



Imbalance Pricing Guidance

A guide to electricity imbalance pricing in Great Britain



Any questions?

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About this document:

This document explains the electricity imbalance pricing (cash out) arrangements in the Balancing and Settlement Code (BSC).

[Section 1](#) is a summary of imbalance pricing.

[Section 2](#) introduces the key concepts for imbalance pricing.

[Section 3](#) covers the individual steps for calculating the main Energy Imbalance Price with [Section 4](#) providing an example from start to finish.

[Section 5](#) covers the reverse Energy Imbalance Price (also known as the Market Price).

[Section 6](#) explains when imbalance charges are billed to Parties and [Section 7](#) details how imbalance pricing data is published.

Throughout the document you will find references to the relevant paragraphs of the BSC should you wish to use this document to help you interpret the BSC.

A glossary of terms is also contained in [Section 8](#). Where a term is first defined it appears in the document in bold green font.

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Introduction

Imbalance pricing (also known as “cash out”) is a key part of the wholesale trading arrangements in Great Britain. This document explains why we have imbalance charges, where they fit into the rest of the trading arrangements, how they are calculated and when they are paid. The complete formal rules for Imbalance Settlement are contained in the **Balancing and Settlement Code (BSC)**.

The wholesale electricity market is set up so that organisations that require electricity for their customers, **Suppliers**, enter into contracts with organisations that produce electricity, **Generators**. Together we call these organisations **BSC Parties** or **Parties**.

However, the contracts between Parties do not always cover the generation or demand requirements on the **Transmission System**. This is a problem, as electricity cannot be stored economically in large quantities, and power station generation must always balance out consumer demand plus energy lost as heat when electricity is transported. To balance the Transmission System National Grid acts as the **System Operator (SO)** and takes **balancing actions**. A balancing action is an instruction to a Party, in accordance with agreed rules, to either increase or decrease generation, or increase or decrease demand.

Parties need to submit notifications (**Physical Notifications**) for each half hour Settlement Period so that the SO can understand the imbalance of the Transmission System.

Parties must also submit details of their contracts to the BSC Systems. After the end of the Settlement Period, the BSC Systems compare a Party’s contracted volume with its metered volume in order to determine their imbalance. If a Party is in imbalance of their contracted volume then they will be subject to imbalance charges.

Imbalance Prices

For each Settlement Period, the BSC Systems determine two distinct Energy Imbalance Prices:

1. **System Buy Price (SBP)**; and
2. **System Sell Price (SSP)**.

If a Party has under-generated or over-consumed compared to their contracted volume, it will be charged for that that shortfall of energy at **SBP**.

If a Party has over-generated or under-consumed compared to their contracted volume, it will have to sell that extra energy at **SSP**.

There are two different methods for calculating the Energy Imbalance Prices:

1. the **main pricing method** - reflects the costs of balancing the Transmission System; and
2. the **reverse pricing method** - reflects the market price of electricity for that Settlement Period.

For each Settlement Period, we use the main pricing method to calculate one of prices. Whether this price is SSP or SBP depends on the Transmission System characteristics for the half hour. We then use the reverse pricing method to calculate the other price.

Where the Transmission System is 'long' (too much power), we calculate SSP using the main pricing method and SBP using the reverse pricing method.

Where the Transmission System is 'short' (not enough power), we calculate SBP using the main pricing method and SSP using the reverse pricing method.

The effect of these rules is that the main pricing method is applied to those Parties whose imbalance contributed to the overall Transmissions System imbalance. The reverse pricing method is applied to those Parties whose imbalance reduced the overall Transmission System imbalance.

It is important to note that there are always two prices (SSP and SBP) for each Settlement Period.

Nevertheless there are various ways of referring to the two prices. For example, the price calculated using the main pricing method is normally called the **main Energy Imbalance Price**, irrespective of whether it is the SBP or the SSP. The price calculated using the reverse pricing method is normally called the **reverse Energy Imbalance Price**, irrespective of whether it is the SBP or the SSP. This terminology is sometimes convenient and we shall use it in certain parts of this document.

Main Energy Imbalance Price

The **main Energy Imbalance Price** is calculated using the balancing actions that the SO accepted for that Settlement Period.

However, not all balancing actions are used in the in the same way by the BSC Systems as the SO does not take all balancing actions for the same reason. Some balancing actions are taken purely to balance the half hour energy imbalance of the transmission system. These are '**energy balancing**' actions.

And some balancing actions are taken for non-energy, system management reasons. These are '**system balancing**' actions.

Examples of system balancing actions are:

- Actions that are so small in volume they could be the result of rounding errors (**De Minimis Tagging**);
- Actions taken which have no effect on the energy balancing of the System but lead to an overall financial benefit for the System Operator (**Arbitrage Tagging**);
- Actions taken for locational balancing reasons (**SO-Flagging**); and
- Actions taken to correct short term increases or decreases in generation/demand (**CADL Flagging**).

We use a number of processes to minimise the price impact of system balancing actions on the main Energy Imbalance Price calculation. They can be broadly grouped as:

- **Flagging** – identifying balancing actions that are potentially system balancing. Once identified we will use the Classification process to decide if they are system or energy balancing;
- **Classification** – assessing the Flagged balancing actions against the Unflagged balancing actions to determine whether they are energy balancing or system balancing. If a Flagged Action is more expensive than any Unflagged Action then we consider it to be a system balancing action and remove its price; and
- **Tagging** – completely removing the price and volume of balancing actions so that no part is used in the final calculation.

The full list of processes is on page 14-15. After completing these processes we adjust the remaining balancing actions for Transmission Losses and take a volume weighted average to calculate the main Energy Imbalance Price.

Reverse Energy Imbalance Price

The **reverse Energy Imbalance Price** is calculated from power exchange trading in the short term market. It is intended to reflect the price a Party would have obtained if it had bought or sold its imbalance on a power exchange.

Imbalance Charges

Parties are first billed for Imbalance Charges approximately one month following the Settlement Day. The BSC Systems carry out subsequent reconciliation runs over the next 13 months which update the imbalance charges by replacing any estimated data with actual metered data.

The basic starting point

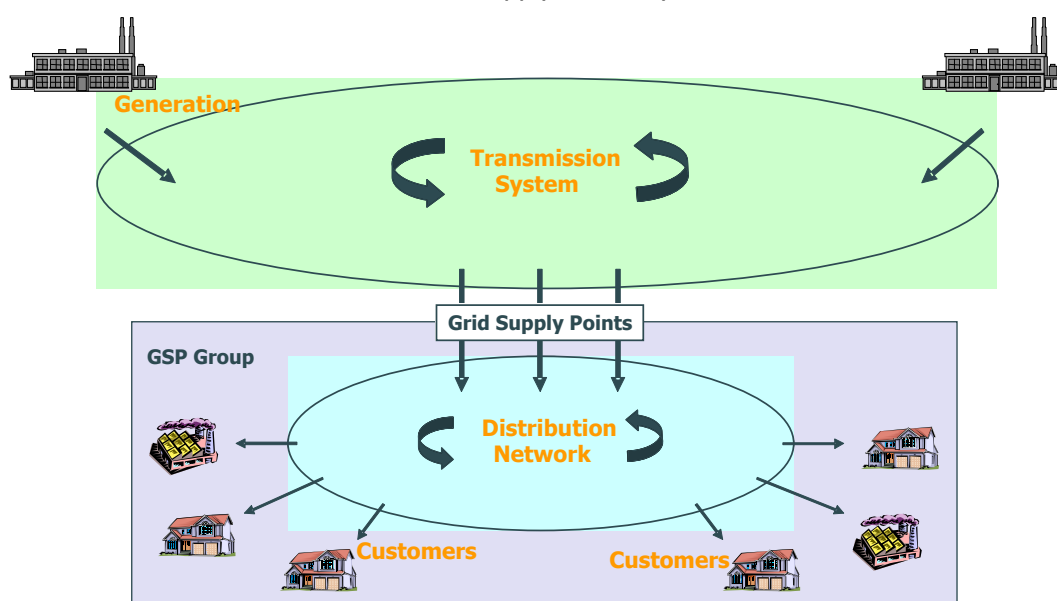
In the wholesale electricity market in Great Britain, organisations that require electricity for their customers, **Suppliers**, enter into contracts with organisations that produce electricity, **Generators**, sometimes via intermediaries called **Non Physical Traders**. These types of organisation are called **BSC Parties**, or simply **Parties**.

The basic trading period for electricity is half an hour. Each day is split into 48 half hour units (unless it is a day where the clocks change, which has either 46 or 50 half hours). Each of these half hour units is called a **Settlement Period**. Suppliers will calculate the estimated electricity requirements for their portfolio of customers for each Settlement Period. They will then enter into contracts with Generators in order that their customers receive the correct quantity of electricity for each Settlement Period.

The complete formal rules for Imbalance Settlement are contained in the **Balancing and Settlement Code (BSC)**.

What is the Transmission System?

The **Transmission System** is the high voltage network that transports electricity throughout Great Britain. The Transmission System delivers electricity to the lower voltage **Distribution Networks** which in turn supply electricity to customers.



Why does the Transmission System need to be balanced?

Electricity cannot be stored economically in large quantities. This means that generation must always equal demand plus energy lost as heat when electricity is transported (**Transmission Losses**). If it does not then the frequency of the Transmission System moves away from the target frequency (50Hz) and the Transmission System becomes unstable.

However, the contracts between Generators and Suppliers do not always completely balance the Transmission System. This could be because:

- Suppliers may not always accurately predict demand;
- Generators may not always be able to tightly control their generation (for example intermittent generation or plant tripping off the Transmission System);

What is a Party?

A BSC Party is an organisation that has signed up to the Balancing and Settlement Code.

- Problems can arise with transmission lines;
- The BSC does not require Parties to meet their contracts. However, if this is the case, then Parties will be subject to imbalance charges; and
- The market trades in half hour Settlement Periods. However, the Transmission System must balance at every instant.

Where the Transmission System is not balanced it is called **imbalance**. National Grid ensures the Transmission System is always balanced. This job is known as system operation, and is managed by the **System Operator (SO)**.



What are Balancing Mechanism Units?

Balancing Mechanism Units (BMUs) represent the generation or consumption at a particular location. Each Party is assigned BMUs for their power stations or areas of demand. The BSC Systems sum up a Party's BMU volumes and contracts when they carry out the Settlement calculations

Physical Notifications, Contract Notifications and Gate Closure

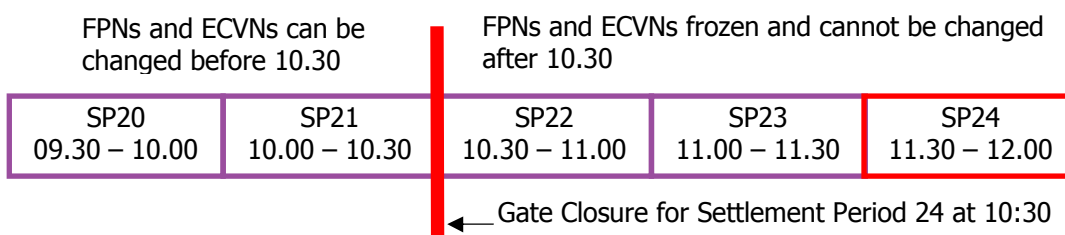
In order to balance the Transmission System, the SO needs to know what Generators intend to generate and what Suppliers intend to consume for each Settlement Period. The SO needs this information before the start of the Settlement Period so they can understand the Transmission System imbalance, plan how to balance it and take balancing actions.

Therefore, Generators and Suppliers submit **Physical Notifications (PNs)** for each **Balancing Mechanism Unit (BMU)** (see right) to the SO for each Settlement Period. And **one hour** before each Settlement Period the PNs of Parties are frozen. This is called **Gate Closure**. At this point the PNs become **Final Physical Notifications (FPNs)**. After Gate Closure, Parties must try to adhere to the FPNs submitted to the SO. They should only deviate from their FPN at the instruction of the SO.

Parties also submit **Energy Contract Volume Notifications (ECVNs)** to the BSC Systems for each Settlement Period before Gate Closure. The ECVNs notify the BSC Systems of Parties contracted volumes. We will use these contracted volumes later on when we calculate Parties' imbalances.

The diagram below shows Gate Closure for Settlement Period 24.

Gate Closure for Settlement Period 24 (SP24)



Transmission System net imbalance

Following Gate Closure the SO is able to evaluate the net imbalance of the Transmission System. The SO does this by assessing the FPNs of the Generators and Suppliers and comparing that assessment to its own forecasts for the Settlement Period. The Transmission System's net imbalance is also called the Transmission System **length**.

A '**long**' Transmission System is one where there is more generation than demand.

A '**short**' Transmission System is one where there is more demand than generation.

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How does the System Operator balance the Transmission System?

The SO has a number of ways of balancing the Transmission System. Whatever mechanism the SO uses it is trying to balance the Transmission System as efficiently as possible. Ideally the SO would choose the cheapest balancing action, then the next cheapest, then the next cheapest, and so on. However, this is not always possible as the SO also considers:

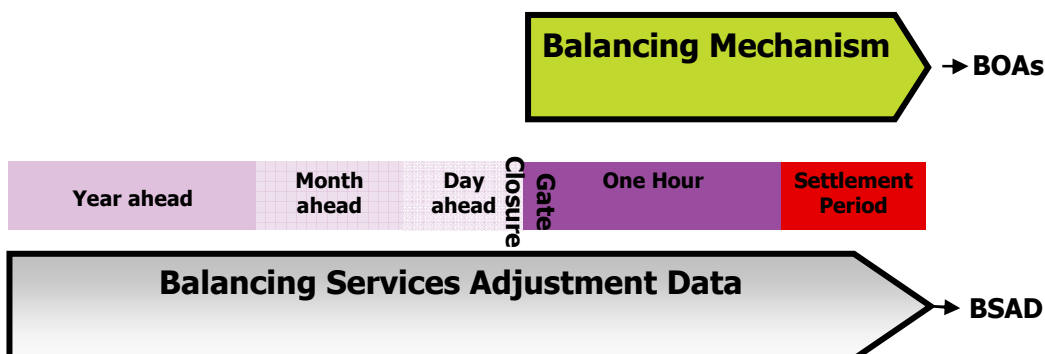
- Technical limitations of the power station or demand manager - is it able to increase or decrease generation/demand quickly enough to meet the requirement; and
- Technical limitations of the Transmission System - can the generation/demand be transmitted to the part of the Transmission System where it is needed.

The SO submits balancing actions to the BSC Systems using:

- The **Balancing Mechanism** – for **Bid Offer Acceptances (BOAs)**; and
- **Balancing Services Adjustment Data (BSAD)** – for balancing actions taken outside of the Balancing Mechanism.

The Balancing Mechanism operates after Gate Closure, whereas balancing actions submitted through BSAD can be taken at any point.

Timing of the Balancing Mechanism and BSAD



Ancillary Services and Commercial agreements

In addition to the Balancing Mechanism and BSAD the SO also uses Ancillary and Commercial Services to balance the Transmission System. Ancillary and Commercial Services cover:

- Reactive Power
- Frequency Response
- Black Start
- Reserve Services

We do not normally consider these services when we calculate the Energy Imbalance Prices as they are 'system balancing' services (see page 14). However, the SO does send the BSC Systems data of the volumes involved so that the Parties that provide these services can have their imbalance volumes suitably adjusted. This is called **Applicable Balancing Services Volume Data (ABSVD)**.

The Balancing Mechanism

The Balancing Mechanism operates from Gate Closure to real time and is managed by the SO. It works in a similar way to an auction. Parties submit notices telling the SO how much it would cost for them to deviate from their Final Physical Notification. These notices are called **Bids** and **Offers**.

An **Offer** is a proposal to **increase generation** or **reduce demand**.

A **Bid** is a proposal to **reduce generation** or **increase demand**.

The SO assesses all the Bids and Offers for each Settlement Period and chooses the ones that, alongside the balancing actions submitted through BSAD, best satisfy the balancing requirements of the Transmission System. Participation in the Balancing Mechanism is optional, and Parties that choose to do so must submit Bids and Offers before Gate Closure for each Settlement Period. For each BM Unit, a Party can submit up to 10 Bid-Offer Pairs.


Each Bid-Offer Pair includes:

- An Offer Price - the price a Party wants to be paid per MWh for an increase in generation or decrease in demand;
- A Bid Price - the price a Party wants to pay per MWh for a decrease in generation or an increase in demand (although it is possible to submit negatively priced Bids, i.e. a Party is paid to reduce generation);
- The Settlement Period for which the Bid/Offer applies (for example, between 20:00 to 20:30 on 24/07/2009);
- The upper and lower power levels between which the Bid/Offer applies (for example, Bid-Offer +1 applies from FPN to 50MW above the FPN, Bid-Offer +2 applies from 50MW above FPN to 100MW above FPN).

Bids and Offers are submitted in pairs because this provides an undo mechanism for Acceptances. For an Accepted Offer, the paired Bid price is the 'undo' option (and for a Bid the associated Offer price is the 'undo' option). If the SO has already accepted the Offer, this is the price SO will be paid per MWh to undo the acceptance. There's usually a difference between the two, which ensures that if a Party's Bid or Offer is accepted and then undone, they will still receive a payment. Over the page is an example of 10 Bid-Offer Pairs.

Bid-Offer Pairs for a BM Unit

Operating volume	
275 MW	Pair + 5: Offer Price £100/MWh Bid Price £2/MWh
250 MW	Pair + 4: Offer Price £50/MWh Bid Price £5/MWh
225 MW	Pair + 3: Offer Price £35/MWh Bid Price £7/MWh
200 MW	Pair + 2: Offer Price £25/MWh Bid Price £13/MWh
175 MW	Pair + 1: Offer Price £20/MWh Bid Price £18/MWh
150 MW	FPN
125 MW	Pair - 1: Offer Price £25/MWh Bid Price £20/MWh
100 MW	Pair - 2: Offer Price £20/MWh Bid Price £15/MWh
75 MW	Pair - 3: Offer Price £15/MWh Bid Price £10/MWh
50 MW	Pair - 4: Offer Price £10/MWh Bid Price £5/MWh
25 MW	Pair - 5: Offer Price £7/MWh Bid Price £2/MWh



Settlement Period

Bid Offer Acceptances (BOAs)

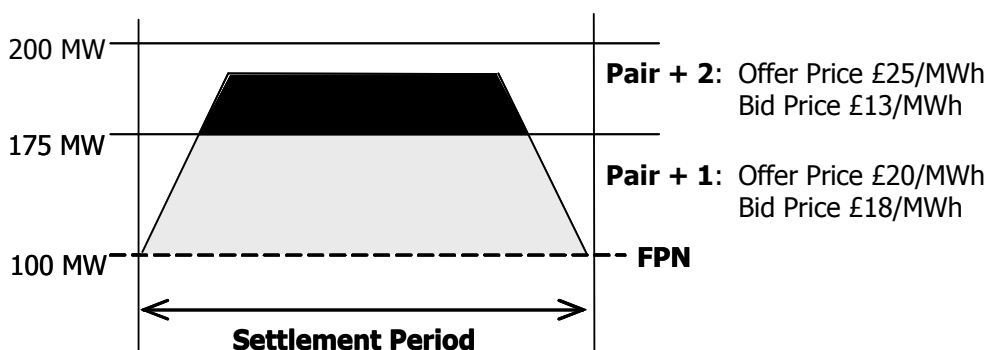
Accepted Bids and Offers are called **Bid Offer Acceptances (BOAs)**. For each BOA the SO contacts the BM Unit directly and instructs it to deviate from its FPN via a set of 'spot points'. Each spot point represents the change in output away from FPN at a particular time.

For example:

- Spot point 1 = 00:00, 100MW;
- Spot point 2 = 00:05, 195MW;
- Spot point 3 = 00:25, 195MW; and
- Spot point 4 = 00:30, 100MW.

Graphically this looks like this:

An Accepted Offer



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Balancing Services Adjustment Data (BSAD)

Balancing actions taken outside of the Balancing Mechanism are submitted to the BSC Systems as **Balancing Services Adjustment Data (BSAD)**. The SO specifies what balancing actions are included in BSAD in the **BSAD Methodology Statement**.

BSAD is split into two components:

- **Balancing Services Adjustment Actions**; and
- the **Buy Price Price Adjuster (BPA)/Sell Price Price Adjuster (SPA)**.

Balancing Services Adjustment Actions

The SO submits an individual Balancing Services Adjustment Action for each of the following Balancing Services:

- Forward Contracts;
 - Energy Related Products;
 - Pre-Gate Closure Balancing Transactions (PGBTs); and
 - System-to-System services,
- Maximum Generation;
- System to Generator Operational Intertripping;
- Emergency de-energisation instructions.

For more detail about Balancing Services Adjustment Actions see page 15.

Buy Price Price Adjuster (BPA)/Sell Price Price Adjuster (SPA)

The other part of BSAD is the Buy Price Price Adjuster (BPA) or the Sell Price Price Adjuster (SPA). The BPA is added when the net imbalance of the Transmission System is short. The SPA is added when the net imbalance of the Transmission System is long.

The BPA/SPA is a reflection of the long term contracts that the SO enters into to provide Short Term Operating Reserve (STOR) and BM Start-up. The STOR component is calculated and allocated using historical data. It does not have a volume because it is based on options (and their associated fees) that the SO can exercise. It simply adjusts the volume weighted average price.

Party imbalances

A Party is in imbalance where its contracted volumes do not match its metered volumes (once the BSC Systems have accounted for any BOAs on the Party's BM Units).

System Buy Price and System Sell Price

For each Settlement Period there are always two imbalance prices, **System Buy Price (SBP)** and **System Sell Price (SSP)**.

If a Party has under-generated or over-consumed compared to their contracted volume they will be charged for that that shortfall of energy at **SBP**.

If a Party has over-generated or under-consumed compared to their contracted volume they will have to sell that extra energy at **SSP**.

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There are two different methods for calculating the imbalance prices:

1. the main pricing method; and
2. the reverse pricing method.

For each Settlement Period, we use the main pricing method to calculate one of prices. Whether this price is SSP or SBP depends on the Transmission System characteristics for the half hour. We then use the reverse pricing method to calculate the other price.

Where the Transmission System is 'long' (too much power), we calculate SSP using the main pricing method and SBP using the reverse pricing method.

Where the Transmission System is 'short' (not enough power), we calculate SBP using the main pricing method and SSP using the reverse pricing method.

It is important to note that there are always two prices (SSP and SBP) for each Settlement Period.

Nevertheless there are various ways of referring to the two prices. For example, the price calculated using the main pricing method is normally called the **main Energy Imbalance Price**, irrespective of whether it is the SBP or the SSP. The price calculated using the reverse pricing method is normally called the **reverse Energy Imbalance Price**, irrespective of whether it is the SBP or the SSP.

The diagram below shows when Parties pay SBP and SSP and what method we use to calculate them:

Diagram showing when Parties pay SBP and SSP and how they are calculated

		System	
		Long	Short
Party Imbalance	Long	Paid SSP (Main Price)	Paid SSP (Reverse Price)
	Short	Pay SBP (Reverse Price)	Pay SBP (Main Price)

The main and reverse pricing methodologies

The main Energy Imbalance Price is calculated using the balancing actions which the SO accepted for that Settlement Period. Section 3 explains how we calculate the main Energy Imbalance Price. Section 4 provides an example of the main Energy Imbalance Price calculation based on a theoretical set of balancing actions.

The reverse Energy Imbalance Price is calculated from power exchange trading in the short term market. This price is also called the Market Price and is intended to reflect the price a Party would have obtained if it had bought or sold its imbalance on a power exchange. Section 5 explains how we calculate the reverse Energy Imbalance Price.

Why are there two imbalance prices and two pricing methods?

The primary reason for having two imbalance prices is to encourage Parties to enter into contracts which balance their own positions to an efficient level.

The main Energy Imbalance Price is normally less beneficial to a Party than the price it could have received if it had traded out its imbalance on a power exchange. This provides the incentives for Parties to trade ahead of time to balance their position to an efficient level.

By having main and reverse pricing methods, Parties are only exposed to the costs of the SO's balancing actions if their imbalances are in the same direction as the overall Transmission System imbalance. If their imbalances are in the opposite direction, they are helping to alleviate the Transmission System imbalance. Therefore they receive an imbalance price similar to what they would have received/paid if they had sold or bought their energy on a power exchange ahead of Gate Closure.

3 How does the main pricing methodology work?



Balancing actions or System Actions?

In the BSC balancing actions are called 'System Actions'. This is because they are actions which balance the Transmission System.

What do we use to calculate the main Energy Imbalance Price?

The BSC Systems calculate the main Energy Imbalance Price using balancing actions accepted by the SO for that Settlement Period.

There are two types of balancing action:

- **Bid Offer Acceptances (BOAs);**
- **Balancing Services Adjustment Actions.**

Balancing actions either increase the energy on the Transmission System (Offers and Buy Balancing Services Adjustment Actions); or decrease the energy on the Transmission System (Bids and Sell Balancing Services Adjustment Actions).

Which balancing actions to use?

We do not use all balancing actions in the same way as the SO does not take all balancing actions for the same reason. Some balancing actions are taken purely to balance the half hourly energy imbalance of the transmission system. These are 'energy balancing' actions.

However, some balancing actions are taken for non-energy, system management reasons. These are 'system balancing' actions.

Examples of system balancing actions are:

- Actions that are so small in volume they could be the result of rounding errors (**De Minimis tagging**);
- Actions taken which have no affect on the energy balancing of the System but lead to an overall financial benefit for the System Operator (**Arbitrage tagging**);
- Actions taken for locational balancing reasons (**SO-Flagging**); and
- Actions taken to correct short term increases or decreases in generation/demand (**CADL Flagging**).

We use a number of processes to minimise the price impact of system balancing actions on the main Energy Imbalance Price calculation. They can be broadly grouped as:

- **Flagging** – identifying balancing actions that are potentially system balancing. Once identified we will use the Classification process to decide if they are system or energy balancing;
- **Classification** – assessing the Flagged balancing Actions against the Unflagged Actions to determine. If Flagged Actions are more expensive than any Unflagged Action then we remove its price; and
- **Tagging** – completely removing the price and volume of balancing actions so that no part is used in the final calculation.

This section describes the processes that remove the price impact of system balancing actions, along with other processes that we use when calculating the main Energy Imbalance Price. These are:

1. **Submitting balancing actions**
2. **System Operator Flagging (SO-Flagging)**
3. **Emergency Instruction Flagging**
4. **Continuous Acceptance Duration Limit (CADL) Flagging**

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5. **Ranked Sets**
6. **De Minimis Tagging**
7. **Arbitrage Tagging**
8. **Classification**
9. **NIV Tagging**
10. **Replacement Price**
11. **PAR Tagging**
12. **BPA/SPA**
13. **Transmission Loss Multiplier**
14. **Final main Energy Imbalance Price calculation**

How are balancing actions submitted to the BSC Systems?

Each Settlement Period the SO sends the following balancing data to the BSC Systems:

- The Final Physical Notifications (FPN);
- The Bid–Offer Data for BM Units;
- Bid–Offer Acceptance data;
- Balancing Services Adjustment Data (BSAD)

Balancing Services Adjustment Actions

Balancing actions taken outside of the Balancing Mechanism are submitted to the BSC Systems using Balancing Services Adjustment Data (BSAD). The SO calculates BSAD in accordance with the BSAD Methodology Statement which is required under the Transmission Licence.

BSAD is made up of two parts:

- Balancing Services Adjustment Actions (disaggregated BSAD)
- Buy Price Price Adjuster (BPA) / Sell Price Price Adjuster (SPA)

The BPA/SPA is used at the end of the process, so go to page 24 for more information.

Explanation

Where the SO takes a balancing action outside the Balancing Mechanism, it submits it to the BSC Systems as a Balancing Services Adjustment Action.

Each Balancing Services Adjustment Action has a:

- **Balancing Services Adjustment Cost** – value in £ (can be a NULL cost);
- **Balancing Services Adjustment Volume** – value in MWh; and
- **SO-Flag** - either set to True/False.

Once the BSC Systems receive the Balancing Services Adjustment Action they convert the Balancing Services Adjustment Cost to a Balancing Services Adjustment Price by dividing the Balancing Services Adjustment Cost by the Balancing Services Adjustment Volume:

$$\text{Price(£/MWh)} = \frac{\text{Cost(£)}}{\text{Volume(MWh)}}$$

NULL priced Balancing Services Adjustment Actions

Balancing Services Adjustment Actions that result from intertrips are submitted with a NULL cost (and therefore a NULL Price). This is because intertrip related Balancing Services Adjustment Actions do not have a cost/price available in the required timescales.



Where in the BSC?

The structure of Balancing Services Adjustment Actions is described in Section Q6.3.2.

The BSC Systems calculation converting Balancing Services Adjustment Cost to Balancing Services Adjustment Price is in Section Q6.3.2A.

Balancing Services Adjustment Actions are referred to throughout Section T Annex T-1, as they undergo all but one of the calculation processes.



What is an intertrip?

An intertrip is a service that automatically disconnects a generator or demand from the Transmission System to relieve localised network overloads, maintain system stability, manage system voltages and/or ensure quick restoration of the transmission system.

There are two types of intertrip service: Commercial Intertrips and System to Generator Operational Intertrips processes

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NULL priced Balancing Services Adjustment Actions are always classified as **Second Stage Flagged balancing actions** (page 22) and are unpriced. However, if NULL priced Balancing Services Adjustment Actions enter the **Net Imbalance Volume** (page 22) they will be subject to a **Replacement Price** (page 23).

System Operator Flagging

Explanation

System Operator Flagging (SO-Flagging) is the process that identifies BOAs and Balancing Services Adjustment Actions that are potentially taken for system balancing reasons. The SO-Flagging process is documented in the **System Management Action Flagging Methodology Statement** which is required under National Grid's Transmission Licence.

For BOAs, the SO flags when it believes the BOA may be impacted by a transmission constraint.

For Balancing Services Adjustment Actions the SO also flags when it believes the balancing action was impacted by a transmission constraint. It also has two additional reasons for flagging a Balancing Services Adjustment Action:

- any system-to-system balancing service over an interconnector used to avoid adverse effects arising on the Transmission System from significant load profile changes.
- any system-to-system balancing service used by another Transmission System Operator (TSO) other than National Grid, for the purposes of resolving a system operation issue.

For the purposes of the Classification process (see page 21) an SO-Flagged balancing action is a **First Stage Flagged balancing action**.

What is a transmission constraint?

A **transmission constraint** is any limit on the ability of the transmission system, or any part of it, to transmit power to a location which demands it.

Transmission constraints arise from:

- the need not to exceed the thermal rating of any asset forming part of the Transmission System (preventing the lines getting too hot);
- the need to maintain voltages on the Transmission System; or
- the need to maintain the transient and dynamic stability of electricity plant, equipment and systems directly or indirectly connected to the Transmission System.

Emergency Flagging

Explanation

The SO issues Emergency Instructions to power stations and potentially customers in circumstances when there is a specific requirement to isolate a generating unit or power station or customer demand from the transmission system. For example, an emergency could occur if there was a fire or breakdown of a piece of transmission system equipment, or if there were a major incident that affected part of the transmission system.

Emergency Instructions are inserted into the main Energy Imbalance Price calculation as BOAs. The SO is able to flag or not flag Emergency Instructions, depending on whether they were issued for system balancing reasons.



Where in the BSC?

The SO-Flagging process is described in Section T Annex T-1 paragraph 3.



Where in the BSC?

Emergency Instructions are defined in Section Q5.1.3(b), Q5.3.1(d) and Q5.3.1(e).

The use of Emergency Flagged actions and Emergency Acceptances in the main Energy Imbalance Price calculation is described in Section T Annex T-1 paragraph 5.

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A flagged Emergency Instruction is called '**Emergency Flagged**'. Emergency Flagged actions are treated in an identical way to SO-Flagged BOAs and are First Stage Flagged balancing action.

An unflagged Emergency instruction is called an '**Emergency Acceptance**'. Emergency Acceptances are treated in an identical way to unflagged BOAs and are First Stage Unflagged balancing actions.



Where in the BSC?

The Continuous Acceptance Duration Limit is defined in Section T paragraph 1.9.

The CADL Flagging process is described in Section T Annex T-1 paragraphs 3 and 12.

Continuous Acceptance Duration Limit (CADL) Flagging

Explanation

The SO may need to accept short duration actions to cater for a sudden increase/decrease in generation or demand. We consider these actions to be potentially system balancing. This is because they are taken in order to balance the Transmission System in real time and may not be required to balance the energy on the Transmission System over the half hour Settlement Period.

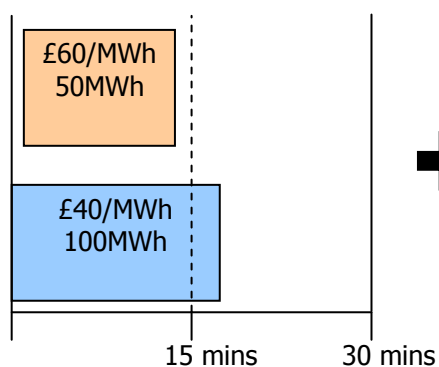
In order to distinguish between such short duration actions we apply a rule called the **Continuous Duration Acceptance Limit (CADL)**. It is a time limit for BOAs. If a BOA is part of a series of acceptances on the same BM Unit which is less than the CADL it will be flagged. A **CADL Flagged** BOA is a First Stage Flagged Action.

The current CADL is set at **15 minutes** and may be altered by the BSC Panel from time to time following consultation with the Transmission Company and Parties, and approval by the Authority.

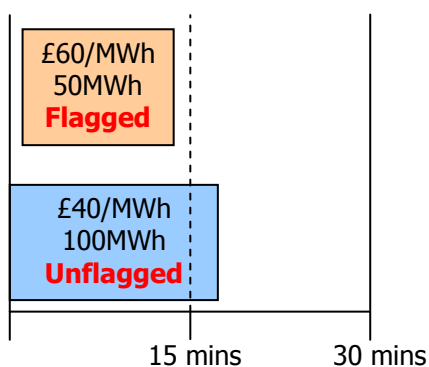
Below is an example of CADL Flagging, two BOAs for different BM Units, one less than 15 minutes, one more than 15 minutes.

CADL Flagging example

Before CADL Flagging



After CADL Flagging



In the example above, the BOA which is less than 15 minutes in length becomes Flagged.

Ranked Sets

Once the BSC Systems have received all the balancing actions they are ranked in price order in two separate **Ranked Sets**:

- The **Sell Ranked Set** includes all the **sell balancing actions** which reduce generation on the Transmission System or increase demand; and
- The **Buy Ranked Set** includes all the **buy balancing actions** which increase generation on the Transmission System or reduce demand.

When ranking in price order we always consider how expensive a balancing action is to the Transmission System. The cheapest balancing action is ranked first and the most expensive balancing action is ranked last.

For a buy balancing action, the higher the price the more expensive the action. So a £10/MWh buy balancing action will be ranked before a £20/MWh buy balancing action.

For a sell balancing action, the lower the price the more expensive the action. This is because the price is what a Party will pay per MWh to reduce their generation or increase demand. So a £20/MWh sell balancing action will be ranked before a £10/MWh sell balancing action.

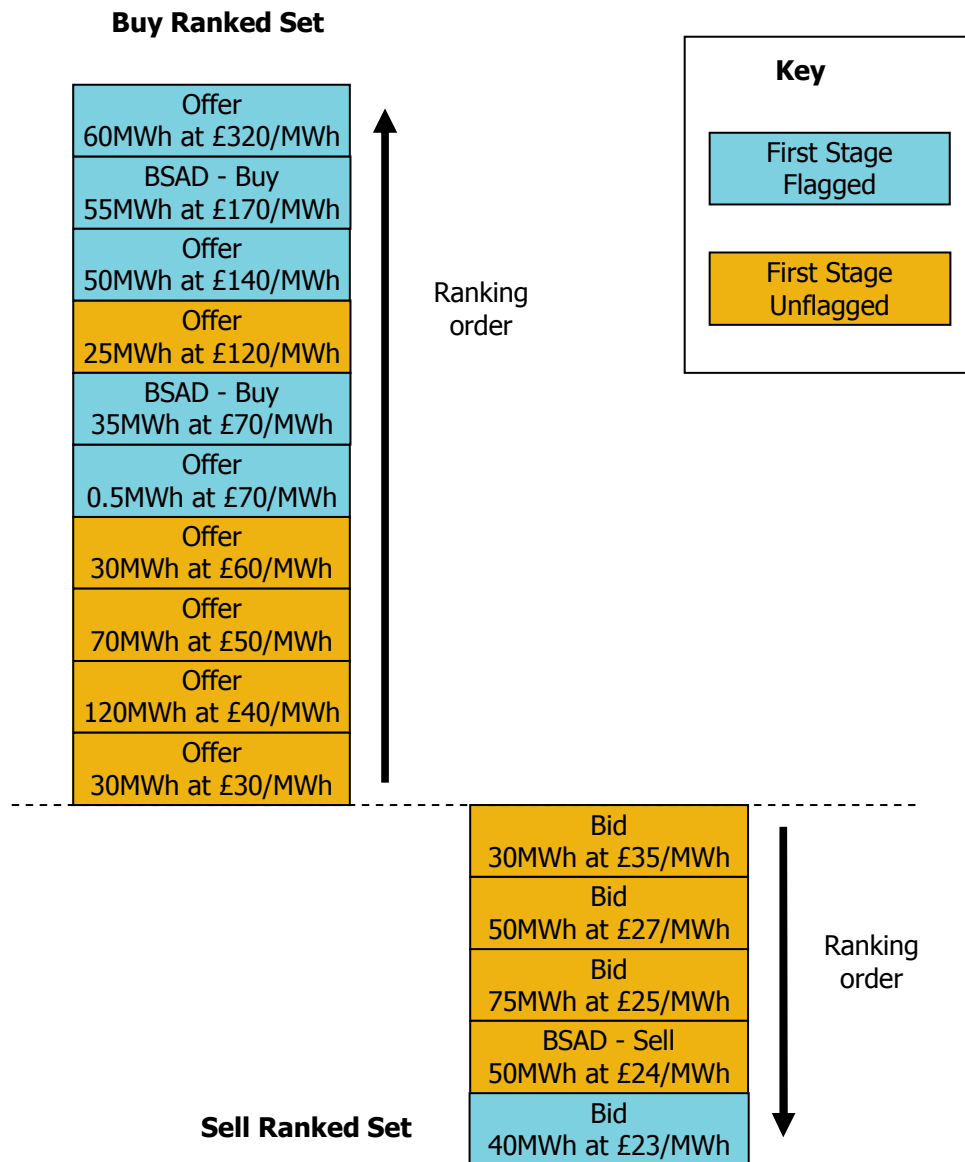
Below is an example of actions being separated out into the Buy Ranked Set and the Sell Ranked Set.

Unranked balancing actions

Offers	Bids	Balancing Services Adjustment Actions (BSAA)			
Offer 50MWh at £140/MWh	Bid 30MWh at £35/MWh	BSAA - Buy 55MWh at £170/MWh			
Offer 25MWh at £120/MWh	Bid 40MWh at £23/MWh	BSAA - Buy 35MWh at £70/MWh			
Offer 60MWh at £320/MWh	Bid 50MWh at £27/MWh	BSAA - Sell 50MWh at £24/MWh			
Offer 30MWh at £30/MWh	Bid 75MWh at £25/MWh				
Offer 120MWh at £40/MWh					
Offer 30MWh at £60/MWh					
Offer 0.5MWh at £70/MWh					
Offer 70MWh at £50/MWh					
<table border="1"> <thead> <tr> <th>Key</th> </tr> </thead> <tbody> <tr> <td>First Stage Flagged</td> </tr> <tr> <td>First Stage Unflagged</td> </tr> </tbody> </table>			Key	First Stage Flagged	First Stage Unflagged
Key					
First Stage Flagged					
First Stage Unflagged					

The above diagram is unranked. Over the page the balancing actions have been ranked into a Buy Ranked Set and a Sell Ranked Set. We show the ranking orders in opposite directions.

Ranked balancing actions



De Minimis Tagging

Explanation

De Minimis Tagging removes all balancing actions (BOAs and Balancing Services Adjustment Actions) with a volume less than the **De Minimis Acceptance Threshold (DMAT)**. This volume is currently set at **1MWh**. The Panel can alter the DMAT following consultation with the Transmission Company and Parties, and approval by the Authority.

De Minimis Tagging removes potentially 'false' actions created due to the finite accuracy of the systems used to calculate Bid and Offer Volumes. All balancing actions less than 1MWh are completely removed from the calculation of the main Energy Imbalance Price, i.e. both the price and volume of a De Minimis tagged BOA is excluded from the main Energy Imbalance Price calculation.



Where in the BSC?

BSC Section T1.8 defines the DMAT and the Panel revision process.

The De Minimis tagging process is described in Annex T-1 paragraph 6.

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Example of a De Minimis Tagged Offer

Ranked Set before De Minimis Tagging

Offer 70MWh at £70/MWh
Offer 0.5MWh at £60/MWh
Offer 70MWh at £50/MWh
Offer 120MWh at £40/MWh
Offer 30MWh at £30/MWh

Ranked Set after De Minimis Tagging

Offer 70MWh at £70/MWh
Offer 70MWh at £50/MWh
Offer 120MWh at £40/MWh
Offer 30MWh at £30/MWh

Offer
0.5MWh at £60/MWh



In this example the 0.5MWh at £60/MWh Offer is removed by De Minimis Tagging.



Where in the BSC?

The Arbitrage Tagging process is described in Annex T-1 paragraphs 7 and 13.

Arbitrage Tagging

Explanation

Arbitrage occurs when the price of a buy balancing action (an accepted Offer or a buy Balancing Services Adjustment Action) is either the same or lower than the price of a sell balancing action (an accepted Bid or a sell Balancing Services Adjustment Action). It is considered arbitrage because the SO can 'purchase' the buy balancing action in the same instant as it 'sells' the sell balancing action, and make an immediate profit for no net change of energy on the Transmission System.

In cases of arbitrage equivalent volumes of sell balancing actions and buy balancing actions are excluded from the main Energy Imbalance Price calculation.

An example of a Bid and an Offer which would be subject to arbitrage is shown below:

Example of BOAs which would be Arbitrage Tagged

Offer
30MWh at £10/MWh

Bid
30MWh at £15/MWh

Here a generator is willing to increase generation by 30MWh for just £10/MWh whilst there is another generator who is willing to pay £15/MWh to decrease generation by 30MWh. It is considered that in an efficient market, these two generators would have traded with each other ahead of Gate Closure. Therefore the equal volumes (30MWh) are removed from the Buy and Sell Ranked Sets.

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Classification

Explanation

Classification determines which balancing actions retain their price and which become unpriced. It is the main way the BSC Systems decide if a balancing action is an energy balancing action or a system balancing action.

Classification occurs independently for the Buy Ranked Set and the Sell Ranked Set. Before Classification, a balancing action will be either a:

- **First Stage Unflagged balancing action** – an energy balancing action; or
- **First Stage Flagged balancing action** – a potentially system balancing action (SO-Flagged, Emergency Flagged or CADL Flagged).

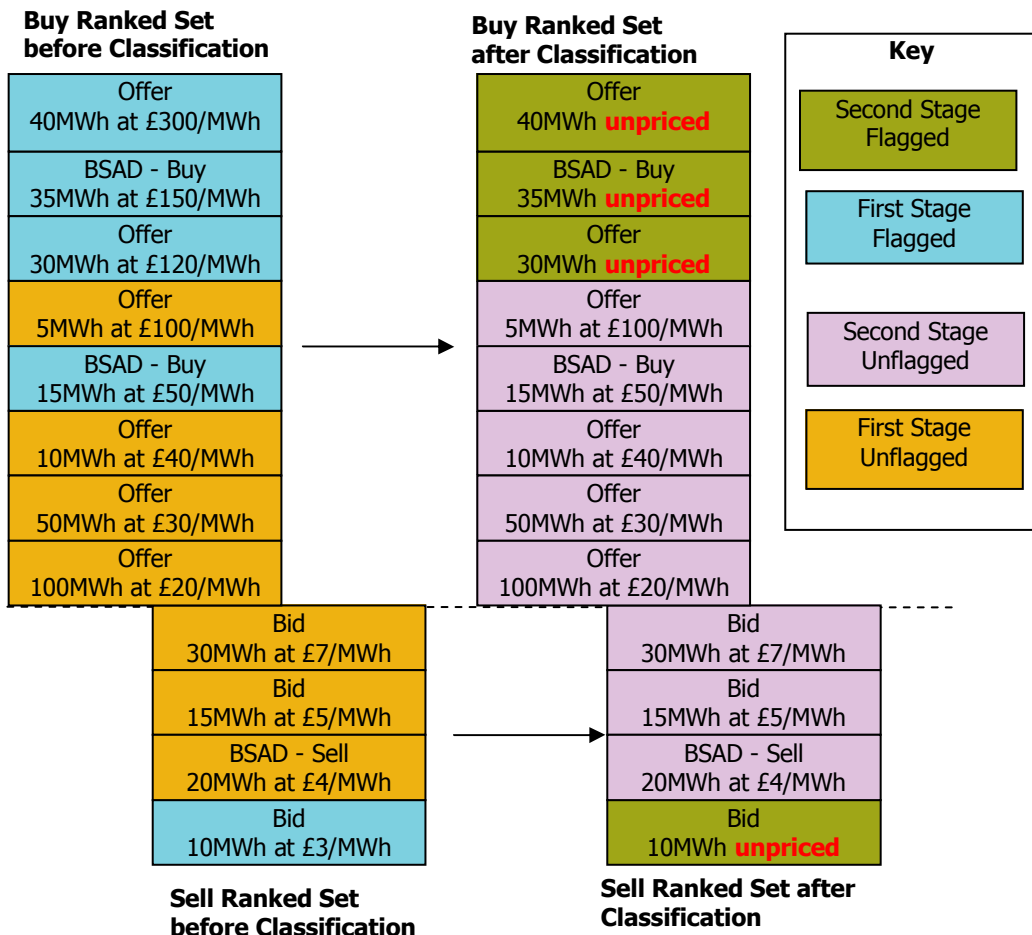
During Classification each First Stage Flagged balancing action is compared to the most expensive First Stage Unflagged balancing action in the respective Ranked Set (Buy or Sell).

If a First Stage Flagged balancing action has a **more expensive price** than the most expensive First Stage Unflagged balancing action it is considered a system balancing action and so becomes **unpriced**.

If a First Stage Flagged balancing action has a **less expensive price** than the most expensive First Stage Unflagged balancing action it is considered a energy balancing action and stays **priced**.

The example below shows Classification at work.

Example of Classification process



Where in the BSC?

Section T Annex T-1 paragraph 8 describes the Classification process.

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When the Transmission System is **short**, and the SO balances the system by accepting a greater volume of buy balancing actions than sell balancing actions, the **NIV will be positive**.

When the Transmission System is **long**, and the SO balances the system by accepting a greater volume of sell balancing actions than buy balancing actions, the **NIV will be negative**.



Where in the BSC?

RPAR is defined in Section T1.11.

The Replacement Price Process is described in Section T Annex T-1 paragraphs 10 and 15.

Replacement Price

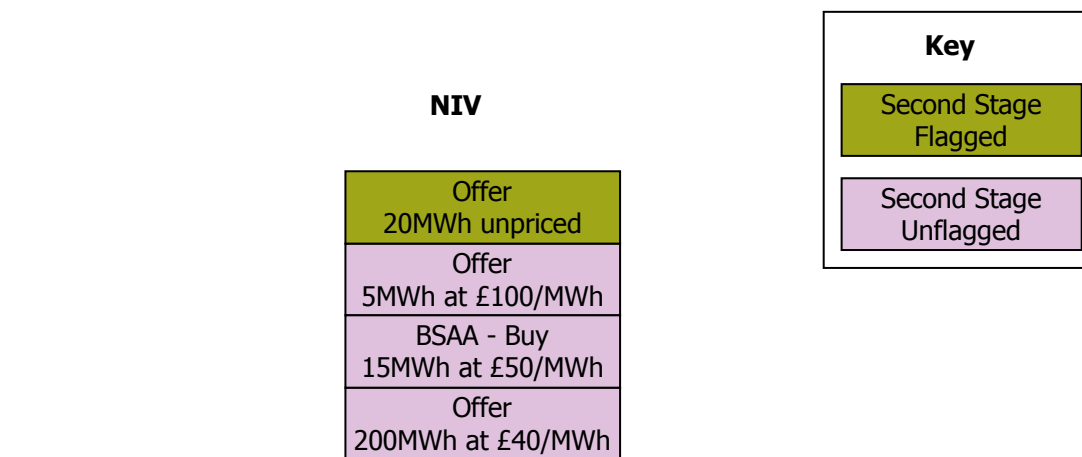
Explanation

There are situations where not all of the volume of the NIV is priced. This may occur if there is a large amount of unpriced volume (that has been classified as Second Stage Flagged) in a particular Settlement Period. Where unpriced volume exists in the NIV it must be assigned a Replacement Price. The Replacement Price is calculated from a volume weighted average of the **most expensively priced 100MWh of priced actions**. This parameter is the **Replacement Price Average Reference Volume (RPAR)**. If we have less than 100MWh of priced volume then we use all the priced volume to calculate the Replacement Price.

An example of the Replacement Price process is shown below. In the example the unpriced 20MWh Offer requires a Replacement Price. To calculate the Replacement Price we use the most expensive 100MWh of priced balancing actions. In this case we use the following balancing actions:

- Offer - 5MWh at £100/MWh
- Buy Balancing Services Adjustment Action - 15MWh at £50/MWh
- Offer - 80MWh at £40MWh - we only need to use 80MWh of the 200MWh Offer to complete the 100MWh of priced volume

Example of a Replacement Price situation



Once the Replacement Price has been assigned to the previously unpriced volume the NIV stack may have to be re-ranked to keep the actions in the price order.

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PAR Tagging

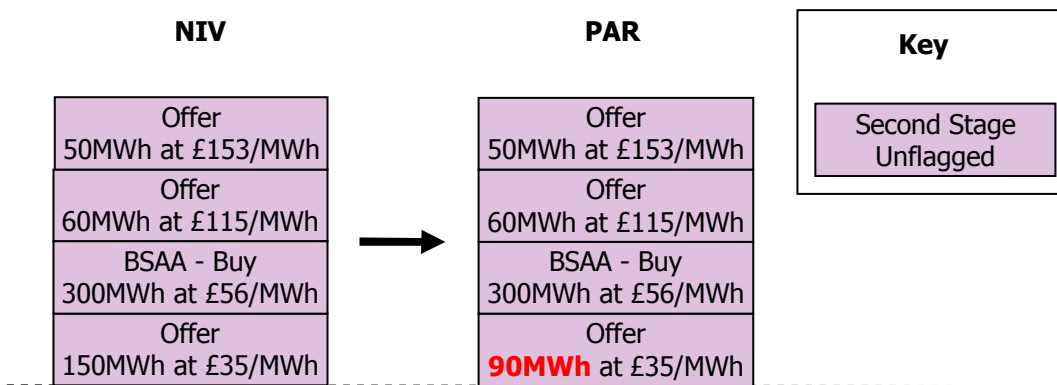
Explanation

The last tagging process is Price Average Reference (PAR) Tagging. The main energy Imbalance Price is calculated based on the volume weighted average of a defined volume of the most expensive actions remaining. This defined volume is the **Price Average Reference Volume (PAR)** and is **500 MWh**. PAR Tagging is applied such that:

- Where the System is short, SBP is calculated as a volume weighted average of not more than 500 MWh of the most expensive actions in the NIV (i.e. up to 500 MWh of highest priced buy balancing actions); and
- Where the System is long, SSP is calculated as a volume weighted average of not more than 500 MWh of the most expensive actions in the NIV (i.e. up to 500 MWh of lowest priced sell balancing actions).

The purpose of the PAR Tagging mechanism is to more closely align the main Energy Imbalance Price with the price of the marginal energy balancing action (i.e. the most expensive action taken by the SO to balance total energy supply and demand).

Example of PAR Tagging



Buy Price Price Adjuster (BPA)/Sell Price Price Adjuster (SPA)

Explanation

The other part of BSAD used for the main Energy Imbalance Price calculation is the BPA/SPA. Only one is used for each Settlement Period. The BPA is used when the Transmission System is short (and the NIV is positive), and the SPA is used when the Transmission System is long (and the NIV is negative).

The BPA/SPA is a reflection of the long term contracts that the System Operator enters into to provide Short Term Operating Reserve (STOR) and BM Start-up. The STOR component is calculated and allocated using historical data. It does not have a volume because it is based on options (and their associated fees) that the SO can exercise. It simply adjusts the volume weighted average price that has been calculated following PAR tagging and TLM adjustment. For further details of the BPA/SPA see Appendix 1 or the BSAD Methodology Statement.

For example:

Volume weighted average for Settlement Period X on an example day = £30/MWh

Buy Price Adjuster for Settlement Period X on example day = £26.50/MWh

System Buy Price = 30 + 26.50 = £56.50/MWh



Where in the BSC?

PAR is defined in Section T1.10.

The PAR process is described in Section T Annex T-1 paragraphs 11 and 16.



Where in the BSC?

The requirement for the Transmission Company to send BPA/SPA in BSAD is in Section Q6.3.2.

The BPA/SPA is then used in the final calculation in Section T4.4.2(a) and T4.4.3(a).

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Transmission Loss Multipliers (TLMs)

Once PAR Tagging has been completed the balancing actions still remaining will be used in the final calculation. At this stage they need to be adjusted for Transmission Losses.

What are Transmission Losses?

When electricity is transmitted over the Transmission System some energy is 'lost'. The energy lost from the Transmission System is commonly referred to as 'transmission losses'.

The total losses are the total energy lost from the Transmission System at any given time, which equates to the difference between total metered generation and total metered demand.

How are Transmission Losses allocated?

Transmission Losses are allocated to Parties on the basis of their metered energy in each half hour.

A Transmission Loss Multiplier (TLM) is used to scale each BM Unit's Metered Volumes in Settlement. The TLM is calculated for each BM Unit for each Settlement Period.

The result is uniform adjustment of the total transmission losses for the Settlement Period such that:

- 45% of losses are allocated across all net delivering Trading Units; and
- 55% of losses are allocated across all net offtaking Trading Units.

Where do we use Transmission Losses in Imbalance Pricing

The BOAs used to calculate the main Energy Imbalance Price are adjusted for Transmission Losses. This is done in the final calculation (see below). Balancing Services Adjustment Actions are adjusted by the SO before they are sent to the BSC Systems.

Final main Energy Imbalance Price calculation

For the final main Energy Imbalance Price calculation we take a volume weighted average of the balancing actions, adjust them for Transmission Losses and add on the BPA/SPA. Section 4 describes an example of how we do this.

Default rules – what happens when there is not enough priced volume?

There are a number of default rules which apply when the data needed to carry out the main pricing method is not available.

Replacement Price

In the situation where the volume of priced actions is less than RPAR (100MWh) volume the used to calculate the Replacement Price will be a volume weighted average of the priced actions (whatever their volume).

In the situation where there is no priced volume the Replacement Price will be calculated using the reverse pricing method for that Settlement Period. See Section 5 for explanation of the reverse pricing method.



Where in the BSC?

The Transmission Losses calculations are defined in Section T2. The TLM is then used in the final calculation in Section T4.4.2(a) and T4.4.3(a).

NIV and PAR

In the situation where the volume of priced (and re-priced from the replacement price) balancing actions is less than the PAR volume, the main Energy Imbalance Price will be a volume weighted average of the priced system Actions (whatever their volume).

In the situation where the NIV is made up of 100% unpriced actions the main Energy Imbalance Price will be calculated using the reverse pricing method for that Settlement Period.

In the situation where the reverse Energy Imbalance Price is zero and the NIV is made up of 100% unpriced actions, the main Energy Imbalance Price will be also be zero.

System Buy Price (SBP) cannot be lower than System Sell Price (SSP)

In the situation where the calculation of SBP (as either the main or reverse Energy Imbalance Price) would result in a lower price than the calculation of SSP, then SBP and SSP will be equivalent and calculated according to the methodology of whichever is the main Energy Imbalance Price.

Actions not included in the calculation of the main Energy Imbalance Price

Applicable Balancing Services Volume Adjustment Data (ABSVD)

Applicable Balancing Services Volume Adjustment Data (ABSVD) are volume adjustments to BM Units that are instructed by the SO to provide automatic frequency response (and therefore are in imbalance of their notified position). These volumes are identified ex-post by the SO using a set of matrices of frequency response for each individual BM unit that provides the service. The volume calculated is removed from the Parties account and entered into the SO account. ABSVD is not included in the calculation of the main Energy Imbalance Price as it is currently not possible to calculate the volume adjustments within the timescales for reporting the main Energy Imbalance Price (15 minutes after the end of the Settlement Period).

Non-Balancing Mechanism Reserve

Non-Balancing Mechanism Reserve, or demand side reserve, refers to contracts that the SO enters into outside the Balancing Mechanism. Non-Balancing Mechanism Reserve contracts are struck up with large electricity users and when called upon lead to a reduction in demand. Like ABSVD they are not included in the calculation of the main Energy Imbalance price as it is not possible to include them within the prompt reporting timescales required by the BSC.

4 Main pricing methodology calculation example

This section provides an example of the main Energy Imbalance Price calculation based on a theoretical set of balancing actions.

Main Energy Imbalance Price Calculation processes

This example will, step by step, go through the following nine stages

1. Receive Balancing Services Adjustment Actions and BOAs (Includes SO-Flagging, CADL Flagging, Emergency Flagging)
2. Rank Buy Ranked Set and Sell Ranked Set
3. De Minimis Tagging and Arbitrage Tagging
4. Classification
5. Net Imbalance Volume (NIV) Tagging
6. Replacement Price
7. Price Average Reference Volume (PAR) Tagging
8. Buy Price Price Adjuster (BPA) / Sell Price Price Adjuster (SPA)
9. Transmission Loss Multiplier and main Energy Imbalance Price calculation

1. Receive Balancing Services Adjustment Actions and BOAs (Includes SO-Flagging, CADL Flagged, Emergency Flagged)

For each Settlement Period the SO matches demand to generation in real time by using balancing actions (BOAs and Balancing Services Adjustment Actions). The SO flags balancing actions potentially impacted by system balancing issues. The BSC Systems flags actions which have duration less than CADL (15 minutes). SO-Flagged and CADL Flagged actions are collectively called First Stage Flagged balancing actions. In the example below First Stage Flagged balancing actions are shown in blue stripes and First Stage Unflagged actions are shown in yellow. For simplicity the volumes are not shown to scale.

Offers	Bids	Balancing Services Adjustment Actions (BSAA)
Offer 30MWh at £120/MWh	Bid 10MWh at £15/MWh	BSAA - Buy 35MWh at £150/MWh
Offer 5MWh at £100/MWh	Bid 20MWh at £3/MWh	BSAA - Buy 15MWh at £50/MWh
Offer 40MWh at £300/MWh	Bid 30MWh at £7/MWh	BSAA - Sell 30MWh at £4/MWh
Offer 10MWh at £10/MWh	Bid 55MWh at £5/MWh	
Offer 100MWh at £20/MWh		
Offer 10MWh at £40/MWh		
Offer 0.5MWh at £50/MWh		
Offer 50MWh at £30/MWh		

Key
First Stage Flagged
First Stage Unflagged

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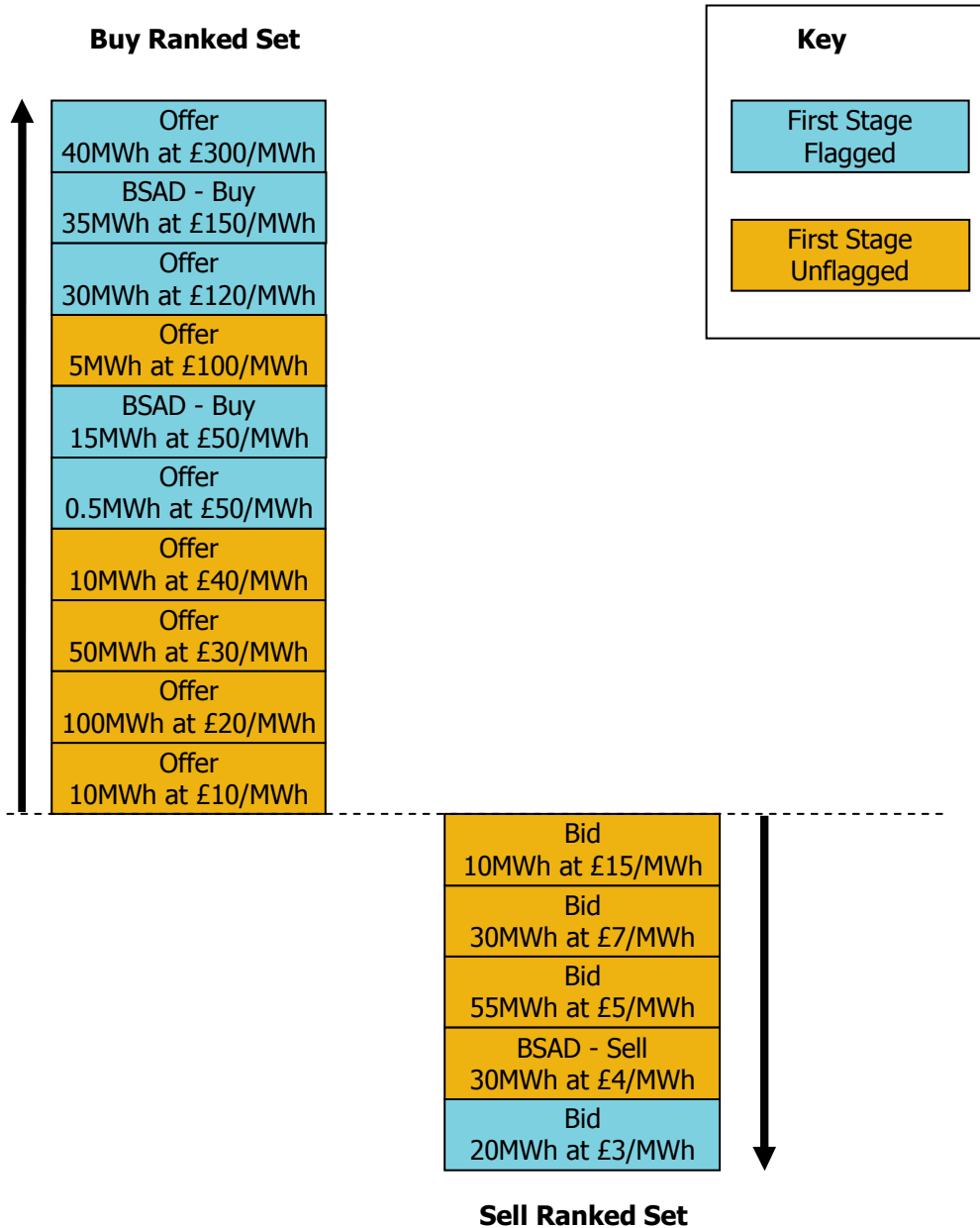
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2. Formulate the Ranked Sets of balancing actions

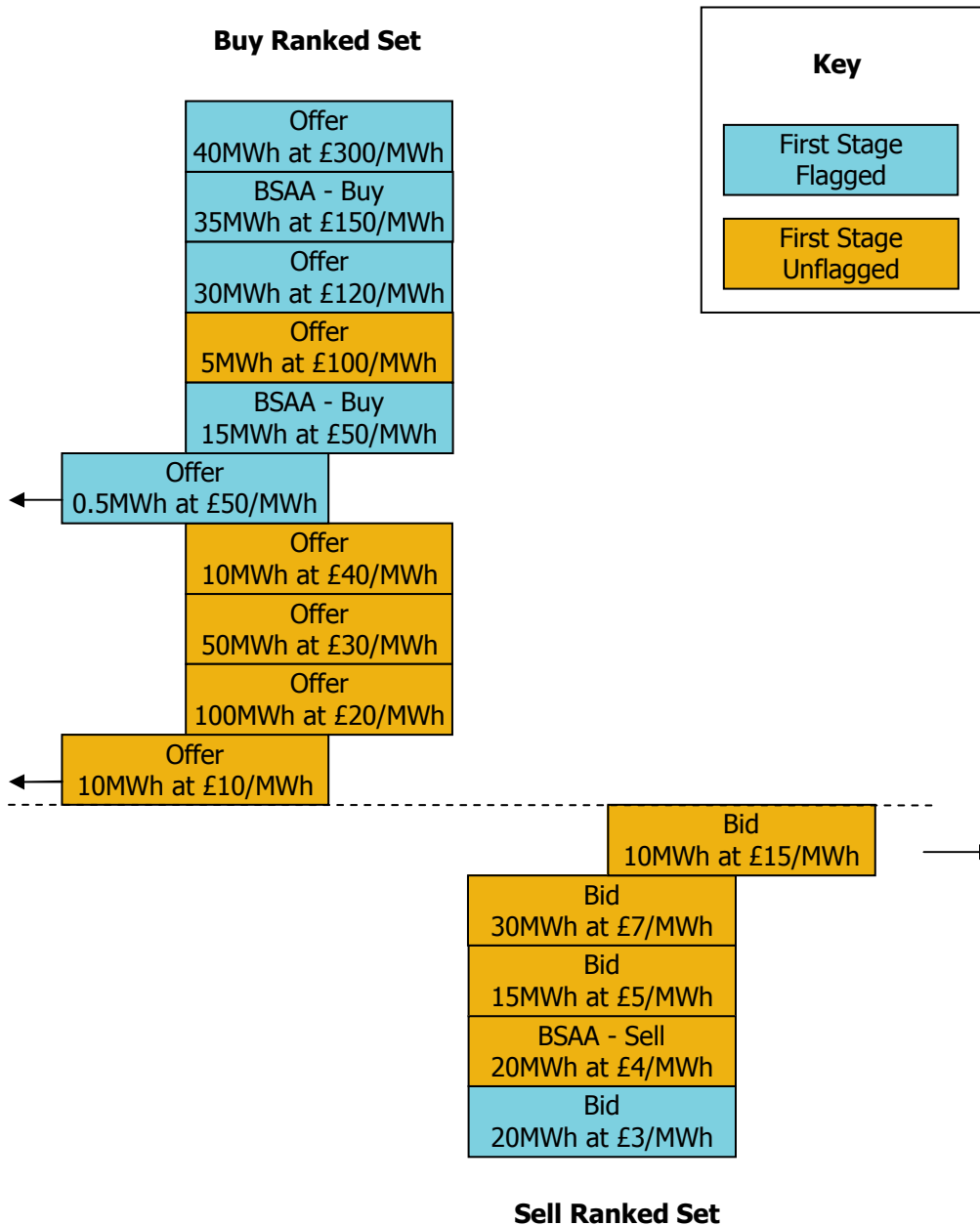
The balancing actions are separated into those that increase the energy on the Transmission System (buy balancing actions) and those that decrease the energy on the Transmission System (sell balancing actions). They are then ranked in price order - least expensive balancing action ranked first, most expensive balancing action ranked last. In the diagram below the direction of the Sell Ranked Set is opposite (the most expensive balancing action is at the bottom) to the direction of the Buy Ranked Set (the most expensive balancing action is at the top). The price ranking is indicated by the arrows.



3. Remove De Minimis and Arbitrage actions

Balancing actions which are less than 1MWh are removed from the price stack. In the example below one action (0.5MWh at £50/MWh) is removed by De Minimis Tagging.

In the example there is also a £10/MWh Offer and a £15/MWh Bid which can be removed through Arbitrage Tagging. Arbitrage Tagging removes equal volume from each Ranked Set.

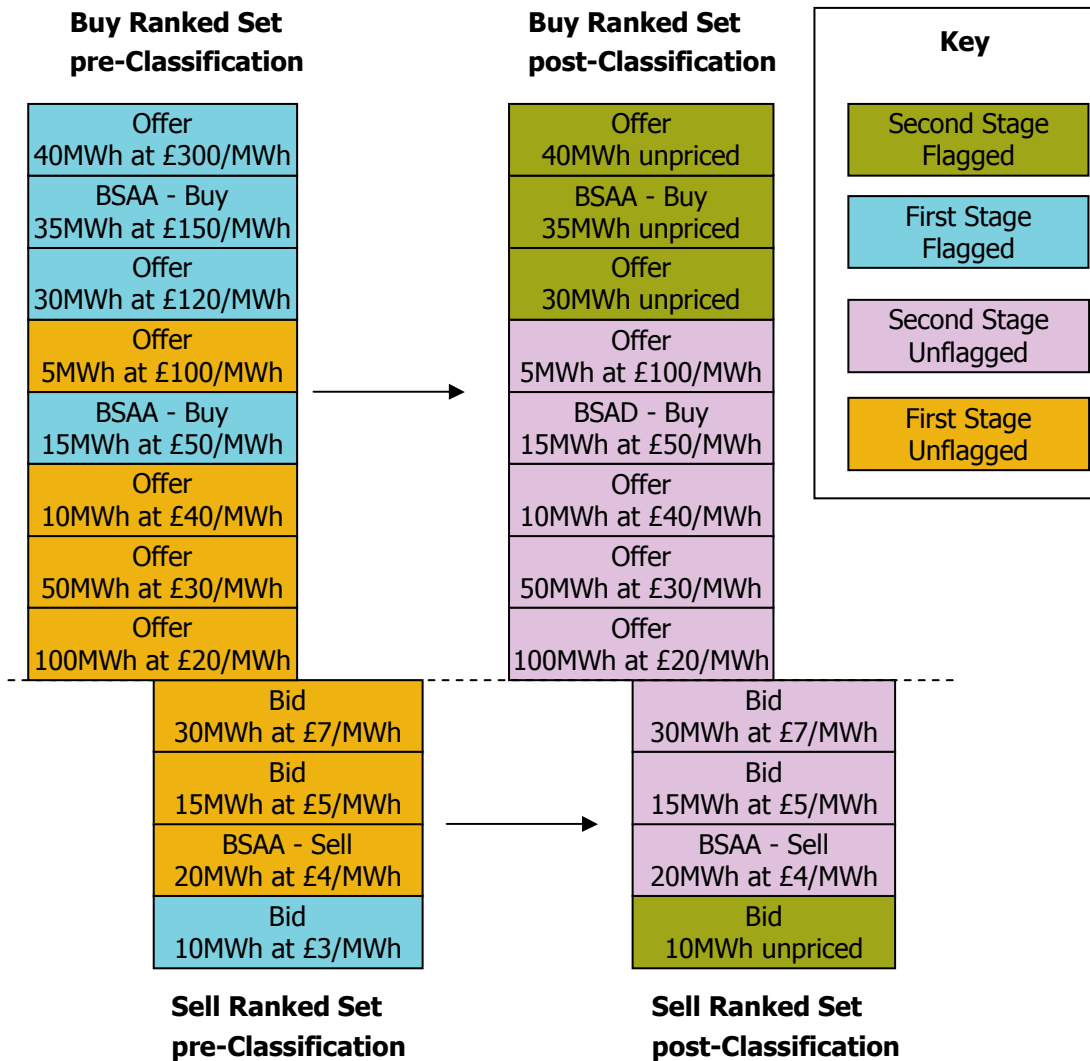


4. Classification

Balancing actions which are First Stage Unflagged are energy balancing actions and so are reclassified as Second Stage Unflagged balancing actions. These remain priced.

For each of the First Stage Flagged balancing actions the BSC Systems consider whether there is a more expensive First Stage Unflagged balancing action. If there is a more expensive First Stage Unflagged balancing action then the First Stage Flagged balancing action is classified as a Second Stage Unflagged balancing action and is priced. If there is not then the First Stage Flagged balancing action is classified as a Second Stage Flagged balancing action and is unpriced.

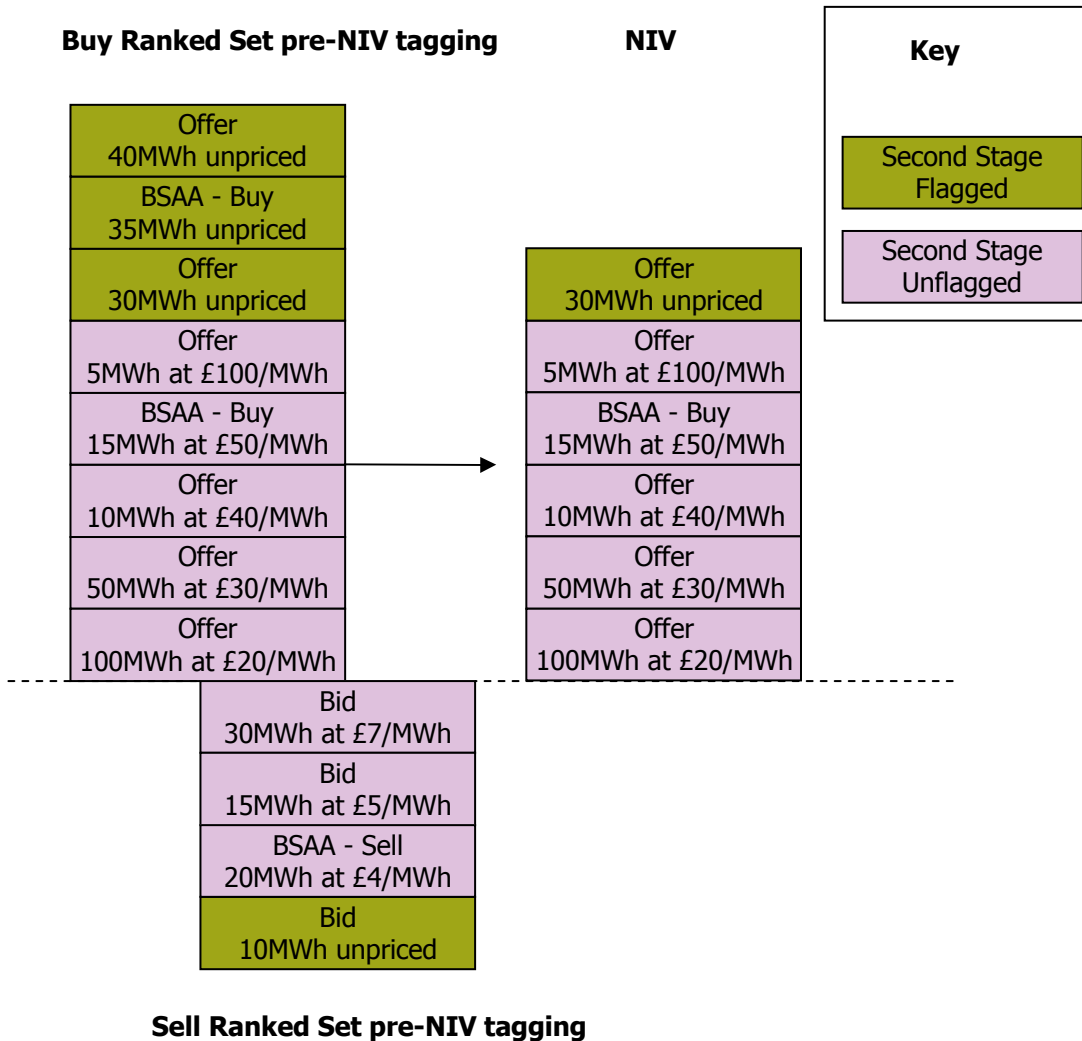
In this example the 15MWh at £50/MWh balancing action becomes Second Stage Unflagged and retains its price.



5. Net Imbalance Volume (NIV) Tagging

In order to establish the NIV the volume of the smaller Sell stack is removed from the top of larger Buy stack. The Sell stack has a volume of 75MWh. The corresponding volume at the top of the Buy stack removes the top two Offers (40MWh and 35MWh).

This gives the following diagram:



6. Replacement Price

BSC Systems assign a Replacement Price to any unpriced balancing actions. In the example there is an unpriced 30MWh balancing action which is assigned a Replacement Price.

The Replacement Price is calculated from a volume weighted average of the most expensive 100MWh of priced balancing actions. For this example the most expensive 100MWh of priced balancing actions are:

Offer 5MWh at £100/MWh	BSAA - Buy 15MWh at £50/MWh	Offer 10MWh at £40/MWh
Offer 50MWh at £30/MWh	Offer 100MWh at £20/MWh	

In the case of the £20/MWh Offer we do not use the full 100MWh volume as we only need 20MWh to complete the most expensive 100MWh of priced volume. This can be seen in the calculation below:

$$\text{Replacement Price} = ((5\text{MWh} \times \text{£}100/\text{MWh}) + (15\text{MWh} \times \text{£}50/\text{MWh}) + (10\text{MWh} \times \text{£}40/\text{MWh}) + (50\text{MWh} \times \text{£}30/\text{MWh}) + (20\text{MWh} \times \text{£}20/\text{MWh})) / 100\text{MWh}$$

Replacement Price = £35.50/MWh

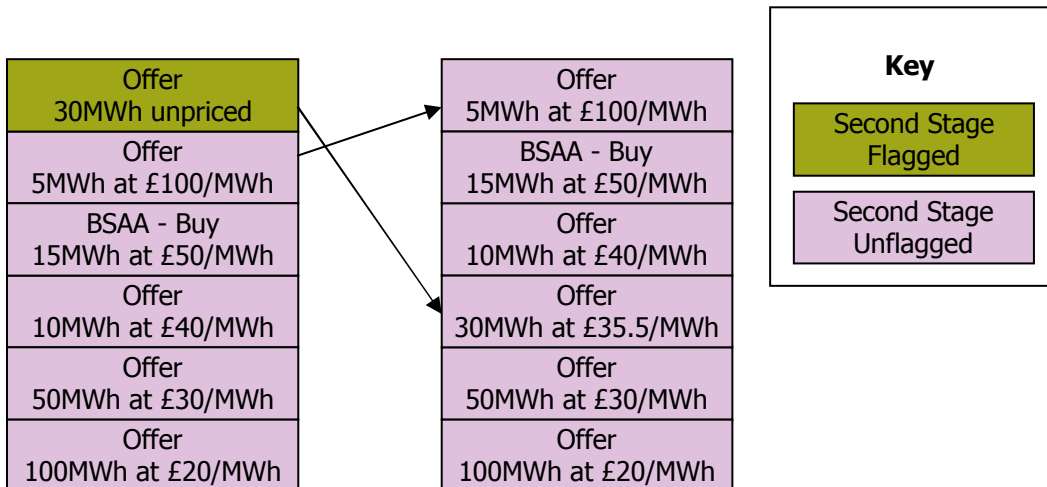
Once the unpriced balancing action is repriced it is considered as a Second Stage Unflagged balancing action.

As the newly priced balancing action now has a price lower than some of the other Second Stage Unflagged balancing actions the NIV has to be re-ranked so that it is in price order.

Once the Replacement Price process has been completed all balancing actions are Second Stage Unflagged and priced.

NIV pre-Replacement Price

NIV post-Replacement Price



7. Price Average Reference Volume (PAR) Tagging

The final tagging rule is PAR Tagging. With PAR Tagging a volume weighted average of the 500MWh of most expensive actions is used to calculate the final main Energy Imbalance Price. In the example the volume of the NIV is 210MWh, so PAR Tagging will use the full NIV as the volume is smaller than 500MWh.

Price Average Reference volume

Offer 5MWh at £100/MWh
BSAA - Buy 15MWh at £50/MWh
Offer 10MWh at £40/MWh
Offer 30MWh at £35.5/MWh
Offer 50MWh at £30/MWh
Offer 100MWh at £20/MWh

Key
Second Stage Unflagged

8. Buy Price Price Adjuster (BPA) / Sell Price Price Adjuster (SPA)

The NIV is positive so we use the BPA (as opposed to the SPA). For this Settlement Period the BPA which the SO sent to us is **£25/MWh**. See Appendix 1 for more information about how the SO calculates the BPA and SPA.

9. Transmission Loss Multiplier and final main Energy Imbalance Price calculation

For this Settlement Period the Transmission Loss Multiplier is assumed to be:

- For Delivering BMUs: **0.99051**
- For Offtaking BMUs: **1.011849**

For this Settlement Period all Offers are from Delivering BMUs. TLMs are not applied to Balancing Services Adjustment Actions as the adjustment has already been made by the SO. In the example the 15MWh at £50/MWh balancing action is not TLM adjusted.

Volume weighted average of PAR = $(5\text{MWh} \times £100/\text{MWh} \times 0.99051) + (15\text{MWh} \times £50/\text{MWh}) + (10\text{MWh} \times £40/\text{MWh} \times 0.99051) + (50\text{MWh} \times £30/\text{MWh} \times 0.99051) + (30\text{MWh} \times £35.50/\text{MWh} \times 0.99051) + (100\text{MWh} \times £20/\text{MWh} \times 0.99051) / ((195\text{MWh} \times 0.99051) + 15\text{MWh})$

Volume weighted average of PAR = £29.60/MWh

System Buy Price = £29.60/MWh + £25/MWh

System Buy Price = £54.60/MWh

5 How does the reverse pricing methodology work?

Introduction

The reverse Energy Imbalance Price is used to settle Parties' imbalances when they are in imbalance in the opposite direction to the Transmission System. This price is meant to be similar to what a Party could have attained if they had traded in the market prior to Gate Closure. The reason for this is the Party's imbalance is helping to resolve the imbalance on the whole system. Thus the Party should not benefit, or be penalised from this imbalance. The method for calculating the reverse Energy Imbalance Price is set out in BSC Section T4.3A based upon **Market Index Data (MID)** received from each **Market Index Data Provider (MIDP)**. The formula for Market Index Data is set out in the **Market Index Definition Statement (MIDS)**.

The Market Index Definition Statement

The reverse Energy Imbalance Price, also called the **Market Price**, is based on trading in the 'short term' market ahead of Gate Closure. The current version of the MIDS is always available on the ELEXON website. The MIDS can only be changed with the approval of the Authority.

The Market Price is derived from trades made on power exchanges. Any power exchange offering energy trades for sale or delivery in the GB market can potentially be appointed as a MIDP. Although, in order to accurately reflect a market price in the 'short term' market, power exchanges with a significant market share of spot market trades are more likely to be appointed as an MIDP.

Each MIDP is required to derive a **Market Index Price (MIP)** and a **Market Index Volume (MIV)** which in combination are referred to as MID for each Settlement Period. The data is calculated by each MIDP in accordance with the MIDS. The MIDP is required to send MID on a Settlement Period basis to the BSC Systems.

The MIDS contains a description of the 'qualifying products', which are types of contract traded on the power exchanges from which the MIP and MIV are derived. The MIDS also sets out the time and qualifying product weightings that should be applied when calculating MID.

In order to reduce the likelihood that the Market Price is set by a single trade there is an **Individual Liquidity Threshold (ILT)**. The ILT is the minimum volume of qualifying products that must be equalled or exceeded for a MIDP's data to contribute to setting the Market Price in that Settlement Period. This is set high enough to reduce the likelihood that the MIP is set on a single trade, but low enough that it minimises the number of Settlement Periods where the MIP cannot be calculated, and hence defaults to the main Energy Imbalance Price.

MIDS – Structure and methodology

The MIDS splits the period deemed to constitute "short term" into defined time bands.

Products traded in the time bands near to real time are weighted more to ensure that they have a more proportionate effect on the Market Index Price. The MIDP is required to provide functionality for weighting qualifying products/timeband combinations by values from 0 to 1.

With Authority approval, the BSC Panel may from time to time adjust the MIDS parameters (qualifying products, weightings and ILT) which define the subset of power exchange trades and data used for calculating the Market Price.

6 Imbalance Charges

How do the BSC Systems calculate Parties' Imbalance Volumes?

A Party's imbalance position is simply its metered volumes compared to its contracted volumes. The contracted volumes are adjusted for any accepted Bids and Offers or delivery of Balancing Services.

$$\text{Energy Imbalance Volume} = \text{Energy} - (\text{Balancing Services} + \text{Contracts})$$

This results in a positive or negative volume of imbalance.

A negative imbalance volume means that a Party has under-contracted and are therefore short of energy. A positive imbalance volume means that a Party has over-contracted and are therefore long on energy. The BSC Systems calculate the imbalance volumes for all Parties for every Settlement Period.

How do the BSC Systems calculate Parties' Imbalance Cashflows?

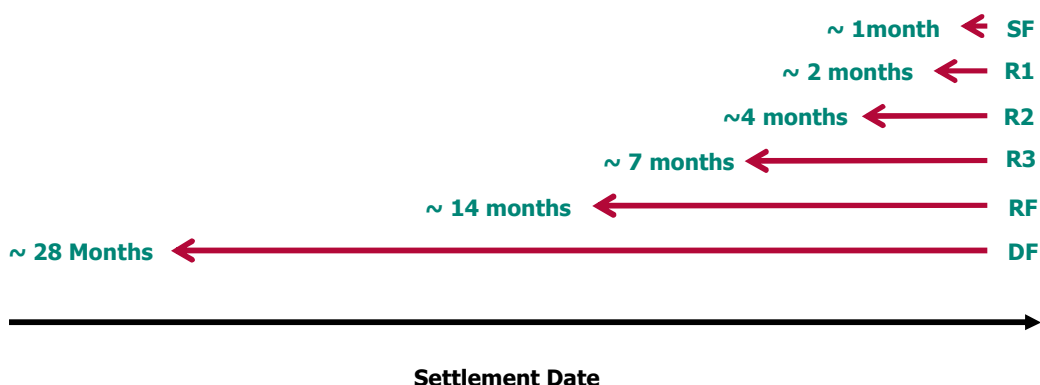
Once the BSC Systems know Parties' imbalance positions, it can calculate Parties' cashflows (imbalance charges) for each Settlement Period:

$$\text{Energy Imbalance Cashflow} = \text{Energy Imbalance Volume} \times \text{Imbalance Price}$$

The Imbalance Price will be SBP if the Party has a negative imbalance volume, or SSP if the Party has a positive imbalance volume.

When are Parties billed for imbalance charges?

In order to accurately calculate imbalance charges a complete set of metered data is required. This presents a problem. The data is readily available for sites metered Half Hourly. However, for Non Half Hourly sites the metered data will not be available until the meter is manually read. Because of this the BSC Systems carry out a number of Settlement Runs at pre-defined points during the year (the Settlement Calendar).



In addition to the Settlement Runs shown above, an Interim Information (II) Settlement Run is calculated 5 Working Days after the Settlement Date. The II Run is for information only and no Parties are charged/credited after this run.

After the SF Run (and after all subsequent reconciliation runs – R1, R2, R3 and RF), invoices are generated and sent out to Parties by the Funds Administration Agent (FAA). The payment date for the SF run is always 29 calendar days after the Settlement Date. If any volumes at RF are still under dispute then another run (DF) can be carried out when the corrected data has been received. Any Party can raise a Dispute but it is the decision of the Trading Disputes Committee as to whether a DF Run is carried out.

7 Imbalance Pricing data

Publishing data on the BMRS

Imbalance Pricing data is published on the Balancing Mechanism Reporting Service (BMRS) by the Balancing Mechanism Reporting Agent (BMRA). The BMRS is available in two services:

- The High Grade service is a dedicated private communications network used by the BMRS to actively publish data to subscribing participants as soon as it is available; and
- The Low Grade service is the public website, <http://www.bmreports.com>, on which we publish the data.

Data is available to the High and Low Grade services at the same time, but if a Party is accessing the Low Grade service they will need to use the Refresh facility to retrieve the latest data as it becomes available.

The following Imbalance Pricing data is available on the BMRS for each Settlement Period:

- FPNs
- Bid-Offer Pairs
- BOAs (including SO-Flagging details)
- SBP/SSP
- BSAD
- Market Price
- NIV

Settlement Reports

The Settlement Run information is reported via the Settlement Administration Agent (SAA) I014 'Settlement Reports' (**SAA-I014**). The SAA produces three variants of the SAA-I014 for each Settlement Run for each Settlement Period:

- SAA-I014 sub-flow 1 – Parties' versions;
- SAA-I014 sub-flow 2 – SO version; and
- SAA-I014 sub-flow 3 – BSCCo version.

The SAA-I014 is electronically sent to the above recipients on a daily basis (so each daily SAA-I014 contains all the Settlement Run data for that day). The SAA-I014 sub-flow 2 is also available to any Party that wants to download it.

The SAA-I014 contains all the data a Party needs to understand its imbalance position for each Settlement Period. The SAA-I014 sub-flow 1 is tailored for each Party (so only contains data for that Party). The SAA-I014 sub-flow 2 contains data for all Parties. This includes:

- Party imbalance charges
- Bid-Offer Pairs
- BOAs (including SO-Flagging details)
- BSAD
- Market Price
- NIV

Glossary	
Applicable Balancing Services Volume Data (ABSVD)	Volume adjustments to BM Units that are instructed by the SO to provide automatic frequency response. These volumes are identified ex-post by the System Operator using a set of matrices of frequency response for each individual BM unit that provides the service.
Arbitrage Tagging	Arbitrage occurs when the price of a Buy balancing action is lower than the price of a Sell balancing action. In cases of arbitrage equivalent Sell balancing actions and Buy balancing actions are excluded from the main Energy Imbalance Price calculation.
Authority	The Gas and Electricity Markets Authority is the regulator of the gas and electricity industries in Great Britain. The Authority's powers and duties are largely provided for in statute, principally the Gas Act 1986, the Electricity Act 1989, the Utilities Act 2000, the Competition Act 1998, the Enterprise Act 2002, the Energy Act 2004 as well as arising from directly effective European Community legislation.
Balancing action	Either a Bid-Offer Acceptance or a Balancing Services Adjustment Action which is taken by the SO to balance the Transmission System.
Balancing and Settlement Code (BSC)	The BSC contains the rules and governance arrangements for electricity balancing and settlement in Great Britain and all licensed electricity companies must sign it (others may choose to do so).
Balancing Mechanism Units (BMUs)	BMUs represent the generation or consumption at a particular location. Each Party is assigned BMUs for their power stations or areas of demand. The BSC Systems sum up a Party's BMU volumes and contracts when they carry out the Settlement calculations.
Balancing Services Adjustment Action	Where the SO takes a balancing action outside the Balancing Mechanism, it inputs it into the BSC Systems as a Balancing Services Adjustment Action.
Balancing Services Adjustment Data (BSAD)	Balancing Services outside of the Balancing Mechanism are submitted using Balancing Services Adjustment Data (BSAD).
Bid	A Bid is a proposal on the Balancing Mechanism to reduce generation or increase demand.
Bid-Offer Acceptance (BOA)	An Offer or Bid which has been accepted by the SO to balance the Transmission System.
BSC Panel	The BSC Panel are the industry committee that are charged with ensuring the provisions of the BSC are carried out correctly and in such a manner as will promote effective competition in the generation, supply, sale and purchase of electricity.
BSC Parties (Parties)	An organisation that has signed up to the Balancing a Settlement Code.

Glossary	
Buy Price Price Adjuster (BPA)	The BPA is a reflection of the long term contracts that the System Operator enters into to provide Short Term Operating Reserve (STOR) and BM Start-up. The STOR component is calculated and allocated using historical data. It is added when the NIV is positive.
CADL Flagged	A BOA which is less than 15 minutes in duration and has been flagged by the BSC Systems.
CADL Flagging	BOAs which are less than 15 minutes in duration are flagged by the BSC Systems.
Classification	The process by which the BSC system distinguish whether a First Stage Flagged Action is an energy balancing or a system balancing action.
Continuous Acceptance Duration Limit (CADL)	The time limit that distinguishes between short duration balancing actions. The current CADL is set at 15 minutes and may be altered by the BSC Panel from time to time following consultation with the Transmission Company and Parties, and approval by the Authority.
De Minimis Acceptance Threshold (DMAT)	The DMAT is 1MWh. The Panel can alter the DMAT following consultation with the Transmission Company and Parties, and approval by the Authority.
De Minimis Tagging	Balancing actions with a volume less than 1MWh are completely removed from the main Energy Imbalance Price calculation.
Distribution Network	The lower voltage network which supplies electricity from the Transmission System to customers.
Emergency Acceptance	An Emergency Instruction taken for energy balancing reasons.
Emergency Flagged	An Emergency Instruction taken for potentially system balancing reasons.
Energy balancing	Balancing actions taken to balance the short term energy imbalance of the transmission system.
Energy Contract Volume Aggregation Agent (ECVAA)	The BSC System responsible for aggregating ECVNs.
Energy Contract Volume Notification (ECVN)	A notification of a bilateral contract between Parties. ECVNs must be submitted before Gate Closure for each Settlement Period.
Final Physical Notification (FPN)	Once Gate Closure has occurred for a Settlement Period the latest Physical Notifications become Final Physical Notifications.
First Stage Flagged balancing action	A balancing action taken for potentially system balancing reasons (SO-Flagged, Emergency Flagged or CADL Flagged).
First Stage Unflagged balancing action	An energy balancing action. At Classification a First Stage Unflagged balancing action will automatically become a Second Stage Unflagged balancing action. It will also keep its original price.
Gate Closure	One hour before each Settlement Period the physical and contractual positions of Parties are frozen. This is called Gate Closure.
Generators	Organisations that produce electricity.

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Glossary	
Individual Liquidity Threshold (ILT)	The ILT sets a minimum requirement for the volume of trades in a given Settlement Period for each MIDP. The ILT is currently set to 25MWh and can be altered via a change to the Market Index Definition Statement by the Panel following industry consultation and Authority approval.
Main Energy Imbalance Price	The main Energy Imbalance Price is calculated using the balancing actions that the SO accepted for that Settlement Period. Parties whose imbalance is in the opposite direction to the Transmission System will be charged their imbalance at the main Energy Imbalance Price.
Market Index Data	The combination of Market Index Price and Market Index Volume derived by each MIDP for each Settlement Period.
Market Index Data Provider (MIDP)	A provider of Market Index Data.
Market Index Definition Statement (MIDS)	The MIDS sets out the methodology for calculating the Market Price (reverse Energy Imbalance Price).
Market Index Price (MIP)	The price derived by each MIDP for each Settlement Period based on the short term trades on its power exchanges made in accordance with the MIDS.
Market Index Volume (MIV)	The volume derived by each MIDP for each Settlement Period based on the short term trades on its power exchanges made in accordance with the MIDS.
Market Price	The Market Price is the reverse Energy Imbalance Price. It is calculated from the MID received from each MIDP for each Settlement Period. It is intended to reflect the price a Party would have obtained if it had bought or sold its imbalance on a power exchange.
Net Imbalance Volume (NIV)	The remaining volume following NIV Tagging.
Net Imbalance Volume Tagging	The volume of the Buy balancing actions are netted off against the volume of Sell balancing actions so that only the Net Imbalance Volume is used to in the final calculation.
Offer	An Offer is a proposal on the Balancing Mechanism to increase generation or reduce demand.
Physical Notifications	Physical Notifications contain details of a Generator's expected level of generation or a Supplier's expected level of demand. Generators and Suppliers must submit Physical Notifications for each BMU to the SO for each Settlement Period.
Price Average Reference volume (PAR)	The Price Average Reference volume is most expensively priced 500MWh of balancing actions in the Net imbalance Volume.
Ranked Set	Once all the BSC Systems have received all the balancing actions from the SO they are ranked in price order in two separate Ranked Sets. One for all the Sell balancing actions and one for Buy balancing actions.
Reverse Energy	The reverse Energy Imbalance Price is calculated from the MID

Glossary

Imbalance Price	received from each MIDP for each Settlement Period. It is also called the Market Price and is intended to reflect the price a Party would have obtained if it had bought or sold its imbalance on a power exchange.
Replacement Price	The price assigned to unpriced balancing actions which enter the Net Imbalance Volume. The Replacement Price is calculated from a volume weighted average of the most expensively priced 100MWh of priced actions. If less than 100MWh of priced volume is in the Net Imbalance Volume then we use all the priced volume to calculate the Replacement Price.
Replacement Price Average Reference volume (RPAR)	The Replacement Price is calculated from a volume weighted average of the most expensively priced 100MWh of priced actions. This is known as the Replacement Price Average Reference Volume (RPAR).
Second Stage Flagged balancing action	A system balancing action which becomes unpriced.
Second Stage Unflagged balancing action	An energy balancing action which keeps its original price.
Sell Price Price Adjuster (SPA)	The SPA is a reflection of the long term contracts that the System Operator enters into to provide Short Term Operating Reserve (STOR) and BM Start-up. The STOR component is calculated and allocated using historical data. It is added when the NIV is negative.
Settlement Period	The basic trading period for electricity is half an hour and is called a Settlement Period. Each day is split into 48 Settlement Period units (unless it is a day where the clocks change, which has either 46 or 50 half hours).
SO-Flagged	A balancing action which has been flagged by the SO.
SO-Flagging	The process by which the SO identifies or 'flags' balancing actions which have been impacted by transmission constraints.
Suppliers	Organisations that supply electricity to their customers.
System balancing	Balancing actions taken for non-energy, system management reasons.
System Buy Price (SBP)	If a Party has under-generated or over-demanded they will have to buy that shortfall of energy from the Transmission System. To do this they pay System Buy Price (SBP).
System Management Action Flagging Methodology Statement	The statement required by the Transmission License which details the SO's methodology for SO-Flagging.
System Operator (SO)	National Grid are the SO and are required to balance the Transmission System. Also called the National Electricity Transmission System Operator (NETSO).
System Sell Price	If a Party has over-generated or under-demanded they will have

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(SSP)	to sell that extra energy to the Transmission System. To do this they are paid System Sell Price (SSP).
Transmission constraint	Any limit on the ability of the transmission system, or any part of it, to transmit power to a location which demands it.
Transmission Loss Multiplier (TLM)	The value calculated for each Settlement Period used to scale each BM Unit's metered volume for Settlement. Transmission losses are allocated so that: <ul style="list-style-type: none"> • 45% of losses are allocated across net delivering BM Units • 55% of losses are allocated across net offtaking BM Units
Transmission System	The high voltage network that transports electricity throughout Great Britain. The Transmission System delivers electricity to the lower voltage Distribution Networks which in turn supply electricity to customers.
Transmission System length / net imbalance	The net imbalance of the Transmission System. When there is not enough generation in the Transmission System it is 'short'. When there is too much generation the Transmission system is 'long'.

9 Appendix 1 – BPA/SPA methodology

The BPA is made up of **Short Term Operating Reserve (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 impacts the main Energy Imbalance Price calculation more frequently than the SPA. This is primarily because option fees for negative reserve and forward contracts occur relatively infrequently compared with STOR option fees and BM start availability fees.

Short Term Operating Reserve

The STOR option fee component of the BPA is procured approximately 6 to 12 months ahead of when it is utilised and the costs are reflected approximately into imbalance prices through the BPA using a method based on historic utilisation.

A daily half-hourly profile is built based on historic STOR utilisation. This profile takes into account historic seasonal and business day/non-business day variations. It is used to determine a weighting factor for the allocation of actual option fees to Energy Imbalance Prices in particular periods via BPA.

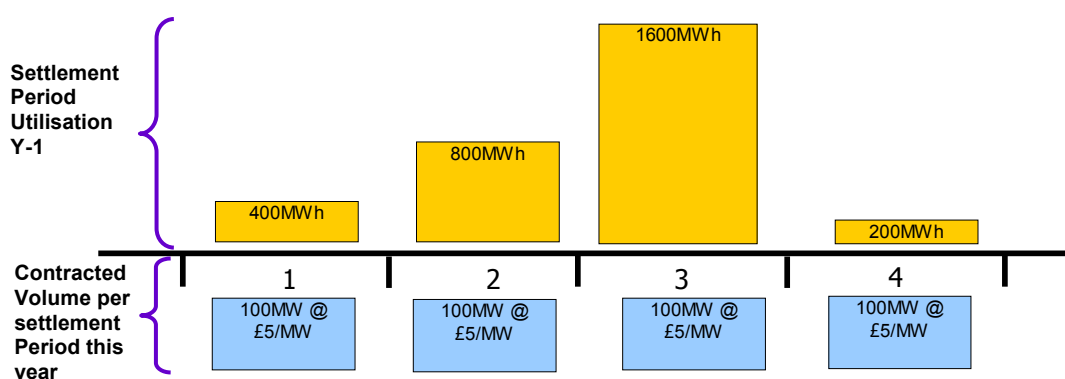
BPA STOR component is calculated as:

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

That is:

$$\text{BPA STOR} = \sum^{1 \text{ to } n} [\text{STOR}_{\text{Daily Available (MWh)}} * \text{STOR}_{\text{price (£/MWh)}}] / \sum^{1 \text{ to } n} \text{STOR}_{\text{Period Available (MWh)}}$$

This can be seen in the example below as the volumes in yellow above the timeline. For simplicity, this example assumes that there are only 4 Settlement Periods in the day, and only one day in the year.



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 = 800/3000 = 0.27

Period 3 Weighting = 1600/3000 = 0.53

Period 4 Weighting = $200/3000 = 0.07$

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

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

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

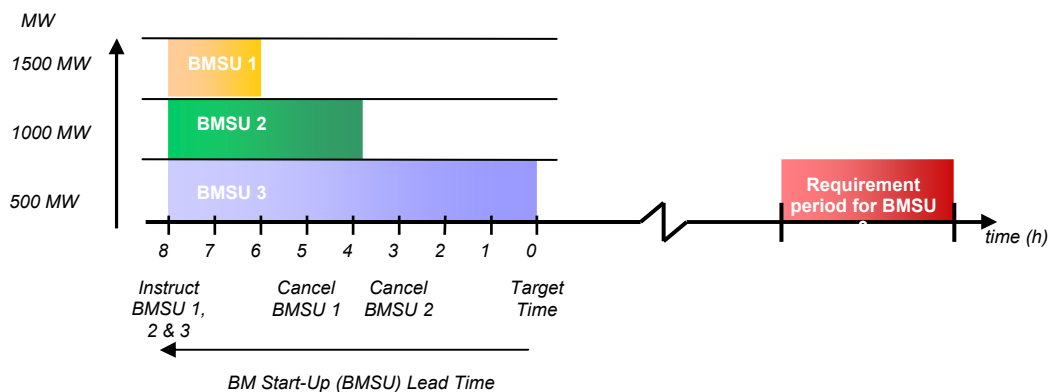
BM Start Up

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) 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.

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 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.

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:

$$\text{BPA BMSU} = (2+2+2+2+2+2+2+2) = \text{£}16/\text{MWh}. \quad (3)$$

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:

$$\text{BPA} = \text{BPASTOR} + \text{BPABMSU}$$

If we assume that the requirement window of BPABMSU fell in Settlement Period 1 of the BPASTOR example then:

$$\text{BPA} = \text{£}2.60/\text{MWh} + \text{£}16/\text{MWh} = \text{£}18.60/\text{MWh} \quad (2) + (3)$$

Furthermore, if we assume that this BPA was for the Energy Imbalance Price calculated in the Section 3 example we get a SBP of:

$$\text{SBP} = \text{£}29.60 + \text{£}18.60 = \text{£}48.20/\text{MWh} \quad (1) + (2) + (3)$$