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Electricity Balancing Significant Code Review: P217A Preliminary Analysis

Analysis

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Overview:

Under the electricity market arrangements in Great Britain, if a market participant generates or consumes more or less electricity than they have contracted for, they face the 'cash-out' price for their imbalance. Ahead of the launch of the electricity balancing Significant Code Review (SCR), we have undertaken preliminary analysis of the impacts of the last change to the calculation of cash-out prices: Modification P217A.

Modification P217A sought to remove system pollution from the cash-out price. System pollution is a distortion of the cash-out price caused by the inclusion of balancing actions taken by the System Operator (SO) to resolve system related imbalances. As far as possible, the cash-out price should reflect the cost of actions taken by the SO for energy balancing only.

P217A has improved the extent to which cash-out prices reflect the cost to the SO of energy balancing. This is particularly the case in periods where the SO took action to resolve constraints on the system. In these periods, P217A reduced the influence of system balancing actions on the cash-out price.

Reducing system pollution could enable the introduction of sharper cash-out price signals. Implementing a sharper cash-out price would increase the incentive for market participants to balance their positions, and would strengthen the signal to invest in flexible capacity. We will consider this option carefully as part of our electricity balancing Significant Code Review.

Context

Ofgem has repeatedly expressed concerns about the current cash-out arrangements. Following responses to our cash-out issues paper we are launching a Significant Code Review (SCR) of the electricity balancing arrangements.

One of our main concerns is that dampened and inaccurate price signals are providing insufficient incentives to invest in additional flexible capacity – the concept of 'missing money'. One possible solution to this could be to make cash-out prices 'more marginal'. However, the pollution of cash-out prices would need to be sufficiently addressed to be able to implement a more marginal price.

The most recent change to the cash-out arrangements (P217A) was implemented in November 2009 and sought to remove system pollution from the calculation of cash-out prices.

The P217A preliminary analysis seeks to assess the impacts of P217A, and the removal of system pollution under the flagging methodology, on the cash-out price. It also considers some of the impacts of moving to a more marginal cash-out price. It presents an initial tranche of evidence on which we intend to build over the SCR.

Associated documents

Electricity Balancing Significant Code Review (SCR) - Initial Consultation, August 2012, Ref: 108/12
www.ofgem.gov.uk/Markets/WhlMkts/CompandEff/electricity-balancing-scr/Documents1/Electricity%20Balancing%20SCR%20initial%20consultation.pdf

Electricity Balancing Significant Code Review Launch Statement, August 2012
www.ofgem.gov.uk/Markets/WhlMkts/CompandEff/electricity-balancing-scr/Documents1/Electricity%20Balancing%20SCR%20Launch%20Statement.pdf

Open letter: Ofgem decision to launch a Significant Code Review (SCR) of the electricity cash-out arrangements, March 2012
www.ofgem.gov.uk/Markets/WhlMkts/CompandEff/CashoutRev/Documents1/electricity-cash-out-SCR.pdf

Electricity cash-out issues paper, November 2011, Ref: 143/11
www.ofgem.gov.uk/Markets/WhlMkts/CompandEff/CashoutRev/Documents1/Electricity%20cash-out%20issues%20paper.pdf

Modification Proposal P217 – final decision letter, November 2009, Ref: 145/08
www.ofgem.gov.uk/Licensing/ElecCodes/BSCode/BSC/Documents1/P217D.pdf

BSC Modification Proposal P217 'Revised Tagging Process and Calculation of Cash-out Prices, August 2008
www.ofgem.gov.uk/Markets/WhlMkts/CompandEff/CashoutRev/Documents1/P217%20IA_FINAL.pdf

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Executive Summary

Cash-out prices provide the main incentive on participants in the electricity market to balance their positions. If a party is out-of-balance relative to its contracted position, it faces the cash-out price for this imbalance. It is the responsibility of the System Operator to maintain the balance of the system in real time.

The System Operator (SO) must take actions to resolve imbalances, either turning up or down generation or demand. These actions have an associated cost. As such, for the cash-out price to be an efficient incentive for parties to balance their positions, the cash-out price should reflect the costs to the SO of its energy balancing actions.

Ofgem has concerns with the current cash-out arrangements. One of our main concerns is that dampened and inaccurate price signals are providing insufficient incentives to invest in additional flexible capacity. This capacity may be needed to maintain adequate security of supply in the future. One possible solution to this could be to make cash-out prices sharper, by making the calculation of cash-out prices 'more marginal'.

A fully marginal cash-out price would be based only on the price of the most expensive action taken by the SO to balance the system. Currently, prices are calculated as a volume weighted average of the most expensive 500MWh of actions. The price is calculated as an average due to concerns around 'pollution', where the cost of actions taken by the SO for reasons other than the energy imbalances of parties influence the cash-out price. To be able to move to a more marginal price, this pollution would need to be sufficiently addressed.

The last modification to the calculation of cash-out prices was Balancing and Settlement Code (BSC) Modification P217A. P217A was introduced in November 2009 and sought to remove system pollution from the calculation of cash-out prices. It did this by introducing a flagging methodology to identify actions taken by the SO to resolve system constraints. P217A also introduced other changes, including improving the consistency of the treatment of different types of balancing actions in the price calculation.

We have undertaken a preliminary analysis of Modification P217A. This considers the impacts of the removal of system pollution under the flagging methodology on cash-out prices. This analysis also considers some of the potential impacts of a more marginal cash-out price.

To assess the impacts, we have used price data over a two year period since P217A was implemented. The live price series is compared to a counterfactual; a comparative price series over the same period using the price calculation methodology before P217A was introduced. However, it is important to note the counterfactual does not capture any potential behavioural change as a consequence of different cash-out prices and as such, any conclusions need to be considered in this context.

Key findings of the P217A preliminary analysis

Since implementation, P217A has improved the extent to which cash-out prices reflect the cost to the SO of 'energy' balancing (resolving imbalances created by parties diverging from their contracted positions). It has done this by reducing the influence of system pollution on the cash-out price calculation.

P217A has had a significant impact in particular settlement periods, for example, when the SO has taken actions to overcome constraints on the electricity system. In these periods, before P217A was introduced expensive actions taken to resolve system constraints would have entered the cash-out price calculation, causing the price to spike. Under P217A, the influence of these actions is reduced, but cash-out prices can still spike in settlement periods to reflect scarcity of energy on the system.

P217A did not impact the price in all periods and on average made cash-out prices less sharp, but has done so as a consequence of improving the extent to which cash-out prices reflect the costs to the SO of energy balancing. Following P217A, the system provides participants with a more accurate signal of the cost of energy balancing.

In addition, modification P217A has reduced the cash-out risk parties face. It has reduced both the spread and volatility of the main cash-out price caused by the influence of the actions flagged as having been taken to resolve system constraints under P217A. It has also reduced the size of total imbalance charges which are redistributed through the Residual Cashflow Reallocation Cashflow.

We will consider options to improve the strength of the signal for investment in flexible generation capacity in our electricity balancing SCR, including the possibility of making prices more marginal, which the flagging introduced by P217A may facilitate.

A more marginal cash-out price would make prices sharper, increasing the incentive for parties to balance. However, there would be wider considerations around such a change, for example, that it could also increase the cash-out risk faced by market participants. It would also increase the price impact of inaccuracies in the implementation of flagging by the SO.

We are seeking feedback on the preliminary analysis of P217A as part of the Initial Consultation on electricity balancing SCR. The detail of feedback requested and how to contribute are set out in the Initial Consultation.

1. Introduction

Chapter Summary

The System Operator is responsible for maintaining the balance of supply and demand on the electricity system in real time. Market participants are incentivised to fulfil their contracted positions through the cash-out price.

Ofgem have repeatedly raised concerns with the current balancing arrangements. A key concern is that dampened cash-out prices reduce the incentive to invest in flexible capacity. One possible solution could be to make prices sharper, but to do this pollution of the cash-out price must be sufficiently removed.

The last modification to cash-out price calculation was P217A which sought to remove system pollution. The preliminary analysis considers what impacts P217A has had on cash-out prices and provides initial analysis of some the impacts of moving to a more marginal price.

Balancing the electricity system

1.1. The current structure of the wholesale electricity market in Great Britain was created through the implementation of the British Electricity Trading and Transmission Arrangements (BETTA)[1]. Under these arrangements, energy companies trade with other market participants for the electricity they need in half-hourly settlement periods. They are incentivised to meet these contracts through the cash-out price.

1.2. In practice, the supply of electricity may not match demand over and within a given settlement period. It is the responsibility of the System Operator (National Grid Electricity Transmission (NGET)) to maintain the balance of the overall system in real time. The System Operator (SO) must balance demand and supply to ensure the security and quality of supply across the GB system.

1.3. The SO takes action to resolve two general types of imbalance: ‘energy’ and ‘system’ imbalances. The SO uses both actions offered by participants through the balancing mechanism (BM), and balancing services contracted in advance, to re-despatch generation in order to solve both energy and system imbalances.

1.4. Energy imbalances result from an overall difference between supply and demand on the system. These imbalances are a consequence of market participants varying from their contracted positions.

[1] BETTA was introduced in April 2005, with the merging of the Scotland and the England and Wales electricity markets. Prior to this, England and Wales operated under the New Trading Arrangements (NETA), introduced in March 2001.

1.5. System imbalances occur due to the physical limitations of the transmission system. For example, thermal constraints can occur due to too much power flowing through certain sections of the system; various parts of the system are subject to export and import constraints, which restrict electricity flowing out of or into a location respectively; and voltage constraints occur as the SO must ensure voltage levels across the system remain at safe levels.

Cash-out prices and incentives to balance

1.6. The actions taken by the SO to balance the system have an associated cost. As such, parties that are out-of-balance face a charge (the cash-out price) for each unit of imbalance which reflects the cost to the SO. This price incentivises parties to balance their positions in each settlement period.

1.7. The cash-out price is calculated based on the cost of actions taken by the SO to balance the system[2]. As such, out-of-balance parties face an incentive to balance where they can do so more cheaply than the SO. Hence cash-out prices provide commercial incentives for parties to maintain reliability of plant; maintain or invest in flexible plant and maintain or improve forecasting accuracy.

1.8. Cash-out prices also signal the relative scarcity of electricity in a given settlement period. When margins are tight, this encourages generators to make any additional capacity available and large consumers to offer to reduce demand, to the SO through the BM for the purpose of balancing the system.

1.9. Further, expectations of cash-out prices also tend to drive prices and volatility in short term markets.

Issues with the current balancing arrangements and Modification P217A

1.10. Ofgem have repeatedly raised concerns with the current cash-out arrangements[3]. In response, we have decided to launch a Significant Code Review (SCR) of electricity cash-out arrangements[4]. This will allow us to consider our concerns further alongside options to address these where appropriate.

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[2] See Annex 1 for further detail on the current methodology of calculating cash-out prices
[3] Concerns around the cash-out arrangements were initially highlighted in Project Discovery (Ofgem (2010): 'Project Discovery: Options for delivering secure and sustainable energy supplies'; www.ofgem.gov.uk/Markets/WhlMkts/monitoring-energy-security/Discovery/Documents1/Project_Discovery_FebConDoc_FINAL.pdf) and were reiterated in our cash-out issues paper (Ofgem (2011); 'Electricity cash-out issues paper'; www.ofgem.gov.uk/Markets/WhlMkts/CompandEff/CashoutRev/Documents1/Electricity%20cash-out%20issues%20paper.pdf)
[4] www.ofgem.gov.uk/Markets/WhlMkts/CompandEff/CashoutRev/Documents1/electricity-cash-out-SCR.pdf

1.11. One of our key concerns is that dampened and inaccurate price signals are providing insufficient incentives to invest in flexible capacity: the problem of 'missing money'. This capacity may be required to maintain the security of the system in the future.

1.12. One possible solution to this could be to make cash-out prices sharper. This could be done by changing the price calculation such that it is based on a smaller volume of actions which were taken by the SO to balance the system, hence making the calculation 'more marginal'. We intend to consider the impacts of more marginal prices as part of the SCR.

1.13. A marginal cash-out price would be based only on the price of the most expensive action taken by the SO to balance the system. Currently cash-out prices are calculated as a volume weighted average of the most expensive 500MWh of actions due to concerns around 'pollution' of cash-out prices.

1.14. Pollution arises as the SO takes actions to resolve both energy and system imbalances on the system in real-time. In theory, market participants should not face the cost of resolving system imbalances, as these are a consequence of physical constraints of the system rather than the divergence of parties from their contracted positions.

1.15. To be able to move to a more marginal price, system pollution would need to be sufficiently addressed. This is because we would need to be confident that the marginal action on which the price is based was taken to resolve an energy imbalance, such that the cash-out price provides an efficient incentive for parties.

1.16. The last modification to the calculation of cash-out prices was Balancing and Settlement Code (BSC) Modification P217A. P217A was introduced in November 2009 and sought to remove system pollution from the calculation of cash-out prices[5]. It proposed to do this by introducing a flagging methodology to identify actions taken by the SO to resolve system constraints[6]. The removal of system pollution from the calculation of cash-out prices under P217A could enable the possibility of making prices more marginal.

P217A Preliminary Analysis

1.17. Ahead of the launch of the SCR, we have undertaken a preliminary analysis of Modification P217A. This assesses what impact the removal of system pollution under the flagging methodology has had on cash-out prices. In our decision letter

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[5] P217A also introduced other changes, including disaggregating Balancing Services Adjustment Data (BSAD) in the price calculation
[6] See Annex 2 for more detail on the changes to the cash-out price calculation introduced by P217A

approving P217A[7], we proposed undertaking a post-implementation review (PIR) of Modification P217A. The P217A preliminary analysis forms part of this process. We intend to undertake further related analysis under the SCR that will inform the issues with the current balancing arrangements we are considering. This will be included in the impact assessment published as part of the SCR.

1.18. The preliminary analysis also considers some of the potential impacts of a more marginal cash-out price. Although this does not represent a complete assessment of the impacts, it provides an initial tranche of evidence on which we intend to build over the course of the SCR.

[7]Ofgem (2008); www.ofgem.gov.uk/Markets/WhlMkts/CompandEff/CashoutRev/Documents1/P217%20Revised%20Tagging%20process%20and%20calculation%20of%20cash-out%20prices.pdf

2. P217A preliminary analysis methodology and assumptions

Chapter Summary

To be able to assess the impacts of P217A, we have compared cash-out prices over a two year period since P217A was implemented, relative to a counterfactual price series. The counterfactual uses the methodology for calculating cash-out prices before P217A was implemented, but over the same two year period.

We also undertook some analysis of the initial impacts of more marginal prices. Additional price scenarios were constructed for this analysis which used the same data for the two-year period assessed, but which also reduced the volume of balancing actions on which the cash-out price is based, hence making the calculation 'more marginal'.

There are important caveats to the modelling. We assume that the flagging methodology under P217A successfully removes system pollution from the cash-out price. Further, we assume that balancing behaviour would not change in response to different cash-out price calculations but this may not necessarily be the case in practice. However, we feel these assumptions would not impact on our high-level findings.

Data, counterfactual and assessment methodology

2.1. The preliminary analysis is based on data and analysis around balancing actions and cash-out prices provided by Elexon and NGET. The period of analysis covers a two year period since P217A was implemented: from the start of April 2010 to end of March 2012. This period was chosen such that any seasonal effects were accounted for by assessing the data over two calendar years.

2.2. The data set used includes information around cash-out prices, and volume data around the imbalances of market participants and the balancing actions taken by the SO. The information around the balancing actions is broken down by those taken through and outside the BM, and by whether the actions were flagged or tagged under the calculation methodology.

Pre-P217A counterfactual and alternative PAR scenarios

2.3. To assess the potential impacts of P217A, we have used a counterfactual which simulated the calculation of the cash-out price before P217A was implemented. Throughout the paper, the counterfactual is referred to as the 'pre-P217A' scenario. The actual realised data for the period under P217A is referred to as the 'live' scenario.

2.4. Both the live and counterfactual scenarios used the same data around the volume of imbalances and actions taken to balance the system by the SO to calculate the cash-out price. However, the counterfactual calculates a different price series for the same set of imbalances using the price calculation method prior to the implementation of P217A. The live scenario calculates cash-out prices using the current methodology.

2.5. This methodology allows us to identify the impact the different calculation process has made relative to a 'pre-P217A' counterfactual. However, the difference must be considered with caution as the 'pre-P217A' scenario was never realised.

2.6. The preliminary analysis also considers some of the impacts of moving to a more marginal cash-out price. To do this, the cash-out price has been calculated under three alternative scenarios where the volume on which the cash-out price is calculated (otherwise known as the Price Average Reference) is reduced to 250MWh, 100MWh and 1MWh.

2.7. For the alternative Price Average Reference (PAR) scenarios, the same data around the volumes of imbalances and actions taken by the SO to balance the system is used as under the live scenario. In addition, the same flagging and tagging process under the current arrangements is applied to these alternative PAR scenarios, such that they are consistent with the live scenario. These alternatives are then compared to the live scenario to analyse the price impacts.

P217A preliminary analysis assessment methodology

2.8. To assess the impacts of P217A, and of more marginal prices, we have considered a number of different metrics. We have assessed the average cash-out price across all periods, and the average in each settlement period over the course of the day. We have also produced these metrics focussing only on those periods where P217A had a significant impact on the cash-out price[8].

2.9. To capture the impact of P217A on cash-out risk for participants, we have calculated the standard deviation and co-efficient of variation of prices as two measures of variation. We have also calculated the average spread of prices, both across all periods and split by settlement period, to assess the average differential between the main and reverse price in each period.

2.10. In addition, we have also looked at the changes in imbalance charges and Residual Cashflow Reallocation Cashflow (RCRC) under different scenarios. This is calculated by combining the price for each settlement period with the gross imbalances of parties to gain the total imbalance charges. These are then modelled

[8] A significant impact is defined as a difference of £0.01 or above between the live and counterfactual scenarios in a particular settlement period. This was chosen given the level of accuracy in the models used to produce the different price series'

to be redistributed to market participants in relation to parties' proportion of total credited energy, as under the current RCRC methodology.

2.11. The results of the analysis are presented as non-weighted averages unless otherwise stated. This means when an average is taken across the two-year period, all settlement periods have an equal weighting, rather than, for example, weighting averages by the volume of imbalances in given periods.

2.12. Further, much of the analysis focuses on the main cash-out price and presents the average of the main price when the system was a given length. For example, average system buy price (SBP) includes only short periods when SBP was the main price, and vice versa for the System Sell Price (SSP) when the system was long. We have focused on the main price as P217A did not change the calculation of the reverse price.

2.13. The preliminary analysis seeks to infer the impact of removing system pollution under the methodology specified by P217A. As such, we would expect that P217A would make the cash-out price less spiky as the influence of actions taken for system balancing is reduced.

2.14. We would also anticipate that the spread between main and reserve price, and the volatility of the main price, to reduce. However, other changes to the price calculation under P217A may have an ambiguous impact on cash-out prices, which may dampen these expected impacts in some periods.

2.15. Under more marginal cash-out prices, we would expect prices to become sharper, with volatility and spread also increasing. This is because the price is based on the most expensive action taken by the SO to balance the system, rather than a volume weighted average of actions.

Assumptions and limitations to modelling

2.16. In the preliminary analysis, we seek to assess what impact P217A has had on cash-out prices through the removal of system pollution under the P217A flagging methodology.

2.17. In doing so, we inherently assume that the flagging methodology successfully removes system pollution from the cash-out price. We have not attempted to assess the extent to which P217A has actually removed system pollution.

2.18. It might be the case that flagging is not perfect and hence prices under the current arrangements may still be polluted to some extent. Further, it may be the case that the flagging methodology is not perfectly implemented, which will also impact the removal of system pollution from prices[9]. Therefore we only assess the impact that the change in price calculation has made under P217A.

2.19. In addition, we have used the same data around the volume of imbalances and actions taken by the SO for the live, counterfactual and alternative PAR price scenarios. In doing so we have assumed away any behavioural changes in the counterfactual and alternative PAR scenarios which could have occurred as a consequence of different cash-out prices.

2.20. This could limit the conclusions drawn from the analysis somewhat as it is likely some behavioural effects would occur in response to different price calculations. For example, if cash-out prices were sharper, parties may make additional effort to reduce or avoid imbalances. These would not be captured in the counterfactual and alternative PAR price series' calculated.

2.21. However, our findings are in line with what we would expect given the changes that have been implemented through P217A. We feel that the high-level conclusions drawn from the modelling are appropriate and that behavioural changes would not impact on the conclusions substantially.

2.22. For example, under a more marginal cash-out price, our modelling would show cash-out prices to be sharper. If parties in practice reduced their imbalances in response, the SO would need to take fewer actions to balance the system, reducing the cash-out price. But under both approaches we can conclude that there has been an increase in the incentive for participants to balance.

Wider Context and Interactions

2.23. It is important to note that our assessment of the efficiency of cash-out prices is made with respect to the current cash-out arrangements as defined by BETTA and subsequent modifications. The fundamental assumption underpinning BETTA is that energy is the same across the network, hence assuming there are no constraints to its delivery.

2.24. The preliminary analysis is an assessment of the impacts of P217A, and the efficiency of cash-out prices, relative to this assumption, rather than in comparison to any potential alternative balancing arrangements in the future, for example, under the European Target Model. We have considered interactions with the development of the European Target Model further in the Initial Consultation[10].

[9] The SO is required to report on the accuracy of the implementation of flagging. The accuracy to date is considered in further detail in the Section 3
[10] Ofgem (2012); 'Electricity Balancing Significant Code Review (SCR) - Initial Consultation'; www.ofgem.gov.uk/Markets/WhlMkts/CompandEff/electricity-balancing-scr/Documents1/Electricity%20Balancing%20SCR%20initial%20consultation.pdf

3. Changes to the cash-out price calculation under P217A

Chapter Summary

P217A was introduced in November 2009 and sought to improve the cash-out price calculation by removing system pollution. It proposed to do this by flagging actions in the price calculation taken by the SO to resolve system imbalances. The modification also introduced consistent treatment between different types of balancing actions in the price calculation.

To gain a sense of the number of periods in which P217A could have impacted on the cash-out price and the possible size of these impacts, we have investigated the volume of actions flagged under P217A and the number of periods where actions were taken to balance the system outside the balancing mechanism since P217A was implemented.

Our analysis suggests the distortion of cash-out prices due to system actions and the inconsistent treatment of balancing actions has fallen under P217A. Hence, P217A has significantly improved the extent to which the cash-out price reflects the cost to the SO of actions taken for energy balancing. This follows from observations that: (a) 28% of the volume of all balancing actions taken by the SO was flagged and; (b) in 40% of periods, the SO took one or more action outside the balancing mechanism to balance the system.

Modification P217A and changes to the price calculation

3.1. Modification P217 was raised in November 2007. The modification sought to remove system pollution from the calculation of cash-out prices, alongside other changes, to improve the efficiency of the main price calculation. It proposed to do this by introducing a methodology to identify which balancing actions had been taken to resolve system imbalances, such that their influence could be reduced.

3.2. Although actions taken for system balancing reasons are necessary for the overall balance of the system, these are not taken to resolve imbalances caused by parties varying from their contracted positions. Including these actions in the cash-out price reduces the extent to which the price reflects the costs to the SO of resolving energy imbalances in a given settlement period, and distorts the price as an incentive for parties to meet their contracted positions.

3.3. Modification P217A was raised as an alternative to P217. Both modifications were identical, with the exception that P217 proposed changing the PAR from 500

MWh to 100 MWh. Modification P217A was accepted as it was considered it would better facilitate the achievement of the Applicable BSC Objectives[11].

Key changes under Modification P217A

3.4. P217A introduced a number of changes to the calculation of the main cash-out price. The key changes are as follows:

3.4.1. The introduction of ex-ante flagging by the SO of Bid-Offer Acceptances (BOAs) in the Balancing Mechanism (BM) that were taken to resolve system imbalances and transmission constraints;

3.4.2. The disaggregation of Balancing Services Adjustment Data[12] (BSAD) (both system and energy balancing services) into individually priced actions. These would subsequently also be included in the flagging process alongside BOAs;

3.4.3. The inclusion of Continuous Acceptance Duration Limit (CADL) actions[13] and Emergency Instructions in the flagging process, and;

3.4.4. Introduction of classification and replacement price, where a flagged action retains its original price if it was 'in-merit'[14]. Actions within the price calculation that are 'out-of-merit' are assigned a replacement price, based on the price of in-merit actions using the Replacement Price Average Reference[15].

3.5. We published an impact assessment (IA) that informed our decision to approve P217A[16]. This IA considered the extent to which cash-out prices were polluted before the introduction of P217A, and the potential impact of the modification on cash-out prices. Its key conclusions are captured in Annex 3.

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[11] Ofgem (2008); ibid

[12] Balancing Services Adjustment Actions are balancing services procured by the SO outside the balancing mechanism. These actions are included as individual actions in the cash-out price calculation using Balancing Services Adjustment Data (BSAD)

[13] Bid or offer acceptances which last less than 15 minutes. Before P217A was implemented, these were tagged rather than flagged

[14] Flagged actions are considered 'in merit' and when they are less expensive than the most expensive unflagged action and 'out-of-merit' where they are more expensive than the most expensive energy action

[15] Volume of 'in-merit' balancing actions on which the replacement price is calculated as a volume weighted average. Under the current arrangements this is 100MWh

[16] Ofgem (2008b): 'BSC Modification Proposal P217 'Revised Tagging Process and Calculation of Cash-out Prices'';
www.ofgem.gov.uk/Markets/WhlMkts/CompandEff/CashoutRev/Documents1/P217%20IA_FINAL.pdf

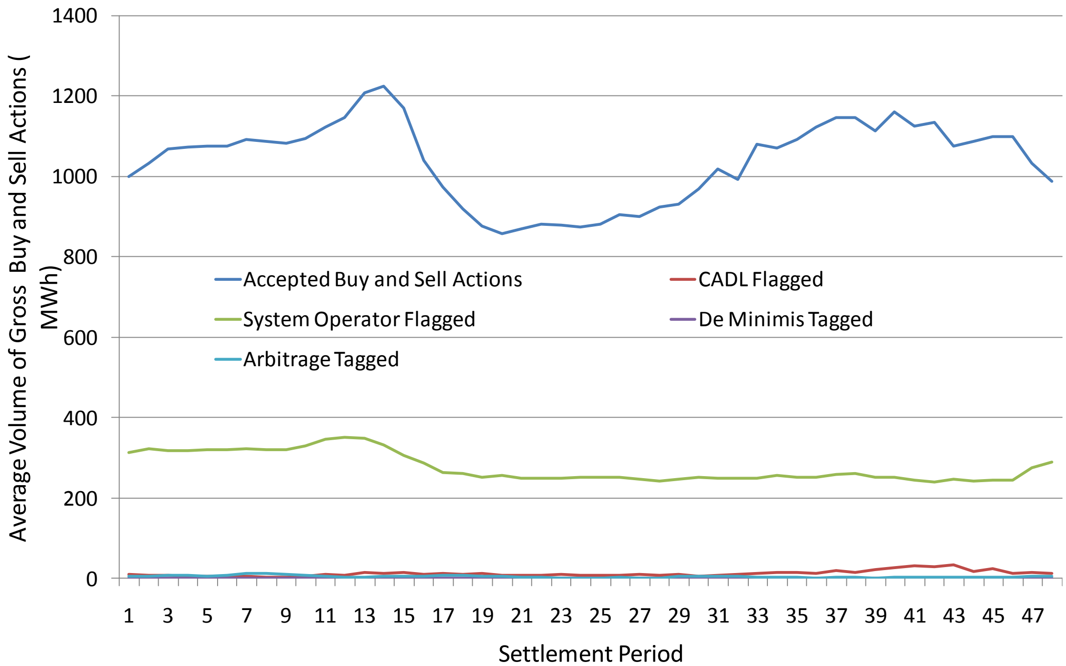
3.6. The alternative proposal was preferred to the original as it was considered that there was not a case for reducing PAR at that time as it could be detrimental to competition. Further in the absence of experience of operating under the new pricing methodology, it could not be proven that reducing PAR would lead to more efficient balancing of the system. However, it was noted that the value of PAR should be kept under review.

3.7. Modification P217A went live on 5th November 2009. The following section considers the size of the impact of the changes under P217A over the two year period assessed.

Implementation of P217A: Experience of Flagging and Tagging

3.8. The SO takes balancing actions to either increase generation or decrease demand (buy actions), or to decrease generation or increase demand (sell actions). In a given settlement period, the SO may take actions in either direction, but will take more of either buy or sell actions depending on the overall system length.

Figure 3.1 – Average amount of balancing actions flagged or tagged per settlement period relative to all balancing actions



3.9. On average, around 28% of the volume of all balancing actions taken by the SO over the two year period was either first stage flagged or tagged[17]. The majority of these were flagged as having been taken to resolve system constraints (27%).

[17] First stage flagging refers to actions flagged or tagged before classification, whereas second stage flagged identifies actions that are still flagged after classification and are hence 'out-of-merit'

The remainder of flagged or tagged actions were predominantly either CADL flagged or arbitrage tagged, with only a relatively small proportion De Minimis tagged.

3.10. Over the two year period, more sell actions were flagged or tagged on average (38%) than buy actions (16%). This is because export constraints are more common than import constraints[18]. Export constraints are resolved by a sell action in the constraint group, whereas import constraints are resolved by a buy action in the constraint group. Only the action taken within the constraint group is flagged, increasing the amount of flagged actions on the sell side relative to the buy.

3.11. Further, of the actions flagged, a greater proportion were considered 'out-of-merit' and assigned a replacement price on the sell side (60% of sell actions flagged) relative to the buy (40%).

3.12. Over the course of the day, the volume of flagged and tagged actions is seen to remain reasonably constant from the figure above. There were slightly higher proportions of actions flagged during the non-peak demand periods. In these periods, a higher proportion of the total electricity generated needs to be transferred across the system as there tends to be a larger spatial mismatch between demand and supply between regions. As such, system constraints are more likely to be an issue.

3.13. The rise in the amount of actions flagged at the start of the morning peak is a consequence of the switch from a particular set of constraints which tend to affect the system overnight, to a different set which tend to affect the system during the day.

3.14. A large volume of actions were flagged over the two year period assessed. Hence the introduction of flagging is likely to have had a significant impact on the pollution of cash-out prices. P217A has improved the extent to which prices reflect the costs to the SO of energy balancing, particularly in periods where the SO has taken action to resolve system constraints.

Accuracy of implementation of flagging methodology and price impacts

3.15. The impact of P217A on the removal of system pollution will depend on the ability of flagging to identify actions taken to resolve system constraints, and on how accurately this methodology is put into place. As discussed in Section 2, the preliminary analysis does not consider the extent to which flagging has removed system pollution. However, some information is available regarding the accuracy with which the flagging methodology has been implemented.

[18] Export constraint refers to constraints in allowing electricity to flow out of an area, whereas import constraints refer to constraints in allowing electricity to flow into an area

3.16. The SO is responsible for flagging which balancing actions are taken for system or energy reasons. However, flagging is complicated by the fact that a single action can be taken for more than one reason. For example, if the system is long and there is an active constraint, both the energy and system imbalance can be solved by reducing the output of a single generator behind the constraint boundary. In this incidence, the action taken by the SO would be flagged but was taken to resolve both imbalances.

3.17. The SO has produced two reports assessing the accuracy of the implementation of flagging to date[19]. In these reports, actions flagged in real time are compared to a counterfactual set of flagged actions to establish their accuracy. The counterfactual set of flags are determined by the SO the day after the given settlement period and identify (in a separate process to flagging for the purpose of calculating the cash-out price) which actions were taken to resolve constraints. It is important to note there may be differences between the two sets of flags for reasons other than mis-flagging[20].

Table 3.1 – Accuracy of implementation of flagging methodology by the SO: November 2009 to April 2011

	Actions with live but no counterfactual flag	Actions with counterfactual but no live flag	Number of periods tested for materiality[21] (number with non-zero impact)	Maximum price impact of corrected flags
Nov '09 to Apr '10	1.6%	1.0%	195 (4)	SSP -£2.37/MWh (6%)
May '10 to Apr '11	0.5%	0.3%	66 (5)	SSP -£1.16/MWh (4%)
Total	0.9%	0.6%	259 (9)	

3.18. In less than 2% of all periods, at least one of the live P217A flags differed from the counterfactual set of flags. Of the periods where flags differed, in only 9 periods this difference is calculated to have had a material effect on prices. Further, the impact when material was small, with the largest reducing SSP by around 6%.

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[19] National Grid (2010):' Report on the accuracy of the system management action flagging methodology: Report covering November 2009 to April 2010': www.nationalgrid.com/NR/rdonlyres/0C22610E-C8D4-4DAF-955D-2CE77D00BADB/41912/P217FlaggingAccuracyReport.pdf; and National Grid (2011):' Report on the accuracy of the system management action flagging methodology: Report covering May 2010 to April 2011 inclusive': www.nationalgrid.com/NR/rdonlyres/BBDBD374-634A-4FAC-9AAE-8AF67A0A98B8/47733/P217AFlaggingAccuracyReport.pdf

[20] See first flagging methodology report (National Grid, 2010: ibid; page 6) for further detail

[21] A period with a material impact is defined in the reports as a period where, for example, a flag has not been applied to a high priced action as being for constraint resolution

3.19. It appears flagging by the SO has been implemented to a high degree of accuracy by the SO, in so far as these flags differ from the counterfactual.

Disaggregating BSAD in cash-out price calculation

3.20. Disaggregating BSAD is also likely to have had a significant impact on the cash-out price calculation. Under the P217A modification, BSAD actions are disaggregated and are subject to flagging and tagging in a manner consistent with the treatment of other balancing actions in the price calculation.

3.21. This change could have impacted on the main cash-out price in around 43% of periods, where at least one BSAD action was taken in the direction of the net imbalance[22]. In these periods an average 2.1 BSAD actions were taken per period. Hence the disaggregation of BSAD, and the inclusion of BSAD taken to resolve system constraints in the price calculation, is could have impacted on the price calculation in these periods.

3.22. The changes to the treatment of BSAD could have had different impacts on the cash-out price in different periods. Where there is only one BSAD action in a given period, the changes under P217A may have had no impact if this action was taken for energy reasons. If a single BSAD action was taken in a given period for system reasons, or more than one energy or system BSAD action is taken, P217A could have impacted on cash-out prices either directly (where BSAD actions interact with actions included in the PAR) or indirectly (through the inclusion of system BSAD in the price calculation).

3.23. The impacts of this change in methodology could have both made cash-out prices more or less spiky in a given settlement period. The impacts, both in terms of size and direction would be determined by the type of BSAD action (system or energy), its price and how these relate to other actions taken by the SO to resolve imbalances through the BM.

[22] For example, if the system is short, a BSAD buy action is taken to help balance the system

4. Impact of P217A on cash-out prices and balancing

Chapter Summary

The distortion of cash-out prices due to system actions has fallen under P217A and the consistency of treatment of different types of balancing actions in the price calculation has improved. Hence since P217A was implemented, cash-out has provided a more efficient price signal as the extent to which prices reflect the costs to the SO of energy balancing has improved.

P217A had a larger impact on cash-out prices in particular periods (for example, where the SO took expensive actions to resolve system constraints) but did not have an impact in all periods.

On average, the overall impact of P217A has been to make prices less sharp. However, this impact has come as a consequence of improving the efficiency of cash-out prices. It is difficult to conclude whether there has been an impact on balancing behaviour and the volume of imbalances since P217A was introduced.

P217A has also reduced cash-out risk for market participants by reducing the volatility of the main price. Volatility is not necessarily bad, as cash-out prices should be able to rise to reflect scarcity on the system. P217A has removed volatility caused by pollution of cash-out price.

Impact of P217A on average level of the main cash-out price

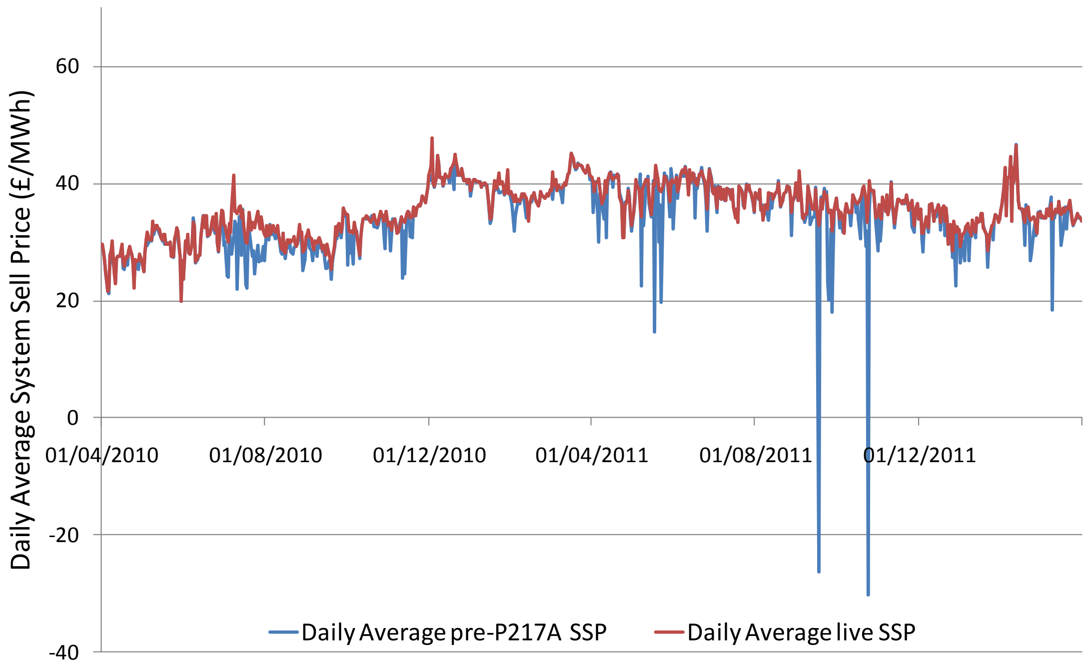
Impact of P217A on daily average cash-out prices across the two year assessment period

4.1. Modification P217A sought to improve the cash-out price calculation through the removal of system pollution and improving the consistency treatment of actions taken by the SO to balance the system. As such, the P217A could have had an impact on cash-out prices in settlement periods where the SO took a system balancing action or a balancing action outside the BM.

4.2. Figures 4.1 and 4.2 present the daily average SSP and SBP over the two year period assessed. From these it is evident that P217A did not have an impact on the cash-out price in all periods.

4.3. This is because system constraints do not affect the system and the SO does not contract ancillary balancing services in all settlement periods. Hence the flagging of actions and the change in treatment of BSAD actions, both of which drive a difference in prices between live and pre-P217A scenarios, will not affect every period. However, where P217A did have an impact, it appears that this impact could have been significant[23].

Figure 4.1 – Daily average SSP over time under live and pre-P217A



4.4. For both the SSP and SBP, cash-out prices appear to become less spiky under P217A relative to the pre-P217A scenario. Flagging actions that have been taken to resolve system imbalances reduced the influence of these actions on the cash-out price. These actions may be repriced based on less expensive actions and depending on the other actions taken to balance the system, may no longer enter the price calculation under P217A.

4.5. Disaggregating BSAD on the other hand has had an ambiguous impact on cash-out price, potentially increasing or decreasing cash-out prices in different settlement periods[24].

4.6. From these figures, it appears that P217A had a more pronounced impact on SSP in comparison to SBP in particular settlement periods. When the system is short, SBP can rise significantly relative to the average SBP, to reflect stress on the system caused by energy imbalances. This would increase the cash-out price under both the live and pre-P217A scenarios.

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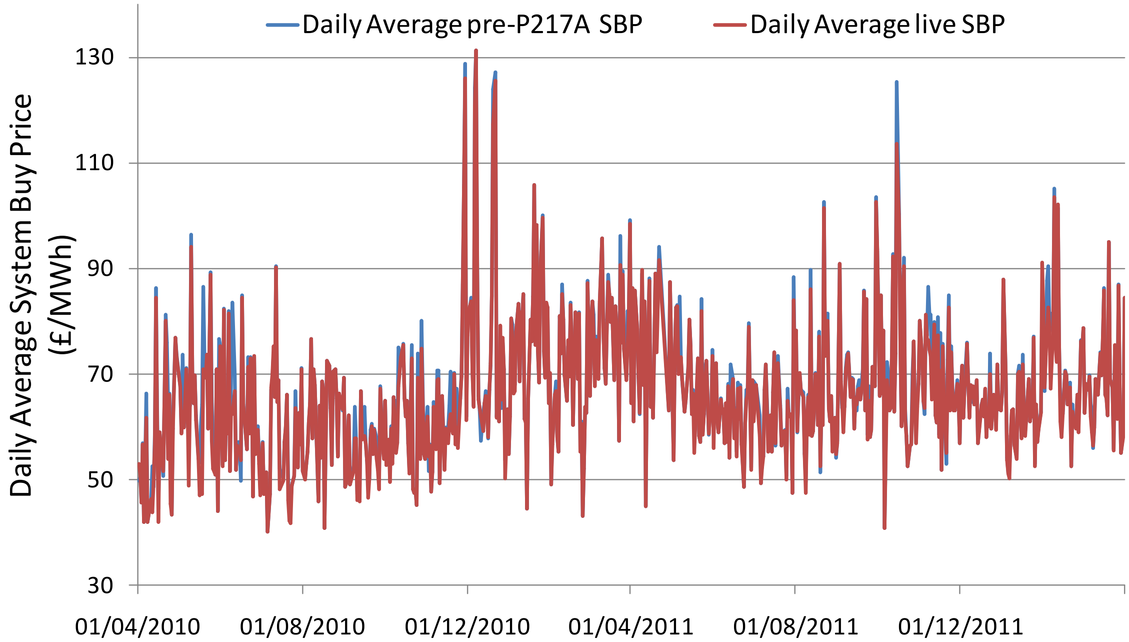
[23] Although Figures 4.1 and 4.2 do not depict the impact for individual settlement periods, the influence of P217A on individual periods will influence the daily average, and hence their impact will be apparent even when looking at daily average cash-out prices
[24] For examples of how the changes to the price calculation under P217A have impacted on the cash-out price, see Annex 4

Figure 4.2 – Daily average SBP over time under live and pre-P217A



4.7. However, when the system is long, prices are more likely to spike under the counterfactual at times of stress due to system constraints. This is because in certain settlement periods when the system is short, highly priced offers can be accepted but not flagged. For example, some reserve products, like short-term operating reserve (STOR), are utilised through the BM. These offers could be more expensive than other actions taken to resolve energy imbalances, but are not being used to manage constraints and hence are not flagged.

4.8. Hence P217A has improved the extent to which the cash-out price reflects the costs to the SO of energy balancing. It has removed price spikes caused by actions taken to resolve system imbalances. However, cash-out prices are still able to rise to reflect scarcity on the system as a consequence of energy imbalances, providing an incentive for parties to balance their positions or invest in capacity with which the SO can balance the system.

4.9. The two example settlement periods in the following box show the impact of P217A on removing system pollution and a where the cash-out price was able to still rise to reflect scarcity on the system under P217A.

Implementation of flagging and tagging: Example Periods

High wind generation and low demand

High wind generation located behind constraint boundaries that corresponded with periods of low demand was a major issue in September 2011. In the early morning example below, a number of extremely negatively priced bids were accepted by the SO to balance the system in a period of low demand. In this particular period, the system was long by around 144MWh.

The negatively priced bids accepted by the SO were located in the North East of Scotland, behind a constraint boundary. The constraint arose due to an outage of the Blyth – Eccles – Stella West 2 circuit and the level of plant output in Scotland.

Figure 4.3 – Sell actions taken by the SO in settlement period 10 on 17/09/2011 and calculation of the cash-out price

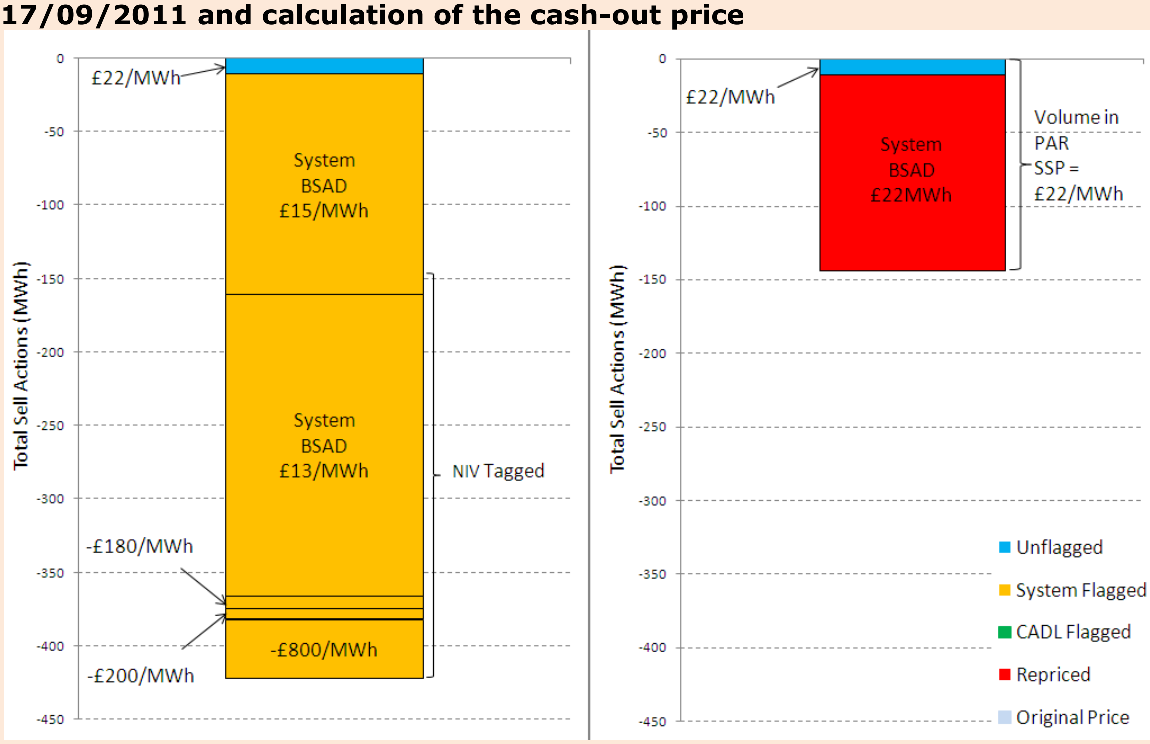


Figure 4.3 shows the sell actions taken to balance the system, and how these are used to calculate the cash-out price. Actions are shown in ranked order, grouped by price. The two different price stacks represent the actions before (left) and after (right hand column) reclassification and Net Imbalance Volume (NIV) tagging.

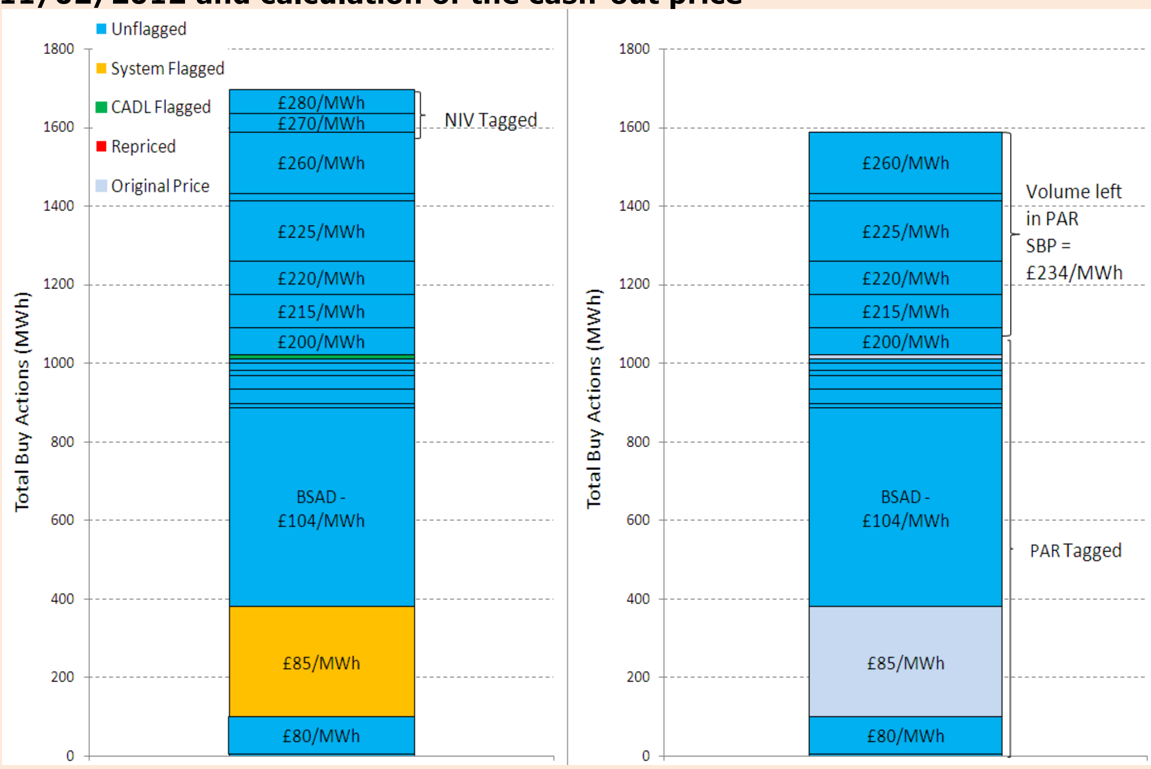
Under the P217A calculation, the negatively priced bids were flagged as having been taken to resolve a system constraint. As these were the most expensive sell actions, these were NIV tagged away. However, one BSAD action was repriced based on other actions in the balancing mechanism. The SSP in this period was £22/MWh. Applying the methodology pre-P217A reduces the SSP to £-522/MWh, as negatively priced bids entered PAR, both unflagged and not repriced.

Implementation of flagging and tagging: Example Periods

Demand control actions taken in response to significant generation outages

In period 22 on 11th February 2012, 3.5GW of generation was lost in the early hours of the morning and very cold weather gave rise to high demand. To balance the system, the SO used around 1.7GW of short-term operating reserve (STOR); emergency assistance was provided over the Interconnector, and; demand control was issued on 5 Distribution Network Operators. In total, buy actions up to £280/MWh were taken and the system was short by 1540MWh. The SBP under P217A in the period was £234/MWh.

Figure 4.4 – Buy actions taken by the SO in Settlement Period 22 on 11/02/2012 and calculation of the cash-out price



There are very few actions which enter the price calculation that are flagged in this period. Given that the large imbalance on the system in this period was caused by a severe reduction in generation and high demand, rather than by a system constraint, the cash-out price rises significantly to reflect the scarcity of generation across the entire system. The SBP under pre-P217A would have been £238, showing that under P217A, the cash-out price is still able to rise to reflect energy scarcity.

Average impact on prices over the two year assessment period: across periods where P217A had a significant impact

4.10. P217A had a significant impact on the cash-out price but not in all settlement periods. In fact, P217A had a significant impact in 35% of settlement periods[25].

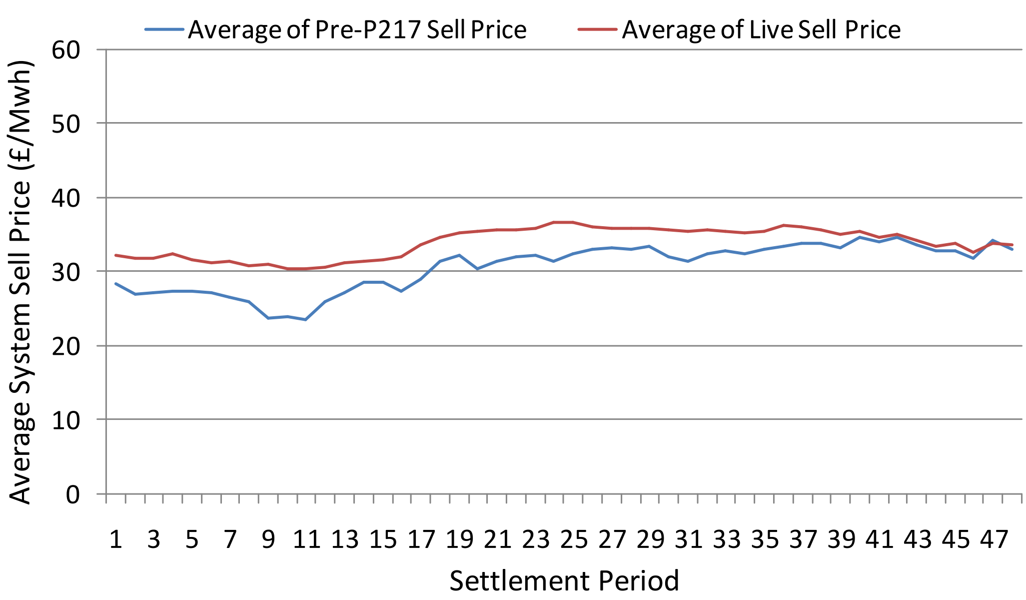
4.11. When P217A did have a significant impact, it made cash-out prices less sharp on average, when the system was both long and short. Under P217A, SBP was 4.8% lower relative to the counterfactual in these periods, and SSP was 7.7% higher.

4.12. When the system was long, P217A had a significant impact on the cash-out price in 37% of periods. Whereas when the system was short, P217A had a significant impact on the cash-out price in 29% of periods.

Table 4.1 – Average main cash-out price in periods where P217A had a significant impact across the two-year assessment period

	Pre-P217A SBP	Live SBP	Pre-P217A SSP	Live SSP
Average main cash-out price (£/MWh)	£77.25	£73.57	£29.79	£32.10
% Difference to pre-P217A counterfactual		-4.8%		+7.7%

Figure 4.5 – Average SSP per settlement period when system long across periods where P217A had a significant impact

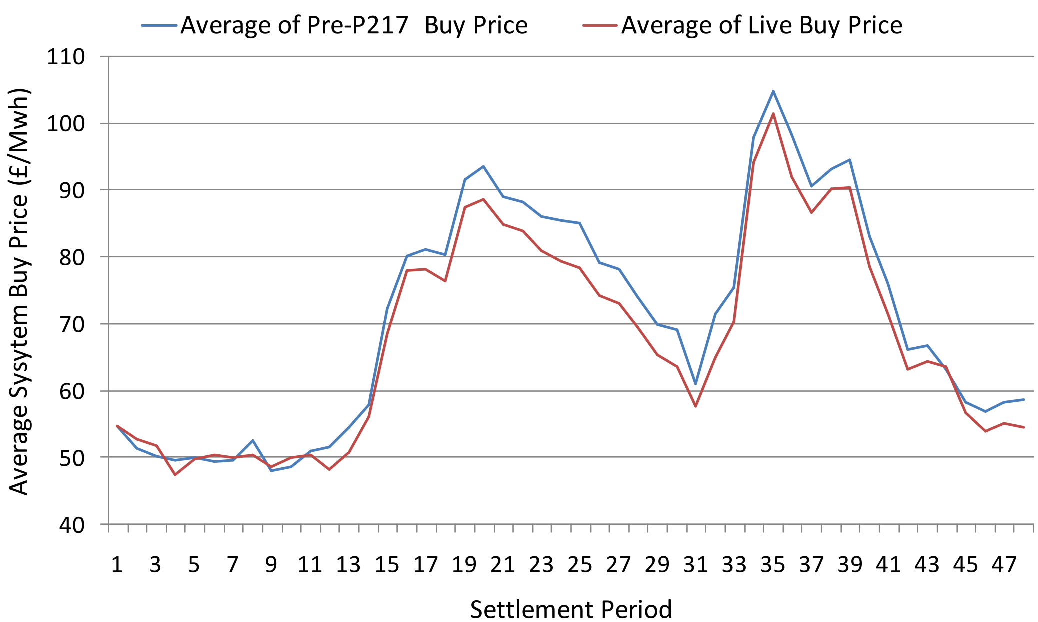


[25] A significant impact is defined as greater than £0.01; smaller changes are omitted as they may be due to different models being used to generate live and counterfactual scenarios

4.13. When the system was long, the largest impact of P217A was overnight in settlement periods 1-12. The price difference was greater in these periods as system constraints were more likely to be an issue, as there was less demand to absorb excess generation in constrained areas. Hence the SO needs to take more actions to resolve system constraints, leading to more flagged and potentially repriced actions.

4.14. Further, a higher proportion of total balancing actions were BSAD actions in these periods. This could be because as the SO may have been able to take more balancing actions in advance at lower cost in these periods, as constraints over night were more predictable. The disaggregation of these BSAD actions would have had an impact on the price, although this would have been ambiguous between settlement periods.

Figure 4.6 – Average SBP per settlement period when system short across periods where P217A had a significant impact



4.15. When the system was short, P217A had a larger impact on SBP during peak-demand periods. This is because there is a higher proportion of buy balancing actions were BSAD in these periods. This may reflect that the SO is able to contract a greater level of balancing services in advance at a lower cost, in anticipation of higher demand during these periods.

Average impact on prices over the two year assessment period: across all settlement periods

4.16. P217A has had a significant impact on the cash-out prices in particular periods. However, when averaged across all periods, the overall impact of P217A on cash-out prices reduces significantly. P217A reduced SBP by 1.6% and increased SSP by 3.8%. As noted above, this is because P217A does not have an impact in all periods.

4.17. Hence P217A has improved the efficiency of the calculation of cash-out prices. It has done this through flagging actions taken to resolve system constraints and ensuring consistent treatment between balancing actions in the cash-out price calculation.

Table 4.2 – Average main cash-out price across all periods in the two-year assessment period

	Pre-P217A SBP	Live SBP	Pre-P217A SSP	Live SSP
Average main cash-out price (£/MWh)	68.60	67.53	33.93	35.23
% Difference to Pre-P217A counterfactual		-1.6%		+3.8%

4.18. P217A has made cash-out prices less sharp. However, it has done so as a consequence of improving the extent to which the cash-out price reflects to costs to the SO of energy balancing. Hence while P217A may not provide a stronger signal for participants to invest in additional flexible capacity compared to the previous arrangements, it appears to provide a more accurate signal.

Periods where prices moved oppositely to the overall average impact

4.19. Although on average prices were less spiky under P217A, this was not the case in every period. In around 28% of settlement periods where live prices significantly diverged from the counterfactual, prices shifted in the opposite direction to the average. In these periods, P217A either increased SBP or decreased SSP relative to the counterfactual.

4.20. In these periods, the average price difference was relatively small: SBP was £2.76/MWh higher and SSP was £1.21/MWh lower. However there are periods where we observe a larger price difference.

4.21. There are a number of reasons why this could occur. First, BSAD actions taken to resolve system constraints enter the price calculation under P217A; if these actions have a high associated cost, these actions could replace cheaper actions previously included in the price calculation. Second, and similar to the first, CADL actions are also now flagged and included in the price calculation; if these have a high associated cost, they also could replace relatively cheap actions in the calculation. Finally, disaggregating energy BSAD actions may replace some actions in the price calculation with more expensive actions previously not included.

Periods where cash-out prices were significantly less spiky due to the type of balancing actions taken

4.22. Under P217A, on average prices have become less spiky. However, there are special circumstances associated with the P217A cash-out price calculation methodology where cash-out prices may become even less spiky relative to pre-P217A, due to the type of balancing actions taken in the settlement period.

4.23. In a given settlement period, it could be the case that all actions taken by the SO to balance the system were flagged or tagged. With no 'pure' energy actions, all these actions were assigned a replacement price based on the reverse price.

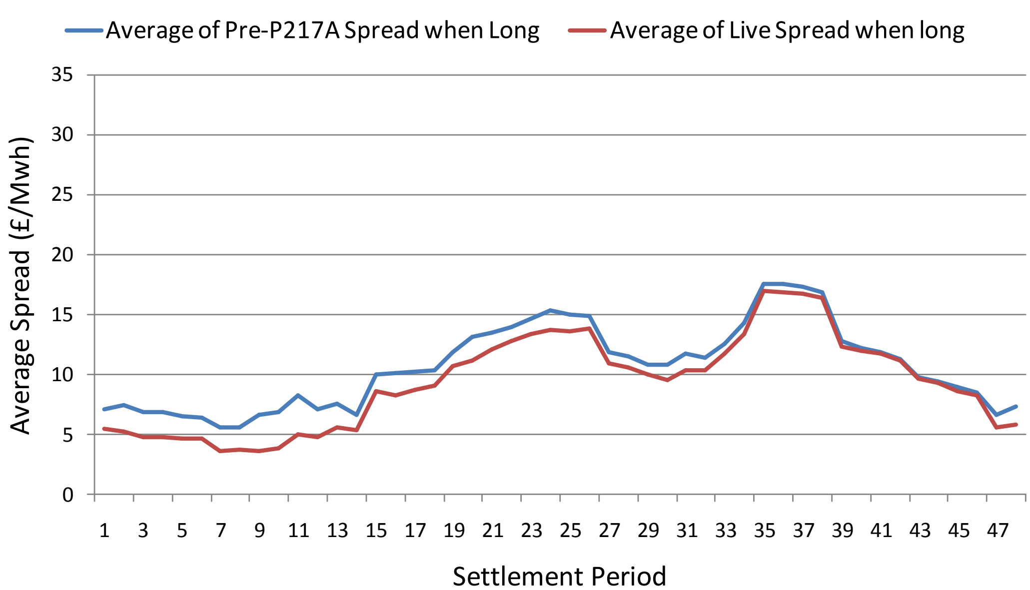
4.24. Given that the reverse will always be less expensive than the main price, the cash-out price under these circumstances is less spiky on average relative to the average main price across all settlement periods under P217A, and even less spiky relative to the pre-P217A counterfactual. However, this is the case in only very few periods: less than 2% and 1% of all periods when the system is long or short respectively.

4.25. A further example when the price calculation only consists of BSAD actions. The SO takes BSAD actions where they offer a cheaper alternative to services in the balancing mechanism. Hence where the price calculation only consists of BSAD actions, the cash-out price is less spiky relative to both the average main cash-out price across all periods under P217A, and counterfactual scenarios. Again this only occurs in a minority of periods; around 7% and 2% of all settlement periods when the system is short or long respectively.

Impact of P217A on the spread between the main and reverse cash-out prices

4.26. Spread is the difference between the main and reverse cash-out price. Spread is important for market players as ex-ante the overall system imbalance is unknown. Hence parties cannot anticipate with certainty which settlement price they will face. Spread between the main and reverse price therefore represents part of the uncertainty for parties around the cash-out price.

Figure 4.7 – Average spread per settlement period when system long

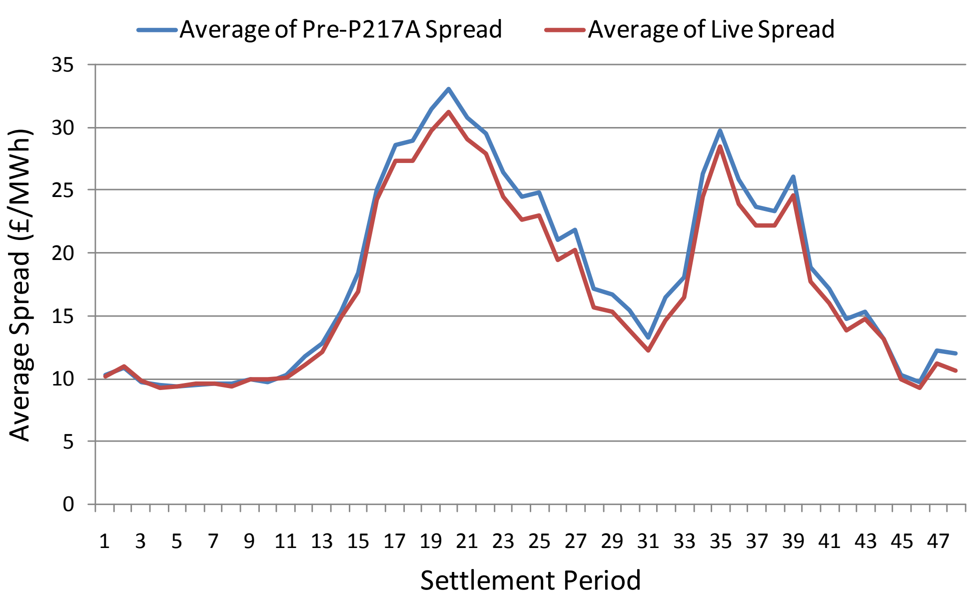


4.27. P217A has reduced the spread between main and reverse price when the system was both short and long. This is because the main price under P217A was less sharp on average under both conditions and the reverse price remained unchanged by P217A.

4.28. P217A has therefore reduced the risk for all market participants by reducing the spread of cash-out prices that they are potentially exposed to.

4.29. In addition, P217A has reduced these spreads by reducing the influence of actions flagged as taken for system reasons, and through improving the consistency of treatment of different balancing actions in the price calculation. Actions taken to resolve system constraints previously created additional risk in the cash-out price as a consequence of system pollution. Hence under P217A, the reduction in the influence of system pollution has improved the efficiency of the cash-out price, and the spread between the main and reverse price.

Figure 4.8 – Average spread per settlement period when system short



Impact of P217A on the volatility of main cash-out price

4.30. Volatility of the main cash-out price represents a further uncertainty faced by parties as a consequence of cash-out: it represents how variable the main cash-out price is. Whilst spread represents uncertainty around the direction of the overall market imbalance, volatility represents how high or low cash-out prices could rise or fall. There is a greater risk of an extremely expensive price under higher volatility.

4.31. P217A has reduced the standard deviation, and coefficient of variation, of cash-out prices when the system was both short and long. The variation of the SSP appears to have reduced to a greater extent than of SBP. This is because P217A has had a greater impact on SSP and in particular, removing the influence of actions taken to resolve system constraints when the system is long.

4.32. It should be noted that changes in the volatility of the cash-out price represent an improvement when prices are able to reflect the underlying fundamentals of the market. Cash-out prices should be able to rise to reflect energy imbalances in periods of system stress and hence provide an efficient incentive for participants to balance or offer balancing services.

4.33. P217A has curbed peak prices relative to the counterfactual in periods where the SO had taken actions to resolve system constraints. As such, P217A has reduced volatility in the cash-out price caused by system pollution. This has therefore improved the signal that cash-out provides at times of scarcity on system.

Table 4.3 – Variation in the main cash-out price across the two year assessment period

	Pre-P217A SBP	Live SBP	Pre-P217A SSP	Live SSP
Standard deviation (£/MWh)[26]	26.09	25.33	10.63	5.56
Coefficient of variation[27]	38%	38%	31%	16%

Net and gross imbalance volumes

4.34. Cash-out prices on average have become less sharp under P217A, potentially reducing the incentive for participants to balance. However, it is uncertain whether balancing behaviour has changed as a result of P217A.

4.35. It is difficult to compare whether net and gross imbalances have changed pre and post P217A, as it is difficult to model what the imbalances would have been under a pre-P217A price calculation, but over the P217A live period. Further it is difficult to compare imbalance volumes before and after P217A was introduced, as other factors would have impacted over time, for example, improvements in imbalance forecasting or changes to the generation mix.

Net imbalance volume (NIV)

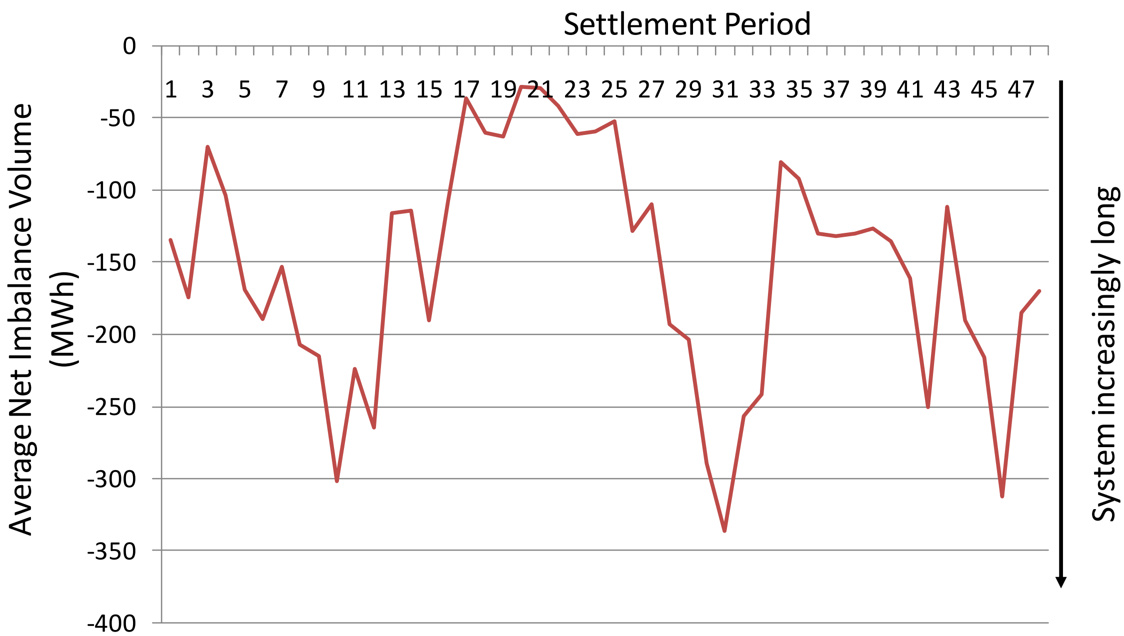
4.36. Over the period assessed, the system was on average around 153 MWh long across all settlement periods. Further, the system was long in around 69% of settlement periods.

[26] Standard deviation is a measure of how much variation there is from the average value
[27] Coefficient of variation is a measure of volatility and is calculated as the ratio between the standard deviation against average price

4.37. The tendency for participants to be long is a rational response to the higher risk faced by market participants from SBP relative to SSP. This is because SBP is less limited in the extent to which it can spike in periods of where the system is constrained. Hence parties tend to go long to hedge against this asymmetric risk.

4.38. The system also tended to be long on average over the course of the day, becoming less long in peak demand periods in which proportionally more periods were short. The incidence of short periods increases in the peak demand periods in part because contracting rigidities not being able to accommodate a relatively defined demand peak, particularly in winter.

Figure 4.9 – Average net imbalance volume per settlement period



Gross imbalance volume

4.39. Trends observed in the NIV are reflected in gross imbalances over the period[28], for example, on average long imbalances per settlement period tend to be larger than short imbalances over the course of the day.

4.40. With less spiky cash-out prices under P217A and a possible reduction in the incentive to balance, we could expect that in general the gross imbalances of parties would increase with the expectation of facing less sharp cash-out prices for their

[28]Gross imbalance volume refers to the difference between parties' contracted and metered positions; net imbalance volume focuses only on the actions that the SO takes to balance the system

imbalances, all other things being equal. However, if we compare gross imbalances before and after P217A was introduced, it appears that gross imbalances have decreased on average after P217A was introduced.

Table 4.4 – Average Gross Imbalance Volumes

	Gross short imbalance (MWh)	Gross long imbalance (MWh)	Total gross imbalance (MWh)
Period pre-P217A[29]	318	541	860
Period post P217A	321	478	799

4.41. This could reflect that less spiky prices under P217A reduce the higher risk of SBP. Hence under P217A parties could have reduced the extent to which they go long to hedge against being exposed to the SBP. However, as noted it is difficult to compare imbalance volumes across different time periods. As such, further analysis would be required to account for other factors that could have affected imbalance volumes over this period.

Impact of P217A on imbalance charges and RCRC

4.42. Cash-out prices, and associated imbalance charges, are not a cost recovery mechanism. Instead, the difference between imbalance charges paid by parties that are short and those paid to parties who are long, are redistributed through RCRC.

4.43. P217A has made cash-out prices less spiky and as such, has reduced RCRC relative to the counterfactual. This is because those with a short imbalance pay a lower SBP on average under P217A, and those with a long imbalance receive a higher SSP.

4.44. On average, smaller parties (parties A-C in Table 4.5) face higher imbalance charges, both through SSP and SBP per unit of credited energy, relative to larger parties (parties D and E in table 4.5).

4.45. This may be because some smaller parties are less able to, or have less experience of, forecasting their own imbalances and those of the entire system. Further, they have smaller portfolios across which they can diversify the risk of imbalance. This in turn increases the risk associated with cash-out for these parties, and may incentivise them to go longer to hedge against the higher risk of SBP.

4.46. As smaller parties encounter larger imbalance charges per unit of credited energy, before P217A was introduced, the pollution of the cash-out price caused by system actions placed a larger burden on smaller parties. As such, improving the efficiency of cash-out prices through P217A has benefitted smaller parties relatively

[29] Note: Pre-P217A refers to gross imbalance over one-year period from beginning April 2008 to end March 2009

more than larger parties, although the differential impact is small when viewed across all credited energy over the two year period.

Figure 4.10 – Total imbalance charges under live and pre-P217A scenarios

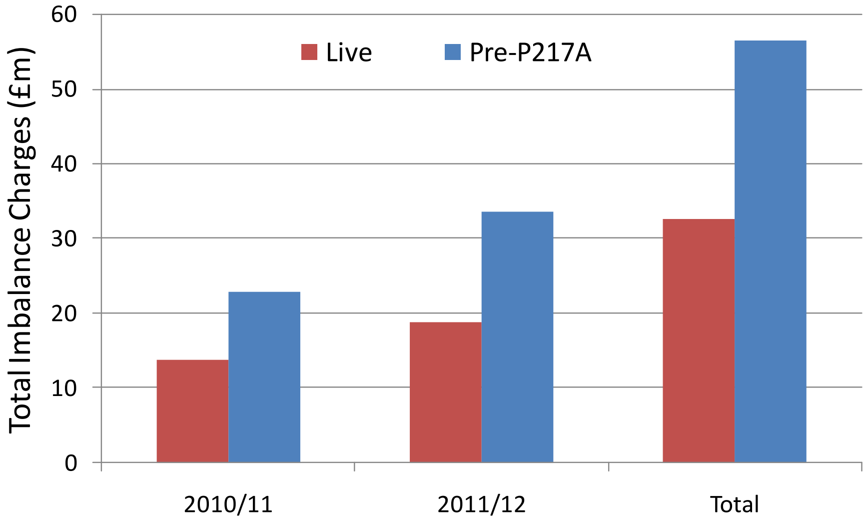


Table 4.5 – Imbalance charges per unit of credited energy split by party size for live and pre-P217A scenarios

Party size[30]	SSP imbalance charges (£/MWh)		SBP imbalance charges (£/MWh)	
	Pre-P217A	Live	Pre-P217A	Live
A	-0.37	-0.38	0.66	0.66
B	-2.17	-2.23	1.74	1.73
C	-1.06	-1.09	0.74	0.74
D	-0.47	-0.48	0.53	0.53
E	-0.42	-0.43	0.49	0.48

[30] Party size is defined according to Elexon's funding share; as used the P217A IA; A represents a party which has 0% funding share; B represents parties with 0-0.5%; C represents parties with 0.5-1%; D represents parties with 1-3.5% and E represents parties with funding share of 3.5% and above

5. Impact of more marginal price calculation on cash-out prices

Chapter Summary

One of our key concerns with the current balancing arrangements is that dampened prices reduce the incentives to invest in flexible capacity. One possible solution is to make cash-out prices sharper by making the price calculation more marginal. Before P217A this was deemed problematic due to system pollution. P217A has reduced system pollution and could therefore allow the possibility of implementing more marginal pricing. As part of the preliminary analysis, we have investigated some of the possible impacts of a more marginal cash-out price.

Under a marginal cash-out price, prices become sharper: the main price when the system is short would be 15% higher, and the price when the system is long would be 5% lower. This increases the incentive for participants to balance their positions.

Further, the sharpening of prices under a more marginal price would not be uniform across settlement periods; the difference would depend on the most expensive action taken to balance the system in a given settlement period. As such, to move to a more marginal price, we would need to be confident that the current flagging and tagging methodology were appropriate.

Introducing a more marginal cash-out price would also have other implications. Cash-out risk for market participants would increase; total imbalance charges redistributed through RCRC would increase and; the price impact of possible mistakes in the implementation of flagging would increase.

Average volume of actions entering the price calculation

5.1. The volume of PAR determines how close the cash-out price is to the cost of the marginal action taken by the SO to balance the system. One option that we intend to consider as part of the SCR is the possibility of making the cash-out price sharper by making the price calculation more marginal. This section discusses some of the impacts associated with a more marginal cash-out price[31] and forms an initial tranche of evidence on which we hope to build over the course of the SCR.

5.2. Cash-out prices are currently based on the volume weighted average of the most expensive 500MWh of actions taken by the SO due to concerns around the influence of system pollution.

[31] We have used a PAR value of 1MWh in our modelling to simulate a marginal cash-out price

5.3. In practise, on average the volume of actions on which the price calculation is based is significantly below the current maximum volume of 500MWh. In these cases, the cash-out price is calculated as a weighted average of all qualifying actions taken by the SO in the direction of the overall imbalance.

Table 5.1 – Average PAR over the two year assessment period, and proportion of settlement periods with a PAR below different volumes

System direction	Average PAR (MWh)	Proportion of all settlement periods with a PAR at or over:		
		250MWh	100MWh	1MWh
Long	-289	56%	83%	100%
Short	218	37%	69%	100%

5.4. However, PAR can vary significantly between settlement periods[32], and 10% and 18% of periods when short and long respectively had a PAR of 500 MWh. The number of periods affected by a change in PAR increases as PAR becomes more marginal. Almost all periods would be affected if PAR was based on the marginal action.

Impact of more marginal price on average main cash-out price

5.5. A smaller PAR would make cash-out prices sharper, increasing the incentive for parties to balance. When the system is short, changing PAR affects the average SBP across all settlement periods, with the largest impact where SBP is highest under live prices. In these periods, the SO is taking more expensive actions to balance the system as the system tends to be shorter, increasing the marginal price relative to a price weighted across a larger volume of actions.

Table 5.2 – Average SBP under alternative PAR scenarios when system short

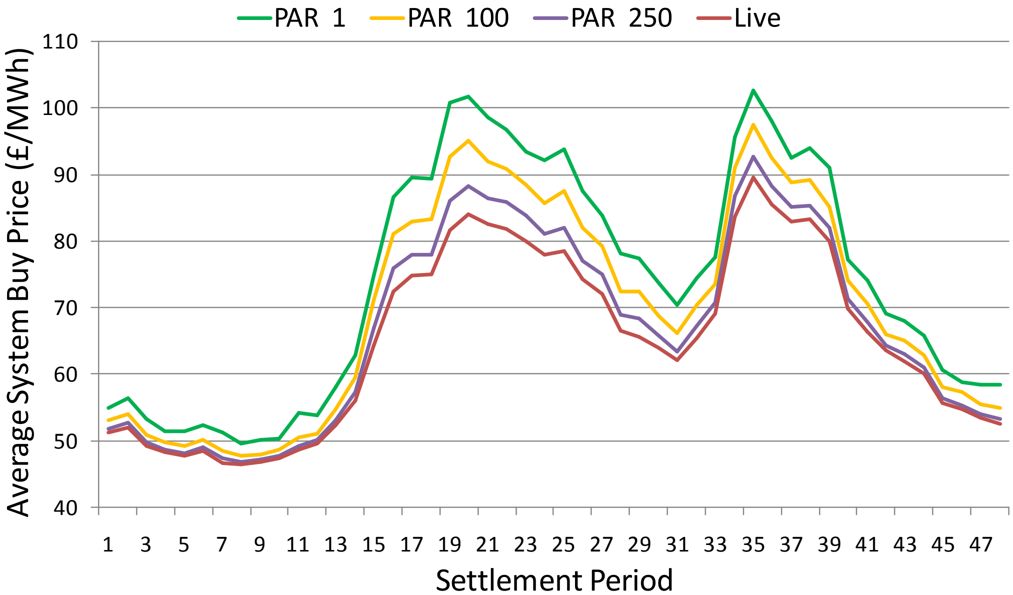
	SBP Live	SBP PAR 250 MWh	SBP PAR 100 MWh	SBP PAR 1 MWh
Average price	£67.53	£69.64	£73.02	£77.38
% Difference to PAR 500 MWh		3%	8%	15%

Table 5.3 – Incidences of high SBP under alternative PAR scenarios

Number of periods where SBP is greater than:	SBP Live	SBP PAR 250 MWh	SBP PAR 100 MWh	SBP PAR 1 MWh
£100/MWh	864	1081	1424	1792
£200/MWh	34	59	108	169
£500/MWh	0	4	7	8

[32] For example, the standard deviation around the average PAR when long is from -454MWh to -124MWh, which is significant considering PAR cannot rise above -500MWh

Figure 5.1 – Average SBP per settlement period under different values of PAR when system short



5.6. On average, SBP under a PAR volume of 1MWh is around 15% higher than under a PAR of 500MWh. The price increase becomes greater with a larger change in PAR.

5.7. A shift to a more marginal price would also increase the number of individual settlement periods with a significantly high SBP. For example, under a PAR volume of 1MWh, SBP would have reached £500 8 times over the two year period, whereas this did not happen once under the live calculation.

5.8. When the system is long, a more marginal price also affects the price across all settlement periods, with the largest impact in the low demand periods of the day, when SSP is at its lowest on average. In these periods, the SO is accepting more expensive bids, which have a smaller influence when averaged across larger values of PAR.

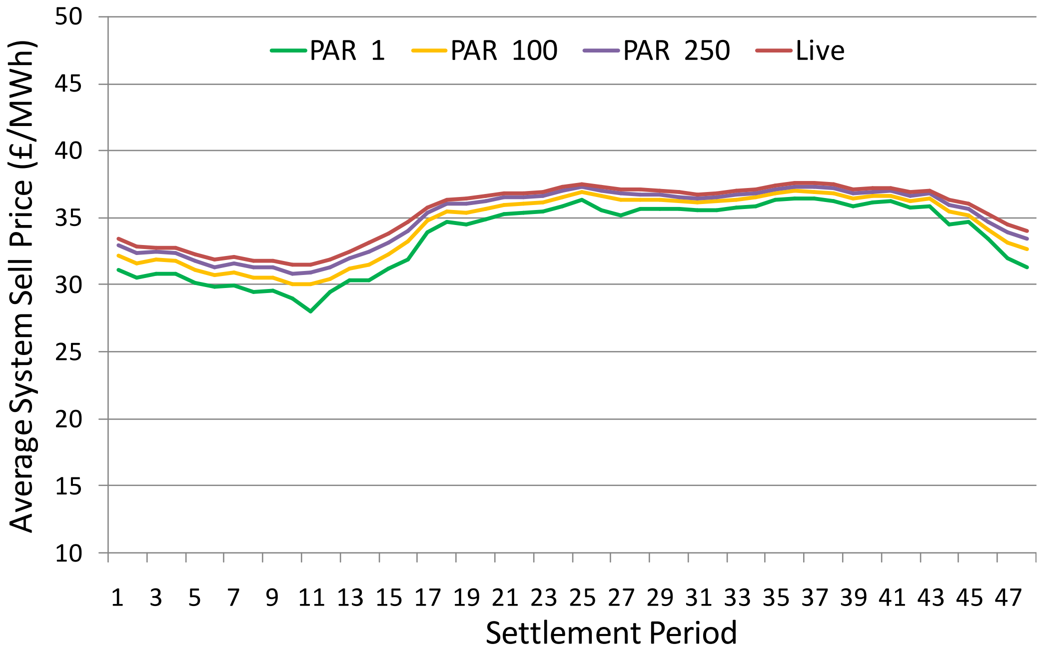
Table 5.4 – Average SSP under alternative PAR scenarios when system short

	SSP Live	SSP PAR 250 MWh	SSP PAR 100 MWh	SSP PAR 1 MWh
Average price	£35.23	£34.83	£34.27	£33.44
% Difference to PAR 500 MWh	0%	-1%	-3%	-5%

Table 5.5 – Incidences of low SSP under alternative PAR scenarios

Number of periods SSP is lower than:	SSP Live	SSP PAR 250 MWh	SSP PAR 100 MWh	SSP PAR 1 MWh
£20/MWh	158	281	496	836
£0/MWh	8	9	25	73
-£50/MWh	0	6	7	15

Figure 5.2 – Average SSP per settlement period under different values of PAR when system long



5.9. On average, shifting to a smaller PAR affects SSP less than SBP as there is less variation between the marginal action and all other actions on the sell side. As with SBP, a more marginal price increases the number of periods with an extremely low SSP: under a marginal price, SSP could have been negative in 73 periods, whereas this only occurred 8 times under live prices.

Peak price periods under alternative values of PAR

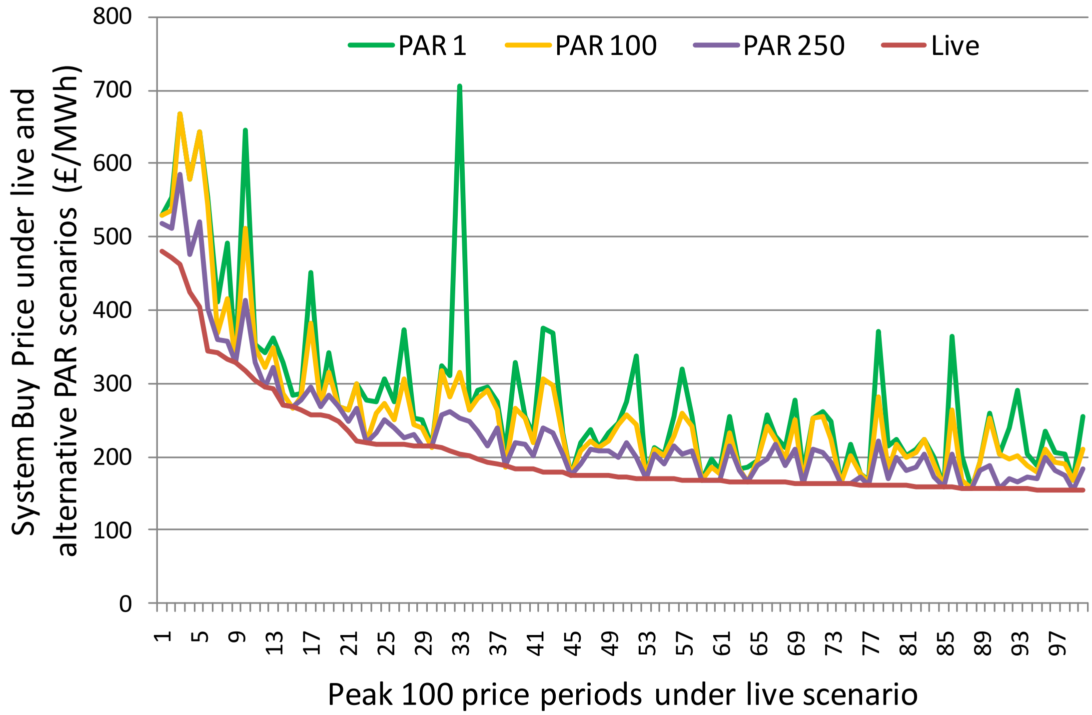
5.10. The periods with the highest price under live prices are not necessarily the periods with the highest peak price under more marginal cash-out prices. As such, the peak price periods in Figure 5.3 do not fully correspond to the peaks under different PAR volumes.

5.11. The effects that a change in PAR will have in a certain period will depend upon the makeup of the actions accepted to balance the system. For example, if there is a single action with a very high price and a small volume, this may be a peak period under a marginal price but not under a larger volume of PAR.

5.12. This example occurs in Figure 5.3 in the period where the live cash-out price is around £200/MWh, but under PAR 1 the SBP rises to over £700MWh. In this particular circumstance, this action is likely to have been small in volume so that it would not have a significant influence on the price under larger values of PAR.

5.13. Hence under a more marginal price, this increases the importance of the methodology to remove or reduce the influence of actions on the cash-out price which is not taken for energy imbalances. To move to a more marginal price, we would need to be confident that flagging removes system pollution and that the parameters defining an action which is De Minimis tagged or CADL flagged are also appropriate.

Figure 5.3 – Plot of 100 peak prices under the live scenario when the system short; and the corresponding prices under alternative PAR scenarios[33]



Impact of changing PAR on price spread and volatility

5.14. The spread between main and reverse price widens as the price becomes more marginal which could increase the risk of cash-out for market participants.

5.15. Further, the spread around SBP increases more than SSP. As such, a shift to a more marginal price could increase parties' incentives to go long to hedge the higher risk of exposure to the SBP. Hence although parties have a greater incentive to balance under more marginal cash-out prices, it is difficult to predict what impact this will have on the behaviour of parties and gross imbalances.

[33] Periods are plotted in price order with period 1 the most expensive under live scenario

5.16. Volatility also increases under more marginal prices as the price is now based upon a single action rather than an average. The impact is greatest on SBP due to the variability in offers accepted. This is because relatively highly priced offers can be accepted for energy reasons. This increase in volatility will increase the risk on parties as there is greater uncertainty around how high or low the main cash-out price could become.

Table 5.6 – Price volatility and spread between main and reverse cash-out prices under alternative PAR scenarios

	Live	PAR 250 MWh	PAR 100 MWh	PAR 1 MWh
SBP				
Average spread between main and reverse price (£/MWh)	18.63	20.71	24.05	28.37
Coefficient of variation	38%	42%	47%	51%
SSP				
Average spread between main and reverse price (£/MWh)	7.32	7.49	7.88	8.79
Coefficient of variation	16%	17%	19%	24%

5.17. For illustration, we can compare the levels of spread and volatility under the pre-P217A counterfactual to the alternative PAR scenarios. For SBP, it appears that both the level of spread and volatility under pre-P217A lies between PAR levels of 250 to 500MWh. However, for SSP, it appears that average spread lies between a PAR level of 1 and 100MWh, and the volatility would have been higher under pre-P217A than under a fully marginal cash-out price. The impact is greater under SSP as P217A has had a more significant impact on SSP than SBP as discussed above.

5.18. Hence it appears that moving to a marginal price would create comparable levels of spread, but a lower level of volatility, around the SSP than the price calculation pre-P217A. However, spread and volatility of SBP could be significantly higher under a marginal price than under the pre-P217A scenario.

5.19. It is important to note that volatility comes from different sources under the pre-P217A and alternative PAR scenarios. Under pre-P217A, the additional volatility over the live scenario was the consequence of pollution of the cash-out price. Under the alternative PAR scenarios, higher volatility relative to the live scenario is based on energy balancing actions, and the fact that cash-out prices rise to a greater extent to reflect scarcity on the system under a more marginal price.

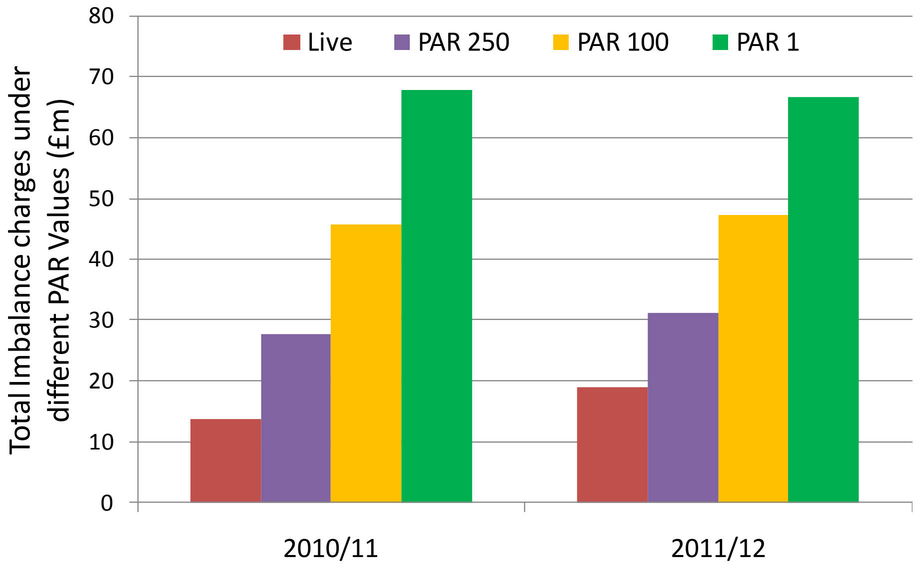
Impact of more marginal price on imbalance charges and RCRC

5.20. Reducing PAR makes cash-out prices spikier and hence increases imbalance charges for party’s out-of-balance. As such, moving to a smaller volume of PAR increases the imbalance charges more per unit of credited energy of smaller parties relative to larger parties.

Table 5.7 – Imbalance charges split by party size pre and post P217A

Party size	SSP imbalance charges (£/MWh)		SBP imbalance charges (£/MWh)	
	Live	PAR 1 MWh	Live	PAR 1 MWh
A	-0.38	-0.36	0.66	0.74
B	-2.23	-2.15	1.73	1.87
C	-1.09	-1.05	0.74	0.81
D	-0.48	-0.47	0.53	0.58
E	-0.43	-0.41	0.48	0.54

Figure 5.4 – RCRC charges under different PARs



Impact of more marginal prices on price impact of flagging inaccuracies

5.21. A further consideration around reducing PAR may be what impact this would have on any flagging inaccuracies by the SO, and the subsequent impact on cash-out prices. To test this we have looked at those periods where flagging errors caused a material impact that were assessed in the first two reports by the SO around the accuracy of flagging. We have assessed the price difference between the live flags and the corrected flags scenarios under different levels of PAR for these periods.

5.22. Actions are defined as being flagged incorrectly if their flag status differs to that under SO's counterfactual set of flags. The impact of a flagging error will depend on system length and whether the action was assigned an incorrect flag, or not attributed a correct flag.

5.23. Under either scenario, as the PAR level reduces, the price impact of flagging inaccuracies is likely to increase. This is because if flagging errors have an impact on the cash-out price, they are either an action wrongly flagged above the marginal energy action, or are the marginal action which has not been flagged correctly.

5.24. Assuming that the price of balancing actions increases exponentially as the SO takes more balancing actions, the live and corrected actions forming the cash-out price under a lower value of PAR will have a greater difference in price than under a higher PAR.

5.25. In seven out of the nine periods tested, this was the case: as PAR reduces, the price impact of the flagging inaccuracies increases as a percentage of the cash-out price under live flags. However, in two instances this is not the case. This is because the impact on prices depends on the shape of the prices of actions taken by the SO to balance the system, and the position of the mis-flagged action in the stack.

Table 5.8 – Price inaccuracies caused by mis-flagging under live and alternative PAR scenarios

Date	Settlement period	Change in cash-out price due to flagging inaccuracies under different PAR scenarios (% as a proportion of price under live-flags)			
		Live	PAR 250 MWh	PAR 100 MWh	PAR 1 MWh
10/12/2009	24	6%	6%	7%	8%
02/03/2010	28	-3%	-7%	-19%	-66%
02/03/2010	29	-5%	-10%	-28%	-66%
02/03/2010	30	-4%	-9%	-26%	-32%
12/08/2010	30	3%	4%	3%	0%
12/08/2010	34	1%	1%	2%	4%
12/08/2010	36	3%	3%	4%	9%
12/08/2010	37	4%	4%	5%	4%
12/08/2010	38	1%	2%	2%	4%

6. Key findings and next steps

Key findings of the P217A preliminary analysis

6.1 Our preliminary analysis of Modification P217A sought to consider the impacts of the removal of system pollution under the flagging methodology, on cash-out prices. Our key findings are as follows:

6.1.1 Since P217A was implemented, cash-out prices have provided a more efficient signal for parties to balance. This is because the extent to which cash-out prices reflect the costs to the SO of energy balancing has improved;

6.1.2 P217A has reduced the influence of the actions flagged as having been taken to resolve system constraints on the cash-out price. This is particularly the case for periods where pre-P217A, the cash-out price would have spiked as a consequence of these actions;

6.1.3 On average the overall impact of P217A has been to make prices less sharp. This could have reduced the incentive for parties to balance. However, this impact has come as a consequence of improving the efficiency of cash-out prices;

6.1.4 One of the issues that we intend to consider over the course of the SCR is the possibility of making cash-out prices more marginal. This would make cash-out prices sharper, increasing the incentive for participants to balance and strengthening the signal to invest in additional flexible capacity;

6.1.5 In addition, more marginal cash-out prices would increase cash-out risk for market participants and the total imbalance charges redistributed through RCRC.

Electricity balancing SCR and further analysis

6.2 The P217A preliminary analysis represents an initial tranche of evidence on which we intend to build over the course of the SCR. Some possible analytical issues for consideration during our SCR include:

6.2.1 A comparison of the costs to the System Operator of energy balancing relative to imbalances charges redistributed through RCRC;

6.2.2 A consideration of the SO's counterfactual to assess the accuracy of the SO's implementation of the flagging methodology;

6.2.3 A consideration of how appropriate the current parameters around De Minimis tagging and CADL flagging are, and how this would impact on more marginal pricing;

6.2.4 Regression analysis of the relationship between cash-out prices and the indicated margin between demand and supply on the electricity system.

6.3 We are seeking feedback from stakeholders on the P217A preliminary analysis. Details of the consultation questions and how to submit feedback can be found in the Initial Consultation for the electricity balancing SCR.

Appendices

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Appendix 1 – Current cash-out price calculation under P217A

1.1 Participants in the electricity market are expected to balance their positions by contracting to buy or sell electricity prior to gate closure. Participants whose metered output or demand deviates from their contracted positions are exposed to the cash-out price for this imbalance.

1.2 In its role as residual balancer, the SO takes actions to maintain the frequency and voltage on the whole network within safe limits. Cash-out prices are derived from the costs of actions taken by the SO to balance the system.

Dual cash-out prices

1.3 There are two energy imbalance prices: the 'Main' and 'Reverse' cash-out prices. Participants pay or receive a different price depending on the direction of their own imbalance in relation the overall system imbalance. Participants who are out of balance in the same direction as the system are seen to be contributing to the system imbalance and face the main imbalance price. Participants that are out of balance in the opposite direction to the system are exposed to the reverse price.

1.4 Further, there are also two different prices which depend on the imbalance of individual parties. The system buy price (SBP) is paid by participants with a negative imbalance position (short relative to their contracted positions). The system sell price (SSP) is paid by participants with a positive imbalance position (long relative to their contracted positions). The table below provides a summary of how cash-out prices are calculated under the different scenarios.

	System Long	**System Short**
SBP	Reverse	Main
SSP	Main	Reverse

Main Price Calculation

1.5 The main energy imbalance price is calculated using the balancing actions taken by the SO in a given settlement period. These actions include bids and offers taken in the BM and services which the SO may have contracted for ahead of real time. The latter enter as Balancing Services Adjustment Data (BSAD). These actions are treated exactly the same as actions taken within the BM.

1.6 All actions are ranked in order of increasing cost to the SO and the main price is calculated as a weighted average of the most expensive 500 MWh of actions. Not all actions are used to determine the price as the SO does not take all actions for the same reason; some actions are taken to balance the half-hourly energy imbalances and some are taken for system management reasons. Examples of system management actions are:

1.6.1 Actions taken for locational balancing reasons: The transmission system has physical constraints on how much electricity can flow across the lines. When flow becomes too great, the SO must take action to reduce the load by accepting bids to turn down generation behind the constraint boundary. These actions are identified ex-ante by the SO and are 'SO flagged';

1.6.2 Actions taken that are so small they could be due to rounding errors: These are defined as all actions below 1MWh and are "De Minimis tagged";

1.6.3 Actions taken that have no effect on the energy balancing of the system but lead to a financial gain for the SO. These are 'Arbitrage tagged', and;

1.6.4 Actions taken to correct short term increases or decreases in generation or demand: These are defined as any action taken with duration less than 15 minutes and are 'CADL flagged'.

1.7 The cash-out price should reflect the cost to the SO of its energy balancing actions. The influence of the actions above are minimised through the following processes:

1.7.1 Flagging: actions are flagged according to the above methodology and once identified, classification is used to decide if they are 'in-merit' or 'out-of-merit';

1.7.2 Classification: Flagged actions that are more expensive than the most expensive unflagged action are 'out-of-merit' and are assigned a replacement price. This price is based on the volume weighted average price of the most expensive 100MWh of unflagged actions. Flagged actions that are less expensive than the most expensive unflagged action are 'in-merit' and retain their original price;

1.7.3 Tagging: Actions that are tagged are completely removed from the price calculation.

1.8 Once the flagging, classification and tagging processes have been completed, two ranked sets of SO actions are left containing either buy or sell actions. To determine the main price, the volume of imbalance actions taken in the opposite direction to the overall imbalance, is subtracted from the volume of actions taken to solve the overall imbalance (NIV tagging).

1.9 Finally, all actions but the most expensive 500MWh of actions remaining are PAR Tagged. The main energy imbalance price is calculated as a volume weighted average of the actions remaining.

Reverse Price Calculation

1.10 The reverse price is based on Market Index Data which is used to calculate a price (expressed in £/MWh) which is intended to reflect the price of wholesale electricity in the wholesale market.

Residual Cashflow Reallocation Cashflow (RCRC)

1.11 Imbalance charges do not recoup the costs to the SO of balancing the system. These charges are aggregated across all parties into the Residual Cashflow Reallocation Cashflow (RCRC), which is subsequently rebated back to all parties on a per MWh basis.

1.12 The direct costs incurred by the SO of balancing are charged to all BSC parties via Balancing System Use of System (BSUoS) charges. However, cash-out prices are intended to replicate these costs such that out-of-balance parties face a charge which reflects the costs to the SO of balancing the system.

Appendix 2 - Modification P217/P217A and changes to cash-out price calculation

2.1 Modification P217A was implemented in November 2009 and sought to improve the efficiency of the main energy imbalance price calculation. It proposed to do this by introducing a methodology to identify which balancing actions had been taken for system imbalances, such that their influence on the cash-out price could be reduced. As such, P217A introduced a number of key changes to the calculation of cash-out prices.

Ex-ante flagging

2.2 P217A introduced ex-ante flagging by the SO of Bid-Offer Acceptances (BOAs) in the Balancing Mechanism (BM). The SO flags actions that may have been required to resolve system imbalances and transmission constraints.

2.3 The flagging procedure was an entirely new part of the SO's within day processes. The SO identifies specific Balancing Mechanism Units (BMUs) that, in the event of a transmission constraint, have been used to resolve a constraint. Those BMUs identified by the SO are flagged in real time, along with any subsequent actions taken from these BMUs.

2.4 Before the implementation of P217A there was no methodology for flagging system actions. Hence all actions taken by the SO could enter the final price calculation, including those taken to resolve system constraints, potentially polluting the cash-out price.

CADL and emergency instructions

2.5 Continuous Acceptance Duration Limit (CADL) actions and emergency instructions have been included within the flagging process since the implementation of P217A. Previously, both these types of actions would have been tagged and removed from the price calculation. Under P217A, these actions are subject to the classification process, alongside actions flagged for system constraint reasons. The price of these actions is therefore not automatically excluded from the cash-out price calculation.

2.6 The revised CADL flagging methodology also resolved a known anomaly in the previous CADL tagging process. If more than one BOA was taken on a given BM unit, the previous process would tag all BOAs for the BM unit if at least one met the CADL criteria. Under P217A, only the single action that meets the CADL criteria is flagged.

Classification

2.7 The process of classification was introduced under P217A. A flagged action would be classified as "in-merit", and hence required for energy balancing, if the flagged action was cheaper than the most expensive unflagged action. These actions retain their original price in the cash-out calculation.

2.8 The rationale for 'in-merit' flagged actions retaining their price is that these actions would have been required to resolve energy imbalances had the system constraint not existed, or the sub-15 minute action not been required.

2.9 If actions are "out-of-merit", and hence are more expensive than the most expensive unflagged action, their volume would remain in the final price calculation but they would be subject to a replacement price.

Replacement Price

2.10 The original price of an 'out-of-merit' action is replaced with a replacement price. The replacement price is calculated as a volume weighted average of 100MWh of the most expensive 'in-merit' actions. Actions are then re-ranked in price order in the price calculation and only the most expensive 500MWh of remaining balancing actions enter the price calculation (a process known as PAR tagging).

Disaggregation of BSAD

2.11 Balancing Services Adjustment Actions are services procured by the SO outside the BM. These actions are included as individual actions in the cash-out calculation using Balancing Services Adjustment Data (BSAD). Once input into the calculation, they are subsequently subjected to the flagging and classification process, alongside BOAs. BSAD is split between actions taken to resolve system constraints (system BSAD) and taken to resolve energy imbalances (energy BSAD).

2.12 Before P217A, all BSAD actions taken in one period would be aggregated together when calculating the cash-out price, resulting in two "blocks" of BSAD actions in the price calculation; energy and a system BSAD block.

2.13 System BSAD would be unpriced and would be subject to NIV tagging first, before other BOAs in the price calculation. If this was not fully tagged away, the remaining volume would be removed from the calculation. System BSAD therefore could not affect price directly, however through the interaction with NIV tagging it could have an indirect effect, preventing other relatively expensive action from being NIV tagged.

2.14 The energy BSAD would similarly be aggregated together as a block. However, this BSAD would be priced as the weighted average of the actions within the block. This would then be placed in the price calculation with the BOAs.

Appendix 3 – BSC Modification Proposal P217/P217A Impact Assessment: Summary of key findings

3.1 We published an Impact Assessment[34] (IA) that informed our decision to approve Modification P217A. The analysis presented in the IA suggested that there was clear evidence that cash-out prices were being polluted by actions taken by the SO to resolve system imbalances. Hence cash-out prices were sharper than if they were based on a 'pure' energy price.

3.2 The P217A flagging methodology was assessed to remove the majority of constraint actions from the price calculation, producing a price more reflective of the costs of energy balancing. As a consequence, P217A was anticipated to make cash-out prices less spiky: reducing SBP by 3.1% and increasing SSP by 0.8%. In response to less spiky prices, the NIV was expected to increase, all else being equal, as a consequence of lower incentives for parties to meet their contracted positions[35].

3.3 The IA also noted that uncertainty around the cash-out price would reduce under P217A as a consequence of a lower spread between the main and reverse price, and lower volatility of the main cash-out price.

3.4 Although P217A was expected to be effective in removing the impact of constraints from cash-out prices, the IA noted that the transparency of the cash-out price, and the ability of parties to forecast prices, would not necessarily be improved under P217A. This was due to the additional complexity in the price calculation under P217A, and its impact not being consistent across periods.

3.5 The IA also considered the possibility of reducing the volume on which the price calculation is based under modification P217. This modification would have made cash-out prices more marginal. The IA concluded that P217A would have made prices sharper, potentially increasing the incentive to balance. But in doing so, it would also increase the spread and volatility of prices and as such, the cash-out risk for market participants.

[34] Ofgem (2008b): ibid

[35] However, the IA acknowledged that it is difficult to quantify behavioural impacts by analysis of historical data. Instead it used an assumed elasticity depicting a given change in NIV for a given change in the cash-out price

Appendix 4 - Examples of the impacts of P217A on cash-out price calculation

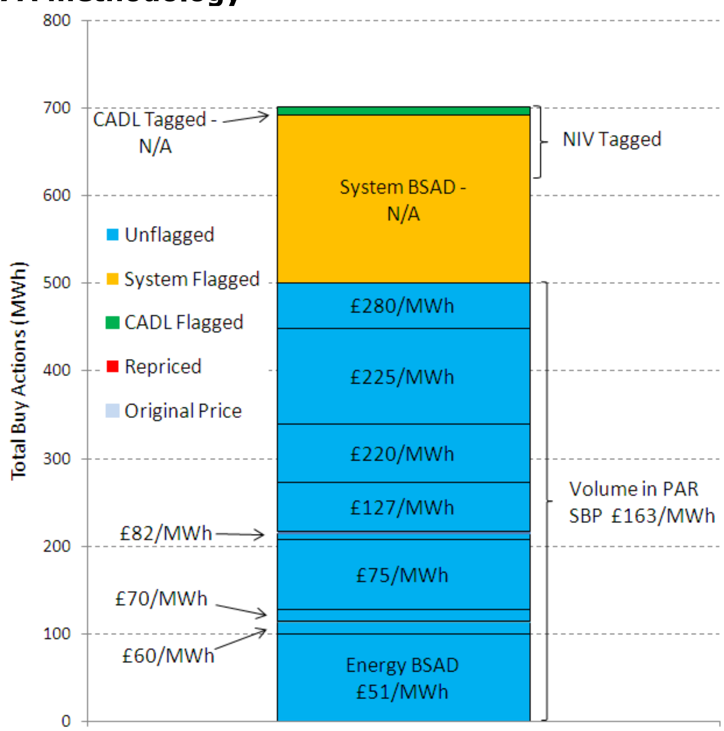
4.1 The following example settlement periods provide a detailed description of how changes under P217A have affected the calculation of cash-out prices.

Example 1: Impact of flagging system actions

4.2 On 7th November 2011, the market was short from settlement period 11 to 35 as temperatures were lower than forecast (leading to greater demand), which was further exacerbated by 1.9GW of plant losses.

4.4 In addition in settlement period 19, there was a constraint on flowing electricity to the south of England; therefore we see a number of flagged actions in the price calculation. It is likely these offers accepted by the SO were to turn up plant in the South of England in order to solve this transmission constraint. In this period, the system was short by 633 MWh. As such, the SBP was the main price.

Figure A4.1: **Offers accepted by the SO and calculation of the cash-out price under pre-P217A methodology**



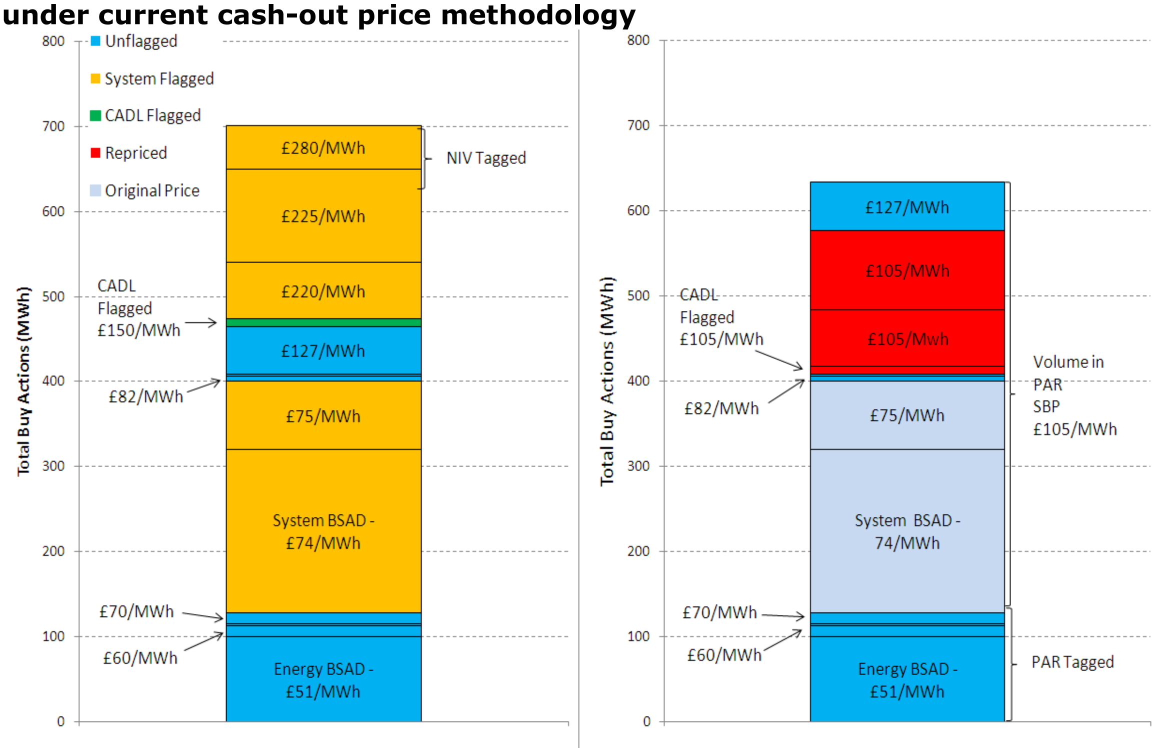
4.5 The figure above shows all the accepted offers taken by the SO in settlement period 19 for generators to turn up to overcome the scarcity on the system. These actions are shown in price order with the most expensive at the top of the stack, and where two or more actions had the same price, these are grouped into one block at that price for illustration.

4.6 Pre-P217A, system BSAD and CADL actions are unpriced and are aggregated above all other accepted offers. These actions cannot influence the price directly but are subject to NIV tagging before other accepted offers. In this period, the SO has only accepted 68MWh of bids in the opposite direction to overall system length. This volume is NIV tagged away from the volume of accepted offers. In this case, only system BSAD and CADL actions are subject to NIV tagging.

4.7 After NIV tagging, this leaves around 130MWh of unpriced actions remaining. Under the pre-P217A methodology, these actions are removed even if they are not fully NIV tagged and as such they do not influence the cash-out price.

4.8 The price calculation is then made up of the remaining “unflagged” actions. There is no PAR tagging as the volume of remaining actions is under 500MWh. The system buy price for this period under the pre-P217A calculation is £163/MWh.

Figure A4.2: **Offers accepted by the SO and calculation of the cash-out price under current cash-out price methodology**



4.9 The figure above again shows the actions entering the price calculation but instead show the price calculation after the implementation of P217A. Again this only shows actions taken in the direction of overall system length but shows two stages of the price calculation: pre and post-classification and repricing on the left and right respectively.

4.10 Under P217A, the previously tagged system BSAD and CADL actions no longer have their price removed. These actions now retain their original price. Further, both the system and energy BSAD actions are now disaggregated into individual actions. In this period there was only one system BSAD action; however the energy BSAD is now disaggregated into 4 individual actions (but is still shown as one block here as all energy BSAD actions had the same price).

4.11 The disaggregated BSAD actions, alongside actions taken to balance the system through the BM, are subsequently subject to flagging and tagging under P217A. Actions which were not flagged pre-P217A that were taken for system reasons now become flagged.

4.12 All actions taken by the SO are then subject to classification. Any flagged actions that are more expensive than the most expensive "pure energy" unflagged action are re-priced, based on the most expensive unflagged action. Actions which are less expensive retain their original price. From the figure above, we can see that some flagged actions are 'out-of-merit' and are repriced from over £220/MWh to £105/MWh.

4.13 The remaining actions are then subject to PAR tagging to leave only the most expensive 500MWh of actions. The system buy price for this period under P217A is £105MWh.

4.14 Comparing the calculation of cash-out prices under the pre-P217A and current cash-out price methodologies, the key impact is caused by the flagging and subsequent re-pricing of some system actions under P217A. Pre-P217A, the actions are not re-priced, allowing actions taken for system reason to pollute the cash-out price.

4.15 There is also an additional impact of how system BSAD actions interact with NIV tagging. Pre-P217A the system BSAD and tagged actions are subject to NIV tagging first before all other actions. However, under P217A, these actions are now priced and are treated consistently with other balancing actions. These actions are reordered according to price, resulting in the NIV tagging of more expensive actions. This will also have the effect of lowering the cash-out price.

Example 2: Impact of disaggregating system BSAD

4.16 The second example period also considers an example of when the system was short. On 3rd February 2012, in settlement period 41, the system was short due to high demand caused by low temperatures. This required offers to be taken for energy balancing. Constraints were also active and restricting flows to the south of England. As such, the SO needed to take offers on plant in the south of England to manage the constraints.

4.17 In this period, a large volume of system BSAD was taken to balance the system and the system was short by 372 MWh. Under the pre-P217A price calculation, these actions are unpriced and aggregated. The system BSAD and CADL actions are subject to NIV tagging before other actions. In fact, the volume of these actions is greater than the amount NIV tagged and the remaining unpriced volume is then removed such that it is not included in the cash-out price calculation.

4.18 The cash-out price calculated from the remaining actions under the pre-P217A calculation is £173/MWh.

Figure A4.3: **Offers accepted by the SO and calculation of the cash-out price under pre-P217A methodology**

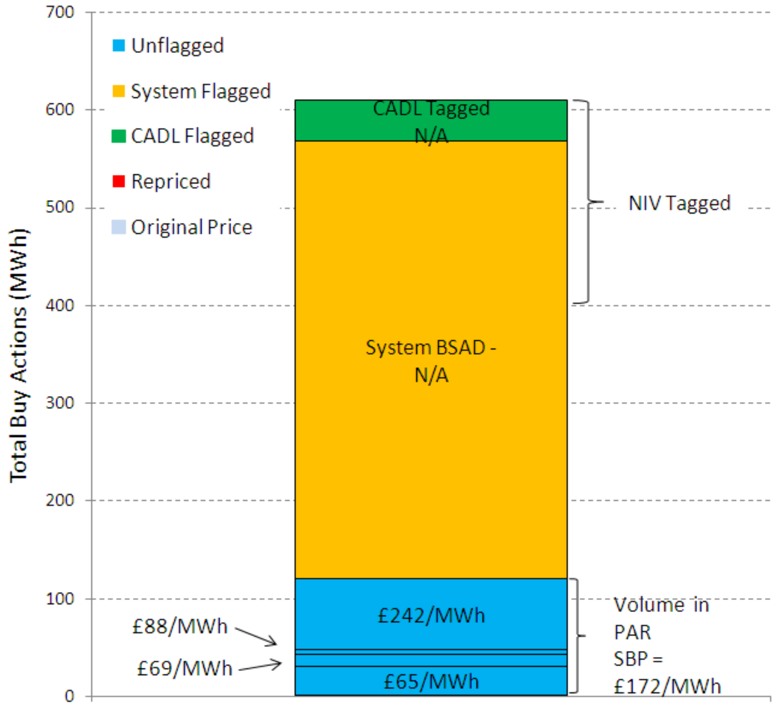
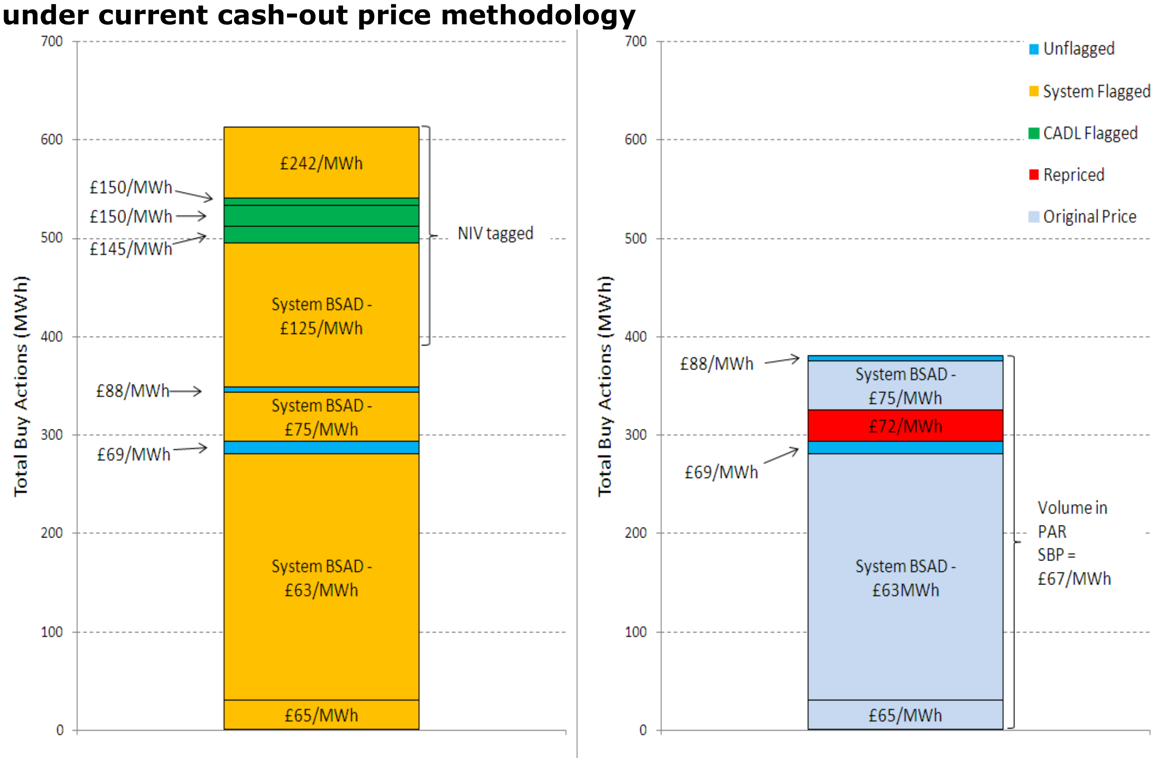


Figure A4.4: **Offers accepted by the SO and calculation of the cash-out price under current cash-out price methodology**



4.19 Under P217A, the system BSAD is disaggregated into three separate volumes. These volumes each have their own price and all actions are subsequently reordered in terms of price. Further under the P217A methodology, two of the offers taken in this period are also flagged as having been taken for system reasons.

4.20 NIV tagging now begins with the most expensive action, whereas under pre-P217A, system BSAD and tagged actions were first subject to NIV tagging. This process removes some of the most expensive actions, including the £242/MWh flagged action which previously influenced the cash-out price. The remaining flagged volume which is more expensive than the top energy action, and classified as 'out-of-merit', is repriced at £72/MWh. The other actions, including a large volume of system BSAD which is has been classified as 'in-merit', retain their original price. The system buy price for this period under P217A is £67/MWh.

4.21 Comparing the price calculation under pre and post P217A methodologies, it appears that under this example both the disaggregation of system BSAD and flagging have had impacts on the cash-out price. Disaggregating system BSAD and the interaction with which actions are then subject to NIV tagging, has a significant impact on price, as more expensive actions are NIV tagged instead. Further, some actions which remain 'out-of-merit' are repriced, reducing the overall cash-out price.

Appendix 5 – Glossary

A

Arbitrage tagging
The process of removing bids and offers that have been accepted by the SO from the price calculation, where the price of an accepted offer is less than the price of an accepted bid when the system is short, and vice versa when the system is long.

Applicable BSC objectives
The objectives of the BSC trading arrangements are set out in Standard Condition C3 of NGET's Transmission Licence, and are used to evaluate proposed modifications.

B

Balancing and Settlement Code (BSC)
The Balancing and Settlement Code (BSC) contains the governance arrangements for electricity balancing and settlement in Great Britain. The energy balancing aspect allows parties to make submissions to NGET to either buy or sell electricity from/to the market at close to real time in order to balance the system. The settlement aspect relates to monitoring and metering the actual positions of generators and suppliers (and interconnectors) against their contracted positions and settling imbalances when actual delivery or off take does not match contractual positions.

Balancing Mechanism (BM)
The Balancing Mechanism is the principal tool used by the SO to balance the electricity system on a second-by-second basis. Generators and consumers with spare flexibility in their portfolios submit offers (to increase generation or decrease demand) and bids (to decrease generation or increase demand) via the BM.

Balancing Mechanism Unit (BMU)
The basic unit of participation in the Balancing Mechanism, describing one or more generation or demand units which import or export electricity onto the system.

Balancing Services Adjustment Actions (BSAA)
The SO supplements balancing actions taken through the BM with forward contracts for a range of Balancing Services Adjustment Actions. The SO will enter into these agreements where it believes that it cannot source the service through the BM, or it wishes to reduce the costs of BM actions by guaranteeing the availability of certain units.

Balancing Services Adjustment Data (BSAD)
This data is used to incorporate the costs of the SO's Balancing Services contracts into the calculation of Energy Imbalance Prices.

Balancing Services Use of System charges (BSUoS)
The mechanism by which the costs that the SO incurs in the Balancing Mechanism and in procuring balancing services are recovered from parties using the system.

Bid/Offer Acceptances (BOAs)
Acceptances by the SO of Balancing Mechanism offers to increase electricity on the system, or bids to reduce electricity on the system.

C

Classification

The process determines which actions taken by the SO which are flagged as having been taken to resolve system constraints are 'in-merit' or 'out-of-merit'. An action would be 'in-merit' and retain its price if it is less expensive than the most expensive unflagged action. A flagged action which is more expensive than the most expensive unflagged action would be classified as 'out-of-merit' and subject to the Replacement Price.

Continuous Acceptance Duration Limit (CADL)

Accepted bids and offers with short duration (less than 15 minutes) are flagged in the price calculation. This is designed to remove the impact of sub half-hourly balancing actions from cash-out prices.

Contracted position

Parties must notify their contracted position to the SO for each settlement period through the process of Contract Notification at gate closure. This includes a notification of the volume of electricity the party is contracted to generate or deliver and Final Physical Notification.

Constraints

There are various parts of the transmission network where import or export capacity is limited. Constraints can become active when this capacity limit is reached. Constraints may require the SO to take 'sub-economic' balancing actions to reduce generation behind the constraint, and increase generation or reduce demand elsewhere on the network to maintain the energy balance.

D

De Minimis tagging

Individual accepted bid and offer volumes below 1 MWh are excluded from the price calculation. This is intended to remove any 'false' actions which are created because of the finite accuracy of the systems used to calculate bid and offer volumes.

E

Energy Imbalance Prices (or cash-out prices)

Parties are subject to energy imbalance prices for their imbalances in each half-hour period. These are used to incentivise parties to deliver their contracted positions.

F

Final Physical Notification (FPN)

The level of generation or demand that a BMU expects to produce or consume.

Frequency response

The SO has a statutory obligation to maintain system frequency between +/- 1% of 50 hertz. The immediate second-by-second balancing to meet this requirement is provided by continuously modulating output through the procurement and utilisation of mandatory and commercial frequency response.

G

Gate closure

The point in time by which all Contract Notifications and FPNs must be submitted for each settlement period. Parties should not change their positions other than through instruction by the SO after gate closure. This is currently one hour before the start of the relevant settlement period.

I

Imbalance

The difference between parties' contracted position and metered position measured on a half-hourly basis.

M

Main price

There are two Energy Imbalance Prices, "main" and "reverse". The main price is charged to parties out of balance in the same direction as the system.

Market Index Price (MIP)

The Market Index Price (MIP) is used to set the reverse Energy Imbalance Price. It is calculated based on short term trading activity on exchanges. Currently the MIP is set based on trades undertaken on the APX over a period of 20 hours.

Market Index Definition Statement (MIDS)

Defines the methodology for calculating the MIP. It is periodically reviewed by the BSC Panel.

Maximum Export Limit (MEL)

The maximum level at which a BM Unit may be able to export to the BG Transmission System at a given time. These are aggregated by the SO to form a MEL for the entire system.

Metered Volume

The actual volume of electricity imported or exported by each BMU.

Modification Proposal

A proposal to modify the Balancing and Settlement Code (BSC). Modifications can be raised by any Party to the BSC. Modifications are then defined and assessed by a Modification Group formed of BSC Parties in conjunction with Elexon. The BSC Panel will recommend whether a modification should be approved or rejected. The final decision is made by the Authority.

N

Net Imbalance Volume (NIV)

The overall energy imbalance on the system as determined by the net volume of actions taken by the SO to balance the system.

NGET

National Grid Electricity Transmission plc (NGET) is the System Operator (SO) for the electricity transmission system in Great Britain (GB). It has with responsibility for making sure electricity supply and demand stay in balance and the system remains within safe technical and operating limits.

P

Price Average Reference (PAR)
The volume of electricity included in the calculation of the main cash-out price. PAR volume is currently the most expensive 500 MWh of actions taken by the SO after flagging, classification and NIV tagging.

R

Replacement Price
Applied to any unpriced balancing actions that enter into the Net Imbalance Volume (NIV). The Replacement Price is calculated as a volume-weighted average of the 100MWh of most expensive unflagged actions after classification.

Reserve
Additional capacity available to the SO, in the form of either generation or demand reduction, to be able to deal with unforeseen demand increases and/or generation unavailability. The SO holds different reserve products, based on the timescales difference services can be called upon.

Reserve creation
The SO will use BOAs in a given period to position generation units to be able to provide reserve in a later period to increase the level of synchronised MEL.

Residual Cashflow Reallocation Cashflow (RCRC)
The net cashflow received by Elexon through energy imbalance charges is subsequently reallocated amongst participants through the RCRC based on throughput on a half-hourly basis.

Reverse price
There are two Energy Imbalance Prices, “main” and “reverse”. The reverse price is charged to parties out of balance in the opposite direction to the system. When the system is long, short parties pay the reverse price and vice versa. The reverse price is currently set to the Market Index Price.

S

Short Term Operating Reserve (STOR)
A contracted Balancing Service whereby the service provider delivers a contracted level of power when instructed by the SO, within pre-agreed parameters.

SO Flagging
The SO identifies balancing actions deemed as potentially having been taken to resolve a system constraint. These actions are flagged and subject to classification.

System Operator (SO)
The entity charged with operating the GB high voltage electricity transmission system, currently NGET.

System Buy Price (SBP)
The imbalance price which imbalanced parties pay for a short energy imbalance.

System Sell Price (SSP)
The imbalance price which imbalanced parties receive for a long imbalance.