and £30/MWh regardless of system length. When the System was long, 87% of prices were between £10/MWh and £30/MWh. When the System was short, 59% prices were between £50/MWh and £70/MWh with 6% of prices over £100/MWh.

The lowest System Price for the month was -£69.10/MWh on 6 June 2017 in Settlement Period 46. This price was set by five Accepted Bids on Wind BMUs priced at -£69.13/MWh and -£68.17/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

There were 19 Settlement Periods with negative System Prices in June 2017 (compared to three in May 2017). 10 consecutive negative prices occurred during Settlement Periods 3 to 12 on 7 June 2017. The prices were set by sell actions that were re-priced by the Market Index Price during the System Price calculation. These Settlement Periods are analysed in further detail in Appendix 1.

System Prices exceeded £100/MWh 27 times in June (compared to 86 times in May). These high prices were seen in 2% of Settlement Periods regardless of length. The highest System Price for the month was £380.04/MWh on 21 June 2017 in Settlement Period 36. This price was set by two Accepted Offers from CCGT BMUs priced at £167/MWh and £495/MWh.

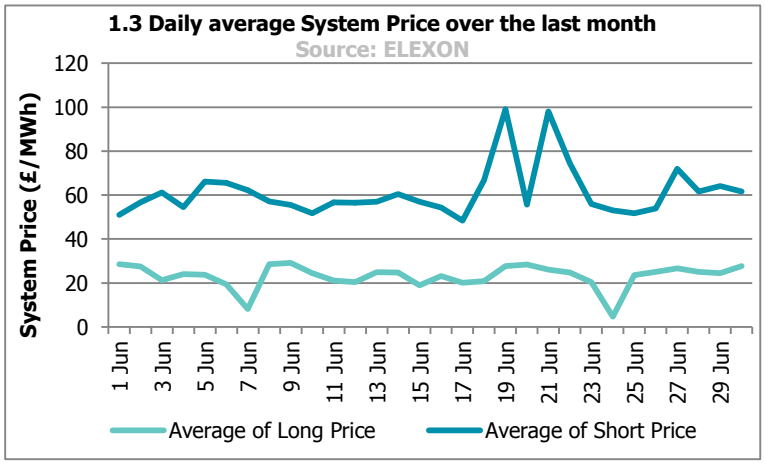
The lowest System Price when the system was short (£33.37/MWh) occured at Settlement Period 20 on 25 June 2017.

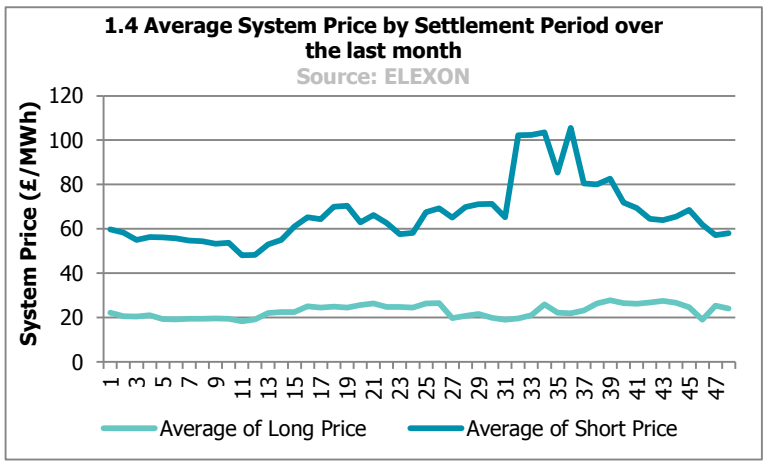
Graph 1.3 shows daily average System Prices over the last month. In June, the average System Price when the system was long was £22.79/MWh and short was £66.01MWh.

The highest daily average price when the system was short was £99.02/MWh and occurred on the 19 June.

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 11. The lowest average System Prices regardless of market length was seen during Settlement Period 12 when the System Price was on average £23.97/MWh.

Long prices show little variance over Settlement Periods, with the price typically between £18/MWh and £28/MWh. Short Prices peak during Settlement Period 36, this is due to a System Price of £380/MWh during this Settlement Period.

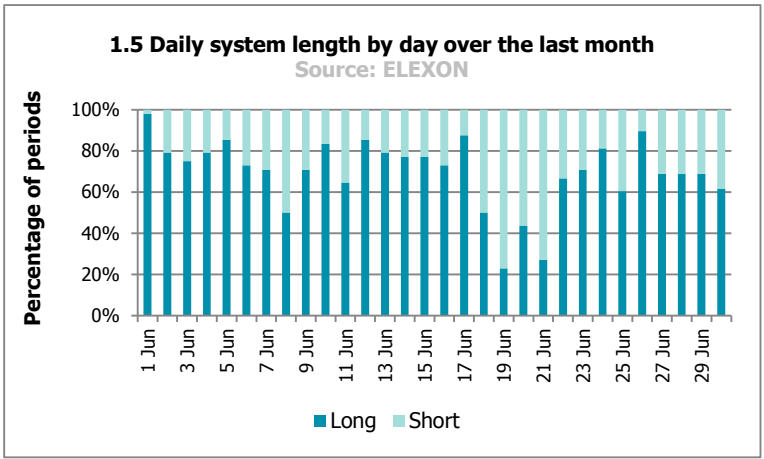


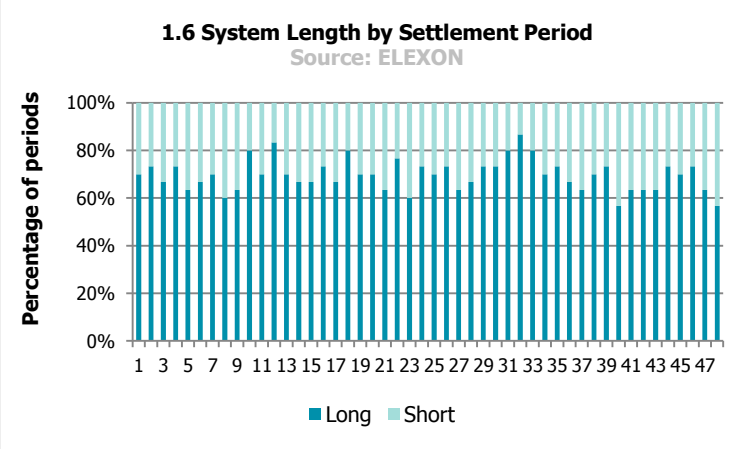


Graph 1.5 shows system length by day, and **Graph 1.6** shows system length by Settlement Period for June. The system was long for 70% of Settlement Periods in June, compared to 59% in May.

On 19 June the system was short for 77% of Settlement Periods. The average NIV while the system was short on this day was 266MWh.

Settlement Periods 40 and 48 were short for 43% of the month, making them the shortest Settlement Periods in June 2017.





2 PARAMETERS

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

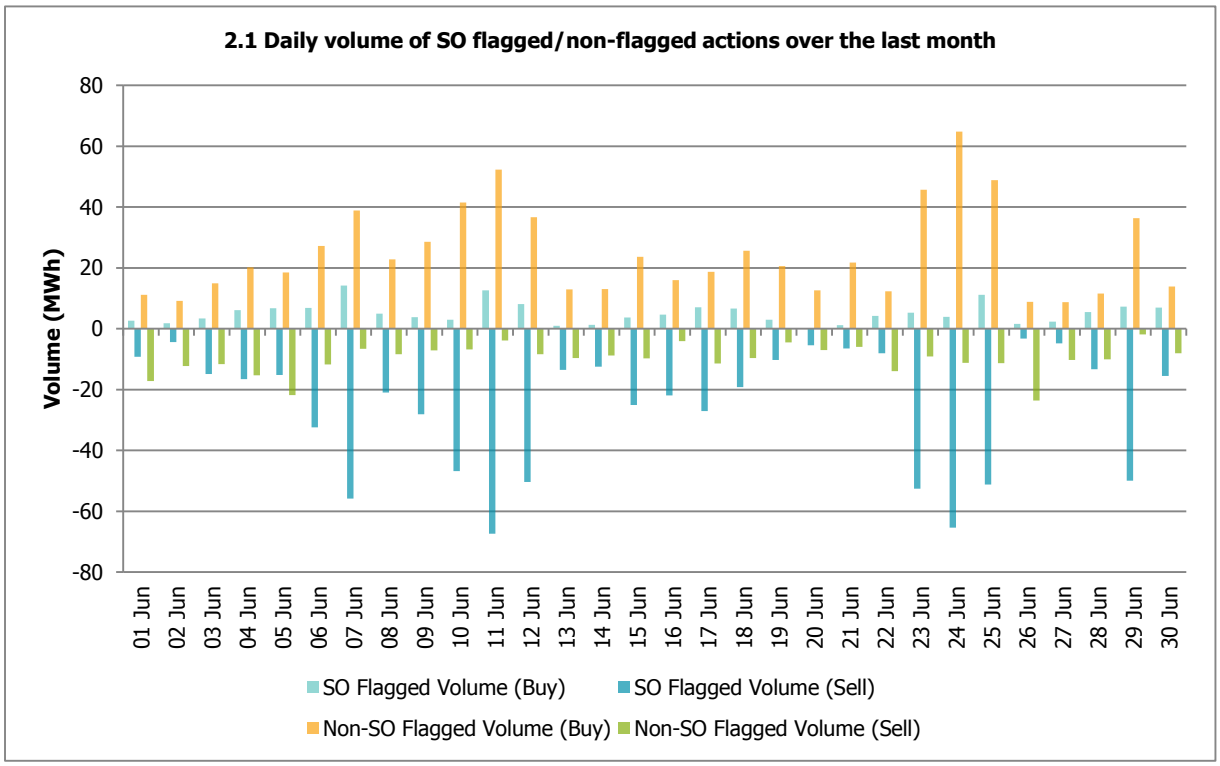
- The impact of flagging balancing actions;
- The impact of NIV tagging;
- The impact of PAR tagging;
- The impact of the Replacement Price; and
- How these mechanisms affect which balancing actions feed into the price.

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 June 2017 as being constraint related.



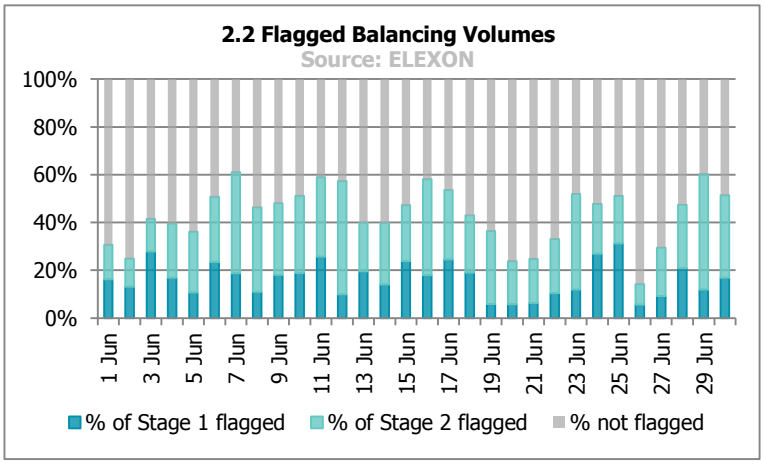
26% of sell balancing actions taken in June had an SO-flag. 52% of SO-flagged sell actions came from Balancing Services Adjustment Actions (BSAAs), 30% from CCGT BMUs and 9% from Wind BMUs. The average initial price (i.e. before any re-pricing) of a SO-flagged sell action was -£4.92/MWh.

60% of buy balancing actions taken in June had an SO-flag. 74% of SO-flagged buy actions came from BSAAs and 20% CCGT BMUs. The average initial price of a SO-flagged buy action was £77.61/MWh.

Any actions which are less than 15 minutes total duration are CADL flagged. 2.5% of buy actions and less than 1% of sell actions were CADL flagged in June. The majority of CADL flagged buy (95%) came from Pumped Storage BMUs. 53% of CADL flagged sell actions were by CCGT 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.



The Replacement Price

If there are 'second stage' flagged action volumes left in the NIV, these will be unpriced. In total 72.3% of sell actions in June were flagged, but of these only 10% were unpriced. Unpriced actions are assigned a Replacement Price, currently based on the most expensive 1MWh of un-flagged actions.

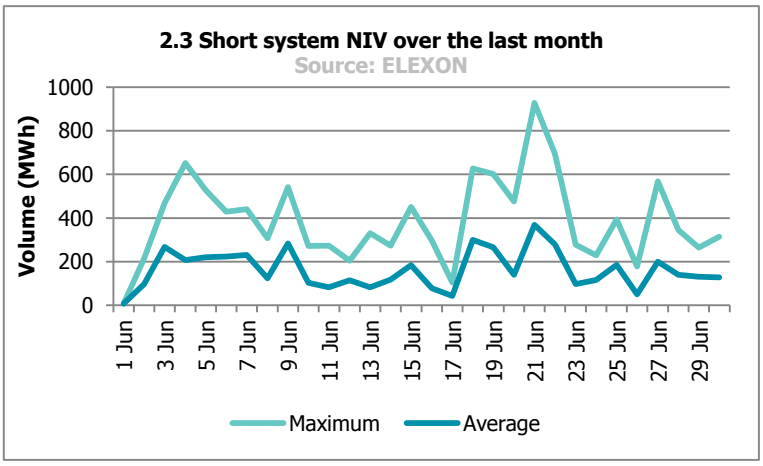
Sell actions will typically have their prices revised upwards by the Replacement Price for the purposes of calculating the System Price. In June, the average original price of a second stage flagged sell action was £9.40/MWh and the average Replacement Price for sell actions (when the System was long) was £24.60/MWh.

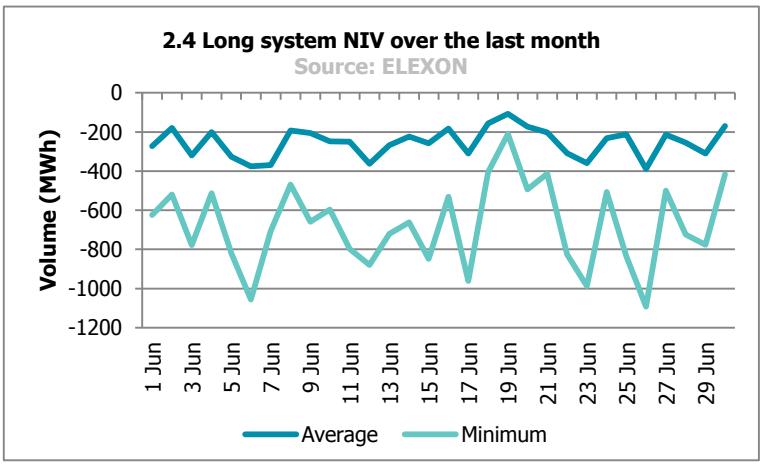
NIV and NIV tagging

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. 82% of volume was removed due to NIV tagging in June. 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.



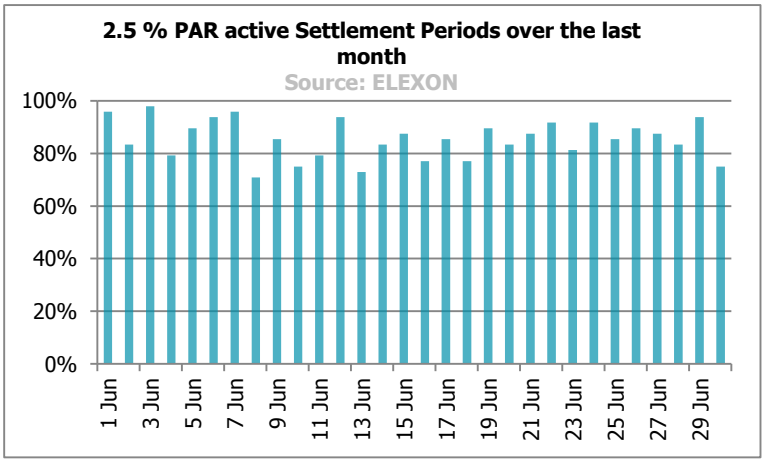


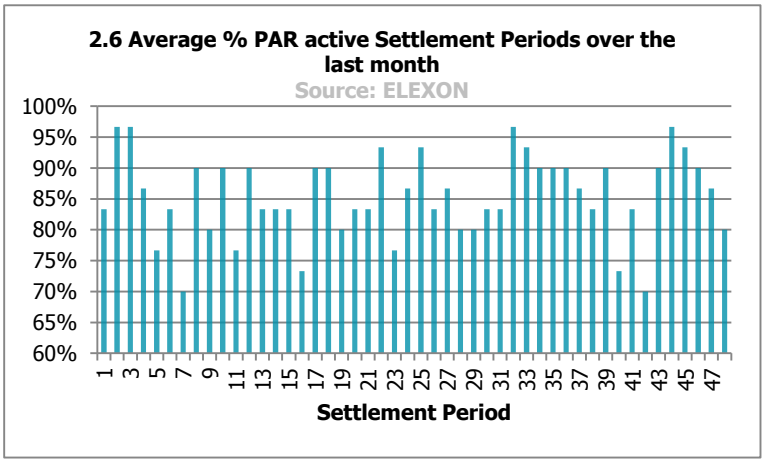
PAR tagging

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.

Graph 2.6 shows the proportion of Settlement Periods over the last month when PAR tagging was active. PAR tagging was active in 70% of days for Settlement Periods 7 and 42, which represented the low for any Settlement Period in June 2017.





DMAT and Arbitrage Tagged Volumes

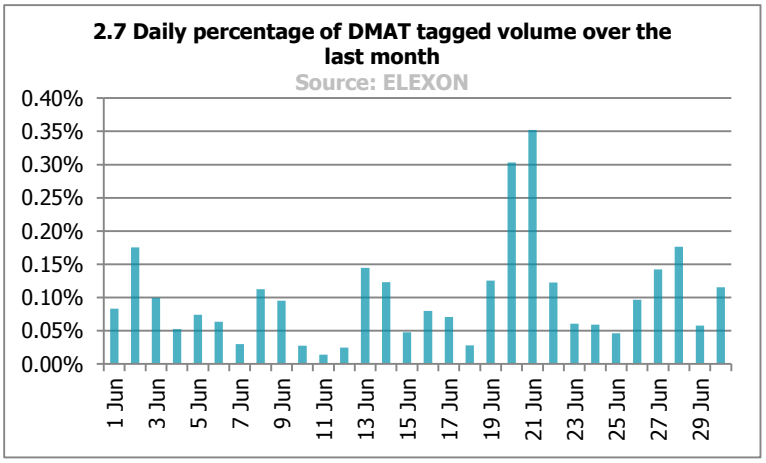
Some actions are always removed from the price calculation (before NIV tagging). These are actions which are less than 1MWh (De Minimis Acceptance Threshold (DMAT) tagging) or buy actions which are either the same price or lower than the price of sell actions (Arbitrage tagging).

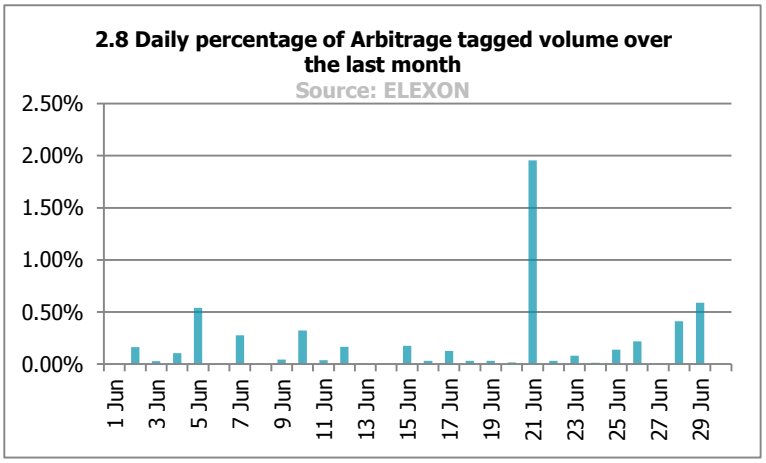
Graph 2.7 shows the volumes of actions which were removed due to DMAT tagging. 0.08% of buy and sell volume was removed by DMAT tagging. 57% of DMAT tagged volume came from CCGT BMUs and 22% from Balancing Services Adjustment Actions (BSAAs).

Graph 2.8 shows the volumes of actions that were removed due to Arbitrage tagging. 41% of Arbitrage tagged volume was from CCGT BMUs and 22% from Wind BMUs.

In June the average initial price of an Arbitrage tagged buy action was £33.32/MWh, average price for a sell action is £42.02/MWh.

On 21 on June 2017 824MWh of actions were arbitrage tagged. The average price of an arbitrage tagged sell action was £62/MWh. The highest priced Arbitrage tagged sell action on this day was priced at £115/MWh. The average price of an arbitrage tagged buy action on 21 June was £57/MWh.





3 BALANCING SERVICES

Short Term Operating Reserve (STOR) costs and volumes

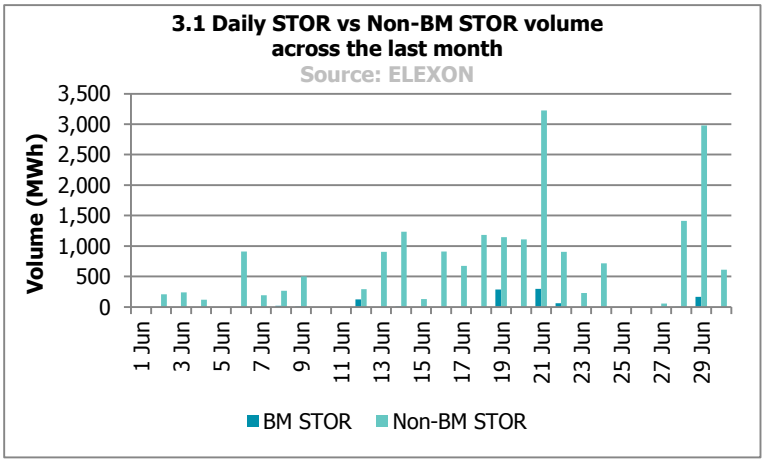
This section covers the balancing services that the System Operator takes outside the Balancing Mechanism that can have an impact on the price.

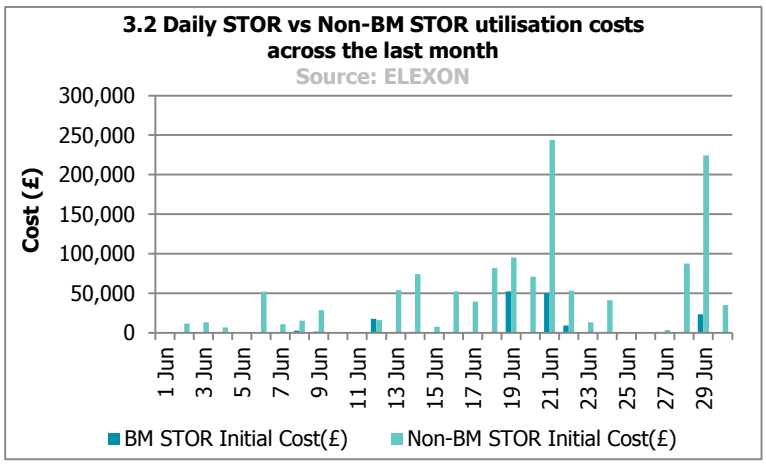
In addition to Bids and Offers available in the Balancing Mechanism, the SO can enter into contracts with providers of balancing capacity to deliver when called upon. These additional sources of power are referred to as reserve, and most of the reserve that the SO procures is called Short Term Operating 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 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. 95% of the total STOR utilised in June came from outside of the Balancing Mechanism.

The average Utilisation Price for STOR capacity in June was £70.49/MWh (for BM STOR it was £162.30/MWh, and for non-BM STOR it was £66.06/MWh).

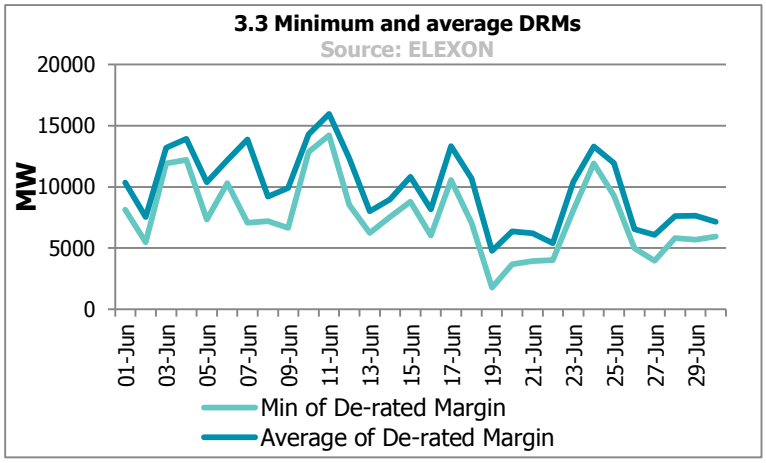




De-Rated Margin, Loss of Load Probability and the Reserve Scarcity Price

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 June 2017.



The System Operator has determined a relationship between each DRM and the LoLP which will determine the RSP[2]. The minimum DRM in June was 1,773MW (May minimum 1,130MW) on 19 June in Settlement Period 38.

The RSP is used to re-price STOR actions in the Imbalance Price calculation if it is higher than the original Utilisation Price. There were no STOR actions that were re-priced using the RSP in June (see **Table 3.4**).

3.4 Top 5 LoLPs and RSPs

Date	SP	DRM	LoLP	RSP	RSP Used	System Length	System Price
19/06/2017	38	1,773.12	0.0057	**16.97**	No	Short	89.56
19/06/2017	37	2,064.59	0.0016	**4.77**	No	Short	74.26
19/06/2017	36	2,302.52	0.0005	**1.50**	No	Short	127.03
19/06/2017	35	2,574.69	0.0001	**0.35**	No	Short	127.17
20/06/2017	37	3,676.30	0.0000	**0.00**	No	Short	48.85

[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.

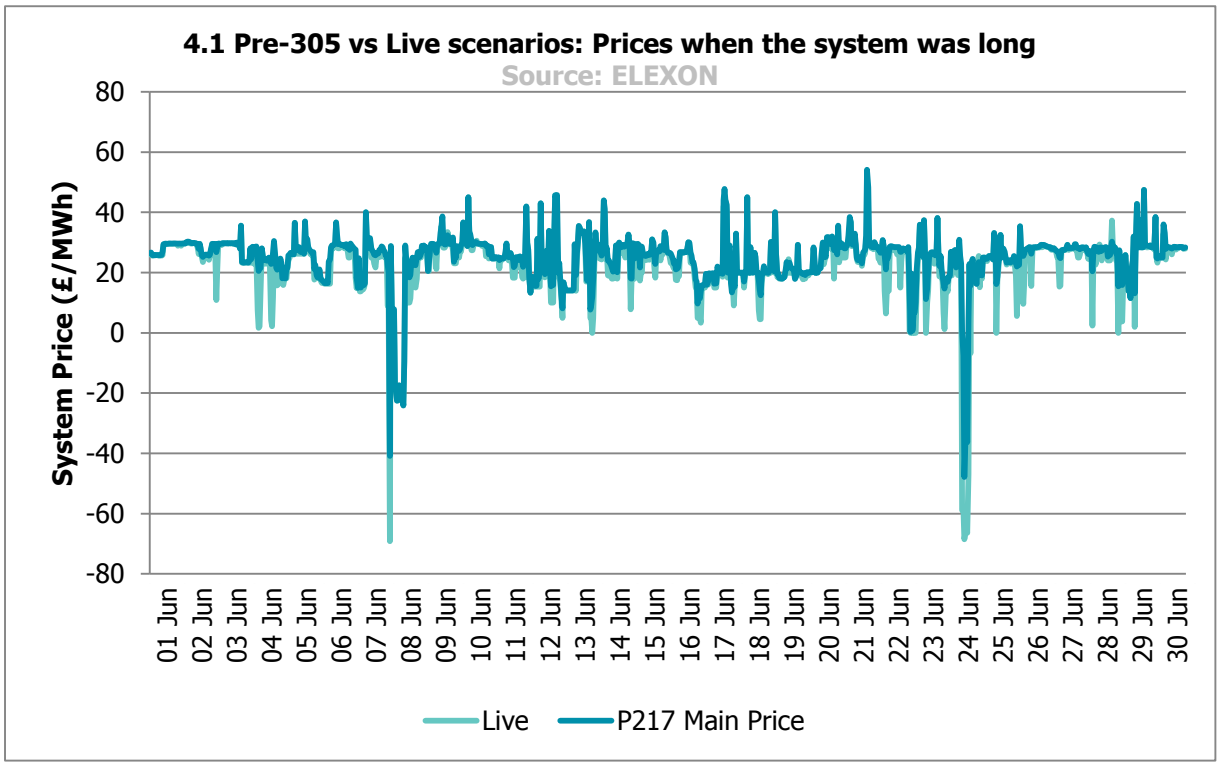
We also consider the **November 2018 Scenario**, which captures the effect of changes to the Imbalance Price parameters that are due to come in on 1 November 2018. These are:

- 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 £2.10/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 78% of Settlement Periods; in 72% of these periods the change was less than £1/MWh. The biggest price change occurred on the 24 June 2017 in Settlement Period 27, where the live price was -£59.62/MWh lower than the System Price would have been under the P217 Scenario. This price change is due to the reduction in PAR.

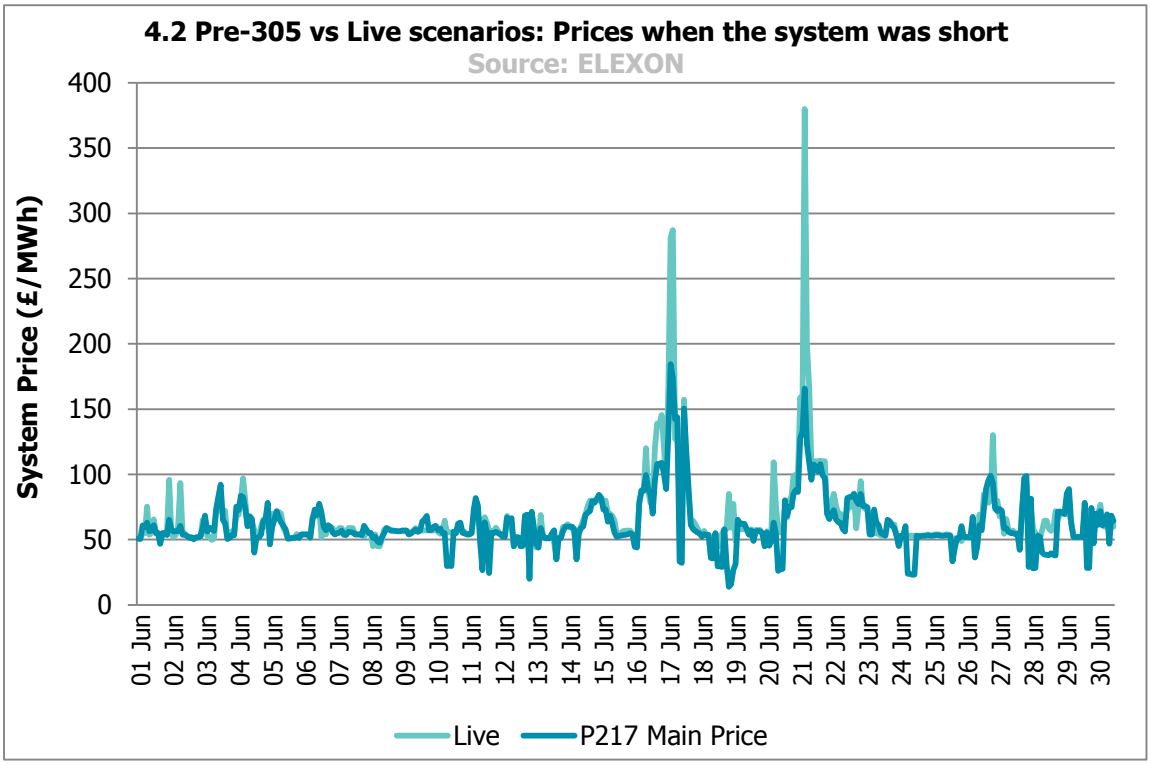


Graph 4.2 compares live System Prices when the system was short with prices re-calculated using the pre-P305 pricing scenario (using the Main Price calculation).

Live prices were on average £4.55/MWh higher when the system was short, and 18% of short Settlement Periods had price changes greater than £10/MWh.

The biggest difference in prices when the system was short was £214.20/MWh, which happened on 21 June 2017 during Settlement Period 36 as a result of the reduction in PAR. In the P217 scenario the Main Price would have been £165.84/MWh whereas in the live scenario the System Price was £380.04/MWh.

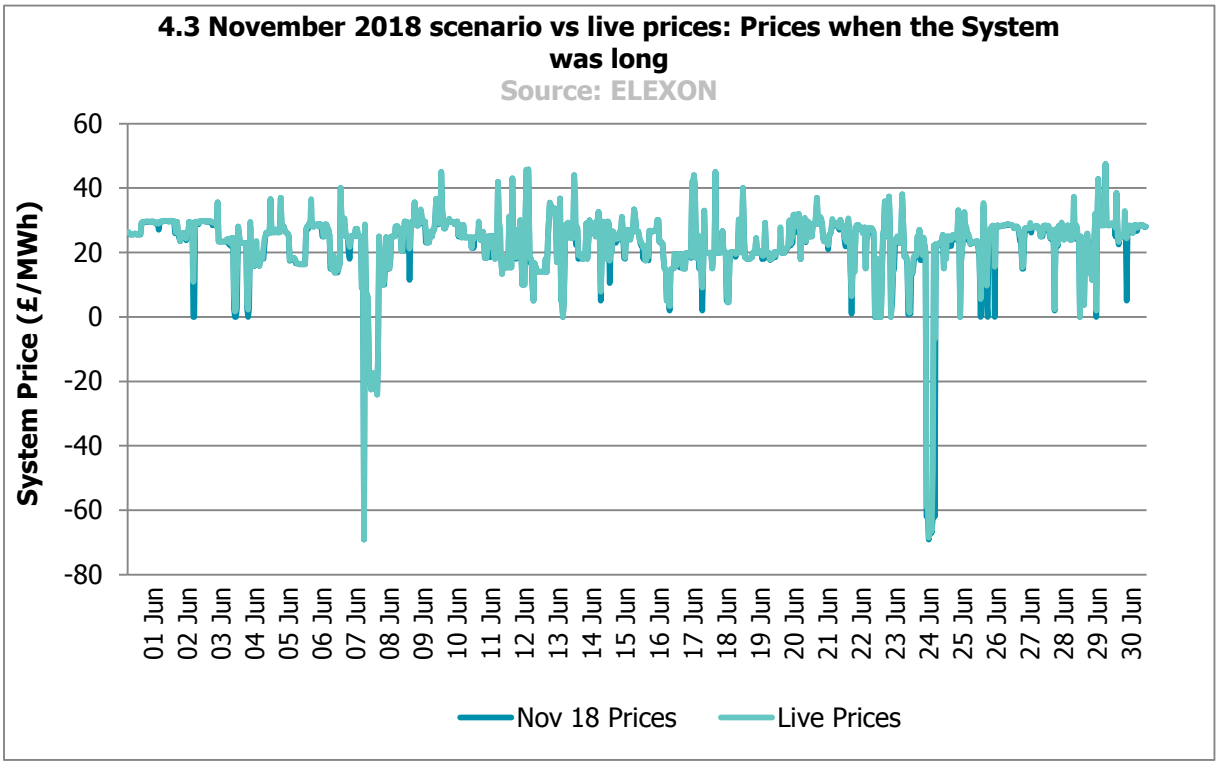
The inclusion of non-BM STOR volumes in the pricing stack changed the system length from long to short in 36 Settlement Periods.



November 2018 Price Calculation

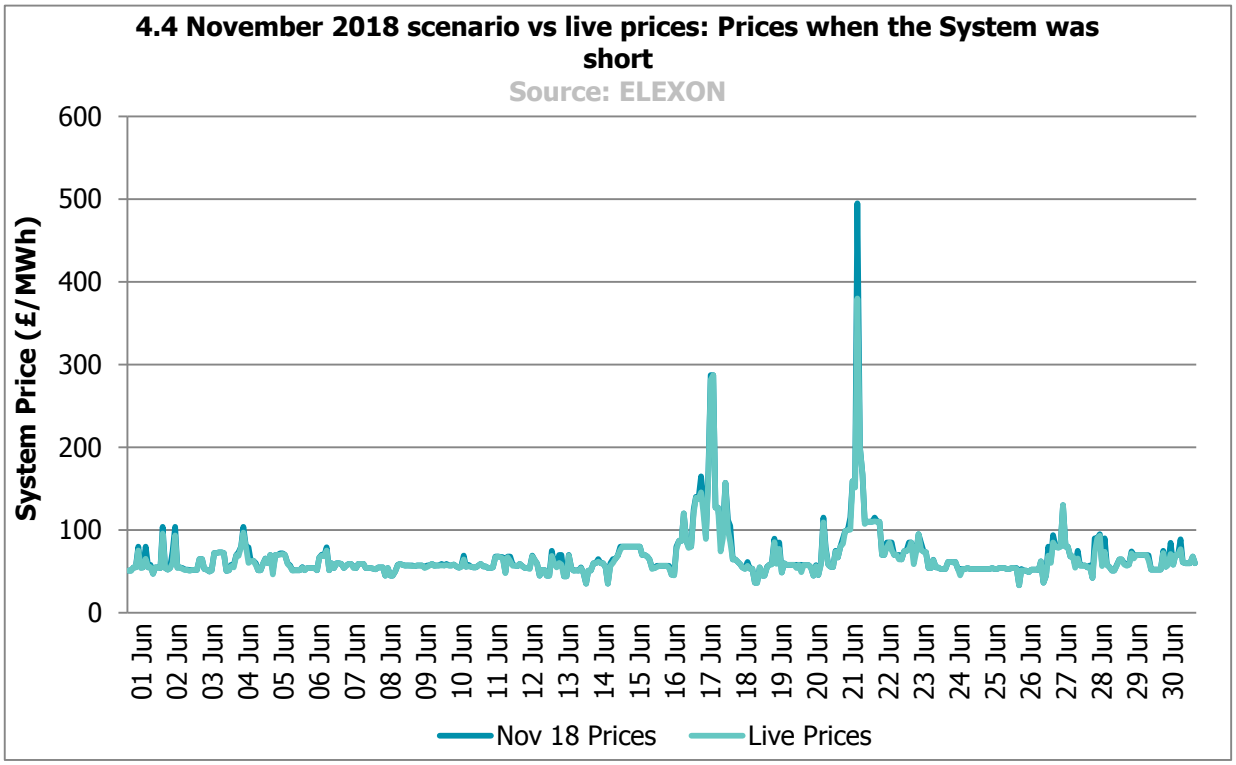
The average price differences across the month are relatively small under the November 2018 scenario. System Prices would be £0.62/MWh lower when the system was long and £1.62/MWh higher when the system was short. There was no change in prices in 59% of Settlement Periods. Note that under the November 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. When the system was long, price changes were less than £1/MWh in 68% of Settlement Periods and greater than £5/MWh in 7% of Settlement Period. The biggest shift in price was £55.15/MWh (Settlement Period 35 on 24 June 2017) when the price would have been -£62.01/MWh under the November 2018 scenario, compared to the current live System Price of -£6.86/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 40% of short Settlement Periods under the November 2018 scenario. Of those, 23% changed by more than £5/MWh and 11% by more than £10/MWh. The biggest difference in price was £114.96/MWh (Settlement Period 36 on 21 June 2017) when the price would have been £495/MWh under the November 2018 scenario, compared to the current live System Price of £380.04/MWh.

Under the November 2018 scenario, there would be 32 Settlement Periods in June 2017 with prices greater than or equal to £100/MWh, compared to 27 periods under the current live scenario.



There were no Demand Control actions taken during June 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 June.

4.5 Reserve Scarcity Prices with VoLL of £6,000

Date	SP	DRM	LoLP	RSP	RSP Used	System Length	System Price
19/06/2017	38	1,773.12	0.0057	**33.94**	No	Short	89.56
19/06/2017	37	2,064.59	0.0016	**9.53**	No	Short	74.26
19/06/2017	36	2,302.52	0.0005	**3.01**	No	Short	127.03
19/06/2017	35	2,574.69	0.0001	**0.70**	No	Short	127.17
20/06/2017	37	3,676.30	0.0000	**0.00**	No	Short	48.85

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 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

6 APPENDIX 1 – NEGATIVE MARKET INDEX PRICE (MIP) SETTING THE SYSTEM PRICE

In this section one of our Market Analysts, Emma Tribe takes a look at the use of the Market Index Price in the Imbalance Price calculation. As well as a detailed look at the Imbalance Price on 7 June 2017 where the System Price was set by the Market Index Price (MIP) for 10 consecutive Settlement Periods.

emma.tribe@elexon.co.uk

Market Index Price

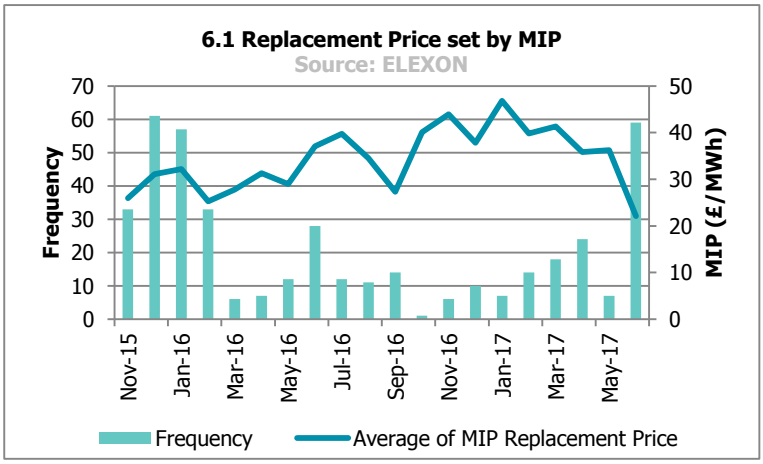
The Market Index Price (MIP) is used to set the System Price when the Net Imbalance Volume (NIV) is equal to zero or when there are no priced actions left in the stack to set the Replacement Price. The MIP is calculated for each Settlement Period to reflect the price of wholesale electricity in the short term or intra-day markets[3].

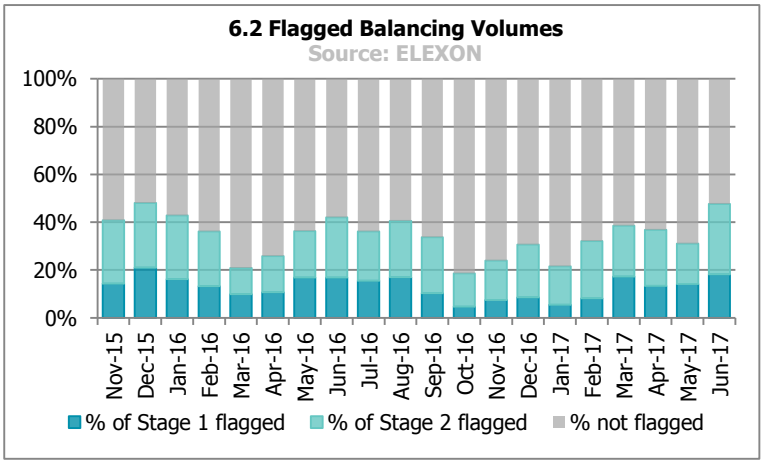
There have been 67 negative MIPs since the introduction of the BSC Modification P305 in November 2015. 12 of these of occurred on 7 June 2017. The lowest MIP occurred on 8 August 2016 when the MIP was -£45.70/MWh.

The MIP has set the Replacement Price in 420 Settlement Periods since the introduction of the BSC Modification P305, shown in **Graph 6.1**. 59 of those Settlement Periods occurred in June 2017 when the average Replacement Price set by the MIP was £22.13/MWh.

A longer term view of **Graph 2.2** has been created in **Graph 6.2**. 48% of balancing volume was flagged and 29% of volume stage 2 flagged in June 2017.

Further analysis on the use of the MIP as part of the Market Index Definition Statement Review will be presented to the ISG in August.





[3] For full detail of the Market Index Price, see the Market Index Definition statement here: https://www.elexon.co.uk/bsc-related-documents/balancing-settlement-code/bsc-sections/

7 June 2017

On 7 June 2017 the MIP set the Replacement Price, which then set the Imbalance Price, for 10 consecutive Settlement Periods. During this period the MIP was negative, leading to 10 consecutive Settlement Periods with a negative Imbalance Price. This was the first time since the implementation of BSC Modification P305 that a negative MIP set the Replacement Price.

Graph 6.3 shows how the MIP and System Price varied over the day. In Settlement Periods 3 to 12 the two prices are equal. The lowest Imbalance Price over the day was -£24.06/MWh during Settlement Period 11.

While the MIP was negative 44% of generation was from Nuclear BMUs, 30% from Wind BMUs and 11% from CCGT BMUs.

Graph 6.4 shows the volumes of flagged sell volume by fuel type. 56GWh of Sell volume was flagged on 7 June; this represents 90% of sell volume.

The average price of a flagged sell action over the day was -£55/MWh, between Settlement Periods 1 and 12 the average was -£73/MWh. 69% of flagged sell volume comes from Wind BMU's between Settlement Periods 1 and 12.