ISG204-SPAR

REPORTING ON MARCH 2018

ISSUE 29 – PUBLISHED 25 APRIL 2018

SYSTEM PRICE ANALYSIS REPORT

The System Prices Analysis Report (SPAR) provides a monthly update on price calculations. It is published by the ELEXON Market Analysis Team to the Imbalance Settlement Group (ISG) and on the ELEXON Website ahead of the monthly ISG meeting.

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

The 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 two appendices: one on National Grid's analysis of Static vs Dynamic LoLP values, and another which takes a detailed look at System Prices and the Net Imbalance Volume on 1 March 2018.

1 SYSTEM PRICES AND LENGTH

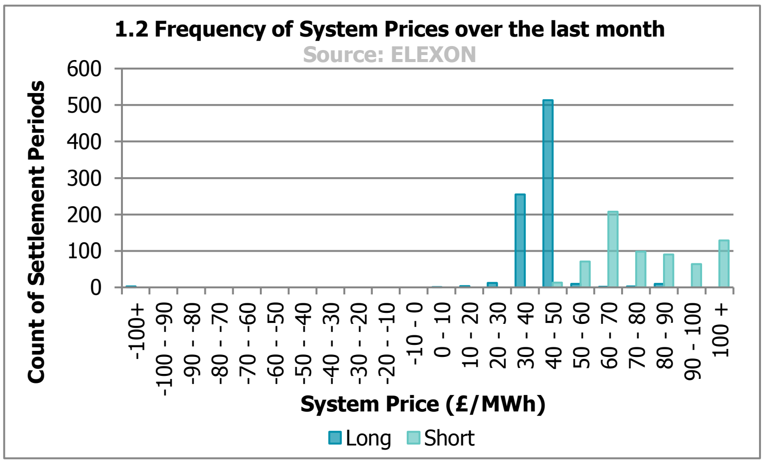
This report covers the month of March. Where available, data uses the latest Settlement Run (in most cases 'II' or 'SF').

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 March 2018, with values shown in £/MWh.

	System Price (Long)				
Month	**Min**	**Max**	**Median**	**Mean**	**Std Dev**
March 2018	-142.78	86.00	41.25	41.04	12.36

	System Price (Short)				
Month	**Min**	**Max**	**Median**	**Mean**	**Std Dev**
March 2018	42.80	990.00	73.79	102.98	91.49

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



58% of System Prices were between £30/MWh and £60/MWh, regardless of system length. When the system was long, 94% of prices were between £30/MWh and £50/MWh. When the system was short, 31% of prices were between £60/MWh and £70/MWh and 19% of prices were over £100/MWh.

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

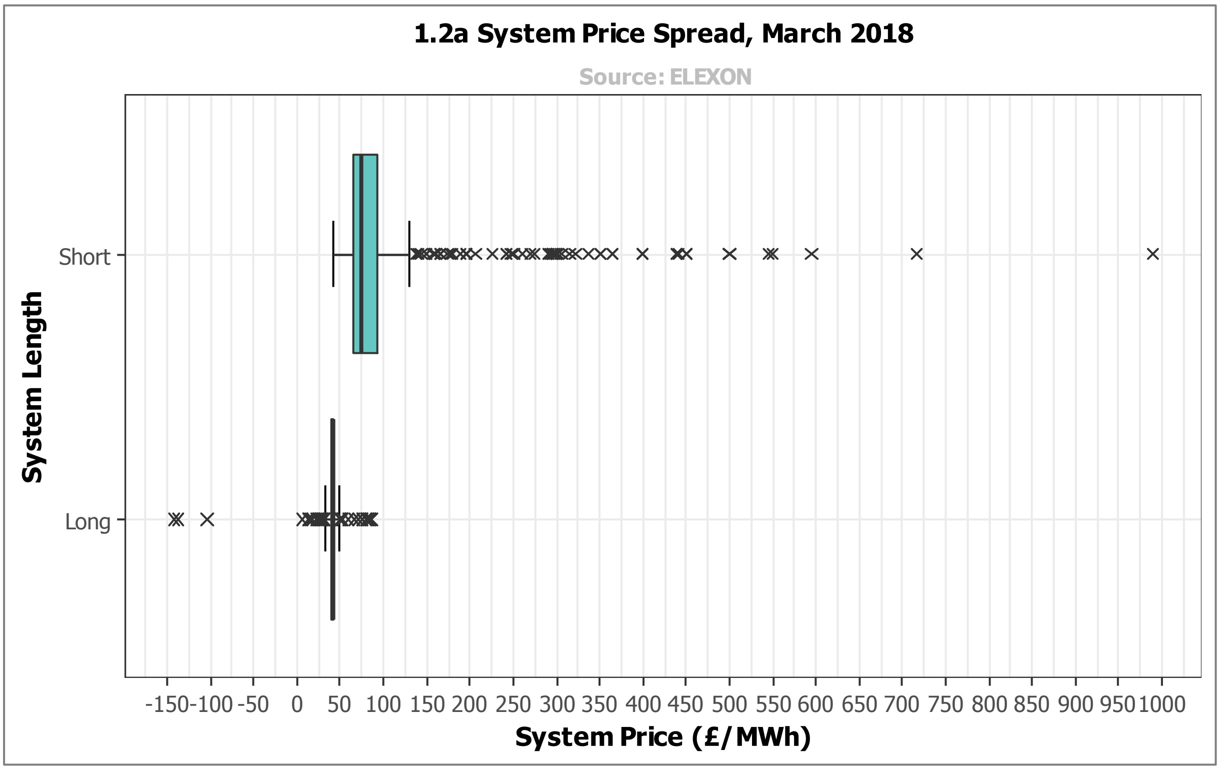
System Prices exceeded £100/MWh 128 times in March 2018 (compared to 66 times in February) across 16 different days. The highest System Price, £990/MWh, occurred in Settlement Period 27 on 1 March 2018. It was set by Offers from two CCGT BMUs priced at £990/MWh.

There were three negative System Prices in March, all less than -£100/MWh. The lowest System Price of the month was -£142.78/MWh. This was the second lowest System Price since the implementation of BSC Modification P305 in November 2015 (following -£150/MWh seen in February 2018). This occurred in Settlement Period 13 on 2 March 2018, and was set by Bids from two Wind BMUs and a Pumped Storage BMU, priced between -£135/MWh and -£152.10/MWh.

Graph 1.2a shows the spread of System Prices in March 2018 displayed as a box plot diagram, and split between a short and long system. The middle line in each box represents the median System Price of the month, which is £73.79/MWh for short Settlement Periods and £41.25/MWh for long Settlement Periods. Each box edge represents the lower and upper quartiles (25^{th} and 75^{th} percentile respectively), with the Interquartile Range (difference between the Upper and Lower quartiles) being £29.00/MWh for short System Prices and £4.04/MWh for long System Prices.

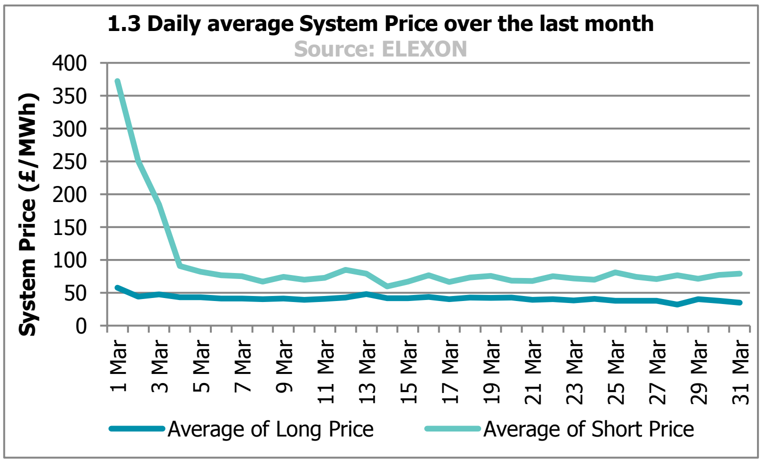
Outliers are shown on the graph as crosses, and have been defined as being greater than 1.5 x the Interquartile Range away from the Upper and Lower quartiles. Under this definition, 84 of the 673 (12.5%) long System Prices for March were outliers - with a System Price greater than £130/MWh. The graph also shows how these high short System Prices are distributed up to the maximum short System Price for the month of £990/MWh.

For long System Prices, the majority of prices fall within a narrow band; 94% of prices are between £30/MWh and £50/MWh. In contrast, the three negative System Prices seen in March are clustered together between -£100/MWh and -£150/MWh.



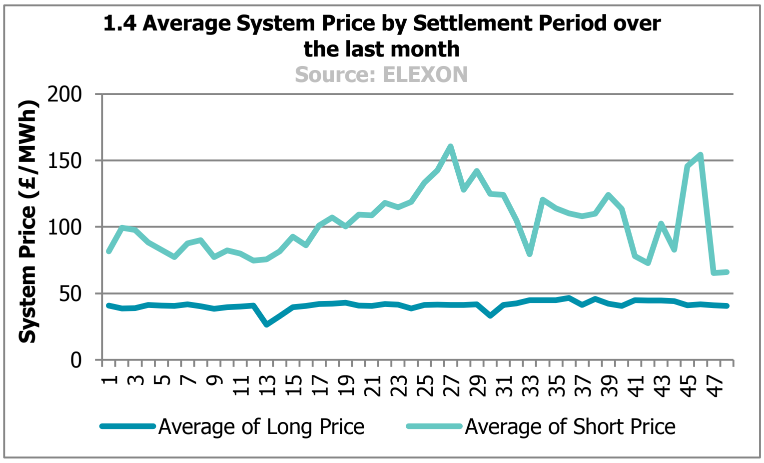
SYSTEM PRICE ANALYSIS REPORT

Graph 1.3 shows daily average System Prices over the last month. In March, the average System Price was £41.04/MWh when the system was long and £102.98/MWh when the system was short.



The highest daily average price when the system was short was £372.41/MWh, and occurred on 1 March. The system was short for 35 Settlement Periods on this day. The average System Price when the system was short across the rest of March was £88.20/MWh.

The lowest daily average price when the system was long was £32.20/MWh on 28 March 2018. The system was long in 33 Settlement Periods on this day, with the average reduced by one of this month's three negative System Prices (-£136.50/MWh in Settlement Period 30) occurring on this day.



Graph 1.4 shows the variation of System Prices across the day. Short prices were highest in Settlement Period 27, with long prices lowest in Settlement Period 13. The lowest average System Prices regardless of market length was seen during Settlement Period 47, when the System Price was, on average, £48.34/MWh.

Long prices averaged £26.29/MWh in Settlement Period 13, but showed less variance over other Settlement Periods, with prices ranging between £32.83/MWh and £46.54/MWh. Average short Settlement Period prices varied more, from £65.22/MWh to £160.58/MWh.

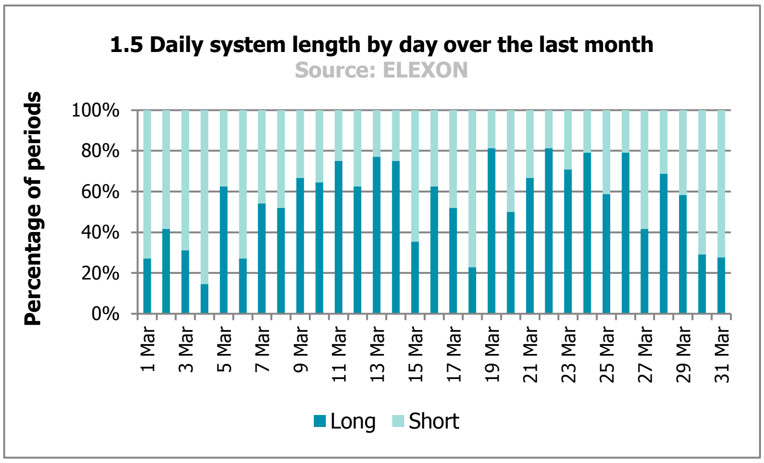
The highest average short Settlement Period and lowest average long Settlement Period correlate with the highest System Price of the month seen in Settlement Period 27 (£990/MWh), and the lowest System Price seen in Settlement Period 13 (-£142.78/MWh).

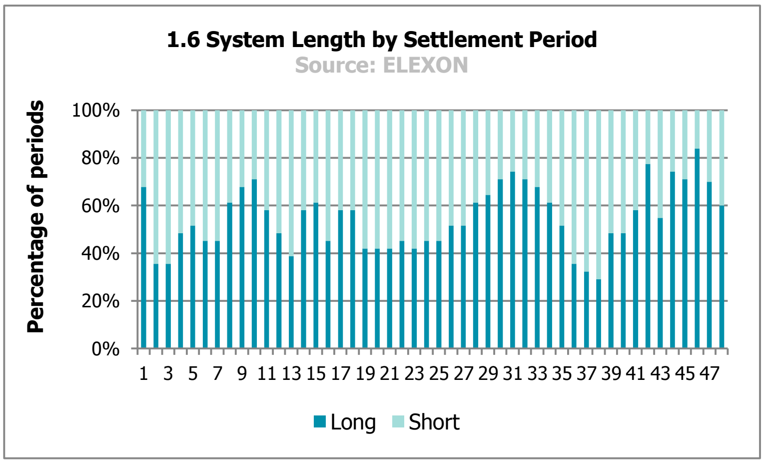
SYSTEM PRICE ANALYSIS REPORT

Graph 1.5 shows system length by day, and **Graph 1.6** shows system length by Settlement Period for March. The system was long for 55% of Settlement Periods in March, compared to 60% in February.

On 4 March, the system was short for 85% of Settlement Periods. The average NIV when the system was short on this day was 397MWh, while the average System Price in a short Settlement Period was £90.73/MWh.

Settlement Period 38 was short for 71% of the month, whilst Settlement Period 46 was short for 16% of the month.





2 PARAMETERS

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

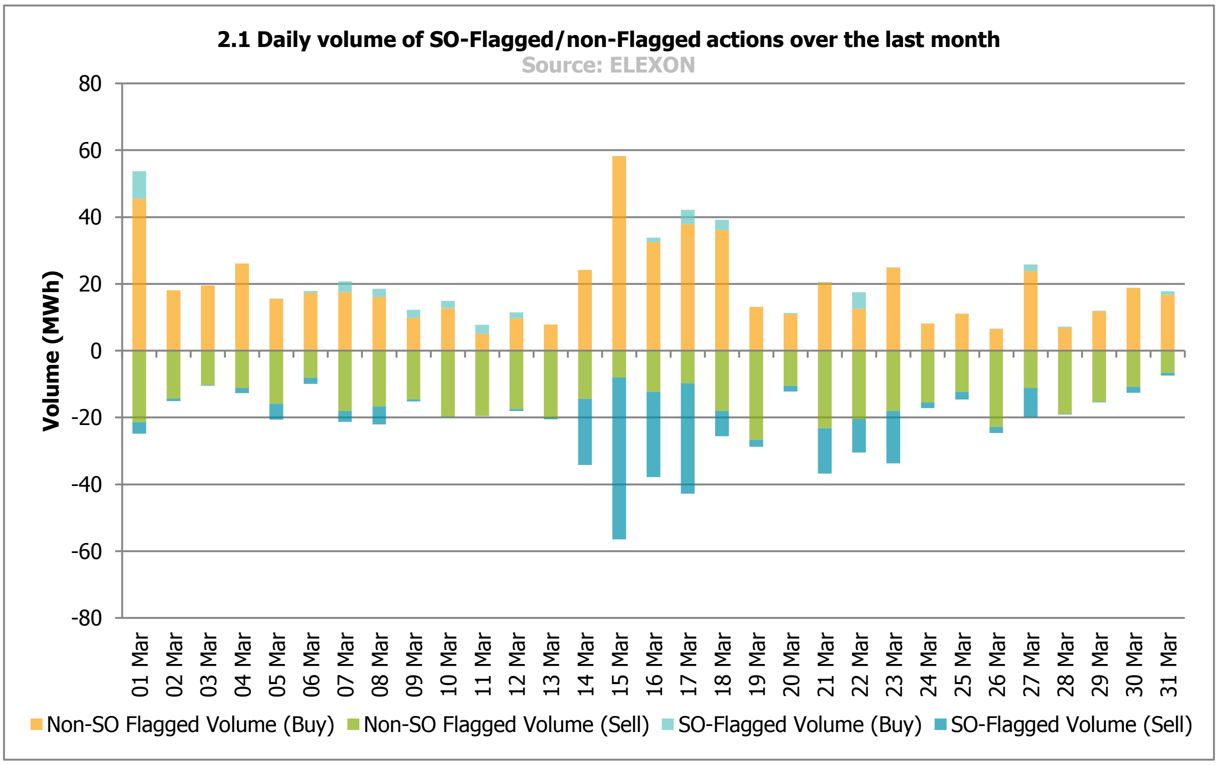
- The impact of Flagging balancing actions;
- The impact of NIV Tagging;
- The impact of PAR Tagging;
- The impact of the Replacement Price; and
- How these mechanisms affect which balancing actions feed into the price.

Flagging

The Imbalance Price calculation aims to distinguish between 'energy' and 'system' balancing actions. Energy balancing actions are those related to the overall energy imbalance on the system (the 'Net Imbalance Volume'). It is these 'energy' balancing actions which the Imbalance Price should reflect. System balancing actions relate to non-energy, system management actions (e.g. locational constraints).

Some actions are 'Flagged'. This means that they have been identified as potentially being 'system related', but rather than removing them completely from the price calculation (i.e. Tagging them) they may be re-priced, depending on their position in relation to the rest of the stack (a process called Classification). The System Operator flags actions when they are taken to resolve a locational constraint on the transmission network (SO-Flagging), or to correct short-term increases or decreases in generation/demand (CADL Flagging).

Graph 2.1 shows the volumes of buy and sell actions that have been Flagged by the SO in March 2018 as being constraint related. On 15 March, 86% of sell volume was SO-Flagged.



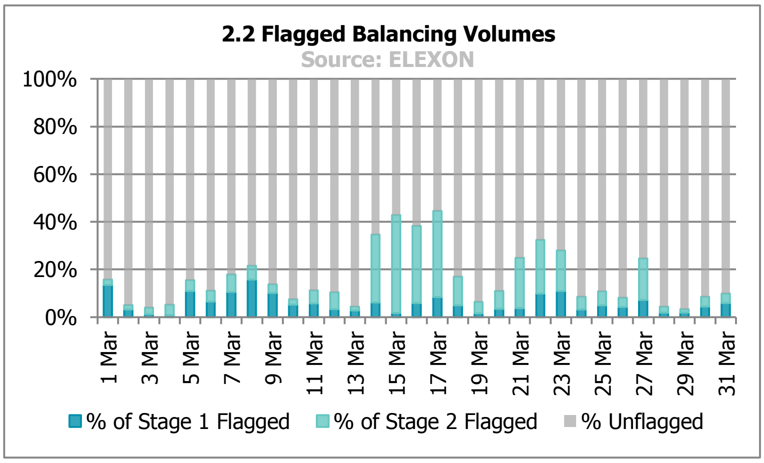
31% of sell balancing actions taken in March had an SO-Flag compared with 29% in February. 38% of SO-Flagged sell actions came from CCGT BMUs, 23% from Wind BMUs and 20% from Balancing Services Adjustment Actions (BSAAs). The average initial price (i.e. before any re-pricing) of a SO-flagged sell action was -£16.28/MWh.

6% of buy balancing actions taken in March had an SO-Flag, compared to 16% in February. 34% of SO-Flagged buy actions came from CCGT BMUs, 33% from BSAAs and 32% from Coal BMUs. The average initial price of a SO-Flagged buy action was £108.39/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 March. The majority of CADL Flagged buy actions (95%) came from Pumped Storage BMUs. 50% of CADL Flagged sell actions came from CCGT BMUs, with Pumped Storage BMUs accounting for a further 46% of 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 the accepted balancing actions – 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 32% of sell actions in March were flagged. Of these 12% 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 March, the average original price of a Second-Stage Flagged repriced sell action was -£0.51/MWh and the average Replacement Price for sell actions (when the System was long) was £40.61/MWh.

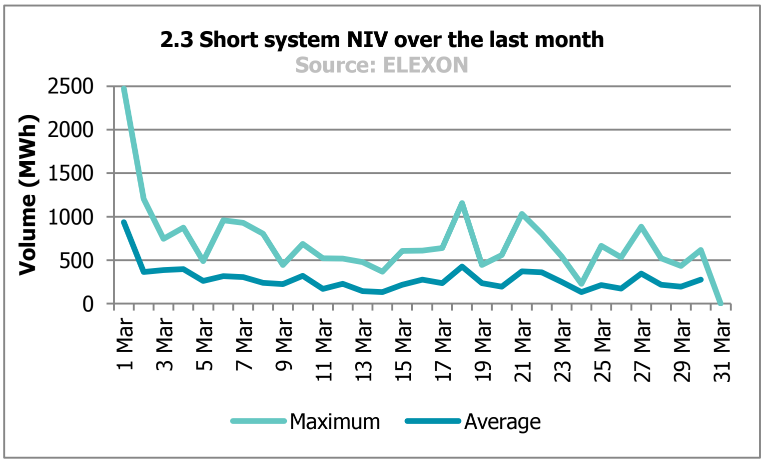
8% of buy actions were Flagged; of these 2% had the Replacement Price applied. The average original price of a buy action with the Replacement Price applied was £128.61/MWh, and the average Replacement Price was £95.69/MWh.

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

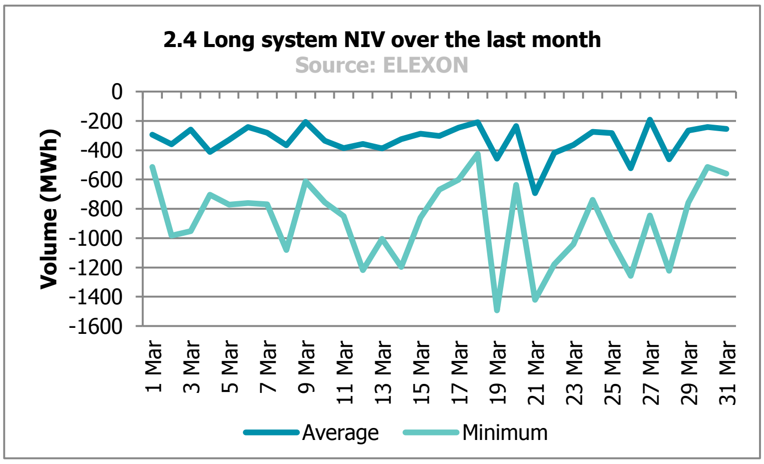
NIV and NIV Tagging

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

In almost all Settlement Periods the System Operator will need to take balancing actions in both directions (buys and sells) to balance the system. However, for the purposes of calculating an Imbalance Price there can only be one imbalance in one direction (the Net Imbalance). 'NIV Tagging' is the process which subtracts the smaller stack of balancing actions from the larger one to determine the Net Imbalance. 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. 61% of volume was removed due to NIV tagging in March. 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 -1,494MWh, on 19 March 2018 during Settlement Period 28.

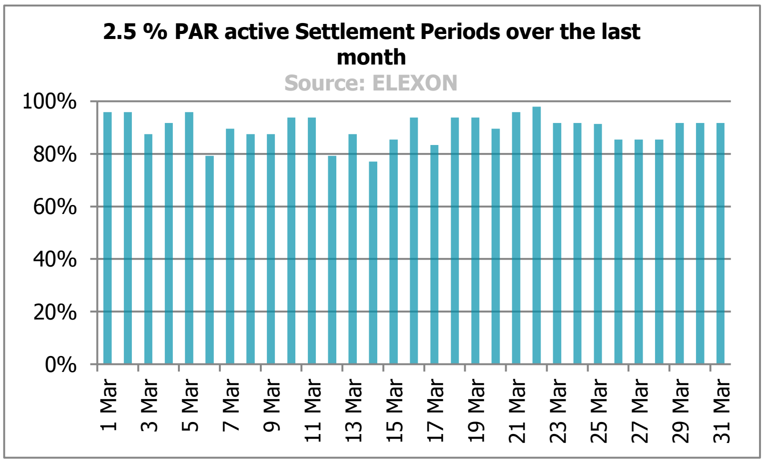
The maximum short system NIV of the month (2,473MWh) was seen on 1 March in Settlement Period 20. There were -154MWh of sell actions in this Settlement Period, and 2,629MWh of buy actions from Offers and system buy actions in this Settlement Period. The System Price was £295/MWh in this Settlement Period.

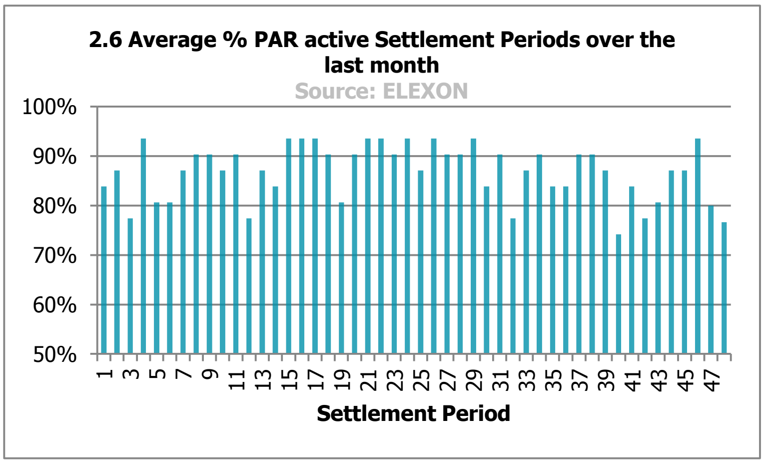
PAR Tagging

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 90% of Settlement Periods in March.

Graph 2.6 shows the proportion of Settlement Periods over the last month when PAR Tagging was active. Settlement Period 40 had the lowest active PAR Tagging in March 2018 with 74%, representing the NIV being smaller in this period or the system being more balanced as a whole prior to System Operator balancing activity.





DMAT and Arbitrage Tagged Volumes

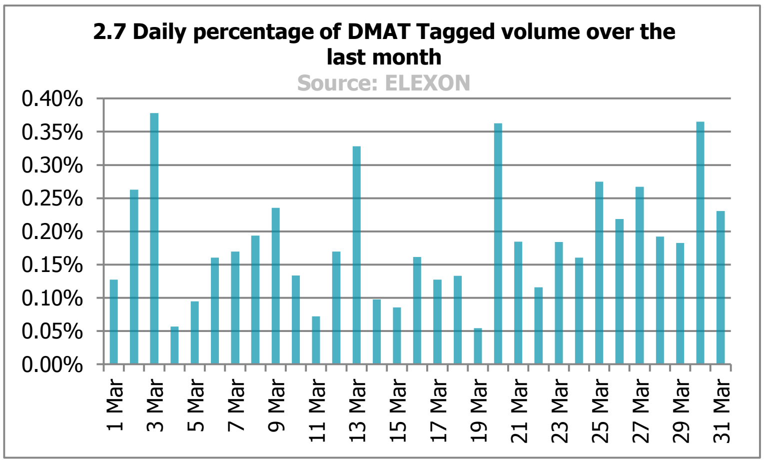
Some actions are always removed from the price calculation (before NIV Tagging). These are actions which are less than 1MWh (De Minimis Acceptance Threshold (DMAT) Tagging) or buy actions which are either the same price or lower than the price of sell actions (Arbitrage Tagging).

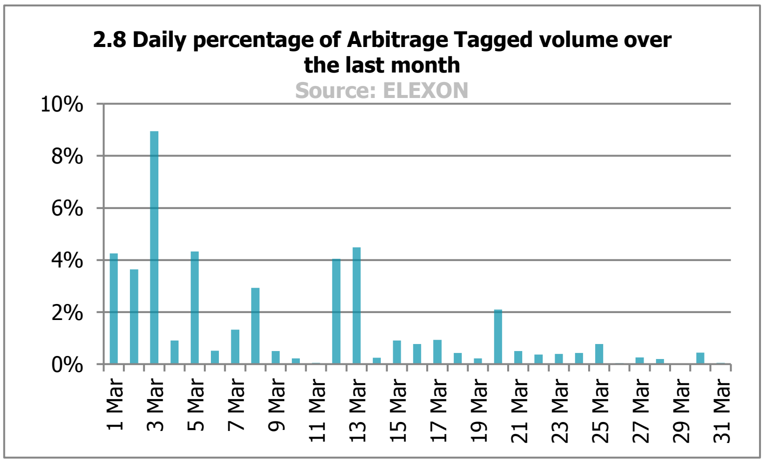
Graph 2.7 shows the volumes of actions which were removed due to DMAT Tagging. 0.17% of total buy and sell volume was removed by DMAT Tagging in March. 58% of DMAT Tagged volume came from Balancing Services Adjustment Actions (BSAAs) whilst 26% came from CCGT BMUs.

Graph 2.8 shows the volumes of actions that were removed due to Arbitrage Tagging. 48% of Arbitrage Tagged volume was from BSAAs, 27% from CCGT BMUs and 16% from Coal BMUs.

In March the average initial price of an Arbitrage Tagged buy action was £49.06/MWh, and for a sell action was £62.10/MWh. The maximum price of an Arbitrage Tagged sell action was £294.16/MWh, and the lowest priced Arbitrage Tagged buy action was £0/MWh.

On 3 March 2018, 2,681MWh of actions were Arbitrage Tagged, representing 9% of daily volume. The average price of an Arbitrage Tagged buy action was £43.41MWh and for a sell action was £52.36MWh. 0.38% of daily volume was DMAT Tagged on this day, which was the highest percentage of the month.





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.

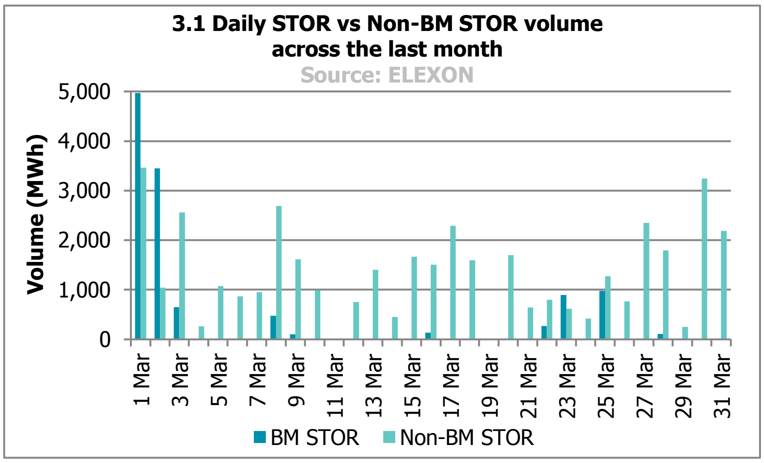
In addition to Bids and Offers available in the Balancing Mechanism, the SO can enter into contracts with providers of balancing capacity to deliver when called upon. These additional sources of power are referred to as reserve, and most of the reserve that the SO procures is called Short Term Operating Reserve (STOR).

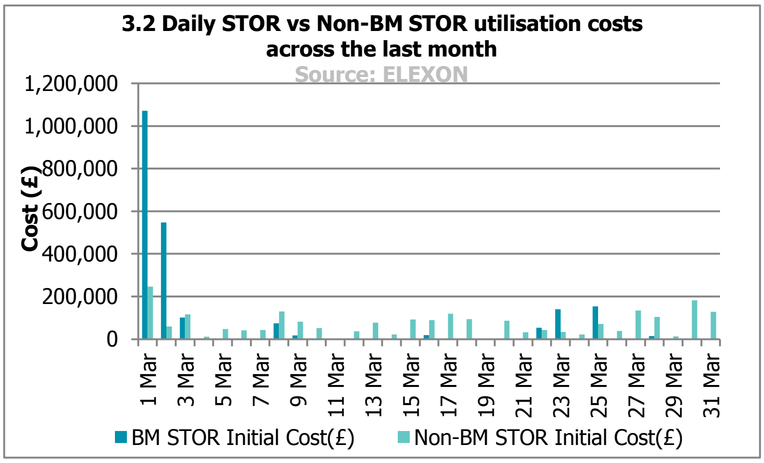
Under STOR contracts, availability payments are made to the balancing service provider in return for capacity being made available to the SO during specific times (STOR Availability Windows). When STOR is called upon, the SO pays for it at a pre-agreed price (its Utilisation Price). Some STOR is dispatched 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. 77% of the total STOR utilised in March came from outside of the Balancing Mechanism.

The average Utilisation Price for STOR capacity in March was £83.40/MWh (£182.59/MWh for BM STOR and £54.46/MWh for non-BM STOR).

Across 1 March and 2 March, the utilisation cost for BM STOR totalled £1.62m. 8,146MWh of BM STOR volume was called upon across these days, which represented 70% of the BM STOR volume in March.





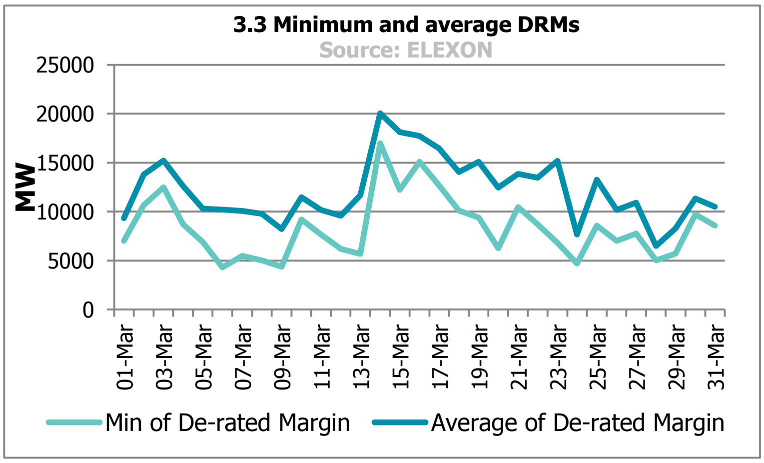
De-Rated Margin, Loss of Load Probability and the Reserve Scarcity Price

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 March 2018.

The System Operator has determined a relationship between each DRM and the LoLP, which will determine the RSP[2]. The minimum DRM in March was 4,307MW on 6 March in Settlement Period 38 (compared to 2,886MW in February).

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 March (see **Table 3.4**).



3.4 Top 5 LoLPs and RSPs

Date	SP	DRM	LoLP	RSP	RSP Used	System Length	System Price
06/03/2018	38	4,307.63	0.0000	**0.00**	No	Short	87.00
09/03/2018	38	4,383.11	0.0000	**0.00**	No	Long	42.60
06/03/2018	37	4,495.66	0.0000	**0.00**	No	Short	87.00
24/03/2018	38	4,717.58	0.0000	**0.00**	No	Short	98.50
09/03/2018	37	4,861.12	0.0000	**0.00**	No	Short	87.00

[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:

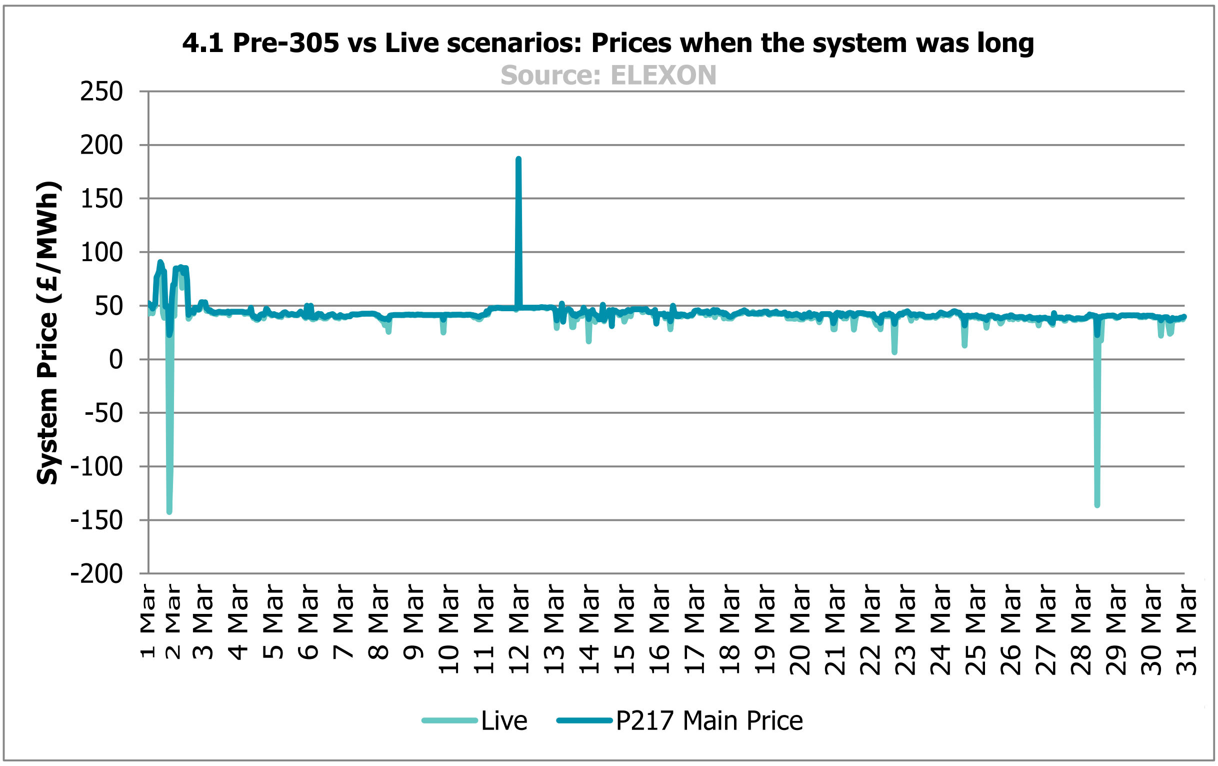
- A reduction in the PAR value to 1MWh (RPAR will remain at 1MWh);
- The introduction of a 'dynamic' LoLP function[3]; and
- An increase in the VoLL to £6,000MWh, which will apply to all instances of VoLL in arrangements, including the RSP function.

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

Pre-P305 Price Calculation

Graph 4.1 compares live System Prices when the system was long with prices re-calculated using the pre-P305 pricing scenario 'P217' (for comparison we use the Main Price calculation). On average, live prices were £2.13/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 73% of these periods the change was less than £1/MWh. The biggest price change occurred on the 2 March 2018 in Settlement Period 13, where the live price was £165.42/MWh lower than the System Price would have been under the P217 Scenario. A large difference was also seen on 28 March 2018 in Settlement Period 30, with the live price £158.91 lower than under P217. These differences were due to the reduction in PAR.

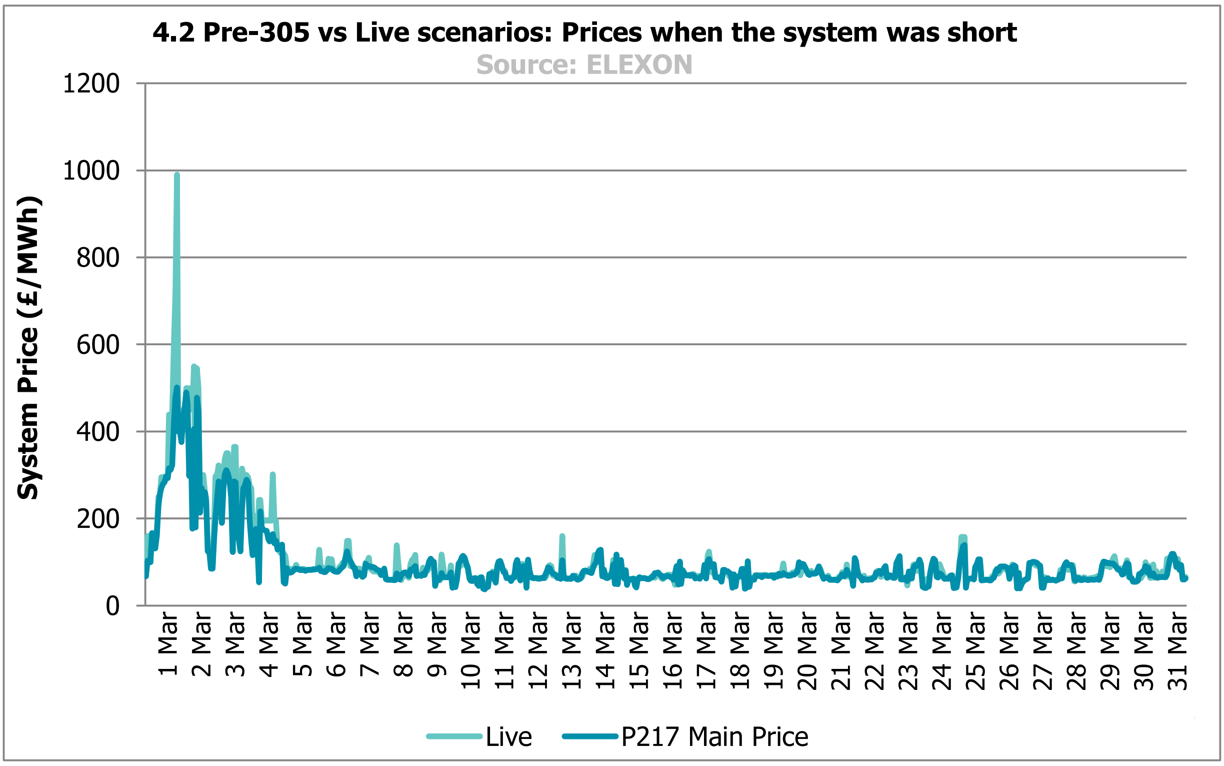


Graph 4.2 compares live System Prices when the system was short with prices re-calculated using the pre-P305 pricing scenario 'P217' (using the Main Price calculation).

Live prices were on average £7.62/MWh higher when the system was short, with 71% of Settlement Periods having live prices higher or the same System Price as the Pre-305 scenario.

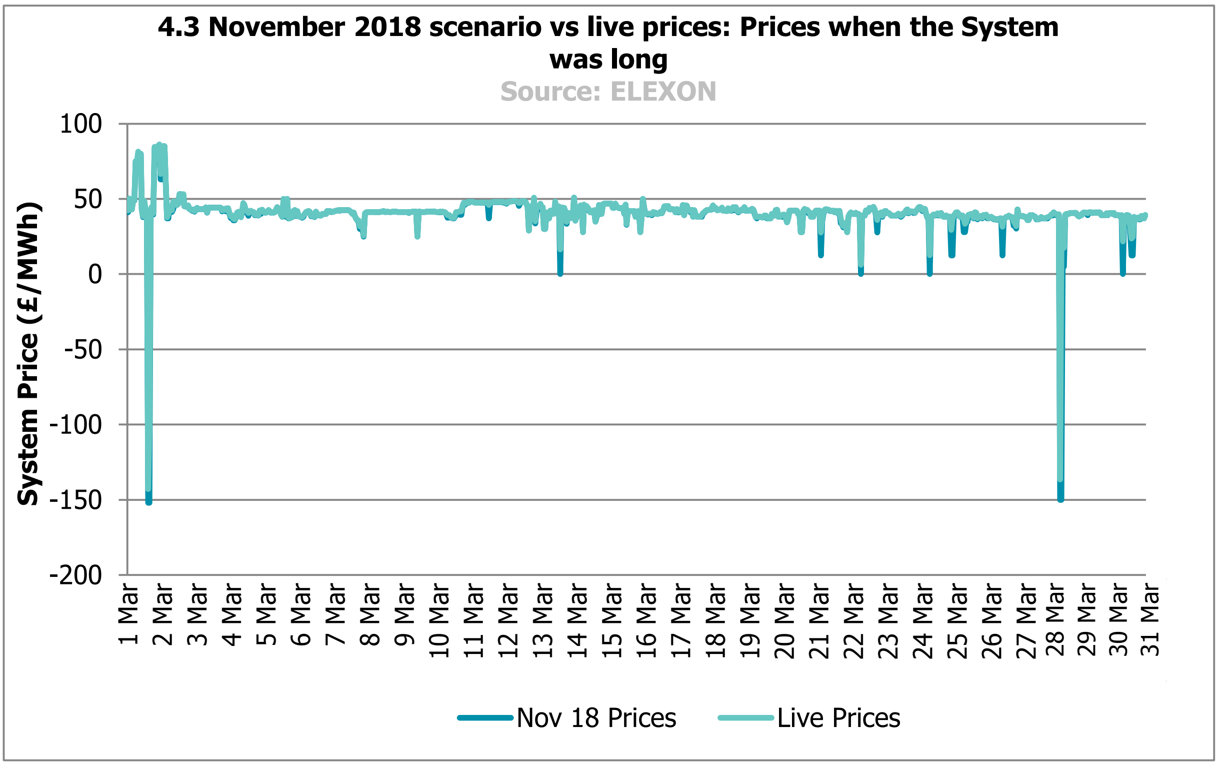
The biggest difference in prices when the system was short was £488.94/MWh (1 March 2018 during Settlement Period 27), as a result of the inclusion of non-BM STOR in the pricing calculation. In the P217 scenario, the Main Price would have been £501.06/MWh compared to the live scenario System Price of £990/MWh.

The inclusion of non-BM STOR volumes in the pricing stack changed the system length from long to short in 38 Settlement Periods.



November 2018 Price Calculation

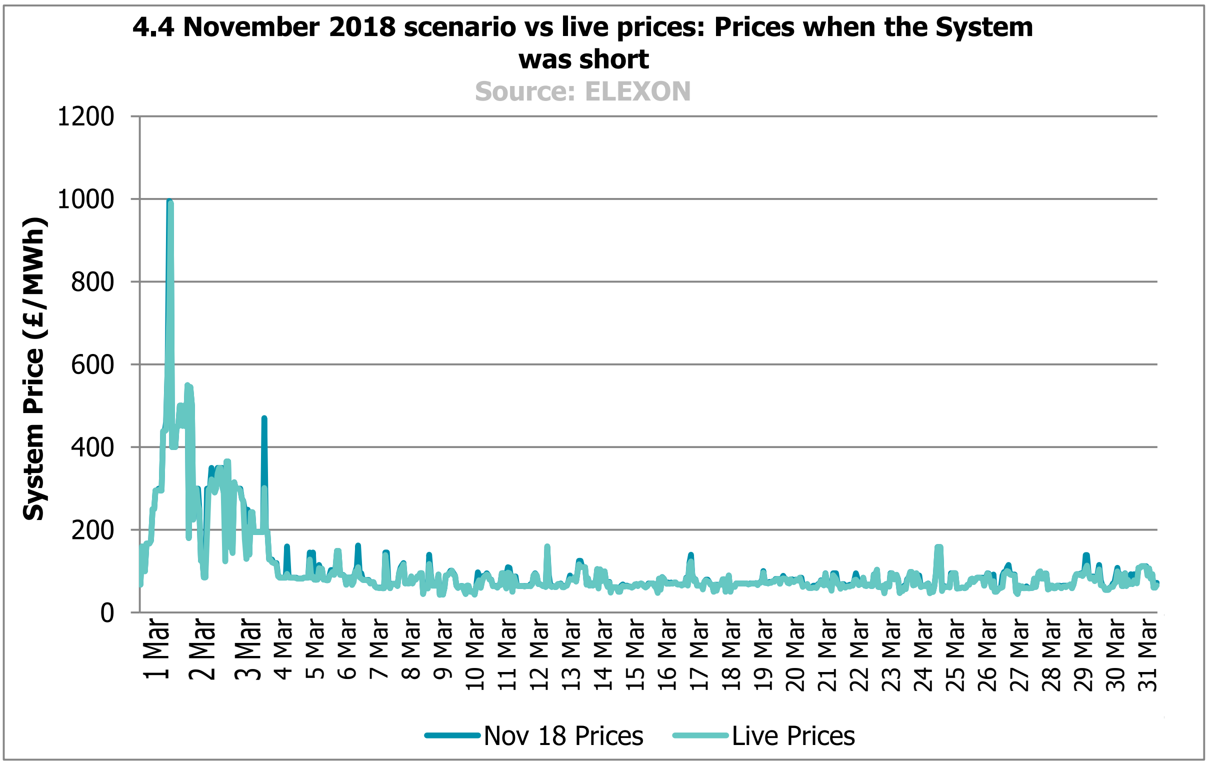
Under the November 2018 scenario, when the system is long prices would be the same or lower, and when the system is short prices would be the same or higher. **Graph 4.3** compares live System Prices with prices recalculated using the November 2018 scenario when the system was long.



The average price differences across the month are relatively small under the November 2018 scenario. Prices were different in 53% of Settlement Periods, with 13% of these changes greater than £1/MWh. System Prices would be £0.86/MWh lower when the system was long, and £3.55/MWh higher when the system was short. When the system was long and System Prices changed, price changes were less than £1/MWh in 83% of Settlement Periods and greater than £5/MWh in 5% of Settlement Periods. The biggest shift in price was -£164.20/MWh (Settlement Period 31 on 28 March 2018), when the price would have been -£150/MWh under the November 2018 scenario compared to the current live System Price of £14.20/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; 29% changed by more than £5/MWh and 16% by more than £10/MWh. The biggest difference in price was £277.74/MWh (Settlement Period 26 on 1 March), when the price would have been £995/MWh under the November 2018 scenario compared to the current live System Price of £717.26/MWh.

Under the November 2018 scenario, there would be 138 Settlement Periods in March 2018 with prices greater than £100/MWh, compared to 128 periods under the current live scenario.



There were no Demand Control actions taken during March 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 March.

4.5 Reserve Scarcity Prices with VoLL of £6,000

Date	SP	DRM	LoLP	RSP	RSP Used	System Length	System Price
06/03/2018	38	4,307.63	0.0000	**0.00**	No	Short	87.00
09/03/2018	38	4,383.11	0.0000	**0.00**	No	Long	42.60
06/03/2018	37	4,495.66	0.0000	**0.00**	No	Short	87.00
24/03/2018	38	4,717.58	0.0000	**0.00**	No	Short	98.50
09/03/2018	37	4,861.12	0.0000	**0.00**	No	Short	87.00

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: · 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.

APPENDIX 1 – NATIONAL GRID PAPER: MOVING FROM STATIC TO DYNAMIC LOLP CALCULATION

In January 2018, National Grid conducted analysis into the potential impacts of moving from a static to dynamic Loss of Load Probability (LoLP) calculation. This section summarises this analysis, prior to the dynamic LoLP values being published alongside the static LoLP values from 1 May 2018. Note the dynamic LoLP calculation will go live, along with all stage 2 P305 modification changes, from 1 November 2018. For more detail on how LoLP is calculated, please refer to the Loss of Load Probability Calculation Statement.

Executive Summary

National Grid's analysis compares dynamic and static Loss of Load Probability (LoLP) values for the six month period from 1 June 2017 to 13 December 2017 (referred to as the analysis period). The analysis shows the move from static to dynamic LoLP should have a minor impact on Reserve Scarcity Price (RSP) at Gate Closure. The key findings from their analysis were:

- The dynamic calculation is consistent with static in circumstances when the value exceeds zero (when static LoLP is greater than zero, dynamic LoLP is also greater than zero and vice versa).
- There are frequently differing values of static and dynamic LoLP for all lead times. However, the magnitude of these differences is small, particularly nearer to gate closure.
- The maximum RSP difference at gate closure over the analysis period was £12.50/MWh, but it is typically much lower than this.
- More frequently at gate closure, static LoLP results in a marginally higher RSP than dynamic LoLP.

Background

Following the introduction of Balancing and Settlement Code Modification P305 (Electricity Balancing Significant Code Review) in November 2015, National Grid began communicating LoLP values to industry

LoLP values are currently calculated using the static methodology, where the LoLP value is linked directly via a lookup table to the Gate Closure (GC) De-rated Margin (DRM) at each settlement period (SP). When multiplied by Value of Lost Load (VOLL), currently £3,000/MWh, it creates the RSP.

From 1 November 2018, National Grid will no longer issue LoLP values calculated using the static methodology. Instead, National Grid will issue LoLP values for each SP for 24, 8, 4 and 2 hour lead times, as well as Gate Closure, using the dynamic methodology.

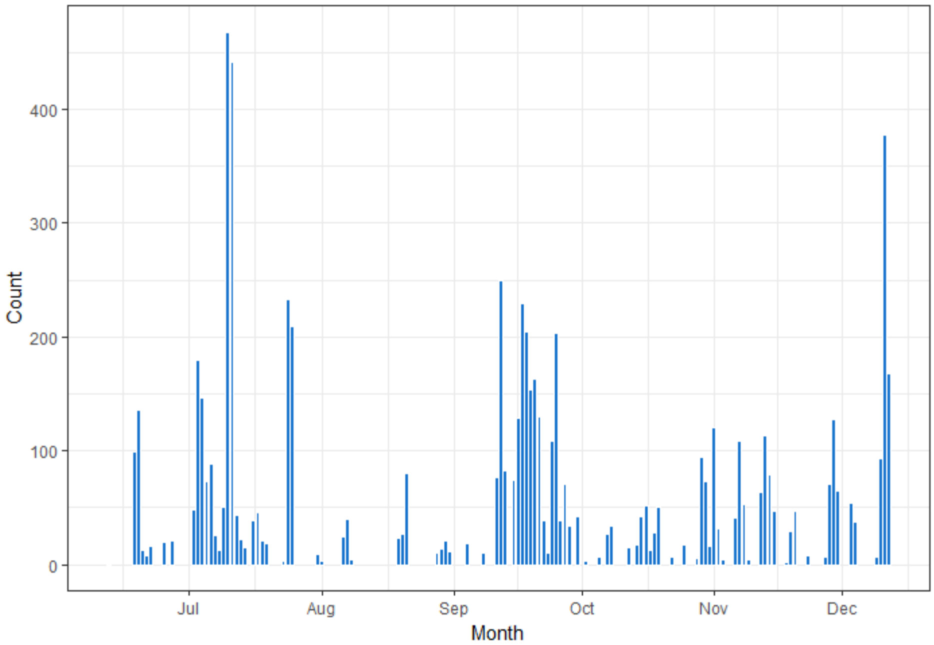
The dynamic calculation separates the direct link between LoLP and DRM via a static look up table, with dynamic LoLP values based on probability distributions of generation and demand.

In order to facilitate comparison, dynamic LoLP information will be shared on a weekly basis between May and October 2018 on a discrete page of the Elexon website. This data will also be backdated for six months prior to 1 May 2018.

Analysis

The analysis below refers to dynamic and static LoLP values produced for every SP for the six month analysis period.

Figure 1: Occurrences when static LoLP is not equal to dynamic LoLP (Source: National Grid)



Instances where static LoLP is not equal to dynamic are shown in Figure 1, and represent less than 2% of the total LoLP values included in the analysis. When static and dynamic LoLP values differ, the value of LoLP for both is above zero. Therefore the dynamic calculation is consistent with static values in exceeding zero - when static LoLP is greater than 0, so is dynamic LoLP (and vice versa).

Figure 2: Occurrences when static LoLP is not equal to dynamic LoLP as a function of lead-time ahead of gate closure (Source: National Grid)

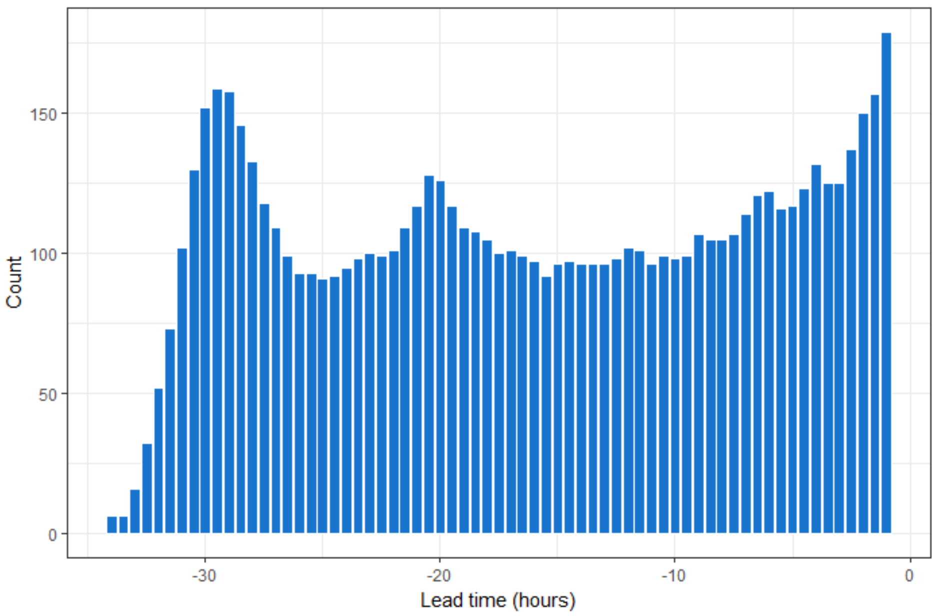
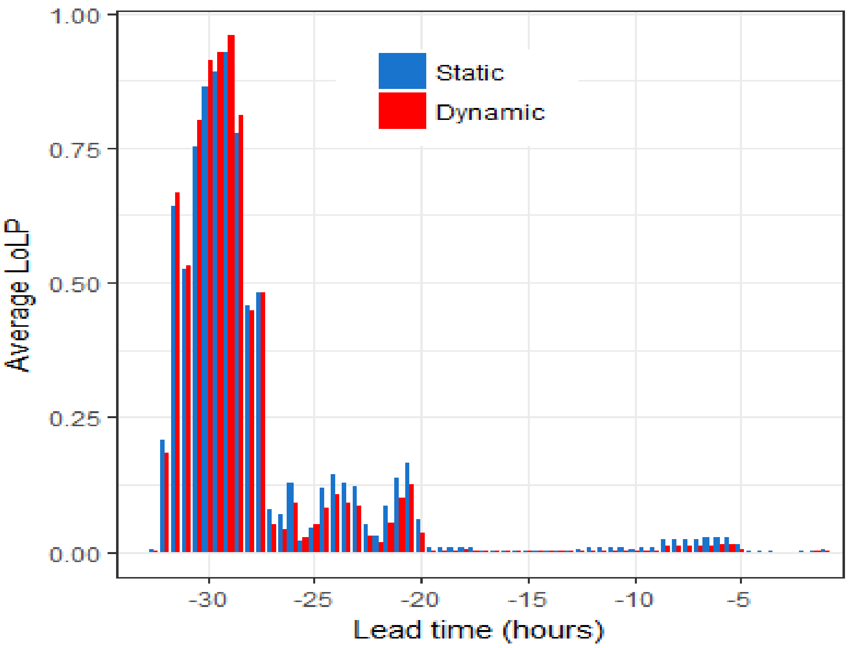


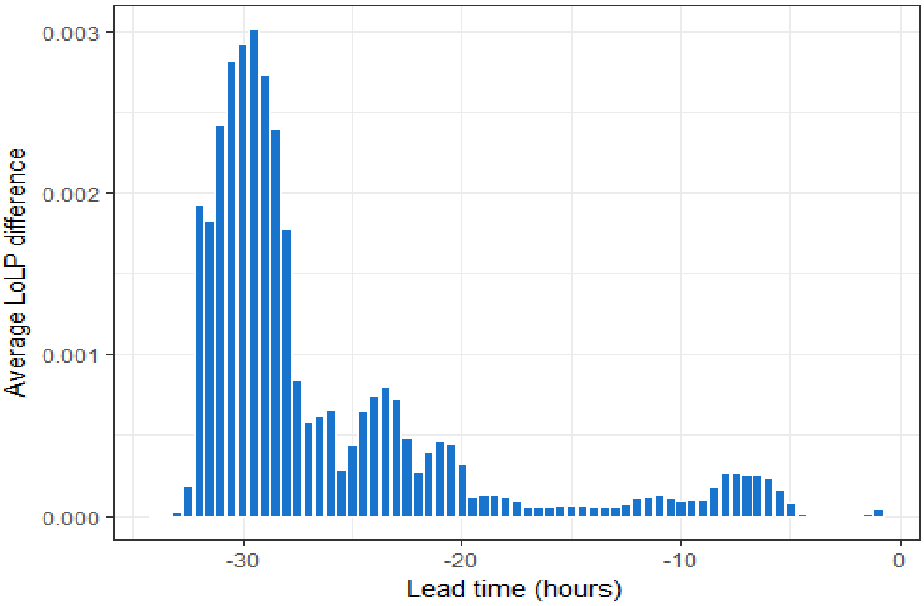
Figure 2 shows instances where the static and dynamic LoLP values differ for each lead-time ahead of gate closure. Static and dynamic LoLP values frequently differ for all lead times, with peaks at the 30 and 20 hour ahead forecasts as well as at gate closure.

Figure 3: A comparison of average static and dynamic LoLP values for each lead-time (Source: National Grid)



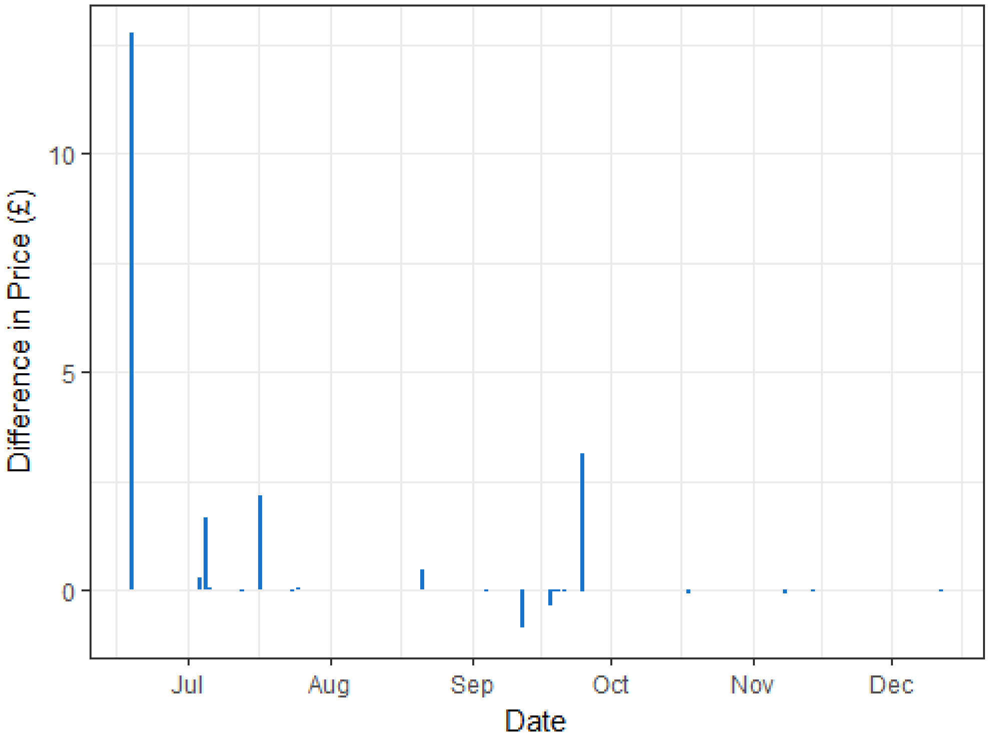
The average differentials between static and dynamic LoLP values for each lead time decrease as we approach gate closure. Generally, for forecasts greater than 27 hours ahead, the dynamic calculation predicts a higher LoLP value than the static calculation; at lead times less than 27 hours ahead, static LoLP values are marginally higher.

Figure 4: The average absolute difference in static and dynamic LoLP for each lead-time (Source: National Grid)



The average differences between static and dynamic LoLP values, for each lead-time, are shown in Figure 4. The average absolute difference in LoLP value decreases as we approach gate closure. The maximum average absolute difference between static and dynamic LoLP values is 0.003, and occurs at ~29 hours ahead of gate closure.

Figure 5: The average difference in price using the static compared to dynamic method at gate closure (Source: National Grid)



The average differences in RSP between the static and dynamic calculation methods at gate closure, across the analysis period, are shown in Figure 5. The maximum price difference between dynamic and static LoLP at gate closure is approximately £12.50/MWh, but is typically much less (note current VoLL of £3,000/MWh is used when calculating the RSP differences).

Conclusions

From 1 November 2018, National Grid will no longer calculate LoLP values using the static methodology. Instead LoLP values will be calculated using the dynamic methodology for Day ahead, 8hr, 4hr, 2hr and Gate Closure lead times (for each SP).

The analysis presented here compares the differences between both calculations across an historic data set stretching over six months. The results of this analysis show that static and dynamic LoLP values frequently differ across all lead times. However, the magnitude of these differences is relatively small, leading to only marginal differences in Reserve Scarcity Price (RSP) at gate closure.

APPENDIX 2 – A DETAILED LOOK AT SYSTEM PRICES AND NET IMBALANCE VOLUME ON 1 MARCH 2018

In this section one of our Market Analysts, Emma Tribe takes a detailed look at the Imbalance Price calculation for 1 March. On this day Imbalance Prices peaked at £990/MWh during Settlement Period 27. This day also saw the highest recorded Net Imbalance Volume, since it was introduced into the Imbalance Price calculation in March 2003 as part of BSC Modification P78.

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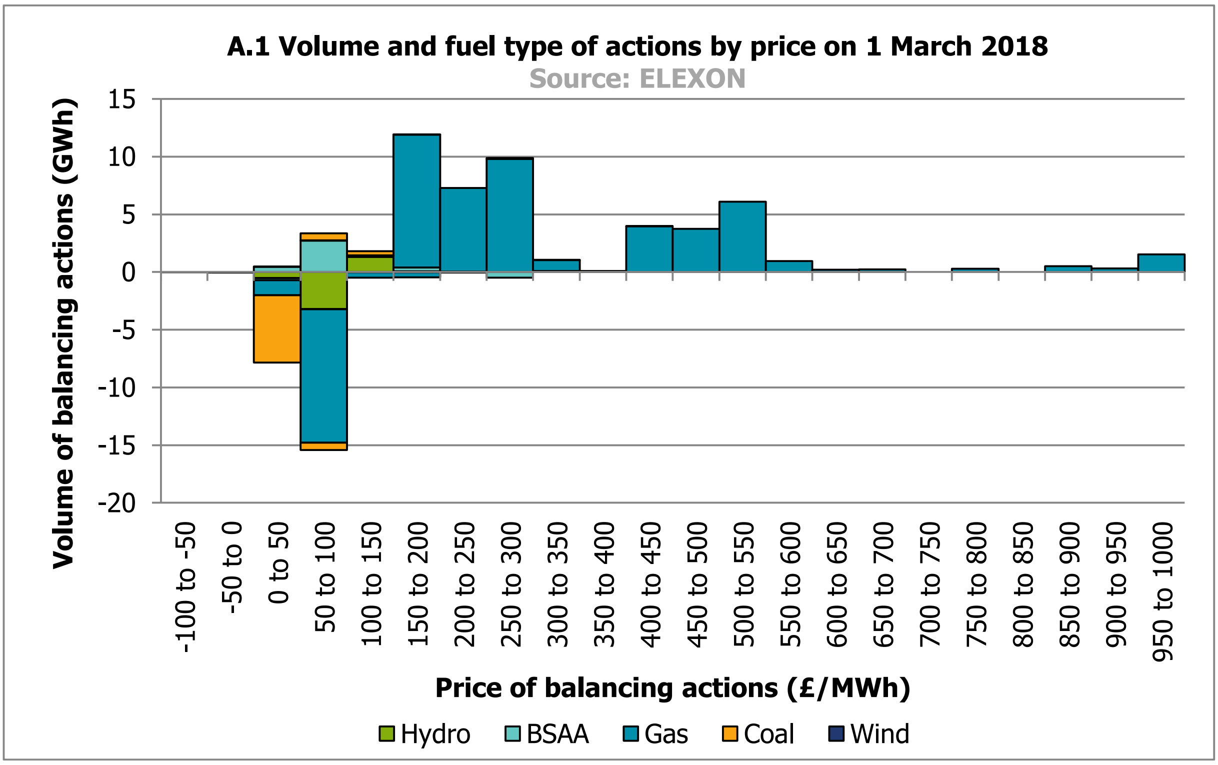
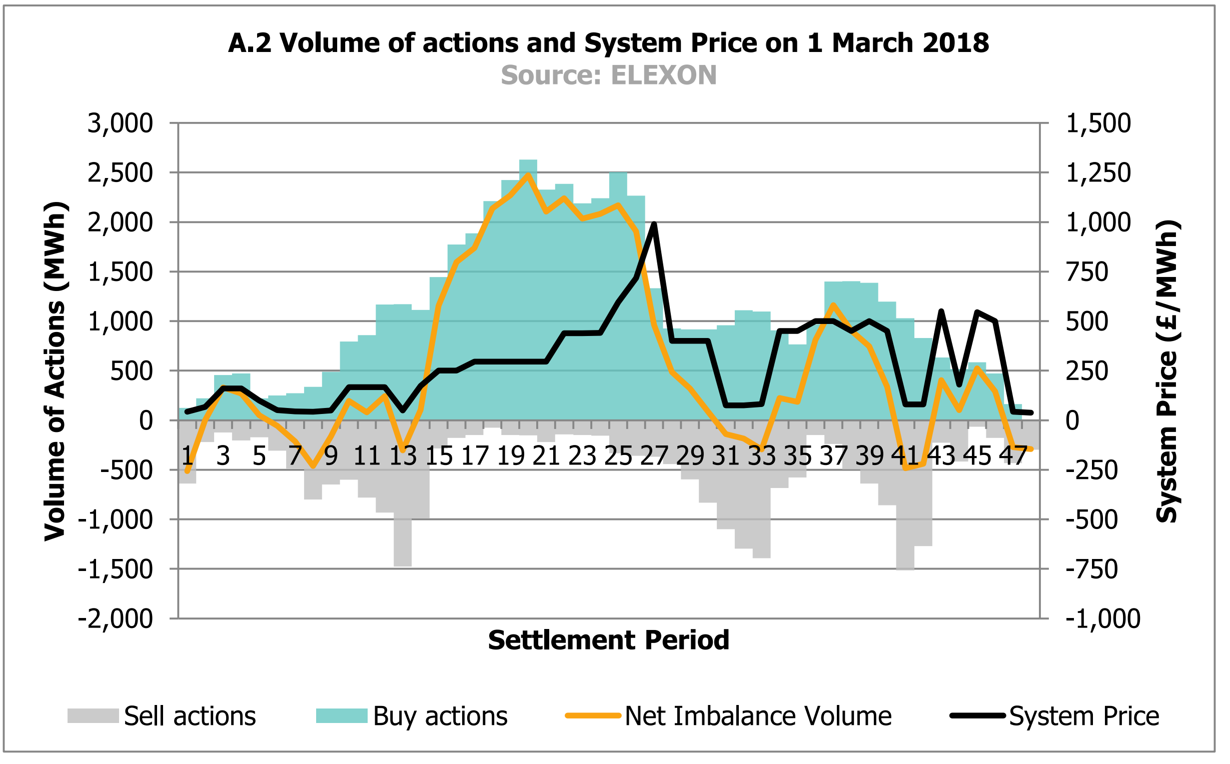
On 1 March temperatures were unseasonably cold, and snow blanketed much of Britain due to the 'Beast from the East'. The average noon day temperature used in settlement for Great Britain was -2.5°C. At 6am (Settlement Period 13) National Grid issued a Gas Deficit Warning which indicates a risk to the end of day gas balance.

Graph A.1 shows how over the day a total of 54GWh of Buy balancing actions and 25GWh of Sell balancing actions were taken. 78% of all balancing actions were taken by Gas BMUs. The price for an accepted Offer from a Gas BMU ranged from £70/MWh to £995/MWh. The average Price of accepted Offer volume from Gas BMUs was £343/MWh and the average price of accepted Bid volume was £75/MWh.



Graph A.2 shows how the balancing volume, Net Imbalance Volume (NIV) and System Price varied over the day. During Settlement Period 27 the System Price peaked at £990/MWh. The System Price in this Settlement Period was set by an accepted Offer from a Gas BMU.

The average System Price when the system was short was £372.41/MWh. The System was short for 35 Settlement Periods over the day and the System Price was greater than £100/MWh for 34 of those Settlement Periods. For 17 consecutive Settlement Periods between Settlement Periods 14 and 30 (06:30 to 15:00) the System was short.



Between Settlement Periods 18 and 25 (08:30 to 12:30) the NIV exceeded 2,000MWh. The NIV reached its maximum during Settlement Period 20 when the NIV was 2,473MWh. This was the largest NIV since it was introduced in March 2003 as part of BSC Modification P78. The System Price in this Settlement Period was £295/MWh and was set by an Offer from a Gas BMU.

In Settlement Period 20, 2,629MWh of Buy actions were taken to increase the level of energy and 154MWh of Sell actions were taken to decrease the level of energy. In this Settlement Period 89% of Buy action volume came from Gas BMUs and 10% from Balancing Services Adjustment Actions (BSAA) action taken outside of the Balancing Mechanism. The remain 1% of Buy actions were from Hydro and Coal BMUs.

Graph A.3 shows the maximum and average NIV when the market is short, with the number of short Settlement Periods, since March 2003 when NIV was introduced. The NIV was introduced so that the System Price is based only on the price of actions taken to reduce the overall energy imbalance of the system. Any NIV tagged actions are considered system balancing and removed as they may distort the System Price.

In the 15 years that the NIV has been in use March 2018 was the first month with a NIV greater than 2,000MWh. The previous maximum NIV was 1,919MWh, this occurred on 5 January 2009 in Settlement Period 39.

The average NIV when the market is short is 241MWh and the Standard Deviation is 214MWh. There have been a total of 84,675 short Settlement Periods since March 2003.