REQUIREMENTS SPECIFICATION for Modification Proposal P211 - Alternative

'Main Imbalance Price Based on Ex-Post Unconstrained Schedule'

Prepared by: P211 Modification Group

Date of Issue:	27 July 2007	**Document Reference:**	P211AS_Alt
Reason for Issue:	For Approval	**Version Number:**	1.0

Alternative Modification P211, like the Proposed Modification, seeks to amend the calculation of the "main" imbalance price such that when the market is short (NIV>0), System Buy Price (SBP) will be based on the least expensive Offers that the System Operator (SO) could have utilised on an unconstrained system. Conversely, when the market is long (NIV<0), System Sell Price (SSP) will be based on the least expensive Bids that the SO could have utilised on an unconstrained system. Additionally, **the Alternative applies a set of rules (including dynamic parameters) to the Bid and Offer volumes that make up the Ex-Post-Unconstrianed Schedule stack to better reflect what Bid and Offer volumes are actually available to the System Operator. As for the Proposed Modification,** PAR Tagging would then be applied to the new price stack to ensure that only the most expensive 500 MWh of Bids or Offers are used to set the main price. The 'reverse' price would remain unchanged.

BACKGROUND AND PURPOSE OF IMPACT ASSESSMENT

The BSC Panel considered P211 at its meeting on 10 May 2007 and submitted the proposal to a 4-month Assessment Procedure to be conducted by the P211 Modification Group (formed from members of the Pricing Standing Modification Group. The P211 Modification Group ('the Group') has met five times to date on 15, 22 May, 6 and 13 June, and 4 and 23 July 2007 and agreed the requirements for the Proposed and Alternative Modification. This document sets out the requirements for an Alternative agreed by the Group, and supports impact assessment by BSC Agents, BSC Parties, the Transmission Company and BSCCo.[1]

Any queries regarding the impact assessment requirements should be addressed to Chris Stewart (020 7380 4309), e-mail address chris.stewart@elexon.co.uk.

[1] The Balancing and Settlement Code Company (ELEXON).

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SUMMARY OF IMPACTED PARTIES AND DOCUMENTS

As far as the Modification Group has been able to assess, the following parties/documents would be impacted by P211.

Please note that this table represents a summary of the full initial impact assessment contained in Section 3.

Parties		Sections of the BSC		Code Subsidiary Documents	
Distribution System Operators	☐	A	☐	BSC Procedures	☒
Generators	☒	B	☐	Codes of Practice	☐
Interconnectors	☒	C	☐	BSC Service Descriptions	☒
Licence Exemptable Generators	☒	D	☐	Party Service Lines	☐
Non-Physical Traders	☒	E	☐	Data Catalogues	☒
Suppliers	☒	F	☐	Communication Requirements Documents	☐
Transmission Company	☒	G	☐	Reporting Catalogue	☒
Party Agents		H	☐	**Core Industry Documents**	
Data Aggregators	☐	I	☐	Ancillary Services Agreement	☐
Data Collectors	☐	J	☐	System Operator – Transmission Owner Code	☐
Meter Administrators	☐	K	☐	Data Transfer Services Agreement	☐
Meter Operator Agents	☐	L	☐	Distribution Code	☐
ECVNA	☐	M	☐	Distribution Connection and Use of System Agreement	☐
MVRNA	☐	N	☐	Grid Code	☐
BSC Agents		O	☐	Master Registration Agreement	☐
SAA	☒	P	☐	Supplemental Agreements	☐
FAA	☐	Q	☒	Use of Interconnector Agreement	☐
BMRA	☒	R	☐	**BSCCo**	
ECVAA	☐	S	☐	Internal Working Procedures	☒
CDCA	☐	T	☒	**BSC Panel/Panel Committees**	
TAA	☐	U	☐	Working Practices	☐
CRA	☐	V	☒	**Other**	
SVAA	☐	W	☐	Market Index Data Provider	☐
Teleswitch Agent	☐	X	☒	Market Index Definition Statement	☐
BSC Auditor	☐			System Operator-Transmission Owner Code	☐
Profile Administrator	☐			Transmission Licence	☐
Certification Agent	☐				
Other Agents					
Supplier Meter Registration Agent	☐				
Unmetered Supplies Operator	☐				
Data Transfer Service Provider	☐				

1 SUMMARY OF PROPOSED MODIFICATION SOLUTION

1.1 The Existing Arrangements

Under the current Balancing and Settlement Code ('Code') baseline, actions taken by the System Operator (SO) to balance supply and demand for a Settlement Period set the main Energy Imbalance Prices: System Buy Price (SBP) when the system is 'short' and System Sell Price (SSP) when the system is 'long'.

The current methodology for determining system length (whether the system is 'long' or 'short') was introduced under Approved Modification P78 'Revised Definitions of System Buy Price and System Sell Price'. Overall system imbalance (i.e. Net Imbalance Volume or 'NIV') is currently determined by summing the Pre-Gate Closure trades (reflected in Balancing Services Adjustment Data or 'BSAD') with the Bids and Offers accepted by the SO. The system is 'long' when Bids and / or Relevant Balancing Services predominate and the system is 'short' when Offers and / or Relevant Balancing Services predominate.

The following information contributes to the calculation of the main Energy Imbalance Price:

- Actions taken within the Balancing Mechanism to increase the total energy on the system (Accepted Offers), or actions within the Balancing Mechanism to decrease the total energy on the system (Accepted Bids); and
- Relevant Balancing Services provided outside the Balancing Mechanism, represented via BSAD.

When the system is estimated by the method above to be short of energy, the main price (i.e. SBP as the price applied to imbalances in the same direction as the system) is based on the volume weighted average of the most expensive 500MWh[2] of priced balancing actions (accepted Offers and BSAD) remaining, following the application of the following rules:

- **De Minimis:** Individual accepted Bid and Offer Volumes below a defined threshold (1 MWh) are excluded from the price calculation completely. This approach is intended to remove 'false' actions created due to the finite accuracy of the systems used to calculate Bid and Offer Volumes;
- **Arbitrage:** Accepted Bids and Offers where no net energy has been delivered to the system but which have provided an overall financial benefit to the system are excluded from the price calculation completely (i.e. where the price of an accepted Offer Volume is less than the price of an accepted Bid Volume);
- **CADL:** Acceptance Volumes associated with Acceptances of short duration (below the Continuous Acceptance Duration Limit (CADL) currently 15 minutes) are treated as un-priced[3] in the price calculation;
- **BSAD:** The SO determines whether Relevant Balancing Services will be treated as priced or un-priced. BSAD is calculated net[4] and represents both priced and un-priced Relevant Balancing Services in aggregate form;
- **Emergency Instructions:** On the determination of the SO, Accepted Bids and Offers associated with Emergency Instructions may be tagged as Excluded Emergency

[2] This is known as the Price Average Reference (PAR) volume. PAR is currently 500MWh. When the system has excess energy (said to be 'long') then the main price (SSP) will be based on the volume weighted average of the most expensive 500MWh of priced balancing actions (accepted Bids and Energy BSAD) remaining following the application of the tagging mechanism rules. If the NIV is less than 500 MWh then no volumes will be PAR tagged.

[3] Un-priced volumes contribute to the determination of which actions set the main Energy Imbalance Price, however the costs of these actions are not included in the main Energy Imbalance Price.

[4] This means that in any Settlement Period there can only be one non-zero volume of Energy BSAD (EBVA or ESVA), and one non-zero volume of System BSAD (either SBVA or SSVA).

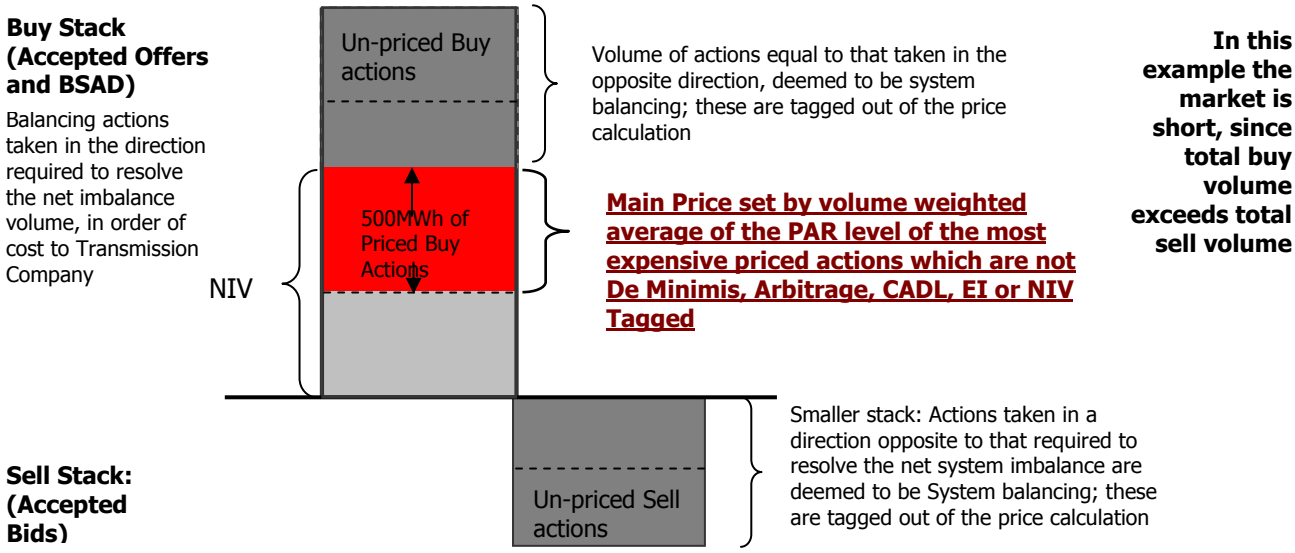
Acceptances and therefore treated as un-priced for the purpose of Energy Imbalance Price Calculation;

- **NIV Tagging:** Following application of the rules outlined previously, the Net Imbalance Volume (NIV) tagging process is applied to determine which of the priced actions will be subject to PAR tagging; and
- **PAR Tagging:** Following application of the rules outlined previously, the Price Average Reference (PAR) tagging process is applied to determine which of the priced actions will contribute to the calculation of Energy Imbalance Prices.

These processes are collectively known as the 'tagging mechanism'. The de-minimis, CADL, Emergency Instructions and NIV Tagging functions are the processes to remove what are deemed to be system balancing actions from the main price.

In addition, trades undertaken on power exchanges feed into market prices provided by Market Index Data Providers (or a single provider, as it currently stands). The reverse Energy Imbalance Price (i.e. the price applied to imbalances in the opposite direction to the system) is based on the market price derived from data submitted by Market Index Data Providers.

Figure 1. Example of the Existing Arrangements Main Imbalance Price Calculation (Short System)



1.2 P211 Alternative Arrangements

Under Alternative P211, the mechanism for calculating Energy Imbalance prices compares to the current baseline as follows:

- Rather than using actions taken within the Balancing Mechanism to increase the total energy on the system (Accepted Offers), or actions within the Balancing Mechanism to decrease the total energy on the system (Accepted Bids), the information that contributes to the calculation of the main Energy Imbalance Price in each Settlement Period will be Deemed Available Offer Volumes (DAOV) and Deemed Available Bid Volumes (DABV) for each price band for each BM Unit which submits bid-offer volumes;
- DABV and DAOV values in each period will be determined from the Final Physical Notification (FPN) and the levels of submitted bid-offer bands capped by Maximum Import Limit (MIL) and Maximum Export Limit (MEL) where relevant;

- The MIL used will be the latest available at the end of the relevant Settlement Period. In the event of system issues prevent the end of Settlement Period view of MIL profiles being promptly provided and loaded by SAA/BMRA, later runs should use the late arriving MIL data when access to this data becomes available;
- The MEL used for each BMU in each Settlement Period will be the lower of the MEL submitted by and existing at Gate Closure or the MEL that includes all the latest declared MEL before the end of the Settlement Period. In the event of system issues preventing the end of Settlement Period view of MEL profiles being promptly provided and loaded by SAA/BMRA, later runs should use the late arriving MEL data when access to this data becomes available;
- For each BMU:
  - The total DABV cannot exceed the difference between the FPN and MIL (N.B. MIL is submitted as a negative integer);
  - The total DAOV cannot exceed the difference between the MEL less the FPN; and
  - Any volumes between MEL and FPN plus the sum of all positive numbered offer volume intervals for that BMU, or between MIL and FPN plus the sum of all negatively numbered bid volume intervals for that BMU, shall be deemed to be 'unpriced' and will not enter the EPUS stack.
- For any Bid-Offer pairs that exists between 0MWh and SEL or between 0MWh and SIL, the price that that volume should appear as in the EPUS stack is the volume weighted average of the Bid-Offer bands below SEL (or above SIL).
- A set of additional dynamic parameter rules will also be applied to better reflect what DAOV and DABV is actually available to the SO. For the purposes of this Alternative, it is assumed that the SO can start instructing plant from Gate Closure and this is why Gate Closure is used within these additional rules. These rules can either be applied on a minute resolution (more accurate but potentially more complex) or half hourly resolution. Costs are therefore sought to apply the rules as described below for both minute resolution and half hourly resolution.

  For both minute and half hour resolution:

  1. NDZ qualifying rule. This rule excludes all potential DAOV or DABV for a BMU where the Notice to Deviate from Zero (NDZ) at Gate Closure is greater than 89 minutes and the FPN for the Settlement Period is equal to zero for the entire Settlement Period.
  2. NDZ and run up rate (RUR). When an FPN is zero at the beginning of the Settlement Period in question, and NDZ is less than or equal to 89 minutes, start profiling each BMU at a time from 'Gate Closure plus NDZ' using the declared RURs[5]. Then the available volume (for the Settlement Period in question) below this profile can be included as DAOV (providing there are existing Bid/Offer pairs submitted for that BMU in that Settlement Period).
  3. RUR and run down rates (RDR). The volume of DAOV and DABV that should be included for a BMU should be restricted by the RUR or RDR of that BMU. If the submitted Bid/Offer pair, or a proportion of it, can be accessed from Gate Closure with the submitted ramp rates applied then this volume can be included as DAOV or DABV.

  For minute resolution:

  4. Where FPN is less than SEL. If a BMU is operating at less than SEL (between 0 and SEL) in the first minute past Gate Closure indicated by the FPN point variable[6] for that minute, and the FPN

[5] This will require the RURs that are valid from Gate Closure to end of the Settlement Period in question (three Settlement Periods including the two Settlement Periods after Gate Closure but before real time).
[6] Use the point variable where one exists for this minute or use the point variable discovered by linear interpolation.

is decreasing in the SP after Gate Closure[7], then no volume can be accessed for the Settlement Period in question.

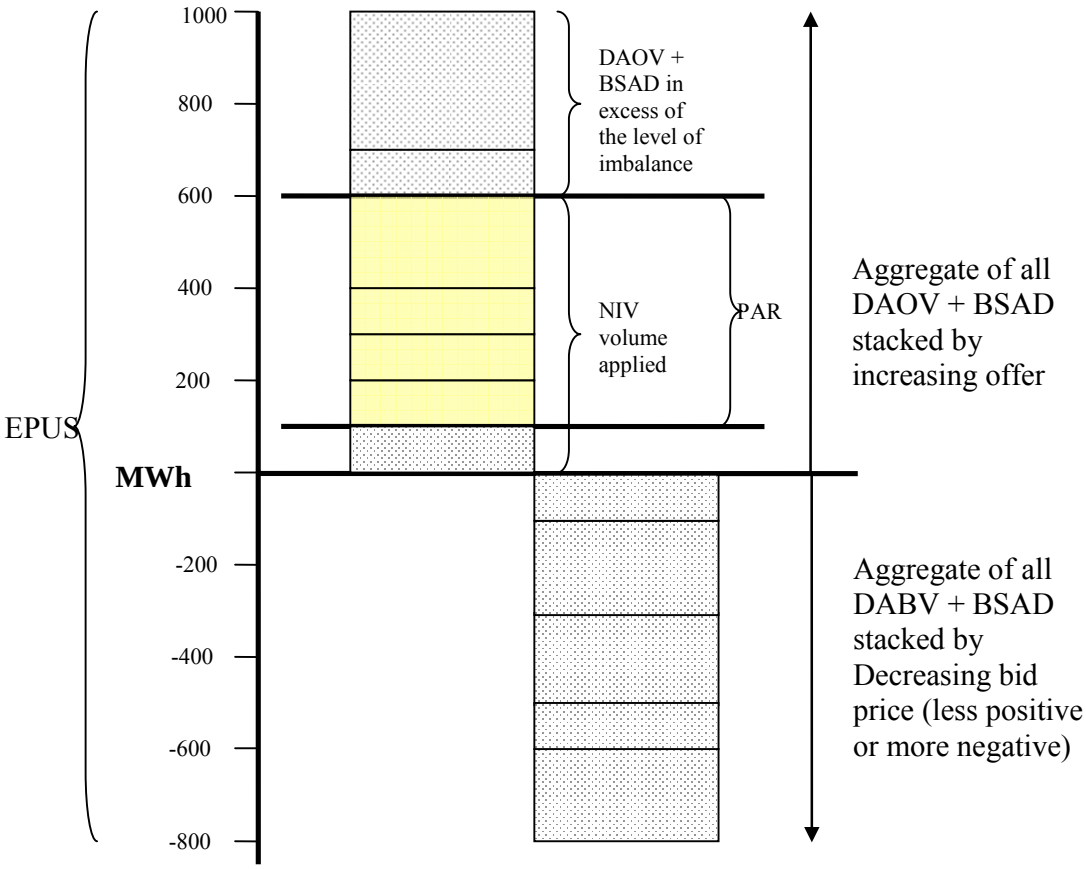
For half hourly resolution:

4. Where FPN is less than SEL. If the FPN for the first Settlement Period past Gate closure (for the Settlement Period in Question) is less than SEL (that is, between 0 and SEL), and the FPN for the Settlement Period in Question is less than the FPN for the first Settlement Period past Gate closure, then no volume can be accessed for the Settlement Period in question.

- The determination of Relevant Balancing Services provided outside the Balancing Mechanism, represented via BSAD will not change;
- The existing process for determining whether SSP or SBP is the main Energy Imbalance Price (the existing NIV process) will not change.
- The existing process for determining the MWh size of the NIV (using accepted bids, offers and BSAD) will not change. However, as the prices of actual acceptances making up NIV would not be used for the Main Imbalance Price calculation it should be noted that the existing process can be simplified as described in 2.5 below.
- A new stack will be built from collating the available Bids (DABV) and Offers (DAOV) plus Energy BSAD[8]. This stack will form the Ex-Post Unconstrained Schedule (EPUS);
- De Minimis and Emergency Instruction tagging will not apply to the EPUS stack;
- EPUS[9] Arbitrage tagging will apply to the EPUS stack to remove any DAOV that are priced less than or equal to DABV;
- EPUS NIV tagging will be applied to the EPUS stack (after the EPUS Arbitrage tagging) to exclude the DABV, DAOV and BSAD that will not be required for determining the main Energy Imbalance Price such that:
    - When NIV is positive, starting from the least expensive, only priced buy volumes up to the volume of NIV are included; and
    - When NIV is negative, starting from the least expensive, only priced sell volumes up to the volume of NIV are included.
- PAR tagging will be applied such that a volume weighted average of the PAR volume portion of the most expensive[10] priced un-(EPUS)-tagged volumes will set the main price;
- The PAR volume will not change from the existing value of 500MWh; and
- The method for calculating the reverse price will not change.
- With regard to Manifest Errors, for the purposes of the EPUS, only the original price submitted for Bid-Offer Pairs should be used.

[7] This is to differentiate between a unit that is synchronising and desynchronising.
[8] Energy BSAD excludes System Buy Price Volume Adjuster (SBVA) and System Sell Price Volume Adjuster (SSVA) which are not to be included in the EPUS stack.
[9] The terms 'EPUS Arbitrage tagging' and 'EPUS NIV tagging' are used here to differentiate from the tagging that occurs in the determination of the NIV.
[10] It should be noted that 'least expensive' should, in this context, be considered in relation to the benefit of the System. Offers are bought by the System for an increase in energy, thus the 'least expensive' will be the Offer that cost the least to take. Since Bids are paid to the System by Parties for a reduction in energy, the least expensive Bid will be the one that pays the system the most. A negative Bid price will be expensive to the System, as the System is paying (rather than being paid) to reduce energy. Similarly, when using the term 'most expensive', it should be considered in this context.

Figure 2. Example of the P211 Arrangements Main Imbalance Price Calculation when Short



2 DETAIL OF PROPOSED MODIFICATION SOLUTION REQUIREMENTS

2.1 Defining period variables

2.1.1 Current Bid-Offer Pairs

Bid-Offer pairs (BO^n_{ij}) consist of a MW band, Offer Price (PO^n_{ij}), Bid Price (PB^n_{ij}) (both in £/MWh), and an associated Bid-Offer pair number 'n'. There can be up to 5 Bid-Offer pairs with positive MW levels relative to FPN (n = 1 to 5) and up to 5 Bid Offer pairs with negative MW levels relative to FPN (n = -1 to -5).

For BMU i in Settlement Period j, positive numbered (n>0) Bid-Offer Pairs are denoted by n+.

For BMU i in Settlement Period j, negative numbered (n<0) Bid-Offer Pairs are denoted by n-.

2.1.2 Integrating FPN, MEL, MIL , SEL, SIL and Bid-Offer Pairs

Generators, Suppliers and large customers can provide Bid-Offer pairs to NGET. These are made up of volumes obtained from the difference between a Balancing Mechanism Unit's (BMU's) Final Physical Notification[11] (FPN) and its Maximum Export Limit (MEL) for Offers, and its Maximum Import Limit (MIL) for Bids. Information on Stable Export Limits (SEL) and Stable Import Limits (SIL) for each BMU are also provided to NGET under the Grid Code.

For each Settlement Period, a value for MEL as submitted by, and that exists at Gate Closure shall be defined as MEL^{GC}. A value for MEL submitted by the end of the Settlement Period shall be defined as MEL^{E}. (The E denoting 'end')

FPN, MELGC, MELE, MIL and Bid-Offer pairs are made up of a set of spot values either within a Settlement Period or spanning more than one Settlement Period. Up to two 'point' variables can be submitted for a single spot time. (i.e. the "to" and "from" time). SEL and SIL data consists of a MW value and a start date and time of a future Operational Day, therefore when a value is submitted it will be valid from the start date and time until a new value is submitted.

For the purposes of P211 Alternative, FPN and Bid Offer pairs used will be those available at Gate Closure. For MIL, the profile to be used will be the latest available at the end of the Settlement Period. For MEL, the lower of MEL^{GC} and MEL^{E} will be used.

As these point variables must be submitted in a whole number of minutes, there are 31 spot times[12] for which point data may be submitted for any Settlement Period.

Interpolation will be used to obtain a value at every instant in the Settlement Period. Integration is then used to give a MWh value for FPN, MEL^{GC}, MEL^{E}, MIL, SIL, SEL and Bid-Offer volume. MEL is then determined to be the lower of MEL^{GC} or MEL^{E}. Where these values are equivalent, MEL^{E} should be used. This can be described as:

$$MEL = \min \{ MEL^{GC} , MEL^{E} \}$$

These time weighted average variables for each BMU i in Settlement Period j shall be known as Period FPN (FPN_{ij})[13], Period MEL (MEL_{ij}), Period MIL (MIL_{ij}), Period SIL (SIL_{ij}), and Period SEL (SEL_{ij}). Period Bid-Offer volume (QBO^n_{ij}) will also be identified by the Bid-Offer Pair number, n.

[11] The Final Physical Notification is the level of generation or demand that the Registrant of the BMU expects to generate or consume. This is submitted to NGC prior to Gate Closure as a series of MWh values with corresponding to and from times.
[12] The 31 spot points allow for the points at the start and the end of the Settlement Period. i.e. minute zero through to minute 30.
[13] This is already defined and calculated in the BSC under T3.2 which covers linear interpolation of the submitted FPN data to create a value $FPN_{ij}(t)$ for each spot time t in the Settlement Period. T4.3.1 covers the integration of $FPN_{ij}(t)$ to produce a MWh value FPN_{ij} for the Settlement Period.

The Period Bid-Offer Volume QBO^n_{ij} should be derived by integrating the Bid-Offer Volume $qBO^n_{ij}(t)$.

Period MEL, Period MIL, Period SEL, and Period SIL values should be derived in the same way as FPN_{ij} i.e. define values $MEL_{ij}(t)$, $MIL_{ij}(t)$, $SIL_{ij}(t)$ and $SEL_{ij}(t)$ for each spot time t in the Settlement Period, and then integrate.

Values for the first minute of each Settlement Period (t = first full minute after the start of the Settlement Period) for FPN and SEL will also need to be defined as $FPN_{ij}(1)$ and $SEL_{ij}(1)$. These can be discovered using the above interpolation.

2.2 Calculating DAOV and DABV

DAOV, in addition to any net Energy BSAD Buy actions, will form the basis for the 'Buy' side of the EPUS stack. Similarly DABV, in addition to any net Energy BSAD Sell actions, will form the basis for the 'Sell' side of the EPUS stack. DAOV and DABV will be sourced from the Bid-Offer pairs as described in 2.2.1 to 2.2.7.

2.2.1 Pricing DAOV and DABV

DAOV and DABV will be denoted by Settlement Period, BMU, and the Bid-Offer pair number ($DAOV^n_{ij}$ and $DABV^n_{ij}$). The price associated with DAOV and DABV will be equivalent to the price submitted for the Bid-Offer pair number except where DAOV or DABV exists below SEL (or above SIL).

P211 Alternative seeks to provide a proxy for the price of DAOV and DABV that exists between SEL and zero or between SIL and zero. This is because, once a BMU is dispatched within these ranges, the whole volume has to be taken by the SO as the BMU in reality would have to run all the way to zero.

Thus, for any volume accessed between zero and SEL (or SIL and zero), the price attached to that volume is to be the average of the Bids or Offer bands applicable for that volume. It should be noted that when FPN is between zero and SIL (negative, therefore importing) that the average of the Bids will be the volume between FPN and SIL.

As a simplified example, consider period values for FPN and SEL as below. If:

FPN = 200MW

SEL = 100MW

Bid-Offer pair -1 (n= -1) is a 70MW band at £20/MW,

Bid-Offer pair -2 (n = - 2) is a 60MW band at £10/MW,

Bid-Offer pair -3 (n = - 3) is a 30MW band at £5/MW,

Then the average volume weighted cost for the DABV below SEL is £7.5/MW. (Given the volume below SEL is 30MW of Bid-Offer pair -2 and 30MW of Bid-Offer pair -3).

Conversely for the example where:

FPN = 10MW

SEL = 100MW

Bid-Offer pair 1 (n= 1) is a 70MW band at £10/MW,

Bid-Offer pair 2 (n = 2) is a 60MW band at £20/MW,

Bid-Offer pair 3 (n = 3) is a 30MW band at £25/MW,

Then the average volume weighted cost for the DAOV between FPN and SEL is £12.2/MW. (Given the volume below SEL is; 70MW of Bid-Offer pair 1 and 20MW of Bid-Offer pair 2).

To be able to do this we need two new variables which are the Updated Bid Price (UPB) and Updated Offer Price (UPO) for each Bid-Offer Pair. This required change in prices can be expressed by:

1. When $FPN_{ij} < QBO^{n}_{ij} < SEL_{ij}$ for any n > 0, there must be a number v (less than x) and a number φ (which may be a fraction or zero) for which:

$$SEL_{ij} = \Sigma^{n\ v<x} (QBO^{n}_{ij}) + \varphi * \Sigma^{n\ x} (QBO^{n}_{ij})$$

Each QBO^{n}_{ij} numbered x-1 or lower shall be defined as $QBO^{n\sim}_{ij}$ and will then be allocated an Updated Offer price (UPO^{n}_{ij}) for the purposes of the main Energy Imbalance Price calculation. The QBO^{n}_{ij} numbered x will be known as the threshold QBO^{n}_{ij} and will be subject to:

The fraction φ of the threshold QBO^{n}_{ij} will also be defined as $QBO^{n\sim}_{ij}$ and will then also be allocated the Updated Offer price (UPO^{n}_{ij}).

Note that the fraction 1 – φ will retain the price PO^{n}_{ij}

Where:

$$UPO^{n}_{ij} = \{ \Sigma^{n\sim} (PO^{n}_{ij} * QBO^{n\sim}_{ij}) \} / \Sigma^{n\sim}\{QBO^{n\sim}_{ij}\}$$

2. When $0 < QBO^{n}_{ij} < SEL_{ij}$ for any n < 0, there must be a number v (greater than x) and a number φ (which may be a fraction or zero) for which:

$$SEL_{ij} = \Sigma^{n\ v>x} (QBO^{n}_{ij}) + \varphi * \Sigma^{n\ x} (QBO^{n}_{ij})$$

Each QBO^{n}_{ij} numbered x+1 or higher shall be defined as $QBO^{n\sim}_{ij}$ and will then be allocated an Updated Bid Price (UPO^{n}_{ij}) for the purposes of the main Energy Imbalance Price calculation. The QBO^{n}_{ij} numbered x will be known as the threshold QBO^{n}_{ij} and will be subject to:

The fraction φ of the threshold QBO^{n}_{ij} will also be defined as $QBO^{n\sim}_{ij}$ and will then also be allocated the Updated Offer price (UPO^{n}_{ij}).

Note that the fraction 1 – φ will retain the price PO^{n}_{ij}

Where:

$$UPB^{n}_{ij} = \{ \Sigma^{n\sim} (PB^{n}_{ij} * QBO^{n\sim}_{ij}) \} / \{ \Sigma^{n\sim} (QBO^{n\sim}_{ij}) \}$$

3. When $0 < QBO^{n}_{ij} < SIL_{ij}$ for any n > 0, there must be a number v (greater than x) and a number φ (which may be a fraction or zero) for which:

$$SIL_{ij} = \Sigma^{n\ v>x} (QBO^{n}_{ij}) + \varphi * \Sigma^{n\ x} (QBO^{n}_{ij})$$

Each QBO^{n}_{ij} numbered x+1 or higher shall be defined as $QBO^{n\sim}_{ij}$ and will then be allocated a new Offer price (UPO^{n}_{ij}) for the purposes of the main Energy Imbalance Price calculation. The QBO^{n}_{ij} numbered x will be known as the threshold QBO^{n}_{ij} and will be subject to:

The fraction φ of the threshold QBO^{n}_{ij} will also be defined as $QBO^{n\sim}_{ij}$ and will then allocated a new Offer price (PO^{n}_{ij}).

Note that the fraction 1 – φ will retain the price PO^{n}_{ij}

Where:

$$UPO^{n}_{ij} = \{ \Sigma^{n\sim} (PO^{n}_{ij} * QBO^{n\sim}_{ij}) \} / \{ \Sigma^{n\sim} (QBO^{n\sim}_{ij}) \}$$

4. When $0 < QBO^{n}_{ij} < SIL_{ij}$ for any n < 0, there must be a number v (less than x) and a number φ (which may be a fraction or zero) for which:

$$SIL_{ij} = \Sigma^{n\ v<x} (QBO^{n}_{ij}) + \varphi * \Sigma^{n\ x} (QBO^{n}_{ij})$$

Each QBO^{n}_{ij} numbered x-1 or lower shall be defined as $QBO^{n\sim}_{ij}$ and will then be allocated an Updated Bid price (UPO^{n}_{ij}) for the purposes of the main Energy Imbalance Price calculation.. The QBO^{n}_{ij} numbered x will be known as the threshold QBO^{n}_{ij} and will be subject to:

The fraction φ of the threshold QBO^{n}_{ij} will also be defined as $QBO^{n\sim}_{ij}$ and will then also be allocated the Updated Offer price (UPO^{n}_{ij}).

Note that the fraction 1 – φ will retain the price PO^{n}_{ij}

Where:

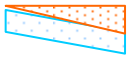
$$UPB^{n}_{ij} = \{ \Sigma^{n\sim} (PB^{n}_{ij} * QBO^{n\sim}_{ij}) \} / \{ \Sigma^{n\sim} (QBO^{n\sim}_{ij}) \}$$

5. In all other cases:

$$UPO^{n}_{ij} = PO^{n}_{ij}$$

$$UPB^{n}_{ij} = PB^{n}_{ij}$$

[Note that these volumes are also shown graphically in Figure 6 below:

- *the DAOV below SEL represented by the area*  *should be priced at the volume weighted average price of the DAOV in this area; and*
- *the DABV below SEL represented by the area*  *should be priced at the volume weighted average price of the DABV in this area.*

Similarly the DAOV and DABV above SIL[14] should be priced at the volume weighted average of the DAOV and DABV respectively.]

2.2.2 Sourcing DAOV and DABV

DAOV will be determined as being the volume of the positive Bid-Offer pairs that lie between the Period FPN and Period MEL for every BMU after dynamic parameters are applied. These dynamic parameters include parameters not currently provided to BSC Systems from the SO such as values for RUR, RDR, SEL, SIL, and NDZ at Gate Closure. For the purposes of this assessment:

- the SVAA should assume that these dynamic parameters are provided to them by the SO; and
- The Transmission Company should take into account the cost of providing these parameters to Central Systems.

As there are four dynamic rules to apply it is simplest to apply these in sequence starting from the description of DAOV and DABV in the P211 Proposed solution (repeated below). Here we will call this volume $DAOV_0$ and $DABV_0$ with the zero denoting the starting point from which the rules will apply. After each rule is applied the remaining DAOV and DABV will be denoted as $DAOV_1$, $DAOV_2$ … etc. Thus $DAOV_2$ will have had dynamic parameter rules 1 and 2 applied to it. This continues up until after the fourth rule is applied where the remaining DAOV and DABV will simply be denoted as DAOV and DABV (having no numeric subscript denoting that all dynamic rules have been applied). It is not required that SVAA processes have to occur in the sequence the rules are explained here if the result is the same and process times would be quicker.

The sum of all positive Bid-Offer Pairs cannot exceed the difference between Period FPN and Period MEL at each BMU. Similarly, the DABV will be determined by the sum of the negative Bid-Offer pairs that lie between the Period FPN and period MIL for every BMU. The sum of all negative numbered Bid-Offer Pairs cannot exceed the difference between Period FPN and Period MIL at each BMU.

Any volume that exists for a BMU between the top priced Offer PO^{n+max}_{ij} and Period MEL (MEL_{ij})[15] that is not priced is excluded from being a DAOV.

[14] By definition, SIL is a negative number.

Any volume that exists for a BMU between the top priced Bid $PB^{n\text{-}min}_{ij}$ and Period MIL (MIL_{ij}) that is not priced is excluded from being a DABV.

This is represented by the following equations and can be seen graphically in Figure 3 below:

For each Settlement Period, for each BM Unit, for each Submitted Bid-Offer Pair for which the associated Bid-Offer Pair Number n is greater than zero, the Deemed Available Offer Volume ($DAOV_0{}^n{}_{ij}$) shall be:

a) For n = 1:

$$DAOV_0{}^n{}_{ij} = \min \{ QBO^n_{ij}, \max (MEL_{ij} - FPN_{ij}, 0) \}$$

b) For n > 1:

$$DAOV_0{}^n{}_{ij} = \min \{ QBO^n_{ij}, \max (MEL_{ij} - FPN_{ij} - \Sigma^{n'+} DAOV_0{}^{n'}{}_{ij}, 0) \}$$

where $\Sigma^{n'+}$ represents the sum over the range of positive Bid-Offer Pair Numbers n' from 1 to (n-1) of Submitted Bid-Offer Pairs.

For each Settlement Period, for each BM Unit, for each Submitted Bid-Offer Pair for which the associated Bid-Offer Pair Number n is less than zero, the potential Deemed Available Bid Volume ($DABV_0{}^n{}_{ij}$) shall be:

a) For n = –1:

$$DABV_0{}^n{}_{ij} = \max \{ QBO^n_{ij}, \min (MIL_{ij} - FPN_{ij}, 0) \}$$

b) For n < -1:

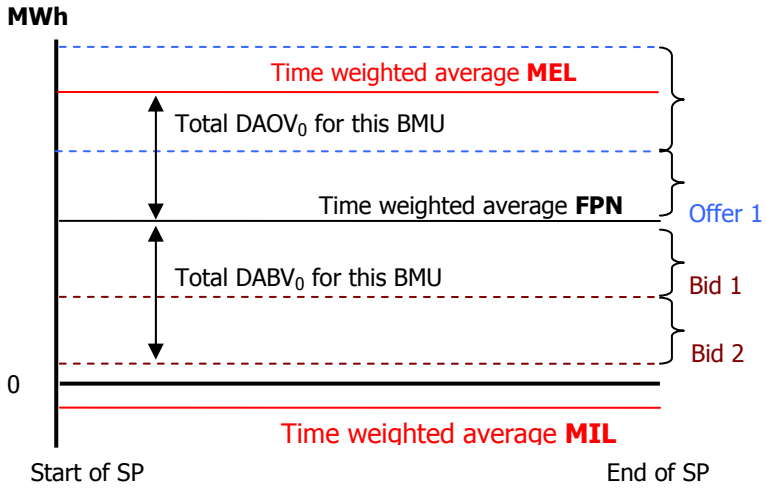
$$DABV_0{}^n{}_{ij} = \max \{ QBO^n_{ij}, \min (MIL_{ij} - FPN_{ij} - \Sigma^{n'-} DABV_0{}^{n'}{}_{ij}, 0) \}$$

where $\Sigma^{n'-}$ represents the sum over the range of negative Bid-Offer Pair Numbers n' from -1 to (n+1) of Submitted Bid-Offer Pairs.

As with the proposed solution, concern has been expressed that it may be inefficient to require BMRA and SAA to calculate MIL_{ij}, MEL_{ij}, $DAOV_{0ij}$ and $DABV_{0ij}$ for all BM Units, when many of these values will then be EPUS NIV Tagged (and hence have no impact on Energy Imbalance Prices). This could be a particular concern in the context of BMRS, where prompt price reporting is of the essence. This is to be addressed by only requiring the BMRA and SAA to build enough of the DAOV/DABV stack to calculate Energy Imbalance Prices (i.e. allow them to start building the stack with the cheapest Bids and Offers, and to stop when a sufficient volume of stack has been constructed in order to complete EPUS Arbitrage tagging and then ensure that all remaining DAOV and DABV volumes would be NIV tagged). As part of this impact assessment, views are sought from service providers on whether this approach would be advantageous. Views are also sought from Parties on whether it would be acceptable (given that it would prevent the reporting of MIL_{ij}, MEL_{ij}, $DAOV_{ij}$ and $DABV_{ij}$ for those Bids and Offers that were wholly EPUS NIV Tagged).

[15] Remembering that MEL_{ij} is the lower of MEL at Gate Closure or that submitted by the end of the Settlement Period.

Figure 3. $DAOV_0$ and $DABV_0$



2.2.3 Rule 1: NDZ Qualifying rule (Minute and half hourly resolution)

All $DAOV_0$ or $DABV_0$ for a BMU where the NDZ[16] at Gate Closure is greater than 89 minutes and the Period FPN for the Settlement Period is equal to zero shall be excluded from the EPUS stack.

This can be expressed as:

For any BMU where:

$FPN_{ij} = 0$, and

$NDZ_{ij-2} > 89$ minutes,

then $DAOV_1{}^n{}_{ij} = DABV_1{}^n{}_{ij} = 0$

otherwise:

$DAOV_1{}^n{}_{ij} = DAOV_0{}^n{}_{ij}$

$DABV_1{}^n{}_{ij} = DABV_0{}^n{}_{ij}$

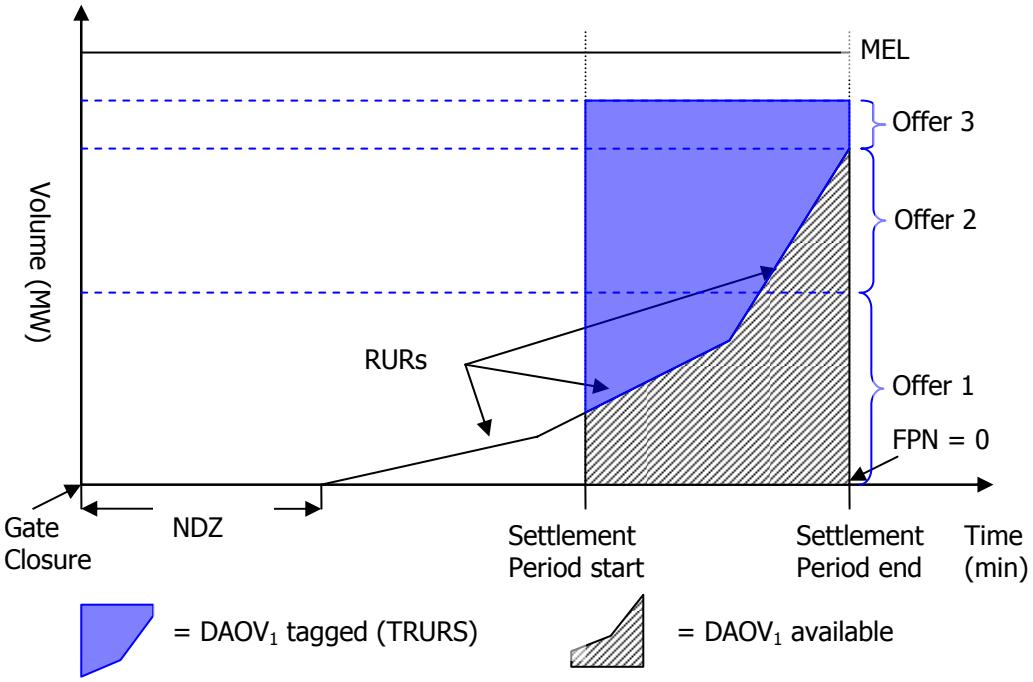
N.B Currently gate closure is one hour and the Settlement Period thirty mins, hence cut–off is one minute less this total time, i.e. 89 minutes. For system purposes this should be parameterised.

2.2.4 Rule 2: NDZ and RUR and FPN=0

After the application of Rule 1 (2.2.3), by definition those BMU's with an FPN equal to zero will have a NDZ at Gate Closure of less than or equal to 89 minutes. Therefore, this rule 2 applies to all BMU's not excluded under Rule 1 which have a FPN equal to zero. Rule 2 will add the time notified in the NDZ from the instant of Gate Closure to represent the expected synchronisation time of the unit. It will then profile the BMUs ramp up in generation according to the RUR supplied for the BMU[17] in Settlement Period j[18]. Only $DAOV_1{}^n{}_{ij}$ that lies beneath the RUR (as determined by linear interpolation from the RURs submitted) will be included as $DAOV_2{}^n{}_{ij}$. As FPN is equal to zero it is assumed that there can be no DABV submitted. The available DAOV is represented in Figure 4.

[16] NDZ is a defined term in the BSC. The definition is 'Has the meaning given to that term in BC1 of the Grid Code'.
[17] RUR and RDR are defined terms in the BSC. The definition is 'Has the meaning given to that term in BC1 of the Grid Code'. Note that 3 RURs or RDR can apply for any BMU within the range of 0.2-40MW per minute.
[18] It is noted that the RURs in Settlement Period j should be the same as the RURs in Settlement Period j-1 and j-2 as the unit is assumed to not be generating.

Figure 4. Rule 2 – Minute and half hourly Resolution



To determine the volume of $DAOV_1{}^n_{ij}$ that would be removed by this rule 2, the volume tagged in the above Figure 4 needs to be calculated. This process can be described as follows:

When FPN = 0:

- Define Synchronisation Time (ST_{ij}) for BMU i in Settlement Period j as the minute that is exactly the NDZ_{ij-2} minutes from Gate Closure.
- From the minute ST_{ij} apply the ramp up rates submitted for BMU i in Settlement Period j (RUR_{ij}).
- Using linear interpolation of the RURs, a profile of the BMU's maximum generation capability from ST_{ij} until the end of Settlement Period j can be determined.
- Using integration, determine the volume of $DAOV_1{}^n_{ij}$ that is above the RUR profile. Define this volume as Tagged Run Up Rate from Synchronisation ($TRURS^n_{ij}$)

Following the application of this rule 2, define:

$$DAOV_2{}^n_{ij} = DAOV_1{}^n_{ij} - TRURS^n_{ij}$$

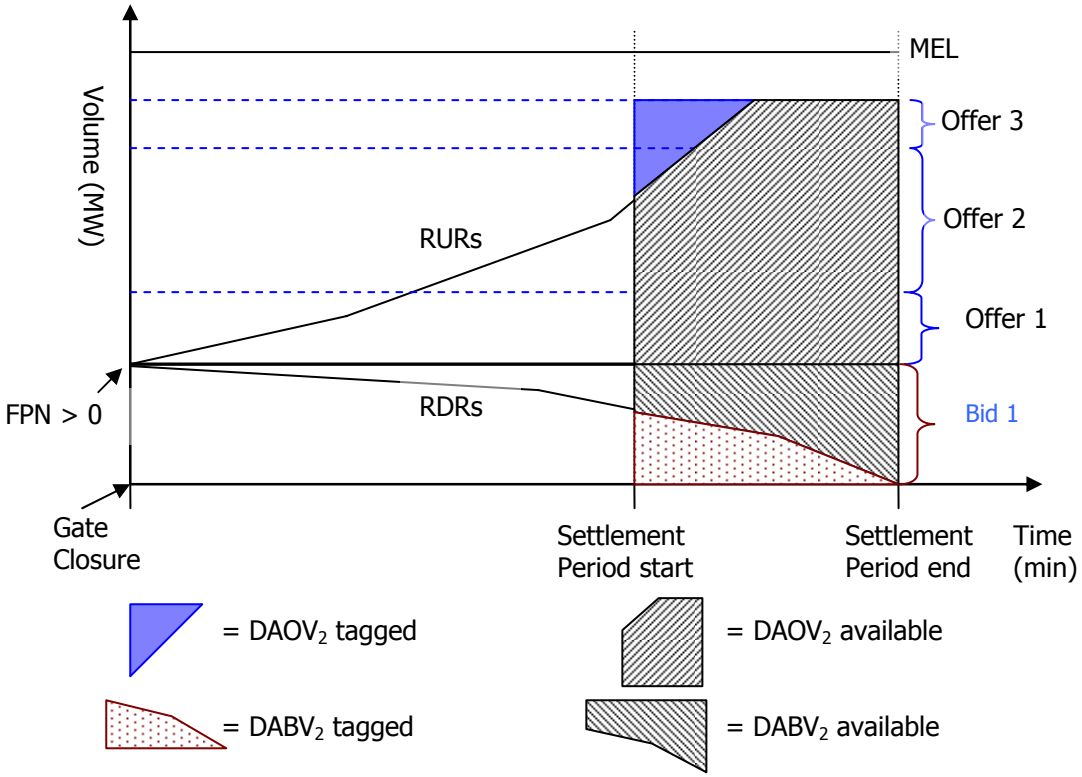
$$DABV_2{}^n_{ij} = DABV_1{}^n_{ij}$$

2.2.5 Rule 3: RUR and RDR (FPN ≠ 0)

Rule 2 dealt with the special case of FPN = 0. However RURs and RDRs should be applied to all BMUs to reflect the time it takes for a unit to get to the level of its Bid or Offer. It is assumed that the SO has the foresight to request a BMU to start ramping from the instant of Gate Closure if required to balance the system. Note that the BMU is considered to ramp from the FPN at Gate Closure (as opposed to any SCADA snapshot of what the BMU was actually doing at Gate Closure).

The available DAOV and DABV is shown in Figure 5.

Figure 5. Rule 3 – Minute and half hourly Resolution



To determine the volume of $DAOV2^{n}_{ij}$ that would be removed by this rule 3, the volume tagged in the above Figure 5 needs to be calculated. This process can be described as:

When FPN ≠ 0:

- For each BMU i, apply the RURs submitted for BMU i in Settlement Periods j, j-1, and j-2 (RUR_{ij}, RUR_{ij-1}, and RUR_{ij-2}) from the instant of Gate Closure for Settlement Period j.
- For each BMU i, apply the RDRs submitted for BMU i in Settlement Period j, j-1, and j-2 (RDR_{ij}, RDR_{ij-1}, and RDR_{ij-2}) from the instant of Gate Closure for Settlement Period j.
- Using linear interpolation of the RURs and RDRs, a profile of the BMU's maximum and minimum generation capability from Gate Closure (for Settlement Period j) until the end of Settlement Period j can be determined.
- Using integration, determine the volume of $DAOV2^{n}_{ij}$ that is above the RUR profile. Define this volume as Tagged Run Up Rate ($TRUR^{n}_{ij}$)
- Using integration, determine the volume of $DABV2^{n}_{ij}$ that is below the RDR profile. Define this volume as Tagged Run Down Rate ($TRDR^{n}_{ij}$)

Following the application of this rule 3, define:

$$DAOV3^{n}_{ij} = DAOV2^{n}_{ij} - TRUR^{n}_{ij}$$

$$DABV3^{n}_{ij} = DABV2^{n}_{ij} - TRDR^{n}_{ij}$$

2.2.6 Rule 4: Where FPN is less than SEL – Minute resolution

This rule seeks to exclude any volume that would not be accessible due to a generation unit desynchronising. It reflects that once a unit is below its declared SEL at Gate Closure that the unit could not be requested to increase load again.

If the FPN[19] for the first Settlement Period past Gate Closure (for the Settlement Period in Question) is less than the SEL for the first Settlement Period past Gate Closure (that is, between 0 and SEL), and the FPN for the Settlement Period in Question is less than the FPN for the first Settlement Period past Gate closure, then no volume can be accessed for the Settlement Period in question[20]. This is shown in Figure 6.

FPN_{ij} and SEL_{ij} have been interpolated in 2.1.2 above. We have also defined the spot value in the first minute of Settlement Period j for each BMU i as $FPN_{ij}(1)$ and $SEL_{ij}(1)$. It is suggested that to determine when FPN is decreasing that FPN in the first minute is compared to FPN in fifteenth minute of the first Settlement Period post Gate closure. Therefore, this Rule 4 can be described as:

Where $FPN_{ij-2} > FPN_{ij-1}$

and $FPN_{ij-2}(1) < SEL_{ij-2}(1)$

then:

$DAOV_4{}^n{}_{ij} = 0$ and

$DABV_4{}^n{}_{ij} = 0$

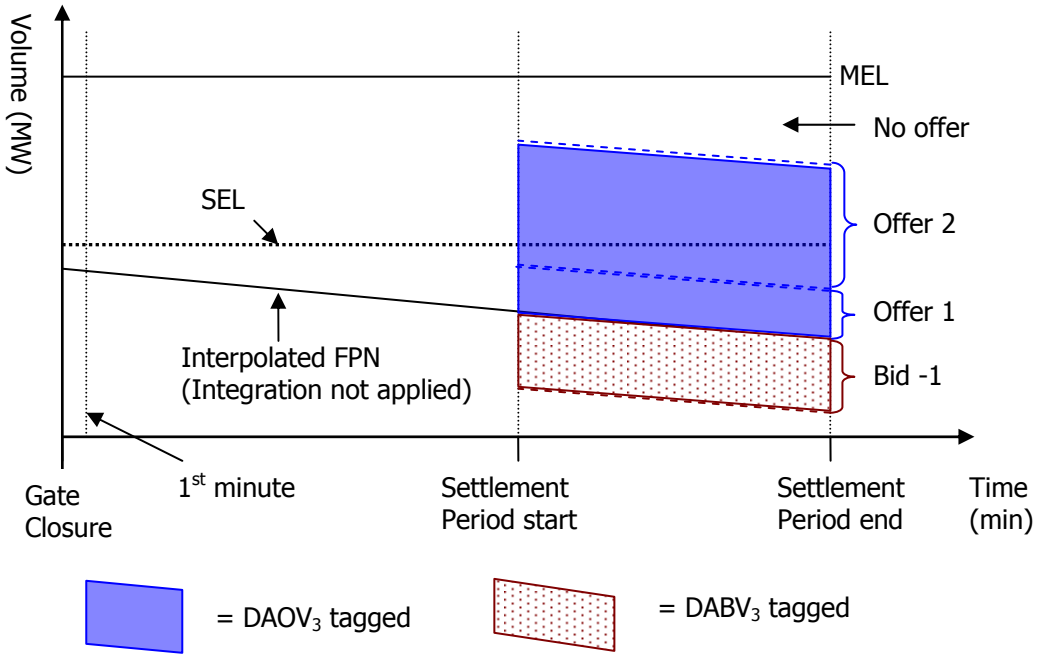
otherwise:

$DAOV_4{}^n{}_{ij} = DAOV_3{}^n{}_{ij}$

$DABV_4{}^n{}_{ij} = DABV_3{}^n{}_{ij}$

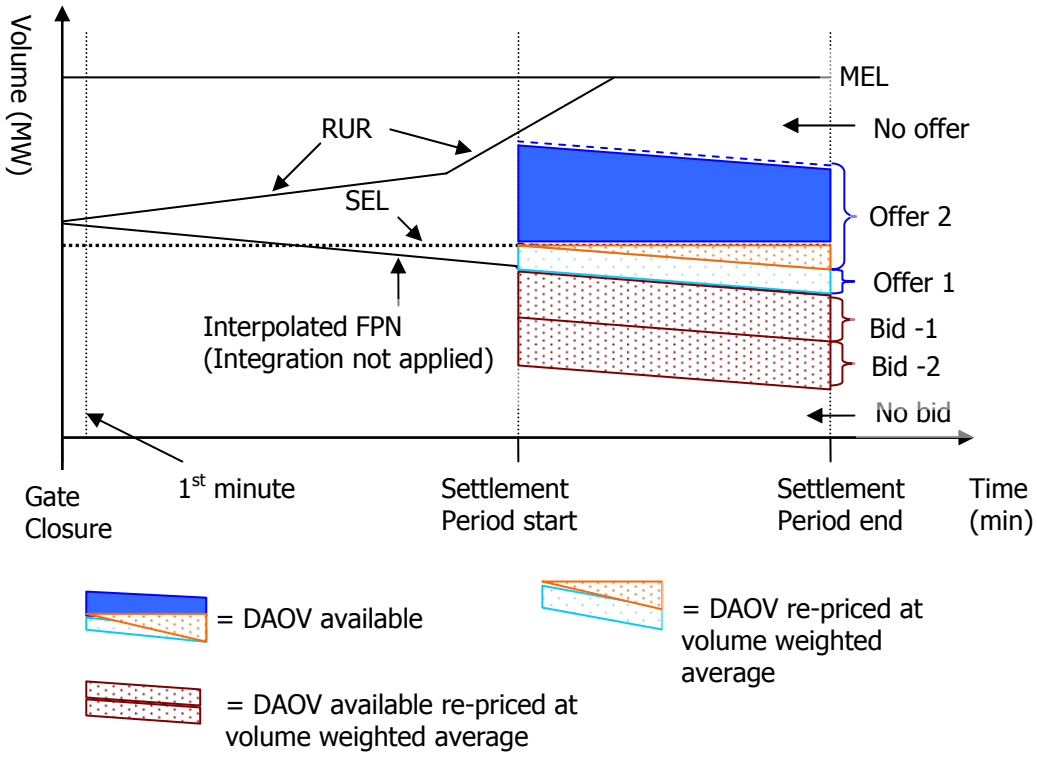
Note that where $FPN_{ij-2} > FPN_{ij-1}$ and $FPN_{ij-2}(1) > SEL_{ij-2}(1)$ that the DAOV and DABV in that Settlement Period j will remain subject to RUR and RDR. This is represented in Figure 7.

Figure 6. Rule 4 – Minute Resolution – FPN less than SEL at one minute past Gate Closure



[19] Here we are using FPN before integration has occurred but after interpolation has occurred so that we are looking at values at a minute resolution.
[20] This second part of this condition is required to verify that the unit is desynchronising and not synchronising.

Figure 7. Rule 4 – Minute Resolution – FPN greater than or equal to SEL at one minute past Gate Closure



2.2.7 Rule 4: Where FPN is less than SEL – Half hourly resolution

As for minute resolution, this rule seeks to exclude any volume that would not be accessible due to a generation unit desynchronising but does so on a half hourly resolution. It reflects that once a unit is below its declared SEL at Gate Closure that the unit could not be requested to increase load again.

If the FPN for the first Settlement Period past Gate closure (for the Settlement Period in Question) is less than SEL (that is, between 0 and SEL), and the FPN for the Settlement Period in Question is less than the FPN for the first Settlement Period past Gate closure, then no volume can be accessed for the Settlement Period in question.

Where $FPN_{ij-2} > FPN_{ij-1}$

and $FPN_{ij-2} < SEL_{ij-2}$

then:

$DAOV_4{}^n{}_{ij} = 0$ and

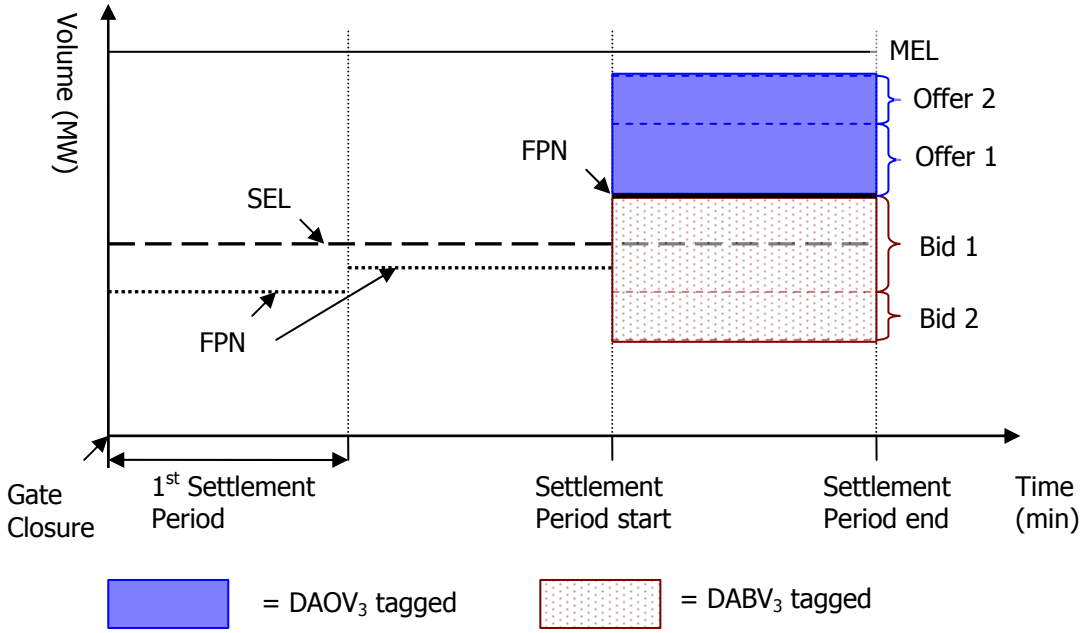
$DABV_4{}^n{}_{ij} = 0$

otherwise:

$DAOV_4{}^n{}_{ij} = DAOV_3{}^n{}_{ij}$

$DABV_4{}^n{}_{ij} = DABV_3{}^n{}_{ij}$

Figure 8. Rule 4 – Half Hour Resolution – FPN less than SEL



2.3 EPUS Arbitrage tagging

In respect of each Settlement Period, Arbitrage DAOV and Arbitrage DABV shall be removed so that these do not enter the EPUS stack. This process for EPUS Arbitrage tagging is the same as the current process for Arbitrage tagging except it is applied to the DABV and DAOV volumes that have had the above dynamic parameter rules applied to them instead of accepted bid and offer volumes.

Arbitrage Bids are those negative numbered[21] Bids (n-) (or parts thereof) capped where appropriate by the rules above in Settlement Period j, for which the Bid Price is greater than or equal to the Offer Price of one or more positively numbered Offer in the same Settlement Period. The quantity of Arbitrage Bids tagged as such in a particular Settlement Period is limited by the aggregate quantity of positively numbered Offers for which the Offer Price is less than or equal to the Bid Price.

Similarly, Arbitrage Offers are those positively numbered Offers (n+) (or parts thereof) capped where appropriate by the rules above in Settlement Period j, for which the Offer Price is less than or equal to the Bid Price of one or more negatively numbered Bid in the same Settlement Period. The quantity of Arbitrage Offers tagged as such in a particular Settlement Period is limited by the aggregate quantity of negatively numbered Bids for which the Bid Price is greater than or equal to the Offer Price.

For the avoidance of doubt, the DAOV and DABV that will be subject to Arbitrage tagging is the $DAOV^{n}_{ij}$ and $DAOV^{n}_{ij}$ discovered under 2.2.6 (for minute resolution) or 2.2.7 (for half hourly resolution).

2.4 Forming the EPUS

P211 builds an EPUS stack for every Settlement Period based on:

- All of the Non-EPUS Arbitrage Tagged DABV and DAOV ranked in price order, cheapest first.
- Including Energy BSAD, as it is currently determined, in the EPUS in price order.

[21] Positively numbered and negatively numbered here refers to the Bid-Offer Pair number, n.

2.4.1 Determining EPUS Ranked Bid Volumes

The set of all Period Bids that are neither EPUS Arbitrage Bids or capped by Period MIL (PMIL) will be ranked in price order, most expensive first (where the most expensive is allocated an n^ value of 1, the next most expensive a value of 2 and so on). If any Period Bids have the same price then the ordering of such Period Bids will be random. The set of non-arbitrage Period Bids (that have been capped where appropriate by PMIL) is then a set of '**EPUS Ranked Priced Bids**'.

The Sell Price Volume Adjustment (Energy) ($ESVA_j$) will be added into the set of EPUS Ranked Priced Bids according to the Sell Price Cost Adjustment (Energy) ($ESCA_j$) (converted to a price in £/MWh, i.e. ESCAj / $ESVA_j$). The volume will be assigned a n^ value and the n^ values of the EPUS Ranked Priced Bids will be adjusted accordingly. The set of EPUS Ranked Priced Bids including the $ESVA_j$ will then be a set of '**EPUS Ranked Bids**'.

Where the price of the $ESVA_j$ is the same as any other EPUS Ranked Priced Bid, then the $ESVA_j$ will be given the higher n^ value with the same price.

This will then constitute a set of 'EPUS Ranked Bid Volumes' as follows:

$$(DABV^{n^\wedge}_{ij}\ldots)(\ ESVA^{n^\wedge}_{j})$$

2.4.2 Determining EPUS Ranked Offer Volumes

The set of all Period Offers that are neither EPUS Arbitrage Bids or capped by Period MEL (PMEL) will be ranked in price order, cheapest first (where the cheapest is allocated an n˜ value of 1, the next cheapest a value of 2 and so on). If any Period Offers have the same price then the ordering of such Period Offers will be random. The set of non-arbitrage Period Offers (that have been capped where appropriate by PMEL) is then a set of '**EPUS Ranked Priced Offers**'.

The Buy Price Volume Adjustment (Energy) ($EBVA_j$) will be added into the set of EPUS Ranked Priced Offers according to the Buy Price Cost Adjustment (Energy) ($EBCA_j$) (converted to a price in £/MWh, i.e. EBCAj / $EBVA_j$). The volume will be assigned a n˜ value and the n˜ values of the EPUS Ranked Priced Offers will be adjusted accordingly. The set of EPUS Ranked Priced Offers including the $EBVA_j$ will then be a set of '**EPUS Ranked Offers**'.

Where the price of the $EBVA_j$ is the same as any other EPUS Ranked Priced Offer, then the $EBVA_j$ will be given the higher n˜ value with the same price.

This will then constitute a set of 'EPUS Ranked Offer Volumes' as follows:

$$(DAOV^{n\tilde{}}_{ij}\ldots)(\ EBVA^{n\tilde{}}_{j})$$

2.5 Determination of System Length

Whilst NIV will remain as the method for determining the direction and MWh value of system imbalance, it is not used for the Main Imbalance Price calculation. Thus it is not necessary for the Bid and Offer Acceptances and BSAD used in the NIV calculation to be ranked in price order. Specifically:

- NIV tagging of Bid–Offer Acceptances is not required as this removes equal volumes from both the buy and sell stacks, and therefore has no impact on the NIV calculation.
- Tagging CADL and Emergency Instructions will not need to occur as this has no impact on the NIV calculation; and
- Arbitrage tagging will not be required as this does not impact the direction or the size of the NIV.

It has been determined by the Modification Group that De Minimis will not be retained in the final solution. Therefore, the current NIV calculation can be simplified to:

$NIV_j = (\Sigma_i \Sigma^n QAO^n_{ij} + EBVA_j + SBVA_j + \Sigma i \Sigma^n QAB^n_{ij} + ESVA_j + SSVA_j)$

where Σ_i is over all BM Units and Σ^n is over all Accepted Bids and Offers.

2.6 EPUS NIV Tagging

P211 will require EPUS NIV tagging to exclude DAOV and DABV and net Energy BSAD that will not contribute to the Energy Imbalance Price calculation. It should be noted that:

- **For the current process**, NIV is equal to the difference in length between the two (Buy and Sell) stacks, and the tagging process removes an equal volume from each stack; and
- **For the new process**, NIV is unrelated to the lengths of the two (EPUS Buy and EPUS Sell) stacks and the tagging process removes different volumes from each.

2.6.1 When NIV < 0

Where NIV is less than zero, only the EPUS Ranked Bid Volumes will be used and thus the EPUS Ranked Offer Volumes are tagged out and will be defined as EPUS NIV tagged.

The EPUS Ranked Bid Volume that will be EPUS NIV tagged is that for which the sum of EPUS Ranked Bid Volumes is less than NIV[22]. This can be described as follows:

When $\Sigma^{n\wedge}(DABV^{n\wedge}_{ij} + ESVA^{n\wedge}_j) \leq NIV$, there must be a number x and a number Þ (which may be a fraction or zero) for which

$NIV = \Sigma^{n\wedge v<x}(DABV^{n\wedge v}_{ij} + ESVA^{n\wedge v}_j) + Þ*\Sigma^{n\wedge x}(DABV^{n\wedge x}_{ij} + ESVA^{n\wedge x}_j)$

Each EPUS Ranked Bid numbered x+1 or higher can then be defined as EPUS NIV tagged. The EPUS Ranked Bid numbered x will be known as the threshold DABV or ESVA and will be subject to:

The fraction 1 – Þ of the threshold DABV or ESVA will also be defined as EPUS NIV tagged.

When $\Sigma^{n\wedge}(DABV^{n\wedge}_{ij} + ESVA^{n\wedge}_j) > NIV$ then no DABV or ESVA will be defined as EPUS NIV tagged.

2.6.2 When NIV > 0

Where NIV is greater than zero, only the EPUS Ranked Offer Volumes will be used and thus the EPUS Ranked Bid Volumes are tagged out and will be defined as EPUS NIV tagged.

The EPUS Ranked Offer Volume that will be EPUS NIV tagged is that for which the sum of EPUS Ranked Offer Volumes is greater than NIV. This can be described as follows:

When $\Sigma^{n\tilde{}}(DAOV^{n\tilde{}}_{ij} + EBVA^{n\tilde{}}_j) \geq NIV$, there must be a number x and a number Þ (which may be a fraction or zero) for which

$NIV = \Sigma^{n\tilde{}v<x}(DAOV^{n\tilde{}v}_{ij} + EBVA^{n\tilde{}v}_j) + Þ*\Sigma^{n\tilde{}x}(DAOV^{n\tilde{}x}_{ij} + EBVA^{n\tilde{}x}_j)$

Each EPUS Ranked Offer numbered x+1 or higher can then be defined as EPUS NIV tagged. The EPUS Ranked Offer numbered x will be known as the threshold DAOV or EBVA and will be subject to:

The fraction 1 – Þ of the threshold DAOV or EBVA will also be defined as EPUS NIV tagged.

[22] Here NIV is a negative number, ESVA is a negative number and, as defined in 2.2, DABV is also a negative number. Thus EPUS NIV tagging will only occur when ESVA plus DABV is a more negative number than NIV.

When $\Sigma^{n\tilde{}}(DAOV^{n\tilde{}}_{ij} + EBVA^{n\tilde{}}_{j}) < NIV$ then no DAOV or EBVA will be defined as EPUS NIV tagged.

2.7 EPUS PAR Tagging

PAR Tagging will occur on all non EPUS NIV tagged volumes. Non EPUS NIV Tagged volumes will be denoted by $n\breve{}$.

This methodology is based on the existing PAR Tagging methodology but uses the new variable defined under P211.

2.7.1 When NIV < 0

When NIV < 0, the set of all EPUS Ranked Bid Volumes that are not EPUS NIV Tagged Bids will be subject to PAR Tagging.

If $\Sigma^{n\breve{}}(DABV^{n\breve{}}_{ij} + ESVA^{n\breve{}}_{j}) \geq (-PAR)$ then none of the EPUS Ranked Offer Volumes will be PAR Tagged.

If $\Sigma^{n\breve{}}(DABV^{n\breve{}}_{ij} + ESVA^{n\breve{}}_{j}) < (-PAR)$ there must exist a number f and number Φ (which may be a fraction or one) for which

$$PAR = \Sigma^{n\breve{} v<f}(DABV^{n\breve{} v}_{ij} + ESVA^{n\breve{} v}_{j}) + \Phi * (DABV^{n\breve{} f}_{ij} + ESVA^{n\breve{} f}_{j})$$

Where $\Sigma^{n\breve{} v<f}$ is the sum over those EPUS Ranked Bid Volumes that are not EPUS NIV Tagged Bid for which v is less than f.

Each $n\breve{}$ numbered f - 1 or lower can then be defined as EPUS PAR tagged. The $n\breve{}$ numbered f will be known as the threshold DABV or ESVA and will be subject to:

The fraction 1 – Φ of the threshold DAOV or EBVA will also be defined as EPUS PAR tagged.

2.7.2 When NIV > 0

When NIV > 0, the set of all EPUS Ranked Offer Volumes that are not EPUS NIV Tagged Offers will be subject to PAR Tagging.

If $\Sigma^{n\breve{}}(DAOV^{n\breve{}}_{ij} + EBVA^{n\breve{}}_{j}) \leq PAR$ then none of the EPUS Ranked Offer Volumes will be PAR Tagged.

If $\Sigma^{n\breve{}}(DAOV^{n\breve{}}_{ij} + EBVA^{n\breve{}}_{j}) > PAR$ there must exist a number f and number Φ (which may be a fraction or one) for which

$$PAR = \Sigma^{n\breve{} v<f}(DAOV^{n\breve{} v}_{ij} + EBVA^{n\breve{} v}_{j}) + \Phi * (DAOV^{n\breve{} f}_{ij} + EBVA^{n\breve{} f}_{j})$$

Where $\Sigma^{n\breve{} v<f}$ is the sum over those EPUS Ranked Offer Volumes that are not EPUS NIV Tagged Offers for which v is less than f.

Each $n\breve{}$ numbered f - 1 or lower can then be defined as EPUS PAR tagged. The $n\breve{}$ numbered f will be known as the threshold DAOV or EBVA and will be subject to:

The fraction 1 – Φ of the threshold DAOV or EBVA will also be defined as EPUS PAR tagged.

2.8 Main Energy Imbalance Price Calculation

Under P211, the main Energy Imbalance Price calculation will change such that when NIV < 0, the formula under 2.8.1 will set SSP. Similarly, the formula under 2.8.2 will set SBP when NIV > 0.

It has not been determined whether the Transmission Loss Multiplier (TLM_{ij}) will be retained in the final solution. Therefore, as part of this impact assessment, costs are sought from service providers to both include and exclude the Transmission Loss Multiplier in the main Energy Imbalance Price calculation.

2.8.1 When NIV < 0

When the system is long (NIV < 0), the main Energy Imbalance price will be calculated as the volume weighted average of the DABV and ESVA that has not been EPUS PAR Tagged[23]. The Sell Price Adjuster (SPA) will be applied as in the current arrangements.

The Modification Group have agreed that TLM is included and with NIV < 0, then System Sell Price is the main price and will be determined as follows:

$$SSP_j = \{\Sigma_i\Sigma^n (DABV^n_{ij} * UPB^n_{ij} * TLM_{ij}) / \Sigma_i\Sigma^n (DABV^n_{ij} * TLM_{ij})\} + SPA_j$$

Where Σ_i represents the sum over all BMU's and Σ^n represents the sum over all EPUS Ranked Bid Volumes that are not EPUS PAR Tagged Bids.

2.8.2 When NIV > 0

When the system is short (NIV > 0), the main Energy Imbalance price will be calculated as the volume weighted average of the DAOV and EBVA that has not been EPUS PAR Tagged[24]. The Buy Price Adjuster (BPA) will be applied as in the current arrangements.

The Modification Group have agreed that TLM is included and with NIV > 0, then System Buy Price is the main price and will be determined as follows:

$$SBP_j = \{\Sigma_i\Sigma^n (DAOV^n_{ij} * UPO^n_{ij} * TLM_{ij}) / \Sigma_i\Sigma^n (DAOV^n_{ij} * TLM_{ij})\} + BPA_j$$

Where Σ_i represents the sum over all BMUs and Σ^n represents the sum over all EPUS Ranked Offer Volumes that are not EPUS PAR Tagged Offers.

3 ESTIMATED IMPACT OF MODIFICATION ON SYSTEMS, PROCESSES AND DOCUMENTATION

a) Impact on BSC Systems and Processes

System / Process	Impact of Proposed/Alternative Modification
Settlement	The amendment of the Energy Imbalance Price calculation impacts the derivation of the Energy Imbalance Prices. The BMRA and SAA systems and processes will be impacted.
Reporting	It is envisaged that the revised Energy Imbalance Prices will be reported within the current interface structure. It will be necessary to amend the Settlement Report (SAA-I014) to reflect the new price derivation (including the new parameters). This will require additional reporting on the elements that make up the EPUS based prices. Specifically for the SAA-I014: • the DAOV, DABV, EBVA and/or ESVA per BM Unit and Bid-Offer number that resolves the NIV; • The DAOV and DABV that is excluded due to the application of the dynamic parameter rules 1 to 4; • the DAOV, DABV, EBVA and/or ESVA per BM Unit and Bid-

[23] This is based on the fact that EPUS PAR tagged DABV and ESVA has already been subject to EPUS NIV tagging, EPUS Arbitrage tagging and capped where appropriate by PMIL.
[24] This is based on the fact that EPUS PAR tagged DOBV and EBVA has already been subject to EPUS NIV tagging, EPUS Arbitrage tagging and capped where appropriate by PMEL.

System / Process	Impact of Proposed/Alternative Modification
	Offer number that have been PAR tagged; and • the DAOV and DABV per BM Unit and Bid-Offer number that have been EPUS Arbitrage tagged. The additional costs for also providing this information on the BMRS also need to be identified. Options and costs for the reporting of the above need to be identified and discussions held on the most cost effective way to achieve the required reporting and other ways of reporting the total/tagged/untagged volumes.

b) Impact on BSC Agent Contractual Arrangements

BSC Agent Contract	Impact of Proposed/Alternative Modification
LogicaCMG	The SAA and BMRA System will be impacted. SAA reporting is affected. The SAA and BMRA Service Descriptions will also be impacted. New parameters RUR, RDR, SEL and SIL will need to be accommodated.

c) Impact on BSC Parties and Party Agents

As this Modification is a change to the Energy Imbalance Calculation, this is a significant change to one of the main tenets of the BSC Arrangements that will impact Settlement for all BSC Parties. Parties will be impacted by the change to sub-flow 1 of the Settlement Report (SAA-I014, sub flow 2).

d) Impact on Transmission Company

The Transmission Company will need to ascertain if there is any impact on its ability to efficiently discharge its Transmission Licence obligations, and any impact on Security of Supply from the proposal due to any effect on incentives to balance.

There would be additional impact due to the requirement for the Transmission Company to supply the additional parameters of SEL, SIL, RUR and RDR to Central Systems. Further, processes will be required for when this data has not been provided and an estimate is required for Settlement Calculation.

There may also be an impact on the computer systems and processes to accommodate the new DABV and DAOV quantities, changes to SAA reports (SAA-I014), and other BMU specific operational parameter information requirements of this Proposal. Additionally, the BMRA SAA Interface Specification will be impacted if NGET is required to send new data to the SAA/BMRA.

e) Impact on BSCCo

Area of Business	Impact of Proposed/Alternative Modification
BSCCo Systems	The Trading Operations Market Assurance System (TOMAS) would be impacted. Any change to the structure of SAA-I014 will impact ELEXON's

Area of Business	Impact of Proposed/Alternative Modification
	Gatekeeper software.
Other (e.g. costs, staffing, etc.)	• Industry guidance notes may require revision to reflect changes to the approach to calculation of Energy Imbalance Prices. • The Change Implementation Team will be required to manage implementation of P212. • Corporate Assurance will be required to support the implementation project. • The Design Authority team will provide Technical Assurance during the implementation project. • Service Delivery will no longer be required to liaise will the SAA to agree revised Energy Imbalance Prices following an Emergency Instruction • BSCP18 would require review as this includes a section (3.3.12 – 3.3.18) on the recalculation of Energy Imbalance Prices following an Emergency Instruction which would no longer be necessary. The SAA interfaces I038, I039 and I040, which were introduced for this process, would also be redundant.

f) Impact on Code

Code Section	Impact of Proposed/Alternative Modification
Section Q 'Balancing Mechanism Activities'	Section Q may require amendment if there are changes to the BM data provided by NGET.
Section T 'Settlement and Trading Charges'	Section T would require amendment to detail the changes to the Energy Imbalance Price calculation.
Section V 'Reporting'	Section V would require amendment to detail the Reporting changes.
Annex X	Annex X would require amendment to introduce new, and remove any redundant, definitions.

g) Impact on Code Subsidiary Documents

Document	Impact of Proposed/Alternative Modification
SAA SD	The SAA Service Description will be impacted.
BMRA SD	The BMRA Service Description will be impacted.
BSCP14 'Processing of Manifest Error Claims'	BSCP14 will be impacted for managing with errors with the new data flows from TC to BMRA/SAA
BSCP18 'Corrections to Bid-Offer Acceptance Related Data'	BSCP18 would be impacted as this includes a section (3.3.12 – 3.3.18) on the recalculation of Energy Imbalance Prices following an Emergency Instruction which would no longer be necessary. The SAA interfaces I038, I039 and I040, which were introduced for this process, would also be redundant.
CVA Data Catalogue	New data or deleted items will impact flows to Parties (e.g. in the

Document	Impact of Proposed/Alternative Modification
	SAA-I014). Annex B lists all data items used in the IDD Part 1.

h) Impact on Core Industry Documents/System Operator-Transmission Owner Code

Document	Impact of Proposed/Alternative Modification
Grid Code	As operational parameters MIL, MEL, SEL, SIL, RUR and RDR will now also be used as a trading parameter to create the ex-post unconstrained schedule.

i) Impact on Other Configurable Items

Document	Impact of Proposed/Alternative Modification
SAA User Requirements Specification (and system documentation)	SAA documentation would require amendment to detail the amendments to the Energy Imbalance Price calculation.
BMRA User Requirements Specification (and system documentation)	BMRA documentation would require amendment to detail the amendments to the Energy Imbalance Price calculation.
BSC Business Process Model	The ELEXON BPM would require amendment to reflect the amendments to the Settlement calculations.
Interface Definition and Design	The IDD parts 1 and 2 will be impacted by the changes.

j) Impact on BSCCo Memorandum and Articles of Association

No Impact

k) Impact on Governance and Regulatory Framework

No Impact

4 DEVELOPMENT PROCESS

For the purposes of the impact assessment, respondents should assume that P211 Alternative would be implemented as a stand-alone development project managed by BSCCo.

5 TERMS USED IN THIS DOCUMENT

Acronyms and defined terms take the meanings defined in Section X of the Code.

6 DOCUMENT CONTROL

6.1 Authorities

Version	Date	Author	Reviewer	Reason for Review
0.1	19/07/07	Chris Stewart	Justin Andrews	For technical review
0.2	23/07/07	Justin Andrews	Modification Group	For Modification Group review
0.3	27/07/07	Justin Andrews	-	Changed marked version
1.0	27/07/07	P211 Modification Group	-	For impact assessment