Balancing Services Adjustment Data Methodology (BSAD)

This paper seeks to provide a simple description of Balancing Services Adjustment Data (BSAD) and using examples, show how it is treated within the BSC cashout arrangements (i.e. within the Balancing Mechanism).

BSAD is calculated in accordance with the BSAD Methodology Statement[1] which is required under National Grid's Transmission Licence.

BSAD is made up of transactions that are undertaken external to the Balancing Mechanism. These include Pre Gate Closure Balancing Trade (PGBT), the availability component of BM start up, System Operator (SO) to SO transactions, the option component of Short Term Operating Reserve (STOR), Energy trading on APX (or brokers) and locational trades.

In accordance with the BSAD Methodology Statement, National Grid is required to determine each transaction as either a system or energy action. A system action is any action taken to alleviate a Transmission constraint[2] or any SO/SO transactions taken to manage the rate at which load flow changes on the interconnectors that connect to the GB transmission system. Energy actions are those that procure reserve to create margin and also include the buying and selling of energy by the SO.

There are 8 BSAD variables that are calculated for the purposes of BSAD. These are shown in table 1.

Table 1 BSAD variables

<table>
<tr><td>System Buy Price Volume Adjustment (SBVA)</td><td rowspan="2">SBVA and SSVA can be considered a pair. The volumes are netted in each Settlement Period so that only one is non-zero and enters the Energy Imbalance Price calculation[3].</td></tr>
<tr><td>System Sell Price Volume adjustment (SSVA)</td></tr>
<tr><td>Energy Buy Price Volume Adjustment (EBVA)</td><td rowspan="2">EBVA and ESVA can be considered a pair. The volumes are netted in each Settlement Period so that only one is non-zero enters the Energy Imbalance Price calculation[3].</td></tr>
<tr><td>Energy Sell Price Volume Adjustment (ESVA)</td></tr>
<tr><td>Energy Buy Price Cost Adjustment (EBCA)</td><td rowspan="2">EBCA and ESCA relate to EBVA and ESVA respectively. EBCA is zero if EBVA is zero. ESCA is zero if ESVA is zero.</td></tr>
<tr><td>Energy Sell Price Cost Adjustment (ESCA)</td></tr>
<tr><td>Buy Price Adjuster (BPA)</td><td rowspan="2">BPA is included in the main Energy Imbalance Price if the system is short. SPA is included if the system is long.</td></tr>
<tr><td>Sell Price Adjuster (SPA)</td></tr>
</table>

Therefore For each Settlement Period, the Energy Imbalance Price will include three of these BSAD components included:

[1] This can be found on National Grid's website here: http://www.nationalgrid.com/NR/rdonlyres/F0122F70-41A3-449B-9322-047986A8C312/12144/BSADv33AppxCFinal.pdf
[2] This can be a thermal, voltage or stability transmission constraint.
[3] Note that this netting would not occur under the Modification Group's principle of disaggregating BSAD.

1. A system volume (SBVA or SSVA) that enters the Net Imbalance Volume (NIV);
2. An Energy volume with an associated energy cash flow (EBVA and EBCA or ESVA and ESCA) that enter the NIV as one priced volume (See example below); and
3. A price adjustment (BPA or SPA) that is added to the main Energy Imbalance Price (BPA when NIV > 0 and SPA when NIV < 0)[4].

Energy Variables

Energy volumes (EBVA and ESVA) need to have an associated cashflow (EBCA and ESCA respectively). A volume weighted average price of all buy and sell contracts is calculated and multiplied by the energy volume (ECBA or ESVA). The methodology aims to approximate the net cost of achieving the energy volume in a Settlement Period. This is shown in the example below.

Example 1: Pricing of Energy Variables

Suppose the SO has a baseload contract that sells -100MWh at £15/MWh. However for a peak Settlement Period the SO buys a contract of 300MWh at £50/MWh.

EBVA = 300MWh + -100MWh = 200MWh

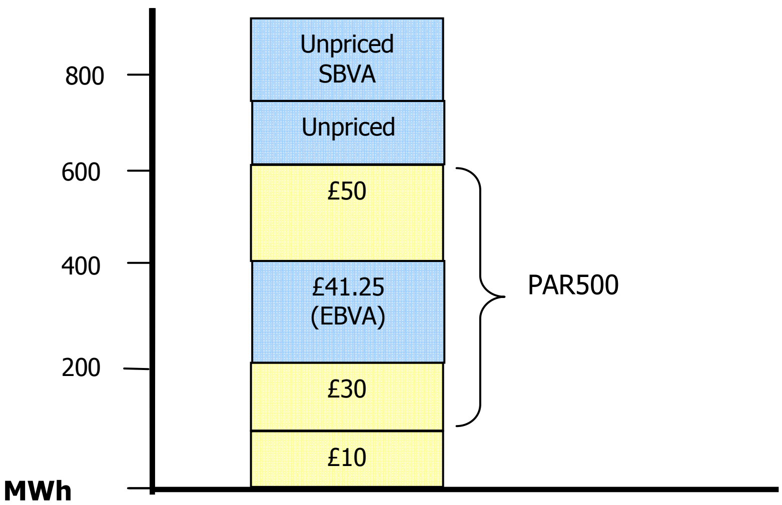
ESVA = 0 (as the volume bought exceeds the volume sold). Therefore ESCA = 0

$$EBCA = \underbrace{(300 * 50 + |-100|*15)/(300 + |-100|)}_{EBCA_{price}} * \underbrace{200}_{EBVA} = £8,250$$

$EBCA_{price}$ = £41.25/MWh

In this case the BSAD can be represented in an example NIV stack as in Figure 1. (For simplicity there are no accepted Bids).

Figure 1. BSAD in the NIV stack – an example



Under Figure 1 the main Energy Imbalance Price would be System Buy Price and would be calculated as[5]:

[4] The system is considered 'short' when NIV > 0 and 'long when NIV < 0.

$$SBP = (100*30 + 200*41.25 + 50*200)/ 500 + BPA = £42.50/MWh + BPA \qquad (1)$$

So to complete the Energy Imbalance Price Calculation the components that make up the BPA need to be addressed.

BPA and SPA

The BPA is made up of STOR option fees, the availability component of BM start up, options for regulating reserve and option fees of forward contracts.

The SPA is made up of option fees for negative reserve and forward contracts.

In practice, the BPA will more frequently impact the main Energy Imbalance Price calculation rather than the SPA. This is primarily through the STOR component and the BM start up component.

STOR

The STOR option fee component of the BPA (BPA_{STOR})[6] is procured approximately 6 to 12 months ahead of when it is utilised and the costs are allocated through the BPA based on historic utilisation.

A day profile is built based on historic STOR utilisation. This day profile takes into account historic seasonal and business day/non-business day variations. This is used in the calculation of BPA_{STOR} and also to determine a weighting factor that is applied to this calculation.

BPA_{STOR} is calculated as:

- The historic 'representative' utilisation for that Settlement Period; multiplied by
- The price of the contracted volume for the Settlement Period for the current year; with the product divided by
- The contracted volume for the Settlement Period for the current year.

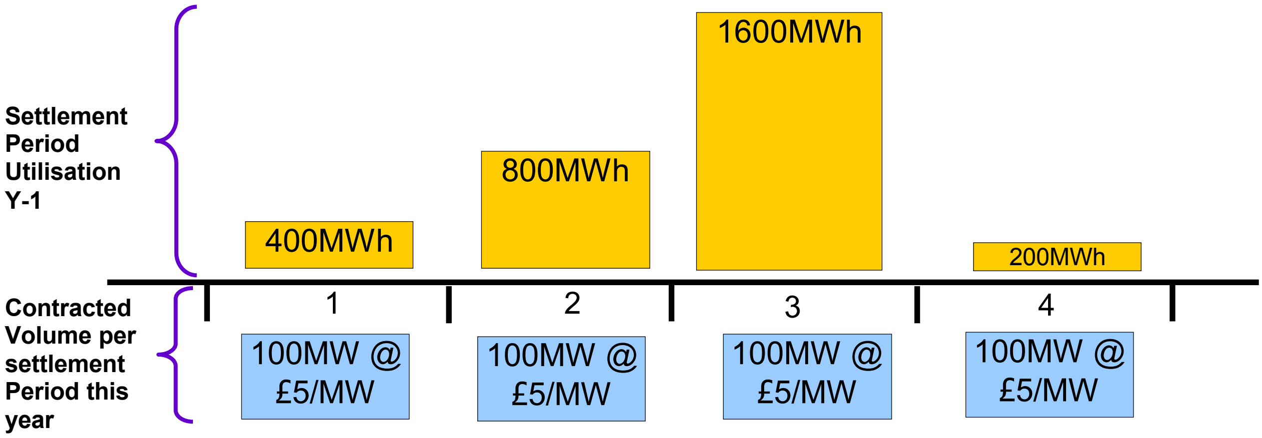
That is:

BPA_{STOR} = (Settlement Period $\text{Volume}_{\text{representative year}}$ * $\text{Price}_{\text{current year}}$)/Settlement Period $\text{Volume}_{\text{current year}}$

This can be seen in the example shown in Figure 2 as the volumes in yellow above the timeline. For simplicity, this example assumes that there are only 4 Settlement Periods in the day.

[5] SBP is calculated as described in Section 2.1 of the main consultation document. There is also a Transmission Loss Multiplier that is assumed to be zero in this example.
[6] It should be noted that BPA_{STOR} and BPA_{BMSU} are not official terms, but are variables used here to aid the explanation.

Figure 2. STOR component.



Weightings for each Settlement Period are calculated as the historic 'representative' utilisation within the Settlement Period divided by the sum of utilisation across that 'representative' day. From figure 2 this gives the following weightings.

Representative day total utilisation = 400 + 800 + 1600 + 200 = 3000MWh

Period 1 Weighting = 400/3000 = 0.13

Period 2 Weighting = 800/2000 = 0.27

Period 3 Weighting = 1600/2000 = 0.53

Period 4 Weighting = 400/2000 = 0.07

Using the above formula, we can see that, For Settlement Period 1:

$$BPA_{STOR} = [(400 * 5) / 100] * 0.13 = £2.60MWh \quad (2)$$

The second part of the BPA (the BM start up component) needs to be calculated. We will call this BPA_{BMSU}

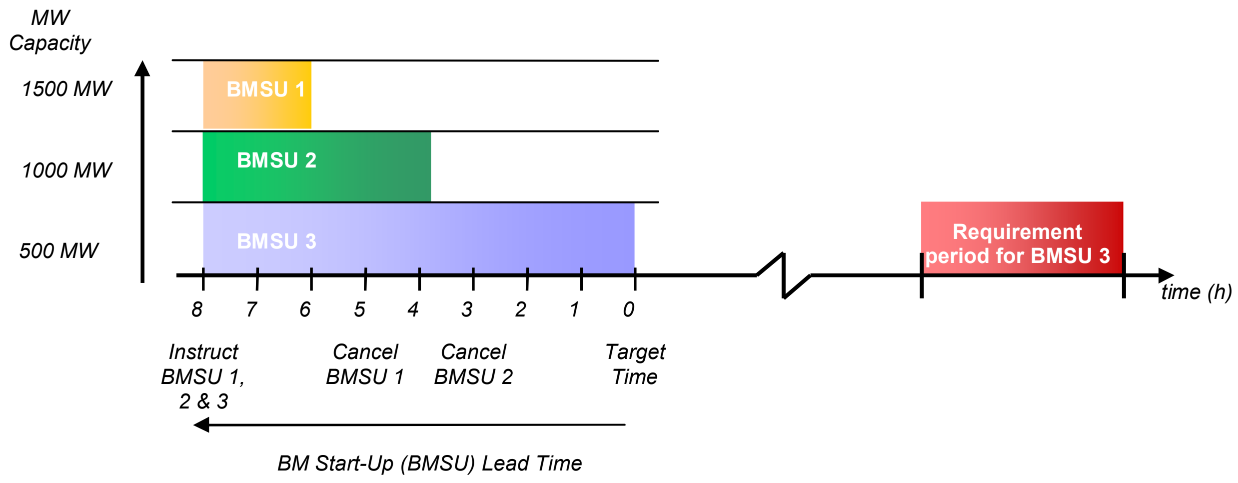
BM Start Up

The SO instructs BM start up units to meet identified additional plant requirements over the peaks. The SO does this for a requirement period (or 'window'). The costs of BM start up are then targeted at the Settlement Periods within this window.

The BM start up component (BPA_{BMSU})[6] is procured on the day. The cost is allocated through the BPA based on the requirement window. The option fee for BM start up is paid hourly from the time it is instructed and not in full at the time of instruction.

As an example, assume that the SO concurrently instructs three BM start-ups at an 8 hour lead time to meet a requirement of 1500MW for 2 hours in the future. Each BM start-up provides 500MW. Getting closer to the requirement window the SO requires less of the BM start up plant and progressively cancels the prior instructions as in Figure 3. All BM start up in the example is paid at a rate of £2000/hr

Figure 3. BM start up component example



BPA_{BMSU} is then calculated based on summing the per hour cost of the BM start ups instructed (and not cancelled) and dividing it by the MWh[7] requirement for that hour. This gives a cost in £/MWh for that hour. These are then summed from the initial instruction until the target time (or the last BM start up is cancelled). This cost is then allocated to each SP within the requirement window in which SBP is the main price.

Therefore, in the example, the cost for the first hour of the instruction (target time minus 8 hours to target time minus 7 hours) is 3 BM start ups at £2000 = £6000. The total BM start up volume gained (for the window) over the hour was 3000MWh. This gives a cost for that hour of £2/MWh.

This needs to be repeated for the entire time in which the BM start-up was instructed (and not cancelled). This can be seen in Table 2.

Table 2. BM Start Up Example

Lead time (hours)	**T - 8 to T - 7**	**T - 7 to T - 6**	**T - 6 to T - 5**	**T - 5 to T - 4**	**T - 4 to T - 3**	**T - 3 to T - 2**	**T - 2 to T - 1**	**T-1 to Target time**
Total cost for this lead time (£)	6000	6000	4000	4000	2000	2000	2000	2000
Total volume (MWh)	3000	3000	2000	2000	1000	1000	1000	1000
Cost/volume (£/MWh)	2	2	2	2	2	2	2	2

Then to sum the total £/MWh cost incurred by the Instruction of BM start up we need to add the bottom row of table 2. This gives:

$$BPA_{BMSU} = (2+2+2+2+2+2+2+2) = £16/MWh. \qquad (3)$$

[7] Note the change from MW per Settlement Period to MWh increases the factor by 2.

Therefore £16/MWh is added to the calculation of the BPA for those Settlement Periods within the requirement window. The BPA is then added to SBP when this is the main Energy Imbalance Price in that window.

Combining the Examples

The total BPA sums the BPA calculated for STOR and that calculated for BM start up. This gives:

$BPA = BPA_{STOR} + BPA_{BMSU}$

If we assume that the requirement window of BPA_{BMSU} fell in Settlement Period 1 of the BPA_{STOR} example then:

BPA = £2.60/MWh + £16/MWh = £18.60/MWh (2) + (3)

Furthermore, if we assume that this BPA was for the Energy Imbalance Price calculated in the first example we get a SBP of:

SBP = £42.50 + £18.60 = £61.10/MWh (1) + (2) + (3)

