ISG182-SPAR
REPORTING ON MAY 2016

ISSUE 5 – PUBLISHED 21 JUNE 2016

SYSTEM PRICE ANALYSIS REPORT

The System Prices Analysis Report (SPAR) provides a monthly update on price calculations. It is published with the Imbalance Settlement Group (ISG) documentation a week ahead of the 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'.

1 SYSTEM PRICES AND LENGTH

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

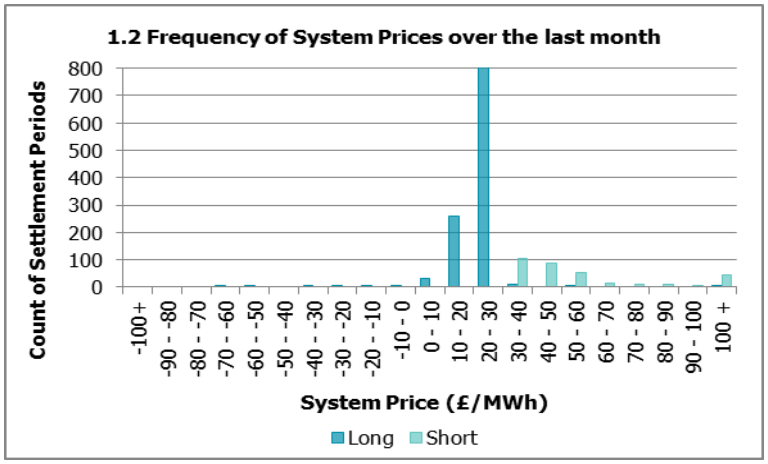
In this report we distinguish between a 'long' and a 'short' market when analysing System Prices because the price calculation differs between two scenarios. When the market is long, System Prices will be based predominantly on the System Operator's 'sell' actions such as Accepted Bids. When the market is short, System Prices will instead be based predominantly on the System Operator's 'buy' actions. In May this tended to result in prices 'flipping' between prices between £60/MWh when the System is short, and prices £21/MWh when the System is long, reflecting the underlying value of Buy and Sell actions respectively.

	System Price (Long)				
Month	**Min**	**Max**	**Median**	**Mean**	**Std Dev**
May 2016	-100.00	248.45	24.00	21.57	10.93

	System Price (Short)				
Month	**Min**	**Max**	**Median**	**Mean**	**Std Dev**
May 2016	36.42	480.38	45.00	59.82	37.71

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 70% of Settlement Periods (in both directions). When the System was long 73% of prices were between £20/MWh and £40/MWh, whereas when the System was short 75% prices were between £30/MWh and £60/MWh. Prices did not rise above £60/MWh when the System was long, or fall below £30/MWh when the System was short.



[1] For further detail of the imbalance price calculation, see our imbalance pricing guidance: https://www.elexon.co.uk/wp-content/uploads/2015/11/Imbalance_pricing_guidance_v9.0.pdfv

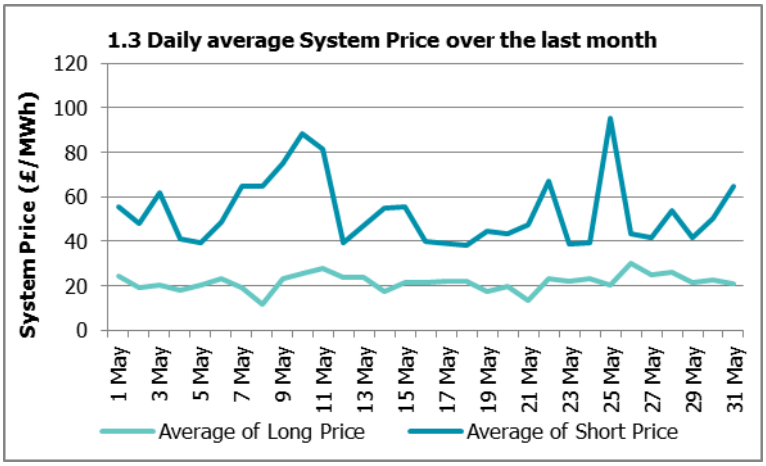
SYSTEM PRICE ANALYSIS REPORT

There were 13 Settlement Periods with **negative System Prices** in May 2016 (compared to 7 the previous month and 79 in total in 2015). The lowest System Price was -£100.00/MWh, which occurred at Settlement Period 22 on 19 May 2016. This price was set by Bids from one combined cycle gas turbine BMU.

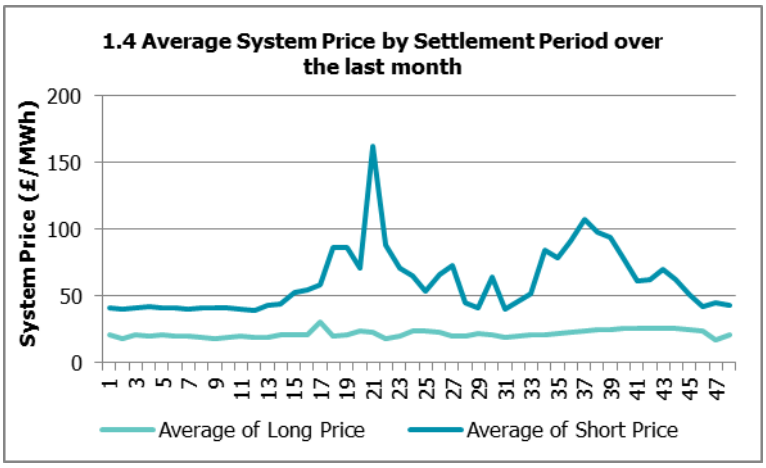
The **System Price was £0/MWh** in five Settlement Periods and System Prices **exceeded £100/MWh** 45 times in May 2016 (compared to 75 times in April).

The **highest System Price** was £480.38/MWh and occurred at Settlement Period 21 on 10 May 2016. The price was set by one Offer from a combined cycle gas turbine BMU at £475.00 plus a Buy Price Adjuster of £5.38.

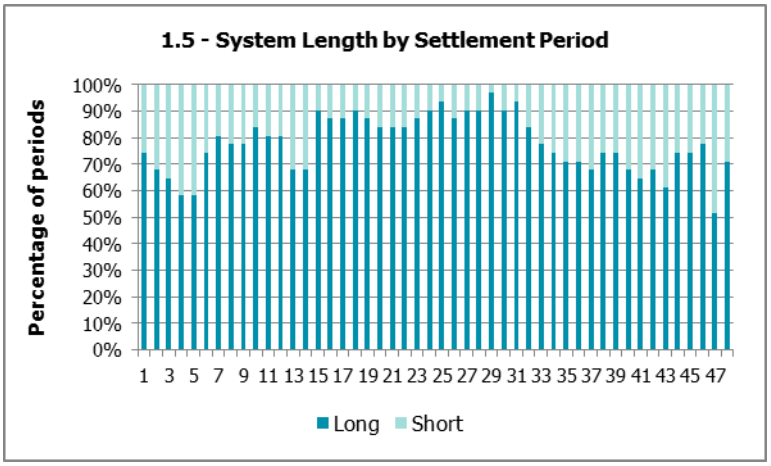
Graph 1.3 shows daily average System Prices over the last month. In May, the average System Price when the system was long was £23.05/MWh. The average System price when the system was short was £59.82/MWh. The highest daily average price when the system was short occurred on 25 May 2016, when the system was short for 10 Settlement Periods .

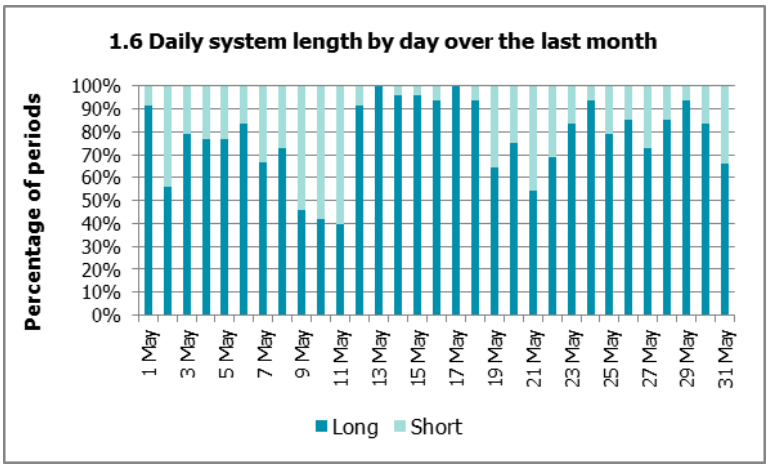


Graph 1.4 shows the variation of System Prices across the day. Short prices were highest in Settlement Period 21 and long prices lowest in Settlement Period 47. Long prices show little variance over settlement periods, with the price typically around £20/MWh. In contrast, short prices tend to increase over the morning and evening peaks.



Graph 1.5 shows system length by Settlement Period, and **graph 1.6** shows system length by day in May. The system was long for 78% of Settlement Periods in May.





2 PARAMETERS

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

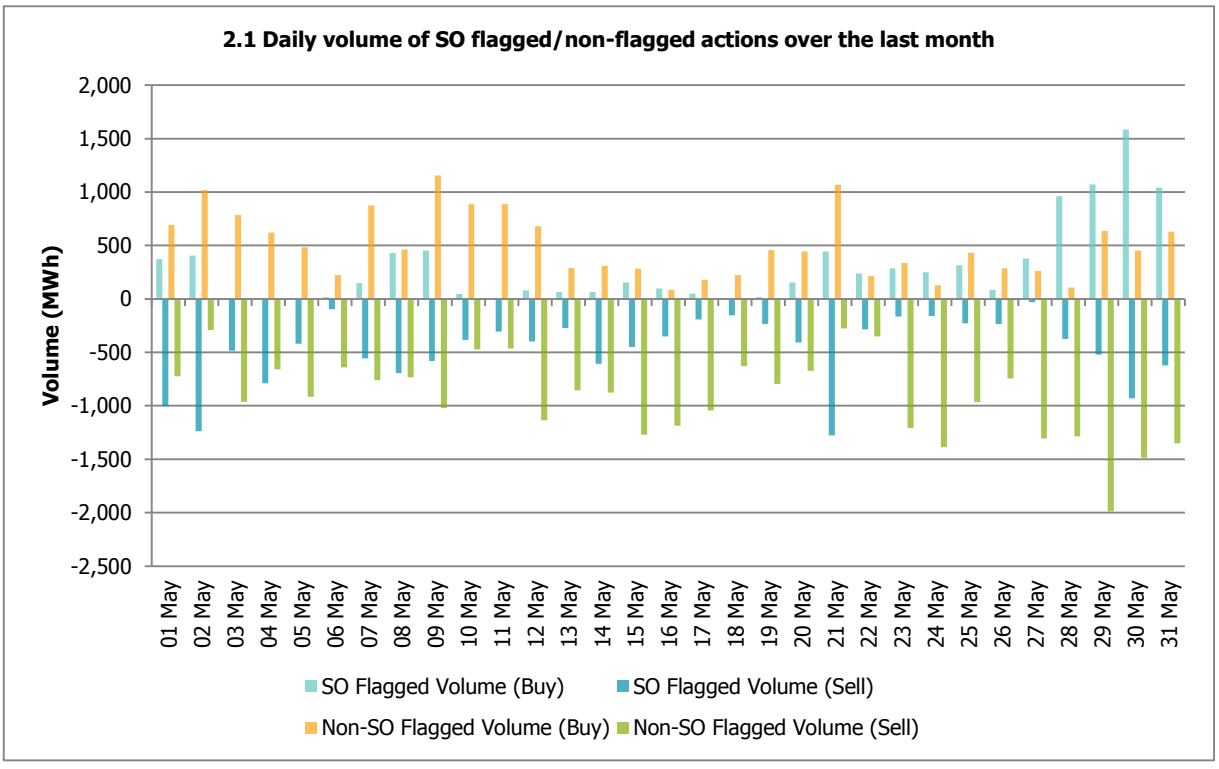
- The impact of flagging balancing actions;
- The impact of NIV tagging;
- The impact of PAR tagging;
- The impact of the Replacement Price; and
- How these mechanisms affect which balancing actions feed into the price.

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 (this process is called Classification). Actions are flagged by the System Operator when they were taken to resolve a locational constraint on the transmission network (SO-flagging), or when they were taken to correct short-term increases or decreases in generation/demand (CADL Flagging).

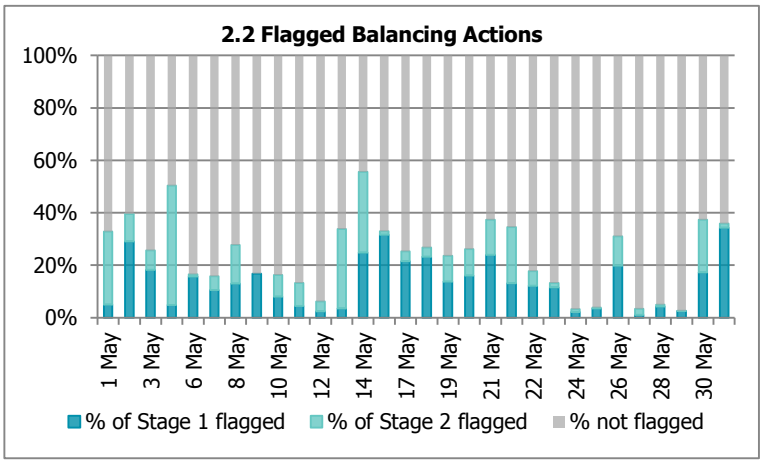
Graph 2.1 shows the volumes of buy and sell actions that have been flagged by the SO as being constraint related across the month.



20% of sell balancing actions taken in May had an SO-flag. 61% of SO-flagged sell actions came from Wind BMUs, 27% from Gas BMUs and 4.26% of actions came from actions taken outside the balancing mechanism (Balancing Service Adjustment Actions, BSAAs). The average initial price (ie before any re-pricing) of a flagged Bid was -£19.60/MWh.

8.81% of buy balancing actions taken in May had an SO-flag. 89.97% of SO-flagged buy actions came from CCGT BMUs. The average initial price of a SO-flagged buy action was £66.83/MWh.

Any actions which are less than 15 minutes total duration (regardless of whether these span across different Settlement Periods) are CADL flagged. 3.15% of Buy actions and less than 1% of Sell actions were CADL flagged in May. The majority of CADL flagged actions (67%) came from Pumped Storage BMUs, with 30% of CADL flagged actions coming from 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 actions 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, as was the case for 4% of Buy actions and 0.04% of Sell actions in May. 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 May, the average second stage flagged sell action was -£27.56/MWh, and the average Replacement Price when the System was long was £19.22/MWh.

Buy actions will typically have their prices revised downwards by the Replacement Price for the purposes of calculating the System Price. In May, the average second stage flagged buy action was £79.26/MWh, and the average Replacement Price when the System was long was £67.42/MWh.

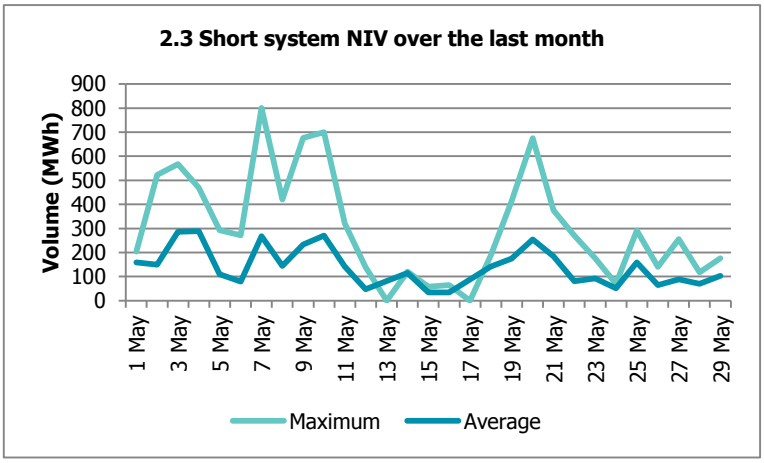
Of those actions that get re-priced only some of these will be reflected in the imbalance price due to NIV and PAR tagging.

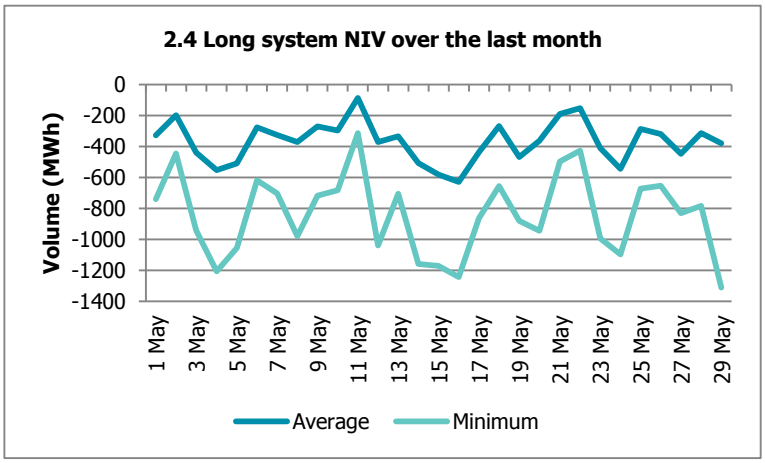
NIV and NIV tagging

The Net Imbalance Volume (NIV) represents the direction of imbalance of the System – ie 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 in May (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.

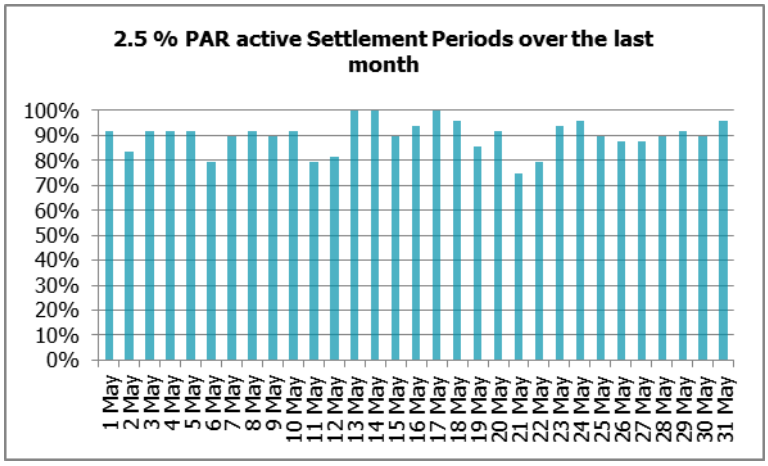
NIV tagging has a significant impact in determining which actions feed through to prices. 55% of actions were NIV tagged in May. Because the most expensive actions are NIV tagged first, NIV tagging has a dampening effect on prices when there are actions in both directions.





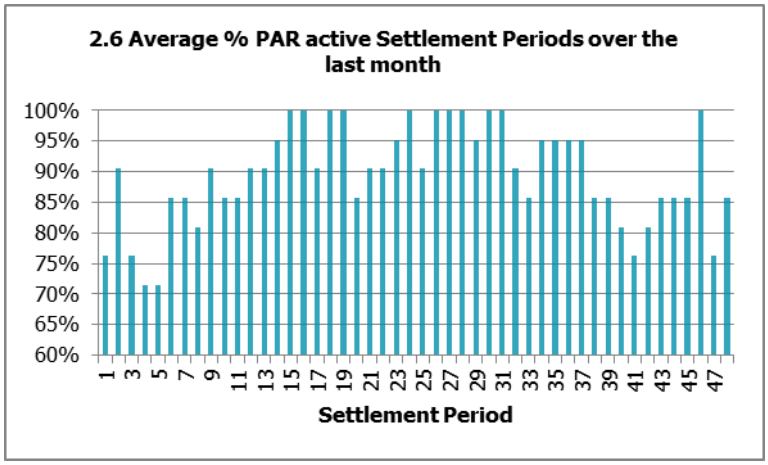
PAR tagging

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. While PAR is currently set to 50MWh, the PAR volume 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**. When PAR tagging is active, this means that there were 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 50MWh are 'PAR tagged' and removed from the price calculation stack.

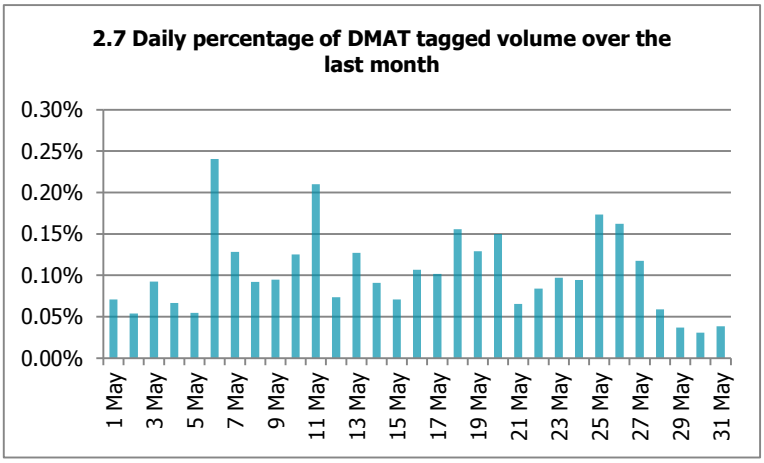
Graph 2.6 shows the proportion of Settlement Periods over the last month when PAR tagging was active.



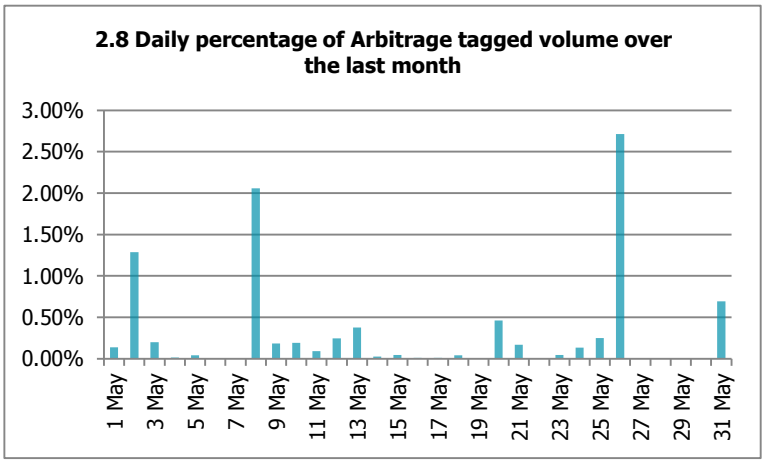
DMAT and Arbitrage Tagged Volumes

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) and 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. The majority of these volumes came from Balancing Services Adjustment Actions (BSAAs) and CCGT BMUs.



Graph 2.8 shows the volumes of actions that were removed to Arbitrage tagging.



3 BALANCING SERVICES

Short Term Operating Reserve (STOR) costs and volumes

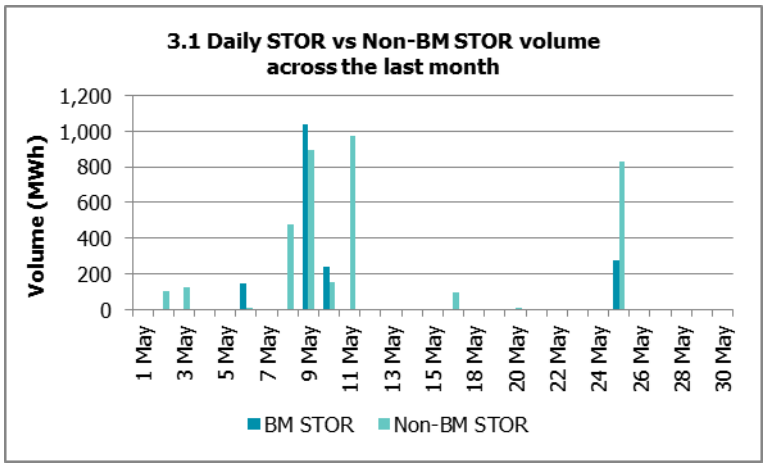
This section covers the balancing services that the System Operator takes outside the Balancing Mechanism that can have an impact on the price.

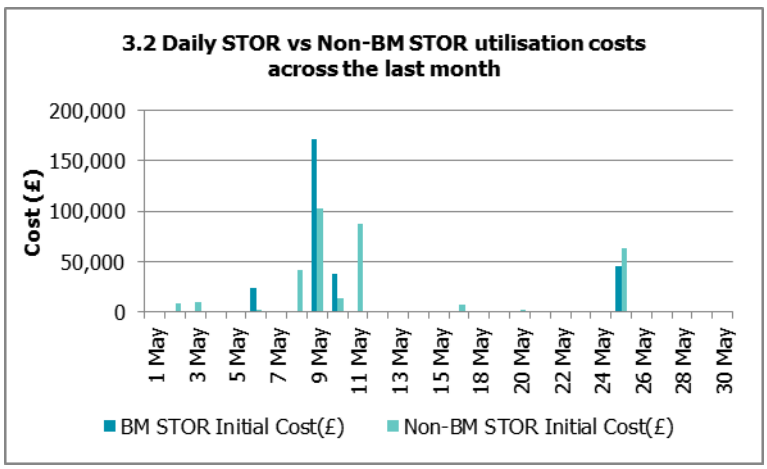
In addition to Bids and Offers available in the Balancing Mechanism, the SO can enter into contracts with providers of balancing capacity to deliver when called upon. These additional sources of power are referred to as reserve and most of the reserve that the SO procures is called Short Term Operating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

The average Utilisation Price for STOR capacity in May was £122.01/MWh (for BM STOR it was £161.35/MWh, and for non-BM STOR it was £82.66/MWh). The maximum Utilisation Price for STOR was £165.43/MWh.



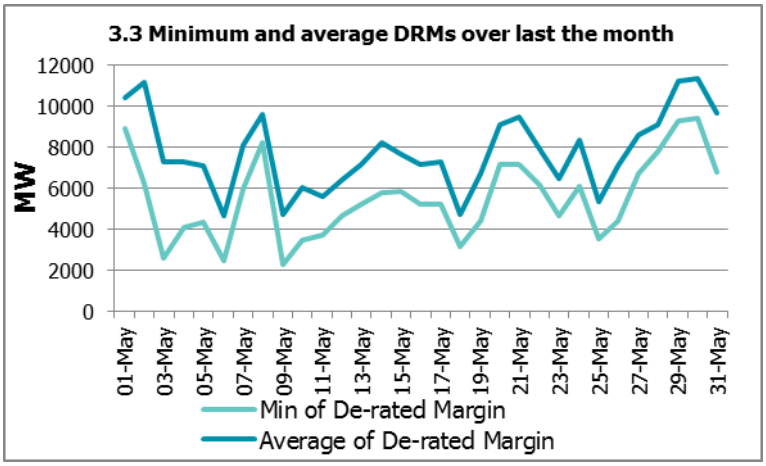


De-rated margin, loss of load probability and the Reserve Scarcity Price

There are times when the Utilisation prices of STOR plant 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 May 2016.

The System Operator has determined a relationship between each DRM and the LOLP which will determine the RSP[2]. The lowest DRM in May of 2245MWh resulted in the highest LoLP and therefore the highest Reserve Scarcity Price (RSP) of £2.01/MWh (see **table 3.4**). The System was short for this Settlement Period, and the System Price was £112.36/MWh.



The RSP will then be used to re-price STOR actions in the Imbalance Price calculation if it is higher than the original Utilisation Price of the STOR capacity. No STOR actions were re-priced using the RSP in May, as RSPs did not exceed STOR Utilisation Prices in any periods; the lowest STOR Utilisation Price in May was £71.21/MWh.

Date	SP	DRM	LoLP	RSP	RSP Used	System Length	System Price
09/05/2016	38	2,244.95	0.0007	**2.01**	No	Short	112.36
09/05/2016	37	2,376.61	0.0003	**1.03**	No	Short	168.15
06/05/2016	23	2,449.57	0.0002	**0.70**	No	Long	25.41
03/05/2016	43	2,595.75	0.0001	**0.31**	No	Short	105.83
06/05/2016	21	2,623.50	0.0001	**0.27**	No	Long	17.02

3.4 Top 5 LOLPs and RSPs in the last month

[2] The System Operators methodology for LOLP is set out in the LOLP Methodology statement: https://www.elexon.co.uk/wp-content/uploads/2014/10/37_244_11A_LOLP_Calculation_Statement_PUBLIC.pdf

4 P305 - SPECIFIC ANALYSIS

The pre-P305 Balancing Services Adjustment Data (BSAD) data is unavailable this month and the price calculation analysis cannot be completed in time for this month's report.

November 2018 Scenario

This section looks at 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:

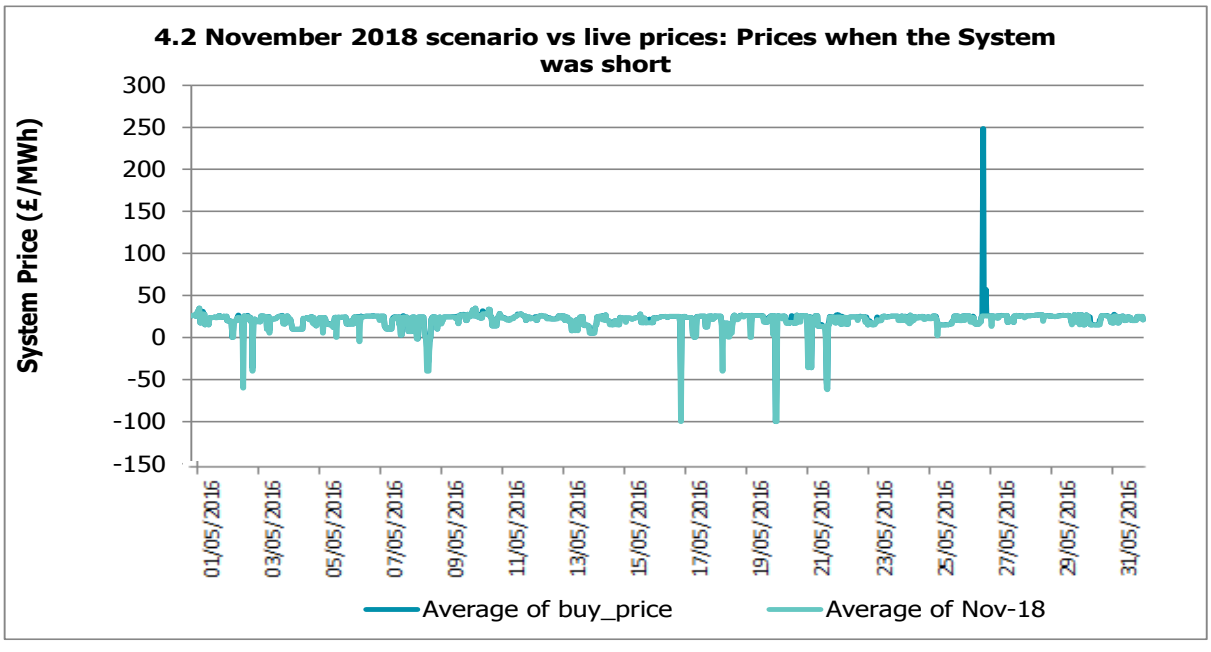
- A reduction in the PAR value to 1MWh (RPAR will remain at 1MWh);
- The introduction of a 'dynamic' LOLP function; and
- An increase in the VoLL to £6,000MWh, which will apply to all instances of VoLL in arrangements, including the RSP function.

The average price differences across the month are relatively small under the November 2018 scenario – prices were £1.04 /MWh lower when the system was long and £2.34 /MWh higher when the system was short. There was no change in prices in 57% of Settlement Periods. When the system was long, prices were always the same or lower, and when the system was short prices were always the same or higher under the November 2018 scenario.

Graph 4.1 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 – price changes were less than £1/MWh in 86% of Settlement Periods when the system was long (and 23% when the system was short).

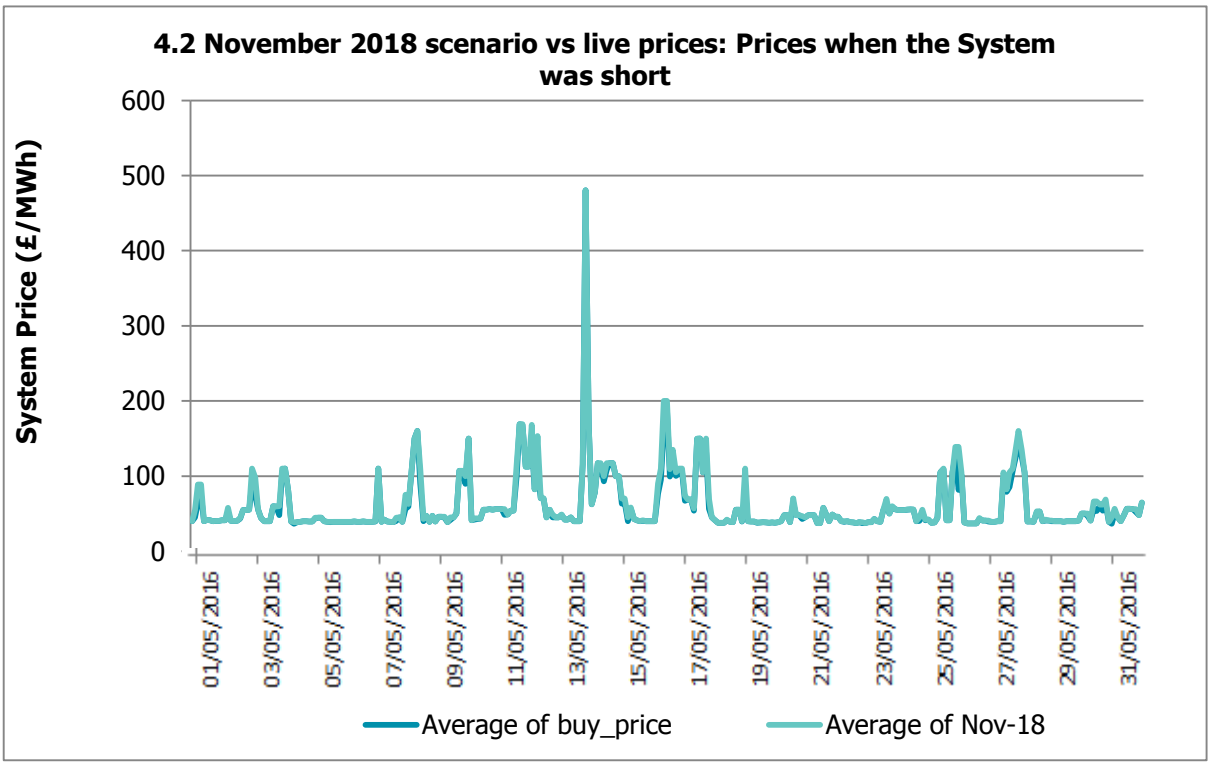
3.46 % of price changes were greater than £5/MWh when the system was long, with some notable shifts in price. The biggest shift in price was £222.45/MWh. This happened at Settlement Period 17 on 26 May 2016 when the price would have been £26/MWh under the November 2018 scenario, whereas the live System Price was £248.52/MWh. In this case a Balancing Service Adjustment Action (BSAA) set the price. The BSAA reflected a SO-SO trade on the French Interconnector. This was one of nine similar actions that day where electricity was traded, at an above average price (and in the balancing mechanism) from GB to France. See appendix one for a detailed look into Settlement Period 17.

Under the November 2018 scenario there would have been 17 Settlement Periods with negative System Prices, which is the same as the number under the live scenario.



Graph 4.2 compares live System Prices with prices re-calculated using the November 2018 scenario when the system was short. Prices would have been higher in 37% of short Settlement Periods under the November 2018 scenario. Of those prices that did change, 36% of these changed by more than £5/MWh under the November 2018 scenario, and 21% by more than £10/MWh. The biggest shift in price was £57.27/MWh at Settlement Period 35 on 22 May. The price would have been £139/MWh under the November 2018 scenario, whereas the live price was £81.73/MWh.

Under the November 2018 scenario there would have been 16 Settlement Periods in May with prices over £100/MWh, compared to 10 periods under the live scenario.



There were no Demand Control, DSBR or SBR actions taken during the month. Under the November 2018 scenario these action types would be priced at a VoLL of £6,000.00/MWh (rather than £3000.00/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 4.3.**

Date	SP	DRM	LoLP	RSP	RSP Used	System Length	System Price
09/05/2016	38	2,244.95	0.0007	8.04	No	Short	112.36
09/05/2016	37	2,376.61	0.0003	4.10	No	Short	168.15
06/05/2016	23	2,449.57	0.0002	2.80	No	Long	25.41
03/05/2016	43	2,595.75	0.0001	1.26	No	Short	105.83
06/05/2016	21	2,623.50	0.0001	1.06	No	Long	17.02

4.3 Top 5 LoLPs and RSPs in the last month with VoLL of £6,000/MWh

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 - A DETAILED LOOK AT SETTLEMENT PERIOD 17, 26 MAY 2016

This section takes a detailed look at how the Imbalance Price was calculated for Settlement Period 17 on 26 May 2016, where the live System Price was £248.52/MWh. On this occasion, the Energy Imbalance Price was set by a SO-Flagged Balancing Service Adjustment Action (BSAA), reflecting a SO-SO trade on the French Interconnector.

The 'system' balancing BSAA retained its price, as it was less expensive to the SO than the most expensive Unflagged action. This Settlement Period is of particular interest as the Energy Imbalance Price calculation aims to reflect 'energy' balancing costs, not 'system' balancing costs. The reverse came to be true for this Settlement Period and the detailed step by step calculation is shown below.

The total number of balancing actions in this Settlement Period was 26. This was broken down as 25 Bid Offer Acceptances (BOAs) (three Bids, 22 Offers) and one BSAA. These have separated into their respective Buy and Sell stacks and ranked from most expensive to least expensive actions, as relevant to the SO.

Table 1. Initial Buy Stack

Action Number	ID	Offer Price	Offer Volume	SO-Flag	CADL Flag	Stage 1 Flag
22	T_CRUA-4	140	8.333	F	**T**	**T**
21	T_FFES-1	110	7.5	F	**T**	**T**
20	T_FFES-1	110	3	F	**T**	**T**
19	T_FFES-2	110	7.5	F	**T**	**T**
18	T_FFES-2	110	6	F	**T**	**T**
17	T_FFES-2	110	3	F	**T**	**T**
16	T_FOYE-1	103	13.758	F	F	F
15	T_FOYE-1	103	10	F	F	F
14	T_FOYE-1	103	7.5	F	F	F
13	T_FOYE-1	103	7.5	F	F	F
12	T_FOYE-1	103	7.5	F	F	F
11	T_FOYE-1	103	7.5	F	F	F
10	T_FOYE-2	103	13.758	F	**T**	**T**
9	T_FOYE-2	103	10	F	**T**	**T**
8	T_FOYE-2	103	7.5	F	**T**	**T**
7	T_RUGPS-6	95	8.75	F	F	F
6	T_SVRP-10	74	0.733	F	**T**	**T**
5	T_SUTB-1	72	3.483	F	**T**	**T**
4	T_BAGE-1	70	2.292	F	**T**	**T**

3	T_SVRP-20	70	1.1	F	**T**	**T**
2	T_COSO-1	59.92	4.167	F	F	F
1	T_DRAXX-4	47	11.25	F	F	F

Table 2. Initial Sell Stack

Action Number	ID	Bid Price	Bid Volume	SO-Flag	CADL Flag	Stage 1 Flag
1	BSAA:1	263.733	-230.211	**T**	F	**T**
2	T_DIDCB6	26	-1.114	F	F	F
3	T_WBURB-1	25.85	-2.125	F	**T**	**T**
4	T_STAY-3	25.76	-0.142	F	F	F

The above Buy/Sell stack tables show if a balancing action has been First-Stage Flagged or not, this process looks to identify if an action is 'system' related and needs to be repriced. Flags are shown by T (True) and F (False). First-Stage Flagged actions in this Settlement Period include a SO-Flagged action (the sell BSAA action) and multiple Continuous Acceptance Duration Limit (CADL) Flagged actions.

The next stage removes balancing actions under the De Minimis Acceptance Threshold (DMAT), which is currently 1MWh. Arbitrage Tagging is applied to remove buy balancing actions (an accepted Offer or a buy BSAA) if they are either the same, or lower than the price of a sell balancing action (an accepted Bid or a sell BSAA). In cases of arbitrage, equivalent volumes of sell balancing actions and buy balancing actions are excluded from the Energy Imbalance Price calculation. Table 3 highlights actions which have been DMAT and Arbitrage Tagged and displays their adjusted volumes which will be used in the price calculation.

Table 3. Buy and Sell stacks with highlighted tagged actions and adjusted volumes.

Buy Stack

Action Number	ID	Offer Price	Offer Volume	Stage 1 Flag	Adjusted Volume
22	T_CRUA-4	140	8.333	T	0
21	T_FFES-1	110	7.5	T	0
20	T_FFES-1	110	3	T	0
19	T_FFES-2	110	7.5	T	0
18	T_FFES-2	110	6	T	0
17	T_FFES-2	110	3	T	0
16	T_FOYE-1	103	13.758	F	0
15	T_FOYE-1	103	10	F	0
14	T_FOYE-1	103	7.5	F	0
13	T_FOYE-1	103	7.5	F	0
12	T_FOYE-1	103	7.5	F	0
11	T_FOYE-1	103	7.5	F	0
10	T_FOYE-2	103	13.758	T	0
9	T_FOYE-2	103	10	T	0
8	T_FOYE-2	103	7.5	T	0
7	T_RUGPS-6	95	8.75	F	0
6	T_SVRP-10	74	0.733	T	0
5	T_SUTB-1	72	3.483	T	0
4	T_BAGE-1	70	2.292	T	0
3	T_SVRP-20	70	1.1	T	0
2	T_COSO-1	59.92	4.167	F	0
1	T_DRAXX-4	47	11.25	F	0

Sell Stack

Action Number	ID	Bid Price	Bid Volume	Stage 1 Flag	Adjusted Volume
1	BSAA:1	263.733	-230.211	T	-78.82
2	T_DIDCB6	26	-1.114	F	-1.114
3	T_WBURB-1	25.85	-2.125	T	-2.125
4	T_STAY-3	25.76	-0.142	F	0

After DMAT tagging, the sum of all the remaining buy actions is 151.39 MWh. As this was less than the BSAA sell action, these volumes can be offset. Therefore the new BSAA volume equals 230.211 - 151.39 = 78.82 MWh.

The next stage of the price calculation process is classification and determining if the balancing actions will become 'Second-Stage Flagged' actions and need re-pricing. First-Stage Flagged actions become Second-Stage Flagged actions if the action has a more expensive price than the most expensive Unflagged action. It is important to remember that, to the perspective of the SO, the lowest prices in the sell stack are the most expensive actions.

The Net Imbalance Volume (NIV) is -82.059 MWh. NIV tagging nets off buy and sell actions to give the net system length, but in this scenario there are only sell actions at this stage, so they all remain in our calculation.

Second-Stage Flagged actions can now be re-priced. From Table 4, Action 2 is the most expensive Second-Stage Unflagged action, therefore Action 1 will retain its price and Action 3 will need to be re-priced. The Replacement Price (RP) is set Action 2 which is the most expensive Second-Stage Unflagged balancing action, therefore making the RP £26/MWh.

PAR Tagging takes a volume-weighted average of the 50MWh of most expensive actions to calculate the final energy Imbalance Price. Table 4 shows these final few stages which have been carried out on the Sell stack.

Table 4. Calculating the final sell stack

Action Number	ID	Bid Price	Stage 2 Flag	Adjusted Volume
1	BSAA:1	263.733	F	-78.82
2	T_DIDCB6	26	F	-1.114
3	T_WBURB-1	25.85	**T**	-2.125

Action Number	ID	Bid Price	Stage 2 Flag	Adjusted Volume
1	BSAA:1	263.733	F	-46.761
2	T_DIDCB6	26	F	-1.114
3	T_WBURB-1	26	**T**	-2.125

We now have our final Sell Stack for imbalance price calculation.

Volume weighted average for Settlement Period 17=

$$\frac{(263.733\ X\ 46.761) + (26\ X\ 1.114) + (26\ X\ 2.125)}{(46.761\ + 1.114\ \ + 2.125)}$$

Price = £248.33/MWh

Please note that this calculated price is slightly different to the actual calculated price for Settlement Period 17 on 26 May 2016, which was £248.52/MWh. The slight difference was due to the application of Transmission Loss Multipliers (TLMs) being applied in the final calculation of the System Price. (The TLM has not been applied to simplify the example).

The key aim of this example is to demonstrate how the price was calculated for Settlement Period 17 on 26 May 2016, highlighting the difference between 'energy' and 'system' balancing actions. 'Energy' balancing actions in the stack, which were applicable to calculating the Energy Imbalance Price, were £26/MWh. In contrast, the 'system' balancing action from the BSAA was £263.733/MWh, and hence caused the high price for this Settlement Period when the system was long.