

Balancing Services Adjustment Data Methodology Statement ~~(price adjusters)~~

Version Date: ~~10 April~~ 24 September 2001

Effective in respect of Settlement Days from and including 25
September 2001

Version Control

<u>Date</u>	<u>Version No.</u>	<u>Notes</u>
20.3.01	1.0	Initial version
10.4.01	1.1	Revision to include price adjusters for reserve option fees
<u>24.9.01</u>	<u>1.2</u>	<u>Revision to incorporate implementation of P8 and P18 within the BSC. Effective in respect of Settlement Days from and including 25 September 2001</u>

This Statement has been developed in consultation with the Authority/Director. The Statement may only be modified in accordance with the processes set out in Condition 7B of the Transmission Licence. Where we buy, sell or acquire any Relevant Balancing Services of a kind or under a mechanism which is not covered by this Statement then we shall promptly seek to establish a revised Statement covering such Balancing Services and/or mechanisms in accordance with the relevant provisions of Condition 7B of the Transmission Licence.

In the event that it is necessary to modify this Statement in advance of issuing an updated version of this document, then this will be done by issuing a supplement to this Statement.

The latest version of this document is available, together with the relevant change marked version (if any), electronically from the National Grid Website; address "www.nationalgrid.com/uk". Alternatively a copy may be requested from the Contracts and Trading Manager, Market Development, The National Grid Company plc, Kirby Corner Road, Coventry, CV4 8JY.

|

CONTENTS

PART A **Introduction**

1. Purpose of Document

PART B **Balancing Services Adjustment Data (BSAD)**

1. Basis of Calculation
 - 1.1 Variables included in the BSAD
 - 1.2 Balancing Services contract costs for inclusion in the BSAD
 - 1.3 BSAD Provision
 - 1.4 Basis of BSAD
 - 1.5 Re-submission of BSAD

PART C **BSAD Methodology**

1. Principles
2. Worked Examples
 - 2.1 Example 1 - No Reserve Service and no Energy Contracts
 - 2.2 Example 2 - Standing & Regulating Reserve Service only
 - 2.3 Example 3 - Standing & Regulating Reserve Service and Energy Contracts

PART A: INTRODUCTION

1. Purpose of Document

This document sets out the Balancing Services Adjustment Data methodology which The National Grid Company plc is required to establish in accordance with Condition 7B of the Transmission Licence. The purpose of this Statement is to set out the information on Relevant Balancing Services that will be taken into account under the Balancing and Settlement Code for the purposes of determining Imbalance Price(s).

In the event that it is necessary to modify this Statement in advance of issuing an updated version of this document, then this will be done by issuing a supplement to this Statement.

This Statement has been developed in consultation with the Authority/Director. The Statement may only be modified in accordance with the processes set out in Condition 7B of the Transmission Licence. Where we buy, sell or acquire any Relevant Balancing Services of a kind or under a mechanism which is not covered by this Statement then we shall promptly seek to establish a revised Statement covering such Balancing Services and/or mechanisms in accordance with the relevant provisions of Condition 7B of the Transmission Licence.

The Statement makes reference to a number of definitions contained in the Grid Code and Balancing and Settlement Code. In the event that any of the relevant provisions in the Grid Code or Balancing and Settlement Code are amended it may become necessary for us to modify the Statement in order that it remains consistent with the Grid Code or Balancing and Settlement Code.

In any event, where our statutory obligations or the provisions of the Grid Code are considered inconsistent with any part of this Statement, then the relevant statutory obligation and/or Grid Code provision will take precedence.

Unless defined in this Statement, terms used herein shall have the same meanings given to them in the Transmission Licence, the Grid Code and/or the Balancing and Settlement Code as the case may be.

The latest version of this document is available electronically from the National Grid Website; address "www.nationalgrid.com/uk". Alternatively a copy may be requested from the Contracts and Trading Manager, Market Development, The National Grid Company plc, Kirby Corner Road, Coventry, CV4 8JY.

PART B: BALANCING SERVICES ADJUSTMENT DATA 'BSAD'

1. Basis of Calculation

1.1 Variables included in the BSAD

The BSAD is specified in Section Q, Paragraph 6.3 of the Balancing and Settlement Code and includes:

- (i) BCA – Buy Price Cost Adjustment;
- (ii) SCA – Sell Price Cost Adjustment;
- (iii) BVA – Buy Price Volume Adjustment; ~~and~~
- (iv) SVA – Sell Price Volume Adjustment; ~~-~~
- (v) BPA – Buy Price Price Adjustment; and
- (vi) SPA – Sell Price Price Adjustment.

This data is used in the calculation of Energy Imbalance Prices, System Buy Price (SBP) and the System Sell Price (SSP) as specified in Section T, Paragraphs 4.4.5 and 4.4.6 of the Balancing and Settlement Code, as shown below:

$$SBP_j = \frac{\{\sum_i \sum^n \{QAO_{ij}^n * PO_{ij}^n * TLM_{ij}\} + BCA_j\}}{\{\sum_i \sum^n \{QAO_{ij}^n * TLM_{ij}\} + BVA_j\}}$$

$$SSP_j = \frac{\{\sum_i \sum^n \{QAB_{ij}^n * PB_{ij}^n * TLM_{ij}\} + SCA_j\}}{\{\sum_i \sum^n \{QAB_{ij}^n * TLM_{ij}\} + SVA_j\}}$$

$$SBP_j = \frac{\{\sum_i \sum^n \{QAPO_{ij}^n * PO_{ij}^n * TLM_{ij}\} + BCA_j\}}{\{\sum_i \sum^n \{QAPO_{ij}^n * TLM_{ij}\} + BVA_j\}} + BPA_j$$

$$SSP_j = \frac{\{\sum_i \sum^n \{QAPB_{ij}^n * PB_{ij}^n * TLM_{ij}\} + SCA_j\}}{\{\sum_i \sum^n \{QAPB_{ij}^n * TLM_{ij}\} + SVA_j\}} + SPA_j$$

All variables within these equations are defined within the Balancing and Settlement Code, and the summations are as defined in BSC Paragraph T4.4.5 and T4.4.6 (i.e. Trade Tagged Accepted Offers and Bids, ~~and~~ Arbitrage Tagged Accepted Offers and Bids, and Bid Offer Acceptances with an acceptance time of less than the Continuous Acceptance Duration Limit (CADL)¹ —are excluded from the summations).

~~This BSAD methodology also describes the calculation of the following variables (also referred to as ‘price adjusters’):~~

- ~~(i) BPA — Buy Price Price Adjustment; and~~
- ~~(ii) SPA — Sell Price Price Adjustment.~~

~~Currently these two variables are not specified in the Balancing and Settlement Code, and until such time as they are, the adjustment mechanism described in Part B section 1.3 of this document will be used to amend the BCA and SCA variables to have the same effect as including the price adjusters. It is National Grid’s view that this approach should be a temporary solution only, and that the required changes should be made to the Balancing and Settlement Code as soon as possible.~~

~~The price adjusters BPA and SPA are £/MWh variables and are intended to add on in the SBP and SSP calculations respectively as shown:~~

$$\begin{aligned}
 \text{SBP}_j = & \left(\sum_i \sum^{T^*} \{ \text{QAO}_{ij}^R * \text{PO}_{ij}^R * \text{TLM}_{ij} \} + \text{BCA}_j \right) / \left(\sum_i \sum^{T^*} \{ \text{QAO}_{ij}^R * \text{TLM}_{ij} \} \right. \\
 & \left. + \text{BVA}_j \right) + \text{BPA}_j
 \end{aligned}$$

¹ CADL is a variable defined within the BSC. The value of CADL is determined by the BSC Panel. For information, the level of CADL as at 25 September 2001 was 15 minutes.

$$SSP_j = \frac{(\sum_i \sum^n \{QAB_{ij}^n * PB_{ij}^n * TLM_{ij}\} + SCA_j)}{(\sum_i \sum^n \{QAB_{ij}^n * TLM_{ij}\} + SVA_j)} + SPA_j$$

This is the derivation of the Energy Imbalance Price that will be used to calculate Energy Imbalance Cashflows.

Note that if $\{\sum_i \sum^n \{QAP_{ij}^n * TLM_{ij}\} + BVA_j\} = 0$, and/or $\{\sum_i \sum^n \{QAP_{ij}^n * TLM_{ij}\} + SVA_j\} = 0$, then ~~the revised values of BCA and SCA will still be determined by NGC and submitted to the BMRA. However,~~ as set ~~out down~~ in paragraphs 4.4.5 and 4.4.6 of the BSC, the values of BCA and SCA will not affect the default imbalance price calculations in such circumstances.

The Energy Imbalance Prices are used to determine the Energy Imbalance Cashflows for each Energy Account in respect of each Settlement Period as defined in Section 4.7 of the Balancing and Settlement Code.

Calculation of the Energy Imbalance Cashflows requires the Account Energy Imbalance Volume (QAEI) which is calculated by subtracting the sum of the Bid Offer Volume (QABO) and Bilateral Contract Volume (QABC) from the Credited Energy Volume (QACE) as specified in Paragraph 4.6.3 of the Balancing and Settlement Code.

The Account Energy Imbalance Volume is then multiplied by System Sell Price for positive imbalance volume and System Buy Price for negative imbalance volume to give the Energy Imbalance Cashflows as specified in Section T, Paragraph 4.4 and 4.6 of the Balancing and Settlement Code.

Where an implicit adjustment for Transmission Losses is not already included in the contracted volume for relevant services described in this Methodology Statement, National Grid will make the necessary adjustments for Transmission Losses by the application of an ex-ante Transmission Loss Multiplier. The values of $ETLMO_j^+$ and $ETLMO_j^-$ as used by the Balancing Mechanism Reporting Agent will be used. This adjustment will be made prior to submission of the BSAD data.

1.2 Balancing Services contract costs for inclusion in the BSAD

Balancing Services are defined in the Procurement Guidelines which National Grid is required to establish in accordance with Licence Condition 7B of the Transmission Licence. The purpose of the Procurement Guidelines is to set out the kinds of Balancing Services which we may be interested in purchasing, together with the mechanisms by which we envisage purchasing such Balancing Services. BSAD covers a subset of the Balancing Services that we intend to procure.

The following relevant energy Balancing Services contracts will be included in the calculation of the BSAD:

- **Standing Reserve** – In these contracts we will pay option fees either £/h or £/MWh for service availability during specific half-hour periods. Utilisation payments for participants within the Balancing Mechanism will be dealt with automatically via the BM and will feed into the energy imbalance price calculation via the acceptance of an Offer. Utilisation payments for non-BM participants will be made via a separate Balancing Services contract payment.

The calculation of BSAD will include the option fees paid to all service providers.

- **Regulating Reserve** – For firm provision of this service we will pay option fees with any utilisation fees being fixed via agreement of BM Offers.

Standing and Firm Regulating Reserve option payments for increasing generation or reducing demand will feed into the calculation of the BPA. This will be calculated by dividing the total option fee in any settlement period by the total contracted capability. Capability will be based upon week ahead availability declarations.

Similarly any option payments for reducing generation or increasing demand (negative reserve) will feed into the calculation of the SPA.

- **Forward energy contracts** – Both the costs and volumes of any forward energy contracts will be included in the calculations as follows:
 - costs and volumes of any energy purchases feed into BCA and BVA respectively; and
 - costs and volumes of any energy sales feed into SCA and SVA respectively.

Forward Energy Contract option fees, sales or purchases, and the contracted MWh associated with the options for Forward Energy Contracts will feed into the calculation of SPA or BPA.

For the avoidance of doubt, BSAD will only include contracts required for energy balancing purposes. Contracts for transport related reasons will be specifically excluded from BSAD.

All costs and volumes will be targeted to the half-hours in which they are incurred/utilised.

For contracts covering bundled services, we will attempt to accurately identify the costs associated with each particular service. If this cannot be achieved then we will allocate the costs equally to each of the contracted services.

1.3 BSAD Provision

BSAD will be submitted to the Balancing Mechanism Reporting Agent (BMRA) at or before 5pm each day to cover the 24 hour period from half-hour ending 00:30 to half-hour ending 24:00 for the following day. ~~BASD~~ BSAD amendments for previous periods will also be included in the submission.

This initial submission of BSAD to the BMRA will include the ~~six~~ four variables ~~BCA, BVA, SCA, and SVA,~~ BPA and SPA for each settlement period.

BSAD will also be published on the National Grid Website. ~~This publication will also include the values of BPA and SPA for each settlement period.~~

~~As the Balancing and Settlement Code does not include the variables BPA and SPA then a post-event adjustment of BCA and SCA is required to ensure that these variables are correctly reflected in the calculation of SBP and SSP respectively. This process is described below.~~

- ~~(i) 5pm Day Ahead – National Grid provide BCA, SCA, BVA and SVA variables to the BMRA for inclusion in the initial calculation of SBP, SSP;~~
- ~~(ii) 5pm Day Ahead – National Grid publish BCA, SCA, BVA, SVA, BPA and SPA on the National Grid website;~~
- ~~(iii) Prior to the Interim Information Settlement Run – National Grid re-submit values of BCA, BVA, SCA and SVA as required pursuant to section 1.5 below;~~

~~(iv) Interim Information Settlement Run — The Settlement Administration Agent (SAA) uses the latest version of the BSAD variables to calculate SBP and SSP;~~

~~(v) After the Interim Information Settlement Run — The SAA provides the following data to National Grid:~~

$$\text{— } \sum_i \sum^n \{QAO_{ij}^n * TLM_{ij}\}$$

$$\text{— } \sum_i \sum^n \{QAB_{ij}^n * TLM_{ij}\}$$

~~Where these variables are as defined within the Balancing and Settlement Code, and \sum_i represents the sum over all BM Units and \sum^n represents the sum over those accepted offers or bids that are not Arbitrage Accepted Offers or Bids and not Trade Tagged Offers or Bids, as defined in paragraphs T4.4.5 and T4.4.6 of the BSC.~~

~~(vi) National Grid then calculate the following cost adjustments for each settlement period:~~

$$\text{— } \text{BCA cost adjustment} = \text{BPA} * (\sum_i \sum^n \{QAO_{ij}^n * TLM_{ij}\} + \text{BVA}_{ij})$$

$$\text{— } \text{SCA cost adjustment} = \text{SPA} * (\sum_i \sum^n \{QAB_{ij}^n * TLM_{ij}\} + \text{SVA}_{ij})$$

~~(vii) National Grid will then add the BCA and SCA cost adjusters to the initial values of BCA and SCA. These new values of BCA and SCA will represent the values to be used in the subsequent settlement runs (in particular for the purposes of the Initial Settlement Run);~~

~~(viii) The SAA will then use the revised BSAD data in the calculation of SBP and SSP in the Initial Settlement Run.~~

1.4 Basis of BSAD

The calculation of the BSAD will be performed on the following basis:

- Reserve availability will be calculated on the basis of week ahead submissions of availability from service providers;
- If no week ahead submission is received then maximum availability will be assumed; and
- Any forward energy contracts struck prior to the submission of BSAD at 5pm at the day-ahead stage will be included. Best endeavours will be employed to include all the contracts that have been entered into prior to 5pm.

1.5 Re-submission of BSAD

The BSAD will be re-submitted, if required, post event to cover:

- The correction of any errors in the original submission made at 5pm at the Day Ahead stage;
- Adjustments to any of the variables to account for any forward energy contracts entered into between the day ahead and real time that were not included in the original submission; and
- Inclusion of any changes caused by the utilisation of contracts with 'difference²' payments.

Any of these circumstances could result in revisions to any of the variables within BSAD and hence SBP and SSP.

~~The process to submit BSAD to include the necessary price adjustments is contained within section 1.3 above. National Grid will not re-submit BSAD other than via this process unless data errors are discovered.~~

If re-submission of BSAD is required, for any of the reasons above, then National Grid will endeavour to do this in sufficient time to allow

² A 'difference' payment will occur if the contract allows a service provider to offer prices into the Balancing Mechanism at any level, but if the contract is exercised then the provider is paid at a fixed level. The difference payment will result from the difference between the BM payment and the contract payment and this will feed into the cost terms of BSAD as appropriate

the revised variables to be included in the calculation of SSP and SBP in the Interim Information Settlement Run.

PART C: BSAD Methodology

1. Principles

As detailed in Part B, the variables associated with BSAD are as follows:

BCA = Aggregated utilisation cost of Energy Contract Purchases;

SCA = Aggregated utilisation cost of Energy Contract Sales;

BPA = (Aggregated cost of purchases of standing reserve option fees + Aggregated cost of purchases of firm regulating reserve option fees + Aggregated cost of purchases of forward energy contract option fees) / (MWh capability of standing reserve contracts purchased + MWh capability of firm regulating reserve contracts purchased + Contracted MWh associated with options for Forward Energy Contracts purchased)

BVA = Aggregated volume of Energy Contract Purchases;

SVA = Aggregated volume of Energy Contract Sales; and

SPA = (Aggregated cost of negative reserve option fees + Aggregated cost of sales of forward energy contract option fees) / (Aggregated volume of negative reserve contracts + Contracted MWh associated with options for Forward Energy Contracts sold)

For the avoidance of doubt, if the denominator of BPA or SPA is zero in any settlement period, then BPA or SPA will be set to zero in that period.

BCA, BVA, SCA and SVA are then used in the calculation of SBP and SSP in accordance with Paragraphs 4.4.5 and 4.4.6 of the Balancing

and Settlement Code. The effect of BPA and SPA is achieved via the manual adjustment process described elsewhere in this methodology.

2. **Worked Examples**

Three examples of how the Imbalance Price(s) prices would be affected by BSAD are given below. The examples chosen show the effect on SBP and SSP, before and after the adjustments have been made.

For a given Settlement Period, the first example shows the effect when there are no reserve services or energy contracts in place, the second example shows the effect when only reserve services are in place, and the final example shows the effect when both reserve services and energy contracts are in place. For simplicity, in these examples it is assumed that all Offers are available at the same price, and accepted Bids and Offers are in accordance with Section 4.4 of the Balancing and Settlement Code.

Any necessary adjustments for Transmission Losses are already included in the volume terms in the examples.

The prices included in these examples are illustrative only and are provided to demonstrate the method in which BSAD will impact on SBP and SSP. They are not indicative of likely contract prices or the actual magnitude of the impact of BSAD on SBP/SSP.

2.1 Example 1 - No Reserve Service and no Energy Contracts

Assumptions for a given Settlement Period:

- No Standing Reserve contracts are in place;
- No Regulating Reserve contracts are in place;
- No Energy Contracts have been purchased;
- No Energy Contracts have been sold;
- Price of accepted Offers ($PO^{n_{ij}}$) = £22 MWh;
- Price of accepted Bids ($PB^{n_{ij}}$) = £20 MWh;
- Volume of accepted Offers [included in SBP](#) ($QAPO^{n_{ij}}$) = 10,000 MWh;
- Volume of accepted Bids [included in SSP](#) ($QAPB^{n_{ij}}$) = 8,000 MWh;
- BCA_j = Aggregated energy contract purchases,
 BCA_j = £0 per settlement period;
- BVA_j = Aggregated volume of Energy contracts
= 0 MWh;
- BPA_j = (Aggregated cost of purchases of standing reserve option fees + Aggregated cost of purchases of firm regulating reserve option fees + Aggregated cost of purchases of forward energy contract option fees) / (MWh capability of standing reserve contracts purchased + MWh capability of firm regulating reserve contracts purchased + Contracted MWh associated with options for Forward Energy Contracts purchased)
= £0/MWh
- SCA_j = Aggregated Energy Contract Sales
= £0;
- SVA_j = Aggregated volume of Energy Contract Sales
= 0 MWh;
- SPA_j = (Aggregated cost of negative reserve option fees + Aggregated cost of sales of forward energy contract option fees) / (Aggregated volume of negative reserve contracts + Contracted MWh associated with options for Forward Energy Contracts sold)

$$= \text{£0/MWh}$$

- $TLM_{ij} = 1.02$.

Calculation of SBP/SSP excluding BSAD

$$\begin{aligned} SBP_j &= \{ \sum_i \sum^n \{ QAP_{PO}^{n_{ij}} * PO^{n_{ij}} * TLM_{ij} \} + BCA_j \} / \{ \sum_i \sum^n \{ QAP_{PO}^{n_{ij}} * \\ TLM_{ij} \} + BVA_j \} &+ \underline{BPA_j} \\ &= \{ \{ 10,000 \text{MWh} * \text{£}22 / \text{MWh} * 1.02 \} + \text{£}0 \} / \{ 10,000 \text{MWh} * 1.02 \} + \\ 0 \text{MWh} \} &+ \underline{\text{£}0 / \text{MWh}} \\ &= \text{£}224,400 / 10,200 \text{MWh} \\ &= \text{£}22.000 / \text{MWh} \end{aligned}$$

$$\begin{aligned} SSP_j &= \{ \sum_i \sum^n \{ QAP_{PB}^{n_{ij}} * PB^{n_{ij}} * TLM_{ij} \} + SCA_j \} / \{ \sum_i \sum^n \{ QAP_{PB}^{n_{ij}} * TLM_{ij} \} + \\ SVA_j \} &+ \underline{SPA_j} \\ &= \{ \{ 8,000 \text{MWh} * \text{£}20 / \text{MWh} * 1.02 \} + \text{£}0 \} / \{ \{ 8,000 \text{MWh} * 1.02 \} + \\ 0 \text{MWh} \} &+ \underline{\text{£}0 / \text{MWh}} \\ &= \text{£}163,200 / 8,160 \text{MWh} \\ &= \text{£}20.000 / \text{MWh} \end{aligned}$$

Calculation of SBP/SSP including initial values of BSAD

$$\begin{aligned} SBP_j &= \{ \sum_i \sum^n \{ QAP_{PO}^{n_{ij}} * PO^{n_{ij}} * TLM_{ij} \} + BCA_j \} / \{ \sum_i \sum^n \{ QAP_{PO}^{n_{ij}} * TLM_{ij} \} + \\ BVA_j \} &+ \underline{BPA_j} \\ &= \{ \{ 10,000 \text{MWh} * \text{£}22 / \text{MWh} * 1.02 \} + \text{£}0 \} / \{ 10,000 \text{MWh} * 1.02 \} + \\ 0 \text{MWh} \} &+ \underline{\text{£}0 / \text{MWh}} \\ &= \text{£} 224,400 / 10,200 \text{MWh} \\ &= \text{£}22.000 / \text{MWh} \end{aligned}$$

$$\begin{aligned} SSP_j &= \{ \sum_i \sum^n \{ QAP_{PB}^{n_{ij}} * PB^{n_{ij}} * TLM_{ij} \} + SCA_j \} / \{ \sum_i \sum^n \{ QAP_{PB}^{n_{ij}} * TLM_{ij} \} + \\ SVA_j \} &+ \underline{SPA_j} \\ &= \{ \{ 8,000 \text{MWh} * \text{£}20 / \text{MWh} * 1.02 \} + \text{£}0 \} / \{ \{ 8,000 \text{MWh} * 1.02 \} + \end{aligned}$$

$$\begin{aligned} & 0\text{MWh} \} + \underline{\text{£0/MWh}} \\ = & \text{£163,200} / 8,160 \text{ MWh} \\ = & \text{£20.000/ MWh} \end{aligned}$$

Resulting in no change in SBP_j and no change in SSP_j .

Calculation of SBP/SSP including revised BSAD

~~In this case, as BPA and SPA are both zero, then there is no requirement for any further adjustment to incorporate them. The effect of non-zero BSAD data is demonstrated in the subsequent examples.~~

2.2 Example 2 - Standing & Regulating Reserve Service only

Assumptions for a given Settlement Period:

- The following Standing Reserve contracts are in place,

Contract A

Option Fee (Price £ per hour) £20 per hour,

Contracted Capability 20 MW

Contract B

Option Fee (Price £ per hour) £30 per hour

Contracted Capability 15MW;

- The following Firm Regulating Reserve contracts are in place,

Contract C

Option Fee (Price £ per hour) £10 per hour;

Contracted Capability 5MW

- No energy contracts have been purchased;
- No energy contracts have been sold;
- Price of accepted Offers ($PO^{n_{ij}}$) = £22/MWh;
- Price of accepted Bids ($PB^{n_{ij}}$) = £20/ MWh;
- Volume of accepted Offers included in SBP ($QAP^{n_{ij}}$) = 10,000 MWh;
- Volume of accepted Bids included in SSP ($QAPB^{n_{ij}}$) = 8,000 MWh;
- BCA_j = Aggregated energy contract purchases;
 $BCA_j = £ 0$
- BPA = (Aggregated cost of purchases of standing reserve option fees + Aggregated cost of purchases of firm regulating reserve option fees + Aggregated cost of purchases of forward energy contract option fees) / (MWh capability of standing reserve contracts purchased + MWh capability of firm regulating reserve contracts purchased + Contracted MWh associated with options for Forward Energy Contracts purchased)
= (20 £/hr + 30 £/hr + 10 £/hr) / (20 MW + 15 MW + 5 MW)

$$= \text{£ } 1.5/\text{MWh}$$

- $BVA_j = \text{Aggregated volume of Energy contracts}$
= 0 MWh;
- $SCA_j = \text{Aggregated Energy Contract Sales}$
= £0;
- $SVA_j = \text{Aggregated volume of Energy Contract Sales}$
= 0 MWh;
- $SPA = (\text{Aggregated cost of negative reserve option fees} + \text{Aggregated cost of sales of forward energy contract option fees}) / (\text{Aggregated volume of negative reserve contracts} + \text{Contracted MWh associated with options for Forward Energy Contracts sold})$
= £0/MWh
- $TLM_{ij} = 1.02$.

Calculation of SBP/SSP excluding BSAD

$$\begin{aligned} SBP_j &= \{ \sum_i \sum^n \{ QAP_{PO}^{n_{ij}} * PO^{n_{ij}} * TLM_{ij} \} + BCA_j \} / \{ \sum_i \sum^n \{ QAP_{PO}^{n_{ij}} * TLM_{ij} \} + \\ & BVA_j \} + \underline{BPA_j} \\ &= \{ \{ 10,000\text{MWh} * \text{£}22/\text{MWh} * 1.02 \} + \text{£}0 \} / \{ 10,000\text{MWh} * 1.02 \} + \\ & 0\text{MWh} \} + \underline{\text{£}0/\text{MWh}} \\ &= \text{£ } 224,400 / 10,200 \text{ MWh} \\ &= \text{£}22.000 / \text{MWh} \end{aligned}$$

$$\begin{aligned} SSP_j &= \{ \sum_i \sum^n \{ QAP_{PB}^{n_{ij}} * PB^{n_{ij}} * TLM_{ij} \} + SCA_j \} / \{ \sum_i \sum^n \{ QAP_{PB}^{n_{ij}} * TLM_{ij} \} + \\ & SVA_j \} + \underline{SPA_j} \\ &= \{ \{ 8,000\text{MWh} * \text{£}20/\text{MWh} * 1.02 \} + \text{£}0 \} / \{ \{ 8,000\text{MWh} * 1.02 \} + \\ & 0\text{MWh} \} + \underline{\text{£}0/\text{MWh}} \\ &= \text{£}163,200 / 8,160 \text{ MWh} \\ &= \text{£}20.000 / \text{MWh} \end{aligned}$$

Calculation of SBP/SSP including initial values of BSAD

$$\begin{aligned}
SBP_j &= \{ \{ 10,000 \text{ MWh} * \text{£}22 / \text{MWh} * 1.02 \} + \text{£}0 \} / \{ 10,000 \text{ MWh} * 1.02 \} + \\
& \text{0 MWh} \} + \text{£}1.50 / \text{MWh} \\
&= \text{£}224,400 / 10,200 \text{ MWh} + \text{£}1.50 / \text{MWh} \\
&= \text{£}22 / \text{MWh} \text{ £}23.50 / \text{MWh}
\end{aligned}$$

$$\begin{aligned}
SSP_j &= \{ \{ 8,000 \text{ MWh} * \text{£}20 / \text{MWh} * 1.02 \} + \text{£}0 \} / \{ 8,000 \text{ MWh} * 1.02 \} + \\
& \text{0 MWh} \} + \text{£}0 / \text{MWh} \\
&= \text{£}163,200 / 8,160 \text{ MWh} \\
&= \text{£}20.000 / \text{MWh}
\end{aligned}$$

Calculation of SBP/SSP including revised BSAD

The necessary adjustments to BCA and SCA can now be calculated to incorporate the effect of BPA and SPA respectively:

$$\begin{aligned}
\text{— BCA cost adjustment} &= \text{BPA} * (\sum_i \sum^n \{ \text{QAO}_{ij}^n * \text{TLM}_{ij} \} + \text{BVA}_i) \\
&= \text{— } 1.5 \text{ £/MWh} * ((10,000 \text{ MWh} * 1.02) + \\
& \text{0}) \\
&= \text{— } \text{£}15,300
\end{aligned}$$

$$\begin{aligned}
\text{— SCA cost adjustment} &= \text{SPA} * (\sum_i \sum^n \{ \text{QAO}_{ij}^n * \text{TLM}_{ij} \} + \text{SVA}_i) \\
&= \text{— } \text{£}0
\end{aligned}$$

These values are now added onto the original values of BCA and SCA as shown:

$$\begin{aligned}
\text{BCA}' &= \text{— } \text{BCA} + \text{price adjuster} \\
&= \text{— } \text{£}0 + \text{£}15,300 \\
&= \text{— } \text{£}15,300
\end{aligned}$$

$$\begin{aligned}
 SCA'_j &= \text{SCA} + \text{price adjuster} \\
 &= \text{£0} + \text{£0} \\
 &= \text{£0}
 \end{aligned}$$

BCA' and SCA' are now incorporated into the calculation of SBP and SSP to produce the final values of these variables:

$$\begin{aligned}
 SBP_j &= (\sum_i \sum^n \{QAO_{ij}^n * PO_{ij}^n * TLM_{ij}\} + BCA'_{j-}) / (\sum_i \sum^n \{QAO_{ij}^n * TLM_{ij}\} + \\
 &BVA_{j-}) \\
 &= \{ \{10,000MWh * \text{£}22 / MWh * 1.02\} + \text{£}15,300 \} / \{10,000MWh * 1.02\} \\
 &+ 0MWh \} \\
 &= (\text{£}224,400 + \text{£}15,300) / (10,200 MWh) \\
 &= \text{£}23.500 / MWh
 \end{aligned}$$

$$\begin{aligned}
 SSP_j &= (\sum_i \sum^n \{QAB_{ij}^n * PB_{ij}^n * TLM_{ij}\} + SCA'_{j-}) / (\sum_i \sum^n \{QAB_{ij}^n * TLM_{ij}\} + \\
 &SVA_{j-}) \\
 &= \{ \{8,000MWh * \text{£}20 / MWh * 1.02\} + \text{£}0 \} / \{ \{8,000MWh * 1.02\} + \\
 &0MWh \} \\
 &= \text{£}163,200 / 8,160 MWh \\
 &= \text{£}20.000 / MWh
 \end{aligned}$$

Resulting in an increase in SBP_j of £1.5/MWh and no change in SSP_j. The effect on SBP is therefore to add on the price adjuster term (BPA).

2.3 Example 3 - Standing & Firm Regulating Reserve Service and Energy Contracts

Assumptions for a given Settlement Period:

- The following Standing Reserve contracts are in place,

Contract A

Option Fee (Price £ per hour) £20 per hour,

Contracted Capability 20 MW

Contract B

Option Fee (Price £ per hour) £30 per hour

Contracted Capability 15MW;

- The following Firm Regulating Reserve contracts are in place,

Contract C

Option Fee (Price £ per hour) £10 per hour;

Contracted Capability 5MW

- Energy contracts have been purchased;

Contract D

Contract for 500MW at £20/MWh for 10 hours,

Total payment is therefore £100,000, or £5,000 per settlement period. Contracting party reflects the 500MW in his physical notification.

Contract E

Option Fee over 20 settlement periods of £5,000 to utilise 200MW at £18/MWh. Contract is exercised pre-gate closure for all 20 periods;

- No energy contracts have been sold;
- Price of accepted Offers ($PO^{n_{ij}}$) = £22/ MWh;
- Price of accepted Bids ($PB^{n_{ij}}$) = £20/ MWh;
- Volume of accepted Offers [included in SBP](#) ($QAP^{n_{ij}}$) = 10,000 MWh;
- Volume of accepted Bids [included in SSP](#) ($QAPB^{n_{ij}}$) = 8,000 MWh;

- $BCA_j =$ Aggregated energy contract purchases,
 $BCA_j = \text{£}5,000 \text{ per SP (D)} + 200\text{MW} * \text{£}18/\text{MWh} * 0.5 \text{ per SP (E exercise)}$
 $= \text{£}5,000 \text{ per SP} + \text{£}1,800 \text{ per SP}$
 $= \text{£} 6,800 \text{ per settlement period};$
- $BVA_j =$ Aggregated volume of Energy contracts per SP
 $= 500/2 \text{ MWh (D)} + 200/2 \text{ MWh (E)}$
 $= 350 \text{ MWh per settlement period};$
- $BPA =$ (Aggregated cost of purchases of standing reserve option fees + Aggregated cost of purchases of firm regulating reserve option fees + Aggregated cost of purchases of forward energy contract option fees) / (MWh capability of standing reserve contracts purchased + MWh capability of firm regulating reserve contracts purchased + Contracted MWh associated with options for Forward Energy Contracts purchased)
 $= (20 \text{ £/hr} + 30 \text{ £/hr} + 10 \text{ £/hr} + 500 \text{ £/hr}) / (20 \text{ MW} + 15 \text{ MW} + 5 \text{ MW} + 200\text{MW})$
 $= \text{£} 2.333/\text{MWh}$
- $SCA_j =$ Aggregated Energy Contract Sales
 $= \text{£}0;$
- $SVA_j =$ Aggregated volume of Energy Contract Sales
 $= 0 \text{ MWh};$
- $SPA =$ (Aggregated cost of negative reserve option fees + Aggregated cost of sales of forward energy contract option fees) / (Aggregated volume of negative reserve contracts + Contracted MWh associated with options for Forward Energy Contracts sold)
 $= \text{£}0/\text{MWh}$
- $TLM_{ij} = 1.02.$

Calculation of SBP/SSP excluding BSAD

$$SBP_j = \{ \sum_i \sum^n \{ QAP_{ij}^{n_{ij}} * PO_{ij}^{n_{ij}} * TLM_{ij} \} + BCA_j \} / \{ \sum_i \sum^n \{ QAP_{ij}^{n_{ij}} * TLM_{ij} \} + BVA_j \} + BPA_j$$

$$\begin{aligned}
&= \{ \{10,000\text{MWh} * \text{£}22/ \text{MWh} * 1.02\} + \text{£}0\} / \{10,000\text{MWh} * 1.02\} + \\
&\quad \text{0MWh}\} + \underline{\text{£}0/\text{MWh}} \\
&= \text{£} 224,400 / 10,200 \text{ MWh} \\
&= \text{£}22.000/ \text{MWh}
\end{aligned}$$

$$\begin{aligned}
\text{SSP}_j &= \{ \sum_i \sum^n \{ \text{QA} \underline{\text{PB}}_{ij}^n * \text{PB}_{ij}^n * \text{TLM}_{ij} + \text{SCA}_j \} / \{ \sum_i \sum^n \{ \text{QA} \underline{\text{PB}}_{ij}^n * \text{TLM}_{ij} \\
&+ \text{SVA}_j \} + \underline{\text{SPA}_j} \\
&= \{ \{8,000\text{MWh} * \text{£}20/\text{MWh} * 1.02\} + \text{£}0\} / \{ \{8,000\text{MWh} * 1.02\} + \\
&\text{0MWh}\} + \underline{\text{£}0/\text{MWh}} \\
&= \text{£}163,200/ 8,160 \text{ MWh} \\
&= \text{£}20.000/ \text{MWh}
\end{aligned}$$

Calculation of SBP/SSP including initial values of BSAD

$$\begin{aligned}
\text{SBP}_j &= \{ \{10,000\text{MWh} * \text{£}22/ \text{MWh} * 1.02\} + \text{£}6,800\} / \{10,000\text{MWh} * 1.02\} \\
&+ 350\text{MWh}\} + \underline{\text{£}2.333/\text{MWh}} \\
&= \text{£}231,200/10,550\text{MWh} + \underline{\text{£}2.333/\text{MWh}} \\
&= \underline{\text{£}21.915/\text{MWh}} \quad \underline{\text{£}24.248/\text{MWh}}
\end{aligned}$$

$$\begin{aligned}
\text{SSP}_j &= \{ \{8,000\text{MWh} * \text{£}20/\text{MWh} * 1.02\} + \text{£}0\} / \{8,000\text{MWh} * 1.02\} + \\
&\text{0MWh}\} + \underline{\text{£}0/\text{MWh}} \\
&= \text{£}163,200 / 8,160 \text{ MWh} \\
&= \text{£}20.000/ \text{MWh}
\end{aligned}$$

Calculation of SBP/SSP including revised BSAD

The necessary adjustments to BCA and SCA can now be calculated to incorporate the effect of BPA and SPA respectively:

$$\begin{aligned}
-\text{BCA cost adjustment} &= \text{BPA} * (\sum_i \sum^n \{ \text{QA} \underline{\text{O}}_{ij}^n * \text{TLM}_{ij} \} + \text{BVA}_j) \\
&= \underline{\underline{2.333}} \text{ £/MWh} * ((10,000 \text{ MWh} * \\
&1.02) + 350\text{MWh})
\end{aligned}$$

$$= \text{£}24,613.15$$

$$\begin{aligned} \text{SCA cost adjustment} &= \text{SPA} * (\sum_i \sum^n \{ \text{QAO}_{ij}^n * \text{TLM}_{ij} \} + \text{SVA}_i) \\ &= \text{£}0 \end{aligned}$$

These values are now added onto the original values of BCA and SCA as shown:

$$\begin{aligned} \text{BCA}' &= \text{BCA} + \text{price adjuster} \\ &= \text{£}6,800 + \text{£}24,613.15 \\ &= \text{£}31,413.15 \end{aligned}$$

$$\begin{aligned} \text{SCA}' &= \text{SCA} + \text{price adjuster} \\ &= \text{£}0 + \text{£}0 \\ &= \text{£}0 \end{aligned}$$

BCA' and SCA' are now incorporated into the calculation of SBP and SSP to produce the final values of these variables:

$$\begin{aligned} \text{SBP}_j &= (\sum_i \sum^n \{ \text{QAO}_{ij}^n * \text{PO}_{ij}^n * \text{TLM}_{ij} \} + \text{BCA}'_j) / (\sum_i \sum^n \{ \text{QAO}_{ij}^n * \text{TLM}_{ij} \} + \text{BVA}_{j-}) \\ &= \{ (10,000 \text{MWh} * \text{£}22 / \text{MWh} * 1.02) + \text{£}31,413.15 \} / \{ (10,000 \text{MWh} * 1.02) + 350 \text{MWh} \} \\ &= (\text{£}224,400 + \text{£}31,413.15) / (10,550 \text{MWh}) \\ &= \text{£}255,813.15 / 10,550 \text{MWh} \\ &= \text{£} 24.248 / \text{MWh} \end{aligned}$$

$$\begin{aligned} \text{SSP}_j &= (\sum_i \sum^n \{ \text{QAB}_{ij}^n * \text{PB}_{ij}^n * \text{TLM}_{ij} \} + \text{SCA}'_j) / (\sum_i \sum^n \{ \text{QAB}_{ij}^n * \text{TLM}_{ij} \} + \text{SVA}_{j-}) \\ &= \{ (8,000 \text{MWh} * \text{£}20 / \text{MWh} * 1.02) + \text{£}0 \} / \{ (8,000 \text{MWh} * 1.02) + 0 \text{MWh} \} \end{aligned}$$

$$= \frac{£163,200}{8,160 \text{ MWh}}$$

$$= £20.000/\text{MWh}$$

Resulting in an increase in SBP_j of £2.248/ MWh and no change in SSP_j .
The effect on SBP is therefore to add on the price adjuster term to the value that was originally calculated.