ISG184/07 - DATA REVIEW FOR THE MARKET INDEX DEFINITION STATEMENT 2016

MEETING NAME	MIDS Consultation
Target Audience	BSC Trading Parties
Purpose of paper	For consultation
Deadline for responses	14.00 - 7 September 2016
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1. Executive Summary

1.1 Each year, ELEXON reviews the Market Index Definition Statement (MIDS) on behalf of the BSC Panel in accordance with BSC Section T1.5.4. Amongst other things, ELEXON completes the review in order to check that parameters used in the calculations defined in the MIDS (i.e. the Individual Liquidity Threshold (ILT), timeband weightings and product weightings) remain fit for purpose. The current review period covers 1 August 2015 to 31 July 2016.

1.2 The 2016 MIDS review indicates that the current Individual Liquidity Threshold (ILT), timeband weightings and product weightings are suitable. Therefore our preliminary recommendations are not to change the ILT, timeband and product weightings.

1.3 We use Market Index Base Data (MIBD) which details individual trades on the two power exchanges[1] to review the performance of the parameters in accordance with the principles defined in the MIDS. Our detailed analysis is in Appendix 1 to this paper. In summary, our key findings are:

- **Volume**: The daily average Market Index Volume (the traded volume across weighted timebands and products[2]) was 666MWh during the review period which has decreased by 27MWh from the previous year (693MWh). See Appendix 1, Chapter 2 for more information.
- **Individual Liquidity Threshold (ILT)**: Over this review period, the traded volume was below the ILT in three out of 17,568 Settlement Periods. This small number of defaulting periods demonstrates that the current 25MWh threshold remains suitable. See Appendix 1, Chapter 3 for more information.
- **Weighting values**: The weightings are applied to determine which products and timebands are (and the extent to which they are) included in the Market Price calculation. Currently, the MIDS defines the use of either '1' or '0' weights, where '1' results in the data being fully included and '0' excluded.
    - **Timebands**: The current '1' weighting of timebands 1 to 6 includes all trades within 12 hours of Gate Closure. The analysis indicates that the current timeband weighting is suitable.
    - **Products**: The weighted products are those of half hour, 1 hour, 2 hour and 4 hour duration. The analysis indicates that the current timeband weighting remain suitable in accordance with the MIDS principles.

[1] APX and N2EX
[2] A qualifying product is a product which is traded on the spot market in the short term and which is eligible for inclusion in the Market Index Data calculation

1.4 The detail of our review is set out below in Appendix 1.

2. Changes due to P305

2.1 Following the implementation of Approved BSC Modification P305 'Electricity Balancing Significant Code Review Developments' in November 2015, the calculation of Imbalance Prices uses the Market Index Price (MIP) significantly (98%) less frequently. The MIP was used to set the 'reverse' Energy Imbalance Price for every Settlement Period prior to P305. Now it is only used in two defaulting scenarios. When the Net Imbalance Volume (NIV) is zero, then the imbalance price will default to the MIP, or if all of the actions in the price stack are unpriced, then the replacement price will be set by the MIP and the imbalance price will consequently be set by the MIP. We note that there is currently an Issue Group (Issue 64) set up to review the use of the MIP in defaulting situations. This review should however, focus on the MIDS principles and ISG should consider the Issue Group 64 conclusions in a further review separately. Note that, because of Issue Group members limited availabilities, the first meeting has been postponed until such time as sufficient members are available.

3. ISG Views

3.1 The ISG considered the analysis presented at its August 2016 meeting. The ISG asked ELEXON to add an additional question to the consultation proforma asking Parties for their opinion on the matter considered by Issue 64.

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Appendix 1 - Market Index Base Data Analysis

Chapter 1 - Background Information

- Definitions of the terminologies used in the review

Chapter 2 - Analysis of the Market Index Volume (MIV)

- An overview of average MIV by Settlement Date
- An overview of average MIV by timebands/products across Settlement Period

Chapter 3 - Analysis of the Individual Liquidity Threshold (ILT)

- Principles to be applied to ILT
- Number of defaults in the review period and previous years
- Analysis of suitability for the current ILT

Chapter 4 - Analysis of the timeband and product Weightings

- Principles to be applied to timeband and product weightings
- Analysis of the current product and timeband weightings

Chapter 5 - Analysis All Products and timebands

- Analysis of all timebands and products for potential changes on the current weightings
- Analysis of the Auction Product

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1. Background Information

1.1 Annually, ELEXON, on behalf of the Panel, reviews the MIDS. The review period covers 1 August 2015 to 31 July 2016. The review consists on checking that parameters used in the Market Index Price (MIP) calculation defined in the MIDS (i.e. the Individual Liquidity Threshold (ILT), timeband weightings and product weightings) remain fit for purpose. The purpose of the MIDS being to "reflect the price of wholesale electricity in Great Britain for delivery in respect of that Settlement Period in the short term market"[3].

1.2 Prior to the implementation of Approved BSC Modification P305 'Electricity Balancing Significant Code Review Developments' on 5 November 2015, we calculated a 'reverse' Energy Imbalance Price for every Settlement Period and used this for Energy Imbalance Settlement. The aim was for this 'reverse' price to reflect the price of wholesale electricity in the short term market for Great Britain. The MIP was used to set this 'reverse' price.

1.3 Following the implementation of Modification P305, the MIP is used to set the imbalance price only in two scenarios. When the Net Imbalance Volume (NIV) is zero, then the imbalance price will default to the MIP, or if all of the actions in the price stack are unpriced, then the replacement price will be set by the MIP and the imbalance price will consequently be set by the MIP. **Table 1** below shows the count of instances when the MIP was used in setting the imbalance price since November 2015. In this reporting period, the NIV has not equalled zero. Since 2001, the NIV has only equalled zero three times.

Table 1: Count of instances when the MIP was used to set the price due to all of the actions in the stack remaining unpriced

Month	Number of times MIP was used to set the price due to the actions in the stack remaining unpriced
Nov-15	33
Dec-15	61
Jan-16	57
Feb-16	33
Mar-16	6
Apr-16	7

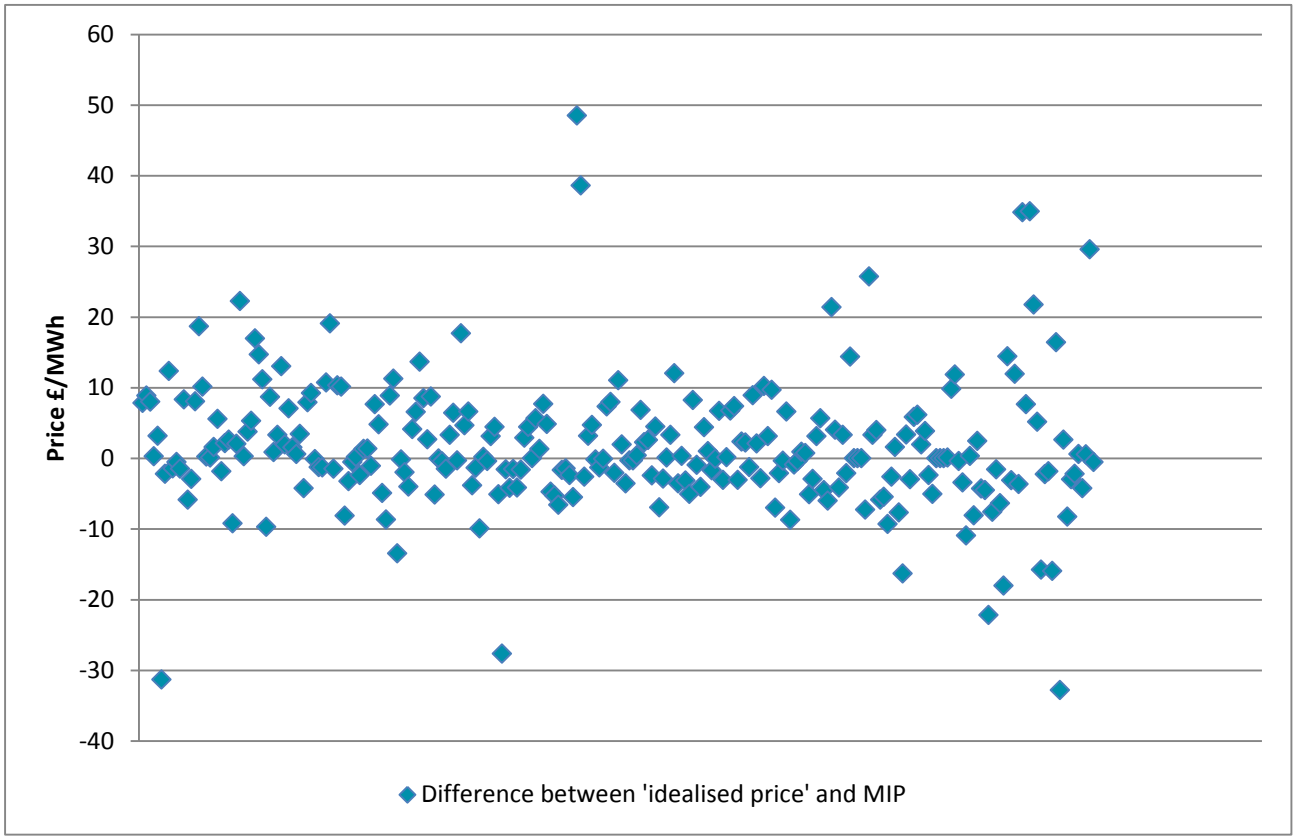
[3] Market Index Definition Statement

Month	Number of times MIP was used to set the price due to the actions in the stack remaining unpriced
May-16	12
Jun-16	28
Jul-16	9

1.4 Parties trade wholesale energy on power exchanges where they can buy and sell power exchange products. The products vary by duration and start time. Modification Proposal P78 introduced the MIP to reflect the price of wholesale electricity in the short term market for Great Britain. In this context, Section T of the BSC defines Short term as 'no more than three Business Days prior to Gate Closure for the relevant Settlement Period'. This meant that the cost of imbalance, when in the opposite direction to the system (eg helping to resolve system imbalance), would reflect the likely cost had the party traded out their position. Since the implementation of P305, the MIP is used as a default price in certain scenarios. Issue Group 64 has been setup to consider the appropriate defaulting price method, table 1 and graph 1 have been included for information. These specifically look at the time period since 5 November 2015 and when the MIP has been used. This review should however, focus on the MIDS principles and ISG should consider the Issue Group 64 conclusions separately.

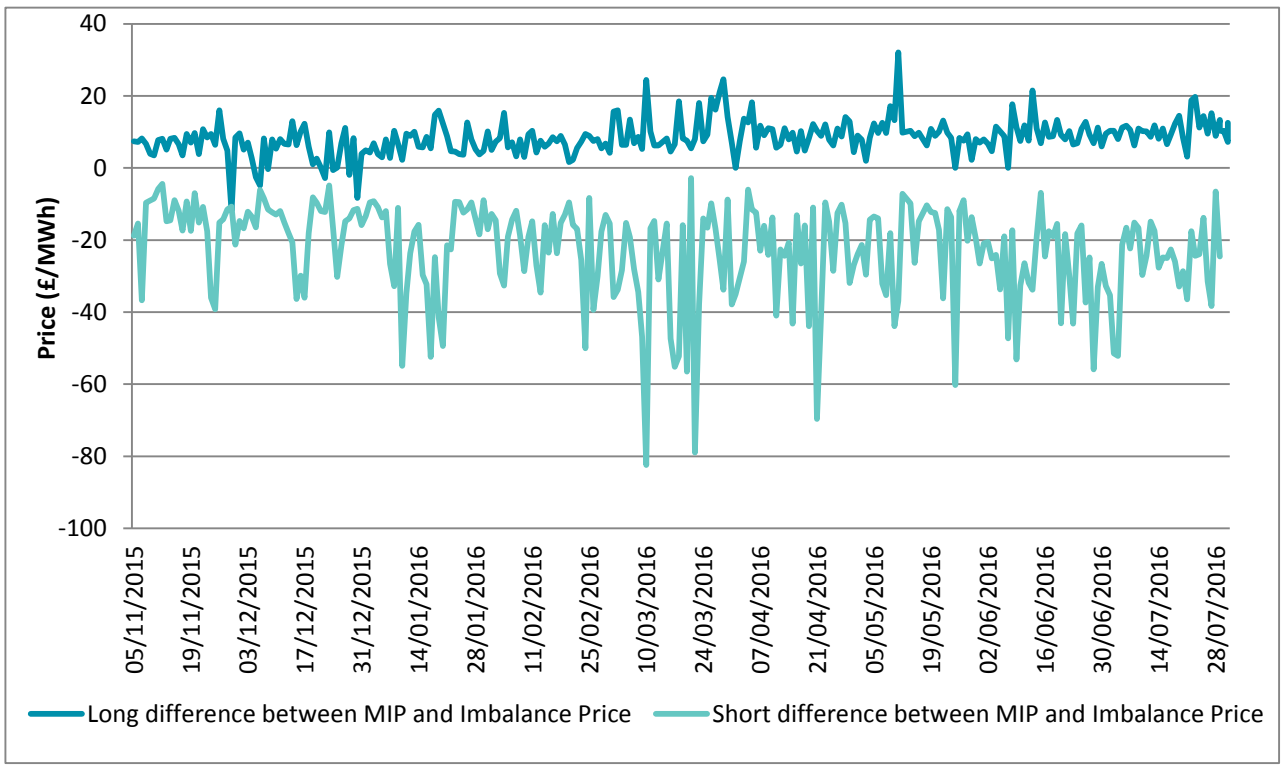
1.5 If the MIP were to be used, in its current form, as a default price, it should therefore track the imbalance price and needs to react in a similar way based on changing market conditions (NIV, De-rated Margin etc). This should prevent large price differentials when the price defaults to the MIP. A crude way to estimate this is to look at the Imbalance Price in the Settlement Period before and after the defaulting scenario. The midpoint between these two can be thought of as an 'idealised price' with which to compare the MIP. Note this method assumes that there is a linear change in price. **Graph 1** below shows the difference between the 'idealised price' described above and the MIP. It appears that, the difference between the 'idealised price' and the 'MIP' is volatile, giving an indication that the current use of the MIP may not be fit for purpose.

Graph 1: Difference between 'Idealised Price' and MIP



1.6 **Graph 2** below shows the difference between the MIP and the imbalance price split by market length. A positive value denotes the MIP as larger than the imbalance price. When the market is long, the MIP tends around £10/MWh greater than the imbalance price. When the market is short the imbalance price is greater than the MIP. It is also worth noting that there is more volatility in the difference when the market is short. This volatility is being driven by the imbalance price (standard deviation of £31.48/MWh), rather than the MIP (standard deviation of £12.59/MWh). Short prices have been more volatile since P305, as can be seen in the P305 Post Implementation Review, which will have contributed to this effect.

Graph 2: Difference between MIP and the Imbalance Price over time



1.7 A power exchange can provide data through its role as a Market Index Data Provider (MIDP). As a MIDP they calculate Market Index Data (MID), which consists of a half hourly prices and volumes. The calculation process is defined in the Market Index Definition Statement (MIDS).

1.8 The Market Index Definition Statement defines:

- The overall price (Market Index Price) and volume (Market Index Volume) calculation process
- A volume threshold (Individual Liquidity Threshold), below which the default rules are applied
- A list of power exchange products that are included in the calculation
- A list of timebands which group trades according to how long before Gate Closure they are made
- Weightings which reflect the importance of the products and timebands

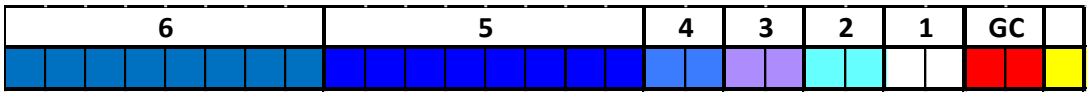
- Principles by which the weightings, products and thresholds are determined

1.9 The Individual Liquidity Threshold (ILT) is a volume threshold that is set to apply default rules when there is insufficient trading on the power exchange to provide a suitable price. The aim is to avoid the price being set on a single trade – i.e. not having the ILT too low – but also to minimise the number of Settlement Periods where the default rule is applied – not having the ILT too high.

1.10 When the volume traded in a half-hour is greater than the ILT, the Market Index Volume (MIV) is calculated as the sum of the traded volume across the selected products and timebands as defined in the MIDS. The Market Index Price (MIP) is the volume weighted average price of the trades. Where the volume does not meet the ILT, the MIP and MIV default to zero.

1.11 Trades are classified by a number of timebands which determine how long before Gate Closure the trade was made. These timebands cover a number of Settlement Periods. Timebands 1-6 are currently used to calculate the MIP. Timeband 6 begins 12 hours ahead of Gate Closure and is four hours in duration. Timeband 1 is the final hour up to Gate Closure. These timebands are shown in **Diagram 1** below.

Diagram 1: Timeband 1 to 6.



1.12 The current MIDS sets the products to be included in each half-hourly price and volume calculation as the half-hour, 1 hour, 2 hour and 4 hour products traded within 12 hours of Gate Closure.

1.13 **Weightings** are applied to reflect the importance of each product and timeband and are currently set to '1' or '0', which either completely include or exclude particular trades. The weightings applied to the different products and timebands used in the calculations are shown in **Table 2**.

Table 2: Live Product and timeband Weightings

		Timeband											
	Product	1	2	3	4	5	6	7	8	9	10	11	12
Half-Hour	H	1	1	1	1	1	1	0	0	0	0	0	0
1 Hour Block	1	1	1	1	1	1	1	0	0	0	0	0	0
2 Hour Block	2	1	1	1	1	1	1	0	0	0	0	0	0
4 Hour Block	4	1	1	1	1	1	1	0	0	0	0	0	0
Overnight	O	0	0	0	0	0	0	0	0	0	0	0	0
Peak	P	0	0	0	0	0	0	0	0	0	0	0	0
Extended Peak	E	0	0	0	0	0	0	0	0	0	0	0	0
Day Ahead Auction	A	0	0	0	0	0	0	0	0	0	0	0	0

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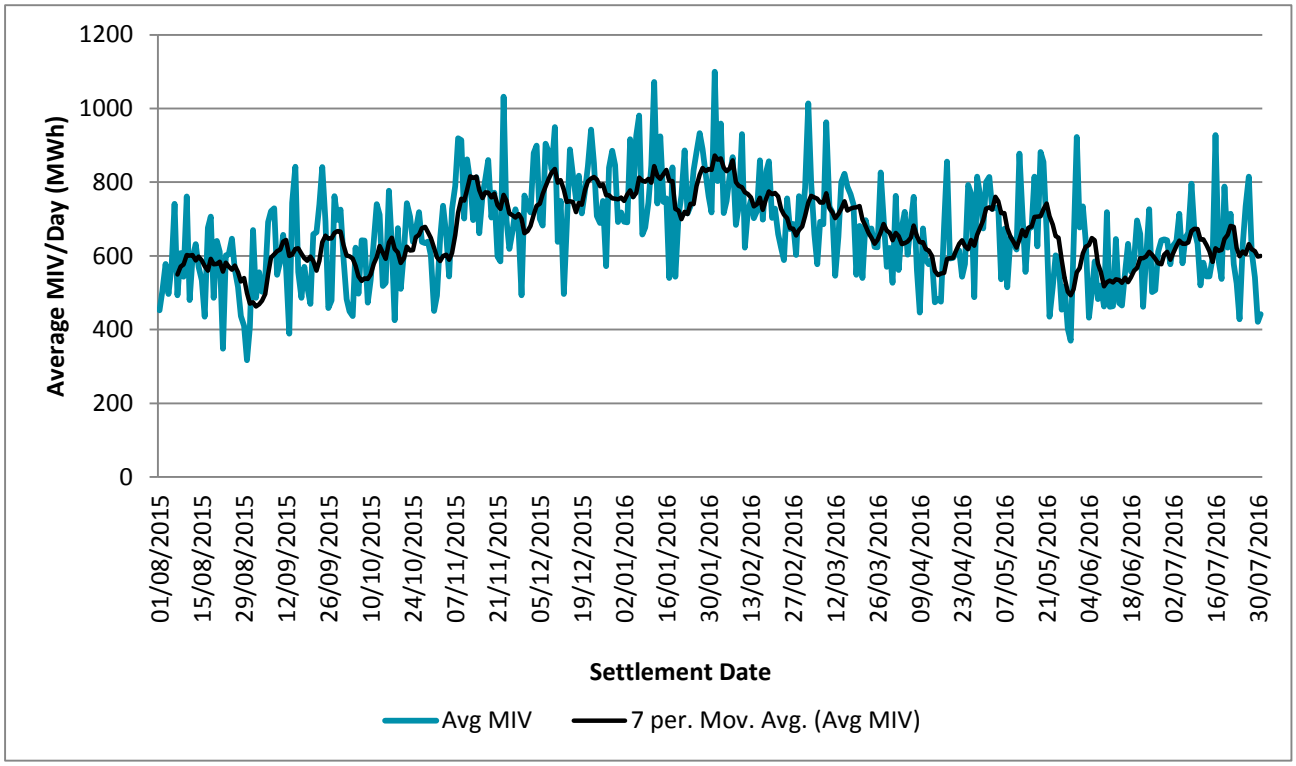
2. Analysis of the Market Index Volume (MIV)

2.1 Market Index Volume (MIV) is the traded volume across the '1' weighted products and within '1' weighted timebands. The weightings are displayed in **Table 2**.

2.2 The daily average MIV was 666MWh over the review period, which has decreased by 27MWh from the previous annual review which had an average of 693MWh.

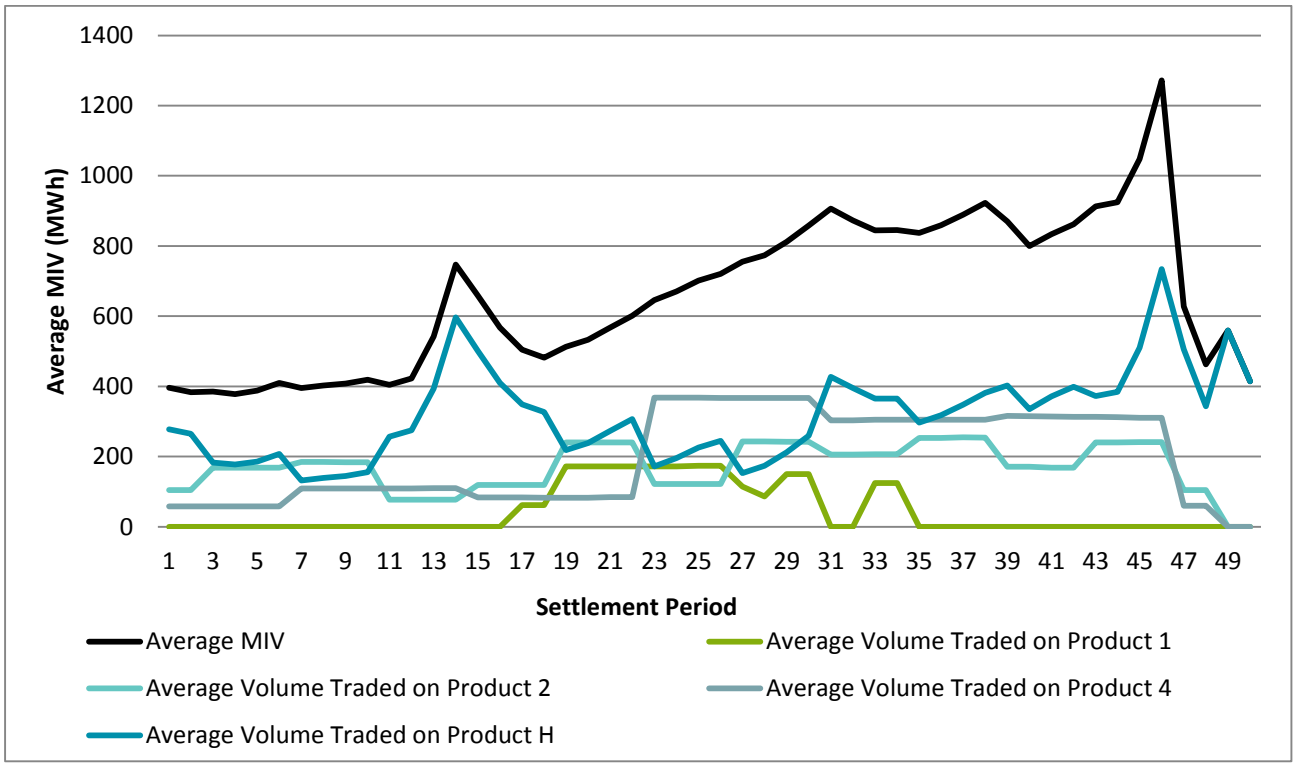
2.3 **Graph 3** displays the daily average MIV throughout the review period. We witness a comparable overall shape to the previous review, with a slight increase in liquidity over the winter period. The MIV reached a peak on 1 February at 1,100 MWh, compared with 1,258MWh in January last year.

Graph 3: Daily Average Market Index Volume by Settlement Date



2.4 **Graph 4** shows the average MIV and average volume traded on each product weighted '1' by Settlement Period. Similar to the previous review, the Settlement Period average MIV increased through the day, until Settlement Period 46. With products H peaking in Settlement Periods 14 and 46. Graph 4 shows that the One Hour Product had the least traded volume in comparison to the other products.

Graph 4: Average Market Index Volume by Settlement Period



3. Analysis of the Individual Liquidity Threshold (ILT)

3.1 We carried out the analysis using the live products and timeband weightings specified in **Table 1**.

3.2 The ILT is currently set to 25MWh and triggers a default rule when there is a low liquidity of trades in a Settlement Period. When the MIV is not greater than the threshold, both the MIP and MIV are defaulted to zero.

3.3 The ILT must be set in accordance with the MIDS principles. We have analysed historic data to consider each of the principles and the results confirm that 25MWh is a suitable value. The principles that are applied in setting the ILT are:

a) Individual Liquidity Thresholds should be set to the same value(s) for every Market Index Data Provider (MIDP);

b) Individual Liquidity Thresholds may be set to zero;

c) Individual Liquidity Thresholds may be set to different values for different Settlement Periods in the day and may vary by Season or Day Type;

d) Individual Liquidity Thresholds should be set based on the analysis of historic data;

e) Individual Liquidity Thresholds should be set at a level that minimises the likelihood that the Market Index Price will be set by a single trade; and

f) Individual Liquidity Thresholds should be set to ensure that the Market Index Price is defaulted in the minimum number of Settlement Periods, subject to the previous principle.

3.4 Currently both MIDPs have the value of 25MWh set, so principle **a)** is met.

3.5 The analysis shows that the ILT could be set to zero as per principle **b)** which would also meet principle **f)**. However, since only three Settlement Periods have defaulted throughout the year, reducing the ILT to zero would not improve any of the 17,565 Settlement Periods of that review period and this would also increase the likelihood that the MIP to be set on a single trade **e)**. In the current review period, one Settlement Period had set the MIP based on a single trade. This was Settlement Period 41 on 17 September 2015. The following Settlement Period, the MIP was set by only one trade as well, but this was lower than the liquidity threshold. However, increasing the ILT increases the chances of the MIP defaulting **f)**. Principle **c)** allows the ILT to change across different periods, however, as mentioned, could result in principle **e)** being compromised.

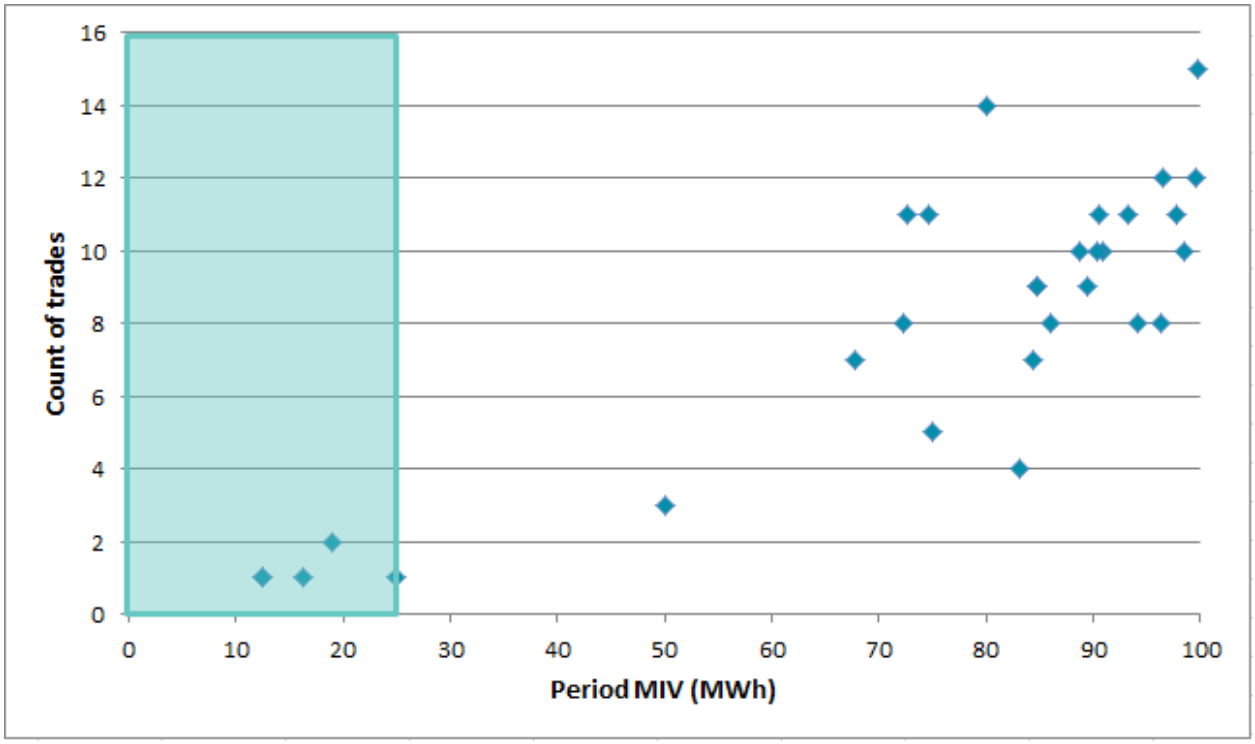
3.6 **Table 3** shows the number of defaults in the recent MIDS Reviews. Over the 2016 review period, three Settlement Periods were defaulted to zero.

Table 3: Defaulted Settlement Periods

Review Periods	No. of Defaulted Settlement Periods
2010	6
2011	11
2012	6
2013	2
2014	0
2015	3
2016	3

3.7 **Graph 5** shows the count of trades for Settlement Periods where the volume of trades was below 100MWh. There were 30 trades below 100 MWh that set the price this year, which is an increase of 13 compared to last year. Three Settlement Periods had the price set by only one trade and two of them defaulted to zero. The third met the liquidity threshold and therefore was not defaulted. Although the principles aim to avoid the price being set on a single trade, and an incident has occurred, we believe there is no strong case to change away from 25MWh.

Graph 5: Count of Trades that the MIP was set by and their respective volumes



3.8 As explained above, the historical data shows that three Settlement Periods have defaulted in the current review period, and that the MIP was set by a single trade, in one instance. The data analysis of **Table 3** indicates that principle **d)** is met as an annual review of the defaulted Settlement Periods is made to ensure it is still relevant.

4. Analysis of the Timeband and Product Weightings

4.1 The analysis was carried out using the '1' weighted products and timebands specified in the live version of the MIDS. This is also shown in **Table 2**.

4.2 The timeband and product weightings determine which trades are included in the MIP and MIV calculation. Like the ILT, the timeband and product weightings are set in accordance with a set of principles detailed in the MIDS.

4.3 The principles are:

a) Weightings should be applied to the components that make up the Market Index Price;

b) Weightings should not be applied to the Market Index Volume and should not be used in determining whether the traded volume meets the Liquidity Threshold for the half hour;

c) Weightings may be applied to reflect how close to real time a trade was made (timeband weighting);

d) Weightings may be applied to the product or contract types which qualify in the index calculation (i.e. those which are traded in the short term as defined in the BSC);

e) The same weightings must be applied to equivalent qualifying products and timebands across all Market Index Data Providers;

f) Weightings may be set to ensure that the Market Index Price is reflective of the price of trades as close as possible to Gate Closure;

g) Weightings may be set to minimise the flattening effect on the Market Index Price of including traded products used in the methodology that have one price for a time period longer than one Settlement Period;

h) Weightings may take values from '0' to '1'; and

i) Where a weighting is set to '0', the weighting is effectively null, trades in the related product type and timeband will be excluded from the Market Index Volume (and Price) calculation.

4.4 A number of the principles - **a), b), c), d), e), h)** and **i) -** are already met under the current operation. The remaining principles **f)** and **g)** are considered below.

4.5 The MIDP calculates the MIP using the weighted products and timebands when the MIV is above the 25MWh ILT. The '1' weighting is currently applied to products H, 1, 2 and 4 in timebands 1 to 6 which results in trades relating to these product and timeband combinations being used to calculate the MIP and MIV.

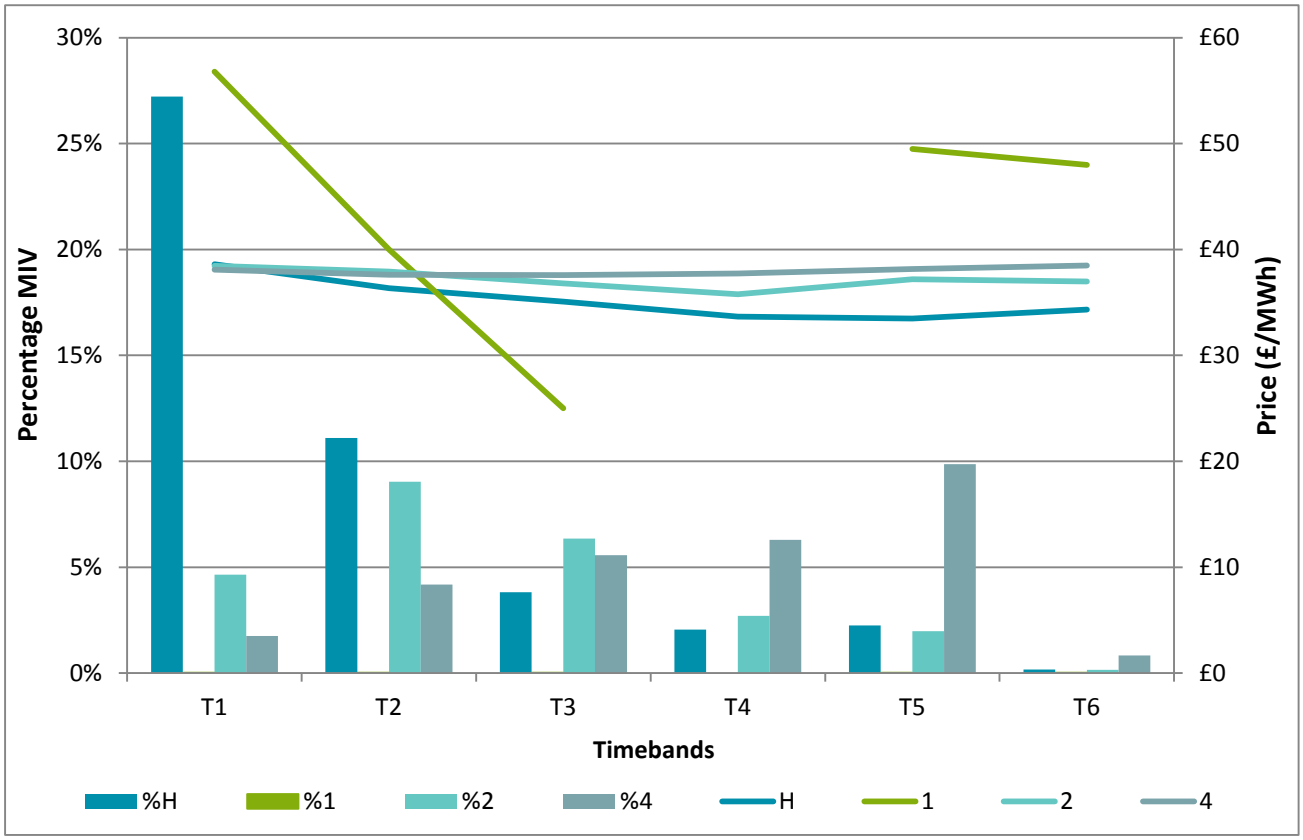
4.6 **Graph 6** shows the price curve for the '1' weighted products in each timeband. It can be seen that the average price was flat from timeband 6 towards Gate Closure (from right to left) for Product H, 2 and 4. The average price for Product 1 varies due to a lower number of trades on this product (0.001% of all volume traded over the six timebands).

4.7 **Graph 6** also shows the percentage of traded volume on the '1' weighted products captured in the '1' weighted timebands. As expected, due to the nature of the products:

- The volume traded on the Half-Hour Product dominated in timebands 1 and 2;
- The volume traded on the 2-Hour Product was mainly captured in timebands 2 and 3; and
- Traded volume on the 4-Hour Product was mainly dominating in timebands 4 and 5.

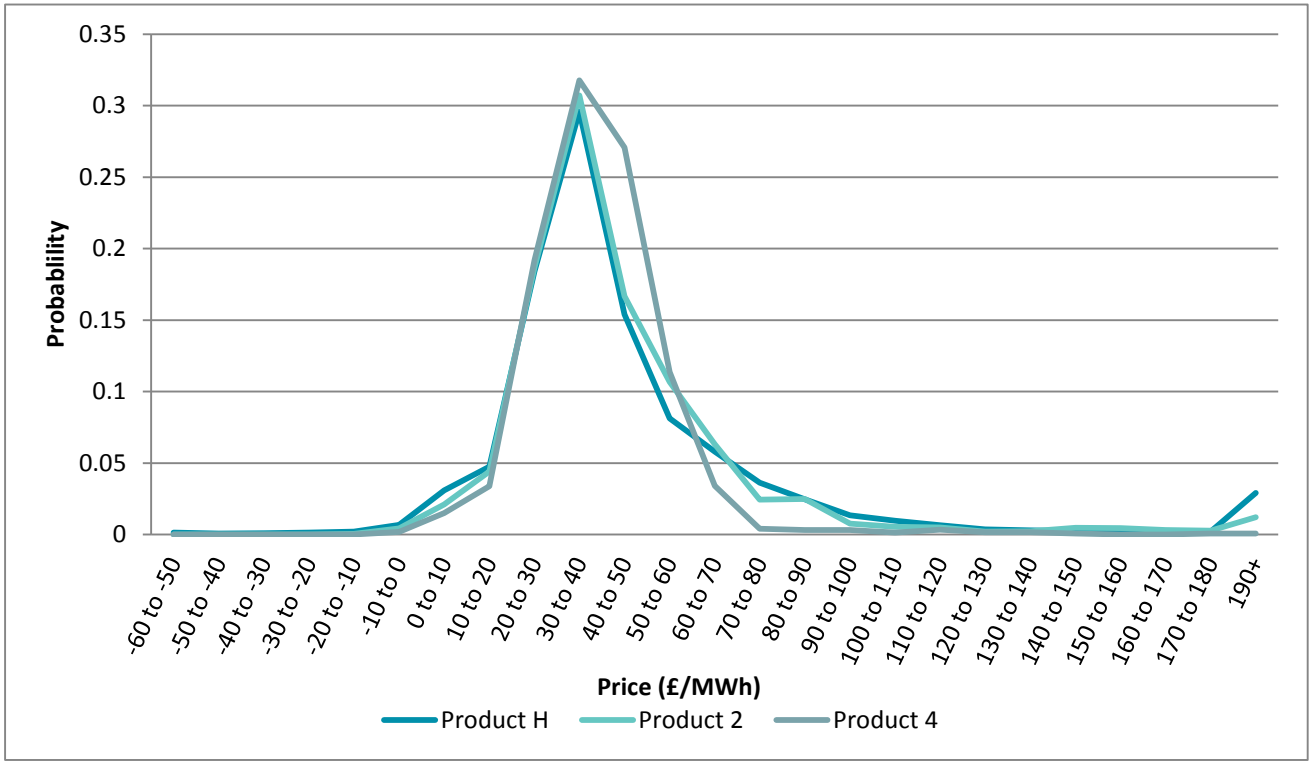
It is worth noting that timebands 5 and 6 are of four hours duration compared to 1 to 4 which are only one hour as highlighted in **Diagram 1**. The volume traded on the 1 Hour Product is typically low, this trend continued this year. There is zero volume of the 1 Hour Product in timeband 4. With the exception of Product 1, the price of all products is lower this year compared with last year.

Graph 6: Average Price and Percentage of Market Index Volume by timeband



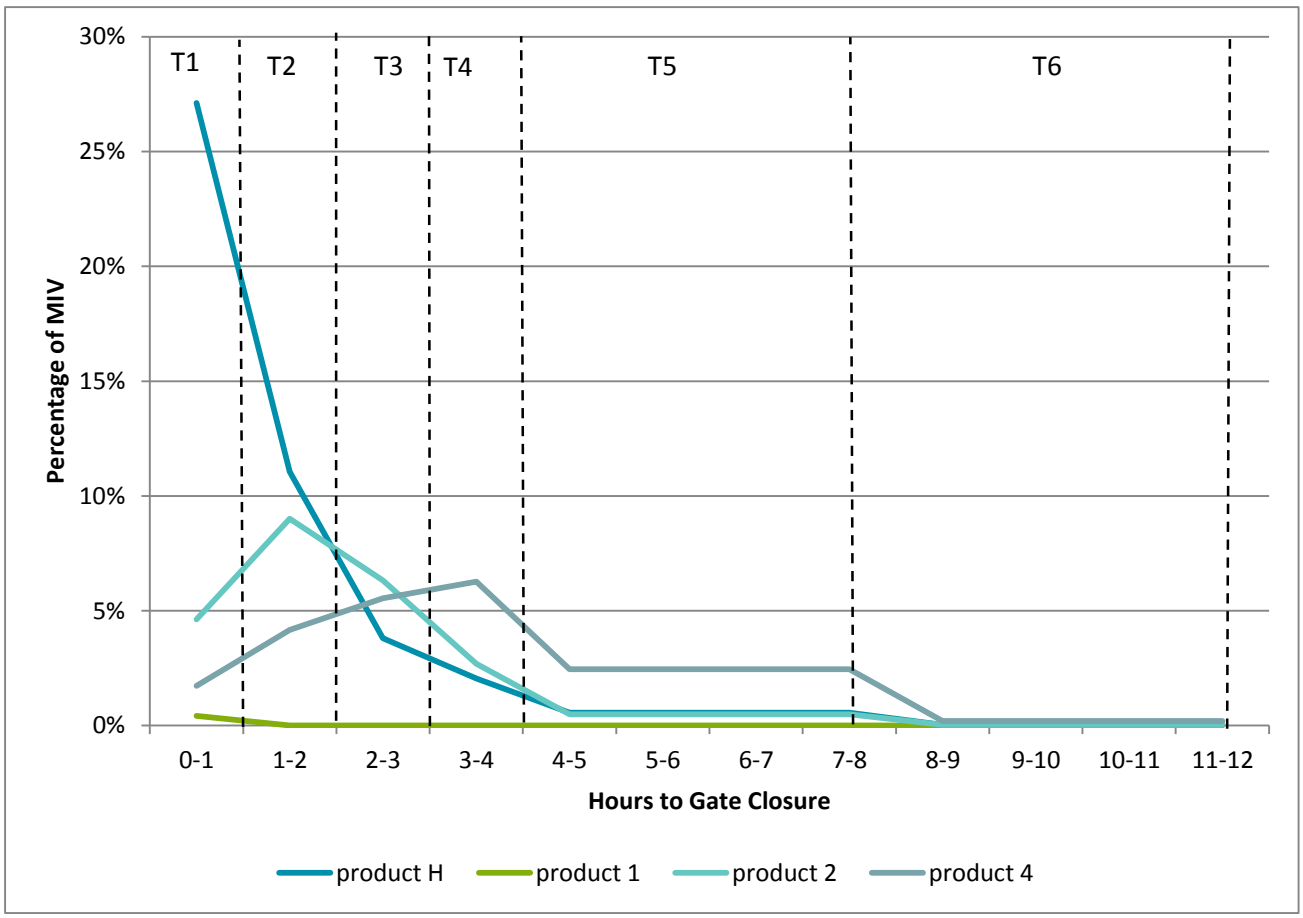
4.8 **Graph 7** shows the probability distribution of prices split by product. There was a low number of trades on Product 1, hence it was excluded from the below graph. It can be seen that product H is the most volatile, due to the negative kurtosis, or 'fat tailed' nature of distribution. In addition, Product H has a 0.029 chance of the price being greater than £190/MWh. Product 4 tends to be the most expensive product, although the average price of all three products are comparable, in the £30/MWh to £40/MWh range.

Graph 7: Probability distribution of Products as a function of prices



4.9 **Graph 8** shows the same information as **Graph 6**, but with the x-axis to hourly scale. The volumes for the longer timebands (5 and 6) are averaged out across each of the four hours. As seen in the previous graph, the respective products percentage of MIV peaks when they are closest to Gate Closure. With the H Hour Product peaking in the hour before Gate Closure, the 2 Hour Product peaking two hours before Gate Closure and so forth. Product H has a higher percentage of MIV compared with last year, increasing by 5%. In addition, Product 4 has more than halved in percentage MIV in timeband T5.

Graph 8: Percentage of Market Index Volume by Time (hours) to Gate Closure



5. Analysis of all Products and Timebands

5.1 All of the MIDS Products are detailed in **Table 4** below and, so far, we have looked at 4 of the 9 products, as the weight of the others remains '0'. The analysis considers all of the products listed below except for the Auction Product (which is considered separately as the volume traded on this product is significantly larger than the other products).

Table 4: Products referenced in the MIDS

Product	Identifier	Duration (hours)
Half-Hour	**H**	0.5
1 Hour Block	**1**	1
2 Hour Block	**2**	2
4 Hour Block	**4**	4
Overnight	**O**	8
Peak	**P**	12
Extended Peak	**E**	16
Base Day	**B**	24
Day Ahead Auction	**A**	1

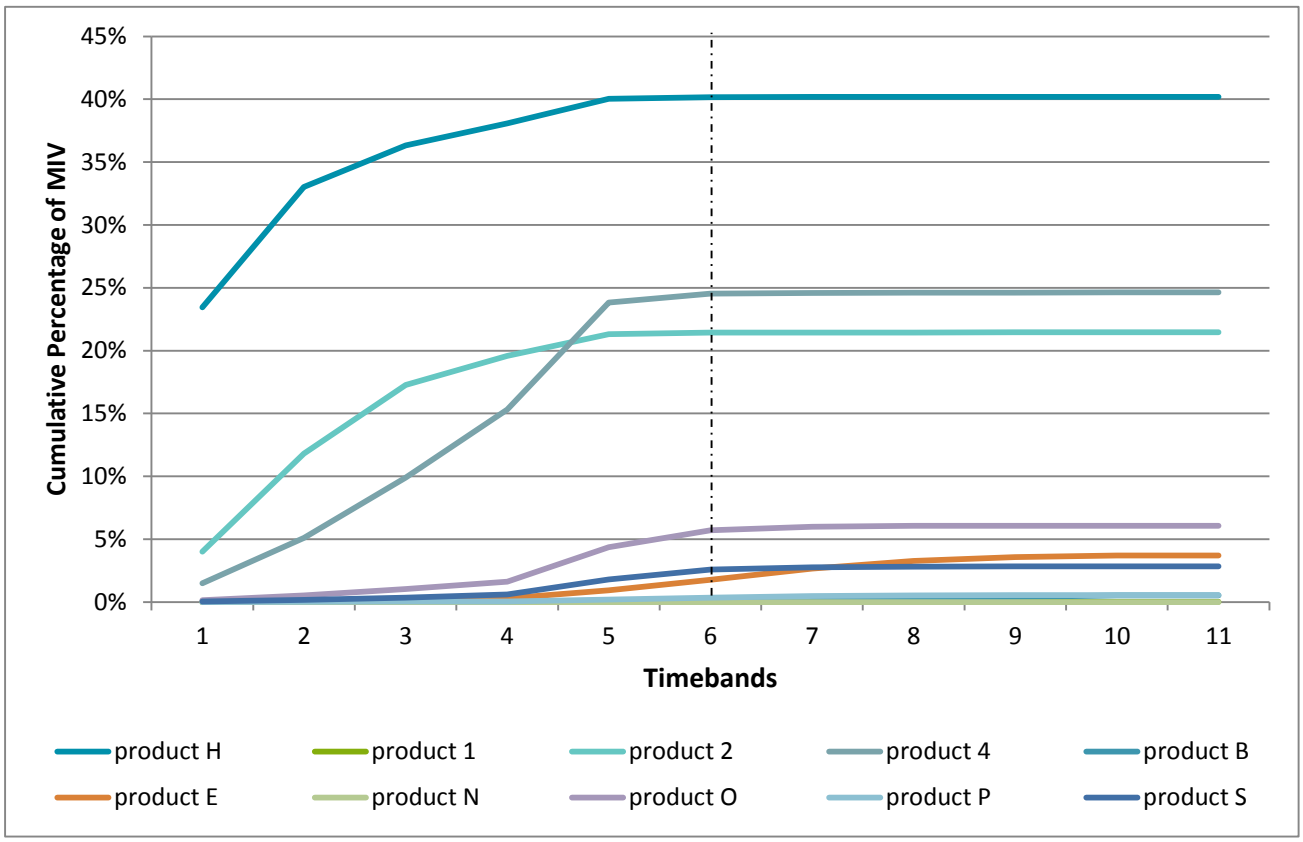
5.2 We have reviewed data for trades up to three Calendar Days ahead of Gate Closure and this period is broken down into 12 timebands. We have already discussed timebands 1-6 which cover trades made up to 12 hours ahead of Gate Closure. We will now consider timebands 1-12 to confirm the relevance of the current weightings. Note that zero trades were made on timeband 12 during this review period.

5.3 **Graph 9** shows the cumulative percentage of volume traded on all products in all timebands for the review period. In the earlier timebands, a much higher percentage of volume is traded on products H, 2 and 4 than any other products. This suggests that the current products remain suitable as they are traded close to Gate Closure (principle **f)**) and represent a significant percentage of the total volume.

5.4 The volume traded on the Overnight Product is visible from timebands 5 onwards, which is similar to that noted in the previous review. Previous consultations with industry on including this product have not resulted in any change to its weighting due to the flattening or 'smoothing' effect.

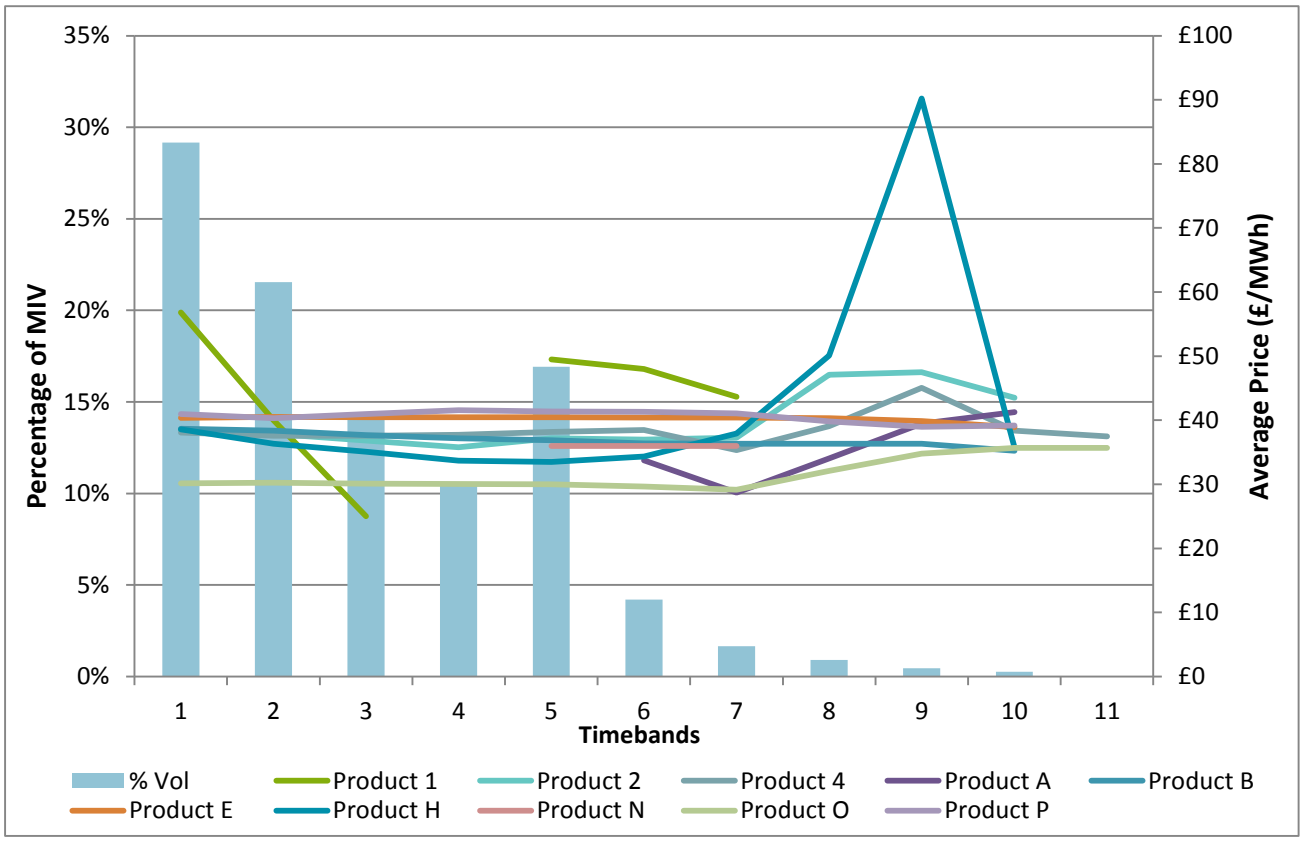
5.5 Trades on Product H have significantly increased by timeband 5 – approximately 5% increase compared to last year's review – whilst trades on Product E have nearly halved, from 7% by timeband 11 last year, compared with 4% this year.

Graph 9: Cumulative Percentage of Total Trade Volume on all Products across all timebands



5.6 **Graph 10** shows the average price of each traded product and the cumulative percentage of total volume traded in each timeband. The largest volumes were traded at timeband 1 (accounting for 29.17% of the total trade), with timebands 1, 2 and 3 all increasing their percentage MIV. Conversely, the largest volume traded last year was at timeband 5, the volume traded this year in this timeband has fallen approximately 7%. Product H spikes in price at around timeband 9, however this price was set by a relatively small number of trades.

Graph 10: Percentage of total volume traded in each timeband



6. Day Ahead Auction Product

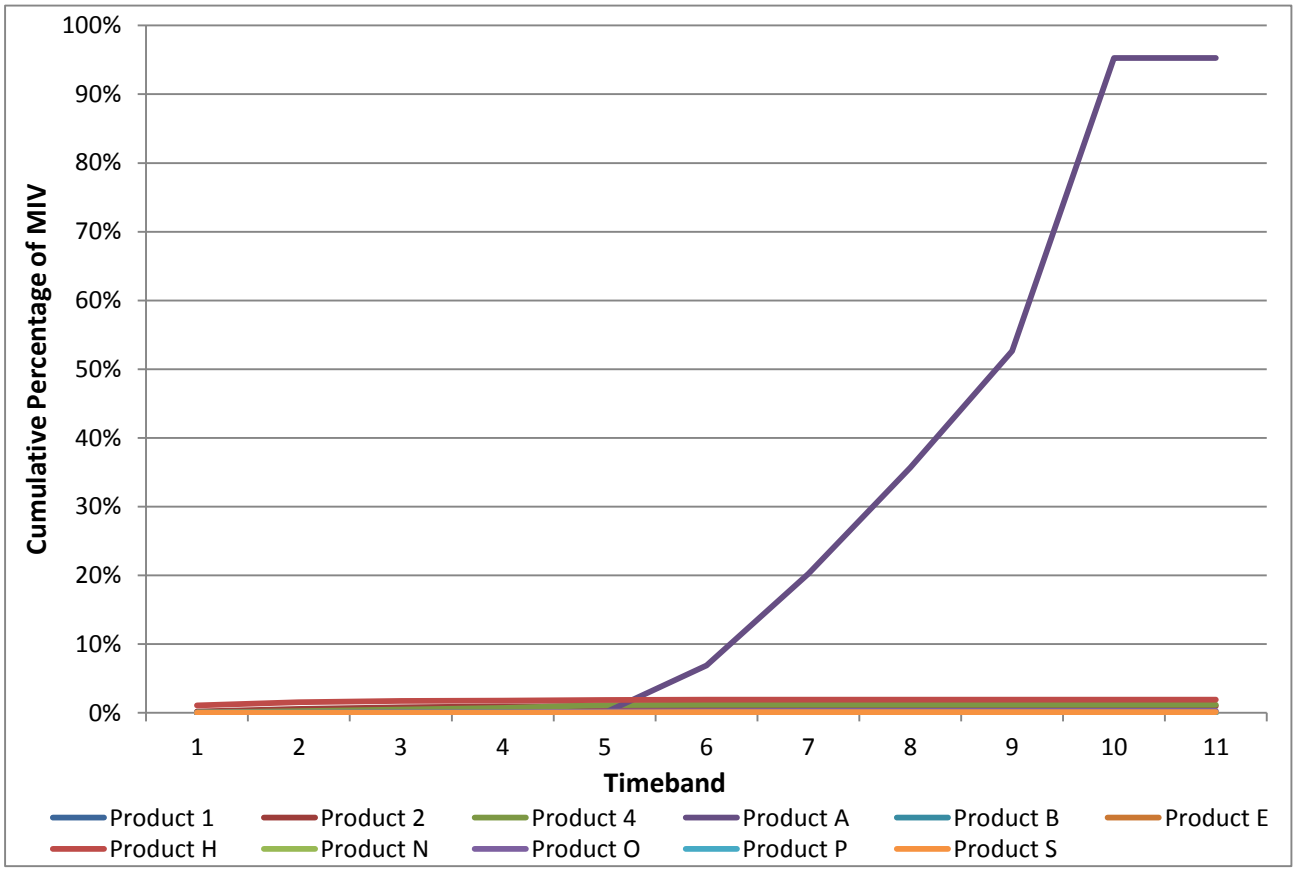
6.1 The Day Ahead Auction product (product A) is a blind auction where buyers and sellers enter anonymous orders for each hourly period from 23:00 to 23:00. The auction market closes at 11:00, after which the orders are matched for each hourly period. The time that the orders are matched gives the trade time used in calculating the timeband for the trade.

6.2 The Auction Product has been given '0' weighting and the ISG recommended that this product should be monitored considering its large traded volume on the market.

6.3 **Graph 11** shows that the Auction Product accounted for 95.25% of total traded volume during the review period. The product only applies from timeband 6. Unlike the other products this product is not traded in timebands 1 to 5 that are closer to Gate Closure.

6.4 Considering the current market liquidity and weighting principle **f)**, the current '0' weighting on the Auction Product remains suitable.

Graph 11: Cumulative Percentage of total traded volume on all Products (including A) across all timebands



6.5 **Table 5** shows the total traded volume on all products across all timebands. As outlined in the above **Graph 10**, Product A accounts for most of the traded products and, overall, a large proportion or all trades (42.62%) is made during timeband 10 driven by Product A (accounting for 42.63% of all trades at timeband 10).

Table 5: Percentage of Total Traded Volume on all Products across all timebands

Products	Timebands												
	1	2	3	4	5	6	7	8	9	10	11	12	Total
1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0%
2	0.19%	0.37%	0.26%	0.11%	0.08%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1%
4	0.07%	0.17%	0.23%	0.26%	0.40%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1%
A	0.00%	0.00%	0.00%	0.00%	0.00%	6.91%	13.33%	15.41%	16.99%	42.61%	0.00%	0.00%	95%
B	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0%
E	0.00%	0.00%	0.00%	0.01%	0.03%	0.04%	0.04%	0.03%	0.01%	0.01%	0.00%	0.00%	0%
H	1.11%	0.45%	0.16%	0.08%	0.09%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2%
N	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0%
O	0.01%	0.02%	0.02%	0.03%	0.13%	0.06%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0%
P	0.00%	0.00%	0.00%	0.00%	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0%
S	0.00%	0.01%	0.01%	0.01%	0.06%	0.04%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0%
Total	**1.39%**	**1.02%**	**0.68%**	**0.50%**	**0.80%**	**7.11%**	**13.41%**	**15.45%**	**17.01%**	**42.62%**	**0.00%**	**0.00%**	**100%**