ELEXON

Market Index Definition Statement Review 2022

Imbalance Settlement Group (ISG)

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Classification	**Public**	Document version	**v1.0**

Summary	**We invite the ISG to review the Market Index Price (MIP) analysis**

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Executive Summary

The Market Index Definition Statement (MIDS) is annually reviewed by the BSCCo. on behalf of the BSC Panel, to ensure that the Market Index Price (MIP) is providing a reasonable reflection of the price of wholesale electricity in the short term market.

The review period covers 1 August to 31 July each year. This year the analysis is based on data from the period 1 August 2021 to 31 July 2022. The review consists of checking that parameters used in the MIP calculation defined in the MIDS (i.e. the Individual Liquidity Threshold (ILT), timeband weightings and product weightings) remain fit for purpose and through the parameters, checking the MIDS principles are being met (BSC Section T1.5.3). The purpose of the MIP is to reflect the price of wholesale electricity in Great Britain in the short term market, for delivery in respect of that Settlement Period.

Background Information

Parties trade wholesale energy on power exchanges where they can buy and sell power exchange products. The products vary by duration and start time. Approved Modification Proposal P78 introduced the MIP to reflect the price of wholesale electricity in the short term market for Great Britain.

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 half hourly prices and volumes. The calculation process is defined in the MIDS. In particular, the Market Index Definition Statement defines:

The overall price (Market Index Price or MIP) and volume (Market Index Volume or MIV) calculation process;

A volume threshold (Individual Liquidity Threshold or ILT), 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 the Submission Deadline they are made;

Weightings which reflect the importance of the products and timebands; and

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

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 by a single trade (i.e. not setting the ILT too low), and to minimise the number of Settlement Periods where the default rule is applied (i.e. not setting the ILT too high).

The MIV is calculated as the sum of the traded volume across the selected products and timebands, as defined in the MIDS. When the MIV traded in a Half Hour is greater than the ILT, the MIP is the volume weighted average price of the trades. Where the MIV does not meet the ILT, the MIP and MIV default to zero.

The current MIDS (effective from 18 April 2019, following the implementation of BSC Modification P377) sets the products to be included in each Half Hourly price and volume calculation as the Half Hour, One Hour, Two Hour and Four Hour products traded within eight hours of the Submission Deadline. Prior to BSC Modification P377, the products were required to be traded within 12 Hours of Gate Closure.

Weightings are applied to reflect the importance of each product and timeband and are set to '1' or '0', which either completely include or exclude particular trades. The current weightings applied to the different products and timebands used in the calculations are shown in Table 1.1.

Table 1.1 Product and Timeband Weightings

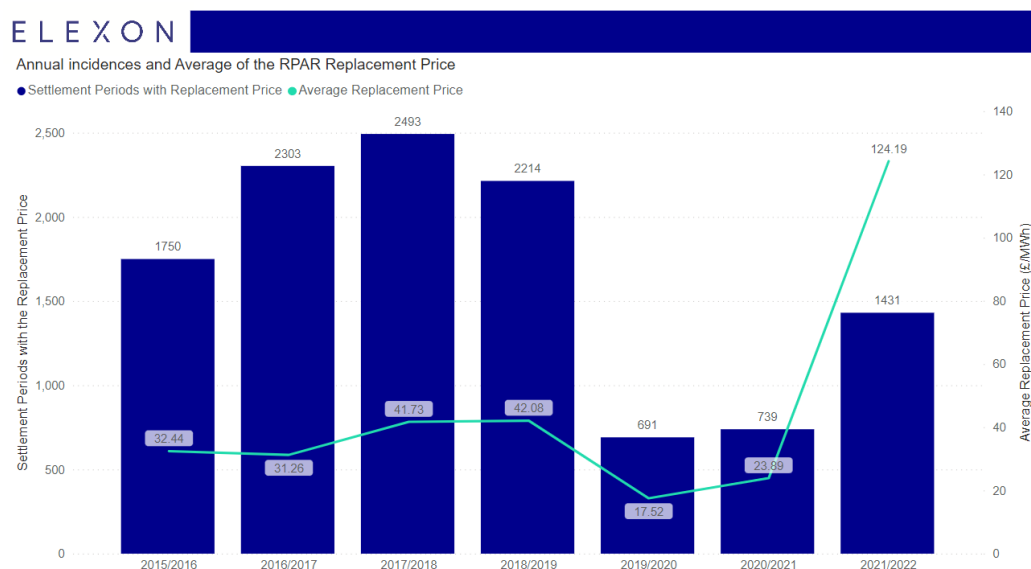|		Timeband											
Product		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Half-Hour	**H**	1	1	1	1	1	0	0	0	0	0	0	0
1 Hour Block	**1**	1	1	1	1	1	0	0	0	0	0	0	0
2 Hour Block	**2**	1	1	1	1	1	0	0	0	0	0	0	0
4 Hour Block	**4**	1	1	1	1	1	0	0	0	0	0	0	0
Overnight	**O**	0	0	0	0	0	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

Use of the Market Index Price (MIP)

Since the introduction of BSC Modification P305 'Electricity Balancing Significant Code Review Developments', implemented on 5 November 2015, the MIP is used to set the System Price in two scenarios:

1. When the Net Imbalance Volume (NIV) is zero, then the System Price will default to the MIP; or
2. If all of the actions in the price stack are unpriced then the Replacement Price, and consequently the System Price, will be set by the MIP.

Prior to the implementation of BSC Modification P305, the 'reverse' System Price was calculated for every Settlement Period and used for Energy Imbalance Settlement. The aim of the 'reverse' price was to reflect the price of wholesale electricity in the short term market for Great Britain, with the MIP used to set the 'reverse' price.

The System Price has not defaulted to the MIP due to a zero NIV since the implementation of BSC Modification P305. Since 2001, the NIV has equalled zero three times: 5 September 2007, Settlement Period 8; 22 September 2009, Settlement Period 10; and 10 May 2015, Settlement Period 7.

The graph below shows the number of Settlement Periods with a Replacement Price determined based on the weighted average cost of the most expensive 1MWh of unflagged balancing actions, the Replacement Price Average Reference (RPAR) over the past nine review periods and the average of the RPAR Replacement Price. Annual review periods are from 1 August to 31 July.
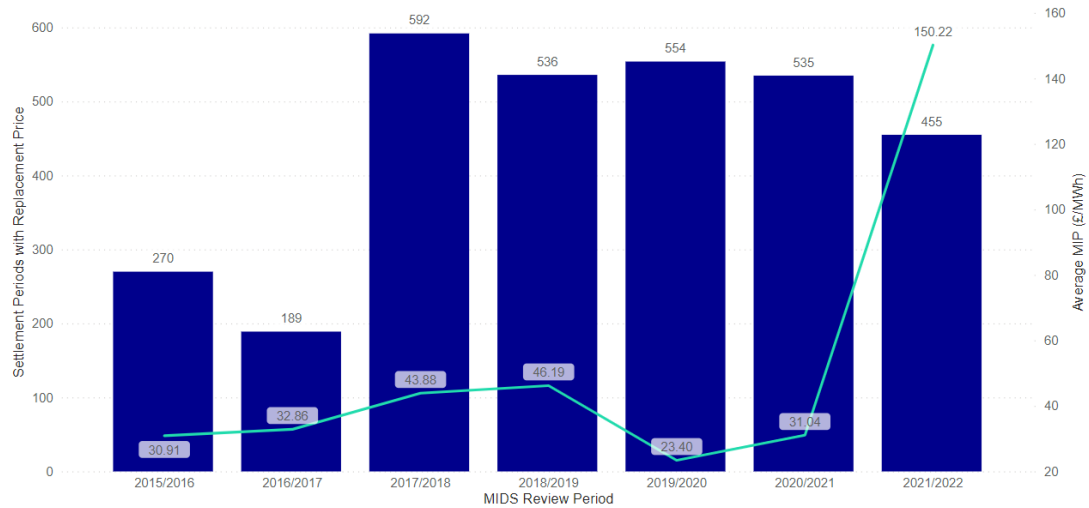

The average RPAR Replacement Price rose by £100.30/MWh (420%) to £124.19/MWh between the 2020/21 and 2021/22 review periods. There were 1,431 Settlement Periods (8% of the reporting period) where the RPAR set the Replacement Price, an increase of 692 Settlement Periods (93%) from the previous review period but less than Review Periods prior to 2019/20.

Where there are no unflagged balancing actions, the Replacement Price is set at the MIP. The graph below shows the average of the MIP when it was used as the Replacement Price and the amount of Settlement Periods where the MIP was used as the Replacement Price to set the System Price. The average MIP increased by £119.18/MWh (384%) to £150.22/MWh. The amount of Settlement Periods where the MIP set the Replacement Price decreased by 80 (15%) to 455 Settlement Periods (3% of the reporting period).

Annual incidences and average of the MIP Replacement Price

● Settlement Periods with Replacement Price ● Average MIP

In total, a 48% increase in the number of Settlement Periods with a Replacement Price was seen since the last review. In 24% of the Settlement Periods with a Replacement Price, the MIP set the Replacement Price.

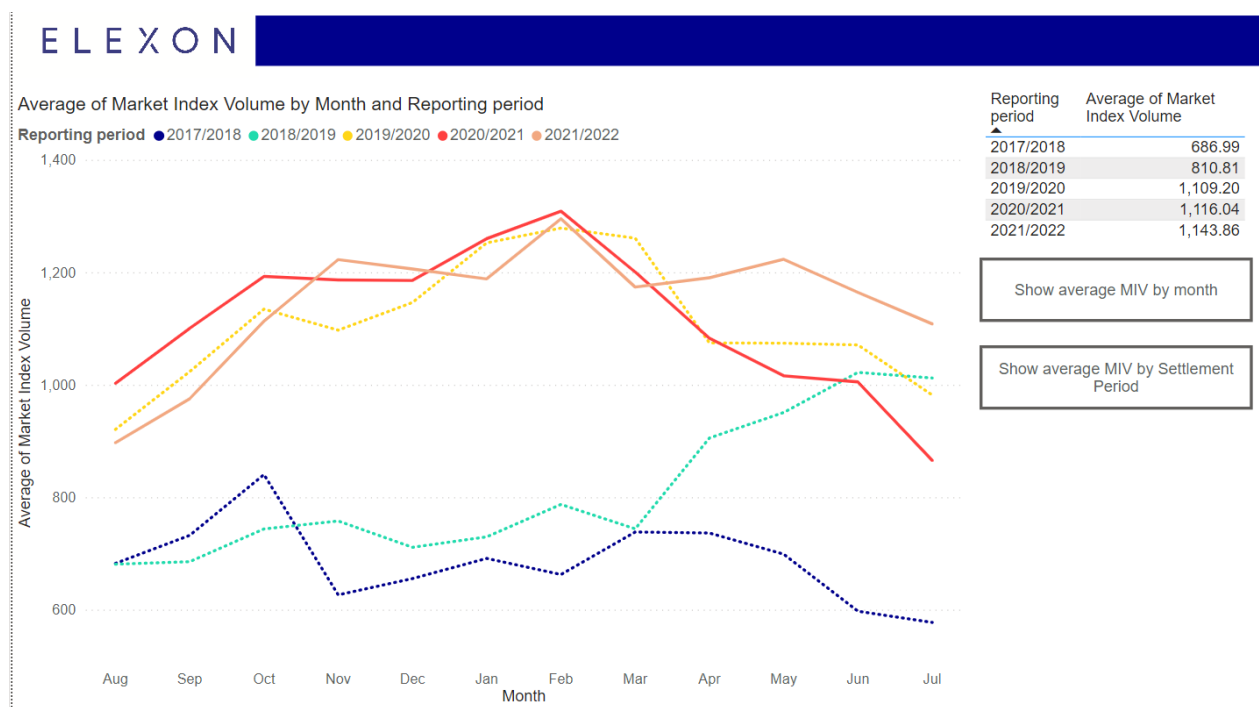**Error! No text of specified style in document.**

Analysis of the Market Index Volume (MIV)

Market Index Volume (MIV) is the total traded volume across the products and timebands included in the calculation. These are the Half Hour, One Hour, Two Hour and Four Hour products traded within eight hours of the Submission Deadline. These products have a weighting of '1' in Table 1.1.

Average Market Index Volume

The MIV shows how much volume was traded in the two power exchanges used to calculate the MIP. A higher MIV indicates a greater volume of traded energy being included in the MIP Calculation. The average MIV was 1,144MWh in the 2021/22 review period, 28MWh higher than the average MIV of previous review period.

BSC Modification P377 changed the timeband reference in the MIDS from Gate Closure to Submission Deadline. This has meant that trades made after Gate Closure, but before the Submission Deadline are able to be included in the MIV calculation. Therefore, the daily average MIV has increased from 18 April 2019.

This graph displays the average MIV for the last five review periods. The two buttons on the right of the graph allow the user to view the average MIV by month or Settlement Period.

The month with the highest average MIV in the 2021/22 review period was February, when the average MIV was 1,295MWh. February was also the month with the highest average MIV in the 2019/20 and 2020/21 review periods with an average MIV of 1,279MWh and 1,309MWh respectively.

The month with the lowest average MIV was August in the 2021/22 review period, with an average MIV of 897MWh. The monthly average MIV for 2021/22 is higher than in the previous three review periods in five out of 12 months.

By viewing the average MIV by Settlement Period rather than by Month we can see the variation in MIV over a day is much greater than any seasonal variation across a year. Settlement Periods 49 and 50 are shown in the graph but only occur during one clock change day a year.
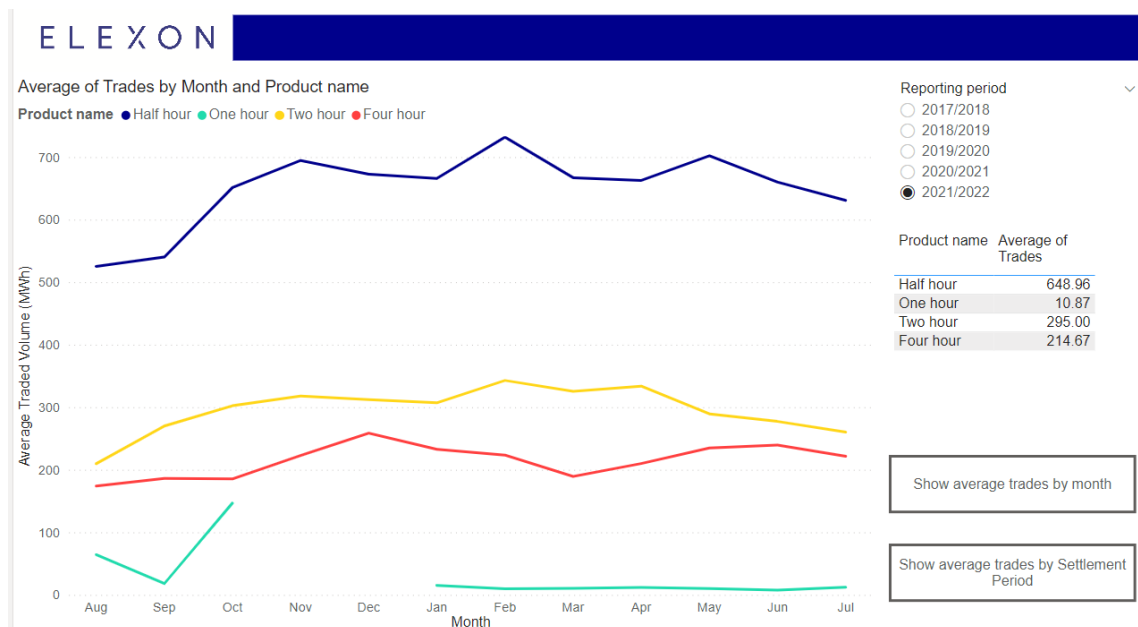
The Settlement Period with the lowest average MIV (68MWh) is Settlement Period 49, which occurred on the short clock change day (31 October 2021). As the short clock change day only occurs once a per review period, this average is based on a single Settlement Period.

Outside of clock change days, the lowest MIV occurred in Settlement Period 1 (00:00 to 00:30) when the average MIV is 660MWh. The average MIV in this Settlement Period is also higher than in previous years. Settlement Period 30 (14:30 to 15:00) has the highest average MIV of 1,590MWh.

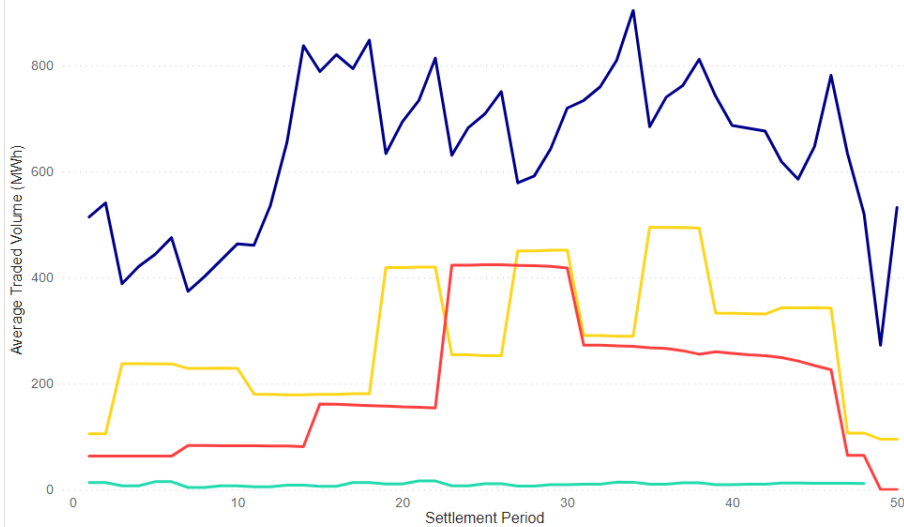## Average traded volume by product

There are four products included in the MIV, the half hour, one hour, two hour and four hour. The graph below shows the average volume traded on each product during the five timebands included in the MIV (see **Table 1.1**).

The graph below displays the average number of trades for the last five review periods. The two buttons on the right of the graph allow the user to view the average number of trades by month or Settlement Period.

Average of Trades by Settlement Period and Product name

Product name ● Half hour ● One hour ● Two hour ● Four hour

Reporting period

○ 2017/2018
○ 2018/2019
○ 2019/2020
○ 2020/2021
● 2021/2022

Product name	Average of Trades
Half hour	648.96
One hour	10.87
Two hour	295.00
Four hour	214.67

Show average MIV by month

Show average MIV by Settlement Period

An average volume of 649MWh was traded on the Half hour product per Settlement Period in 2021/22. Compared to previous years there was more energy traded on the Half Hour product and less traded on the two hour and four hour products. The one hour product remains the least traded product that contributes to the MIV and there was no volume of this traded product in November and December 2021.

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Analysis of the Individual Liquidity Threshold (ILT)

Our analysis indicates that the current ILT is fit for purpose and that there should be no change to the value. Analysis was carried out using the live products and timeband weightings (see **Table 1.1**).

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 less than the threshold, both the MIP and MIV are defaulted to zero.

The ILT must be set in accordance with the Market Index Definition Statement principles. These principles, which are stated in section 4.1 of the Market Index Definition Statement, 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 historical 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.

Currently the ILT for both MIDPs is 25MWh, so principle **a)** is met. The analysis shows that the ILT could be set to zero as per principle **b)**, which would also meet principle **f)**.

Analysis has been carried out by MIDP to show the difference an ILT of zero would have for the two MIDPs:

- There were 22 Settlement Periods (0.11%) in the current review for EPEX SPOT where the MIP and MIV were defaulted to zero. For 19 of these Settlement Periods, there was no traded volume for in the qualifying products. For three of these Settlement Periods, the traded volume was less than the ILT.
- For Nord Pool, 17,446 Settlement Periods (99.15%) had the MIP and MIV defaulted to zero in the 2020/21 review period. For 17,414 of these Settlement Periods, there were no qualifying trades as part of the Market Index Base Data.

Reducing the ILT to zero would ensure all qualifying trades are included in the calculation of MIPs, and so reduce the number of occasions when the MIP is defaulted to zero to when there were no qualifying trades at all. However reducing the ILT to zero would also increase the likelihood that the MIP is set on a single trade and so go against principle **e)**.

In the current review period, zero Settlement Periods for EPEX SPOT had the MIP set based on a single trade. There were one Settlement Periods for Nord Pool that had the MIP set by a single trade. Increasing the ILT increases the chances of the MIP defaulting to zero, which would be contrary to principle **f)**. However, increasing the ILT to 30MWh would have avoided the instance of the Nord Pool MIP being set by a single trade.

The graph below displays the instances for each MIDP where the MIV is greater than zero, but less than 100MWh. The ILT is shown as a red line. Instances where no trades were received are not shown.

There are 70 Settlement Periods where the MIV is greater than zero, but less than 100MWh for Nord Pool for 58 Settlement Periods (0.33%) and 12 Settlement Periods (0.07%) for EPEX SPOT. These Settlement Periods have trades that could be included in the MIV, but low liquidity.

Settlement Periods where the Market Index Volume is less than 100MWh compared to the Individual Liquidity Threshold of 25MWh

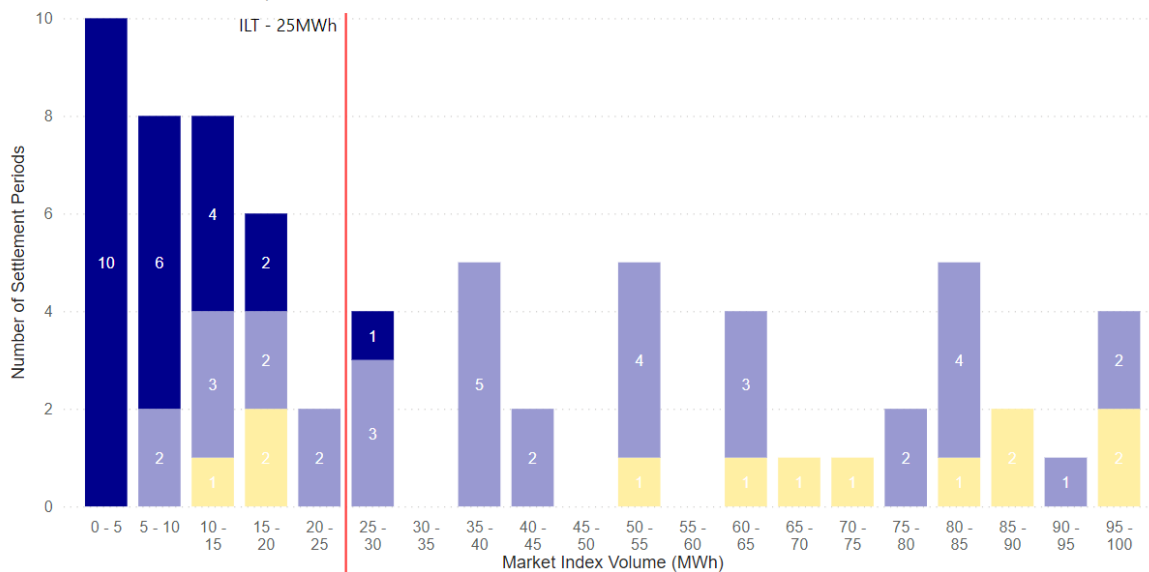**Trades and Provider** ● EPEX Spot >1 Trade ● Nord Pool >1 Trade ● Nord Pool 1 Trade

The ILT could be changed to 30MWh, this would support principle **e)** by reducing the number of instances where the MIP was set by a single trade in three Settlement Periods for Nord Pool. However, it would also increase the number of defaulted Settlement Periods, where there was more than one trade for Nord Pool by one Settlement Period.

Given the small number of Settlement Periods affected by this change (4 Settlement Periods, 0.02%) we are proposing no change to the current ILT of 25MWh.

Analysis of the Timeband and Product Weightings

The analysis was carried out using the '1' weighted products and timebands specified in the current version of the MIDS, which are shown in **Table 1.1**. Descriptions of each Timeband each MIDP are capable of providing without system changes is detailed in **Table 1.2**.

Table 1.2 Timeband descriptions

Number	Timeband	Description
1	1 Hour	Submission Deadline (for the relevant Settlement Period) to >= -1 hour
2	2 Hours	> -1 hour to >= -2 hours
3	3 Hours	> -2 hours to >= -3 hours
4	4 Hours	> -3 hours to >= -4 hours
5	8 Hours	> -4 hours to >= -8 hours
6	12 Hours	> -8 hours to >= -12 hours
7	16 Hours	> -12 hours to >= -16 hours
8	20 Hours	> -16 hours to >= -20 hours
9	24 Hours	> -20 hours to >= -24 hours
10	1 Calendar Day	> -24 hours to SP 1 on CD-1
11	2 Calendar Days	SP 1 to SP48 on CD-2
12	3 Calendar Days	SP 1 to SP48 on CD-3

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.

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 the Submission Deadline;

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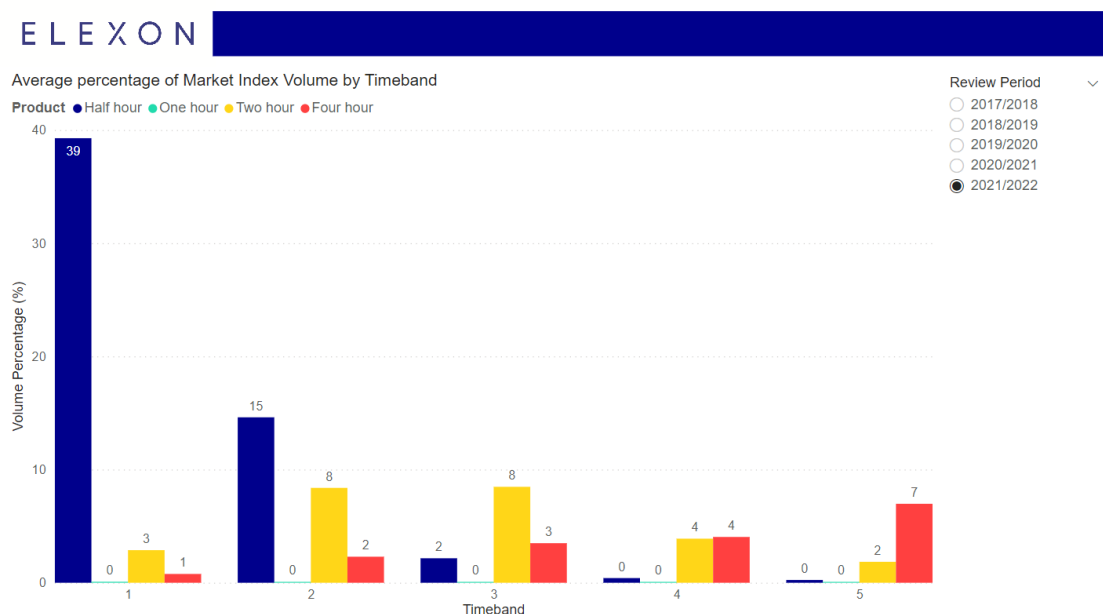
A number of the principles - **a), b), c), d), e), h)** and **i) -** are already met under the current operation. The remaining principles **f)** and **g)** are considered below.

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 5, which results in trades relating to these product and timeband combinations being used to calculate the MIP and MIV.

The graph below 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 was highest in timebands 1 and 2;

- The volume traded on the Two Hour Product was mainly captured in timebands 2 and 3; and

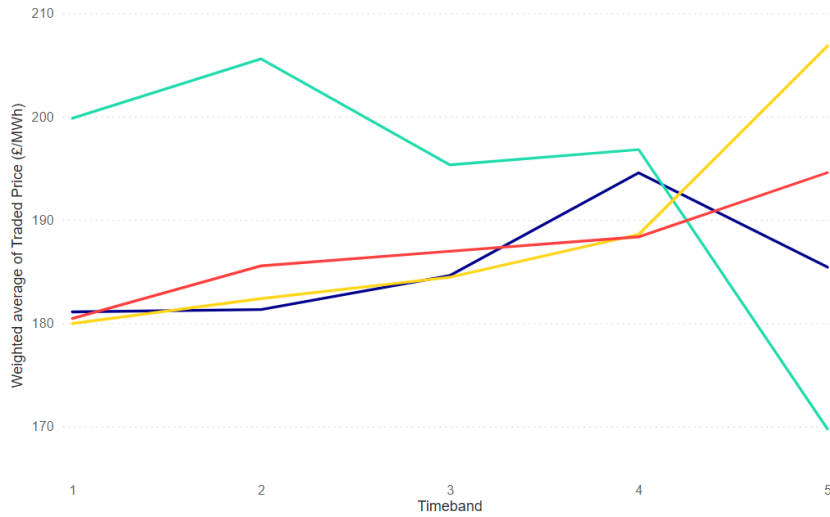- Traded volume on the Four Hour Product was mainly dominating in timeband 5.

It is worth noting that timeband 5 is four hours duration compared to 1 to 4 which are only one hour in duration. The volume traded on the One Hour Product is typically low.

The graph below shows the weighted average price curve for the '1' weighted products in each timeband. Prices increased across all products compared to the previous review period by an average of 239%, as shown in the table on the right-hand side. The weighted average price decreased slightly from timeband 5 towards the Submission Deadline (from right to left) for the Half Hour, Two Hour and Four Hour Products. Average prices for the Half Hour Product decreased by £4.33/MWh, from £185.43/MWh in timeband 5 to £181.10/MWh in timeband 1. Average timeband prices for the Two Hour Product decreased by £26.87/MWh and for the Four Hour Product by £14.13/MWh from timeband 5 to timeband 1. The average price for the One Hour Product varies more than the other three products and the price increased from timeband 5 to timeband 1 by £30.09/MWh. However, there are a lower number of trades on this product, less than 0.18% of all volume traded over the five timebands in the 2021/2022 review period. This shows that the MIP is not distorted by one to the weighted products or timebands, and therefore that the current weighted products and timebands remain suitable.

Weighted Average price of Market Index Volume by Timeband

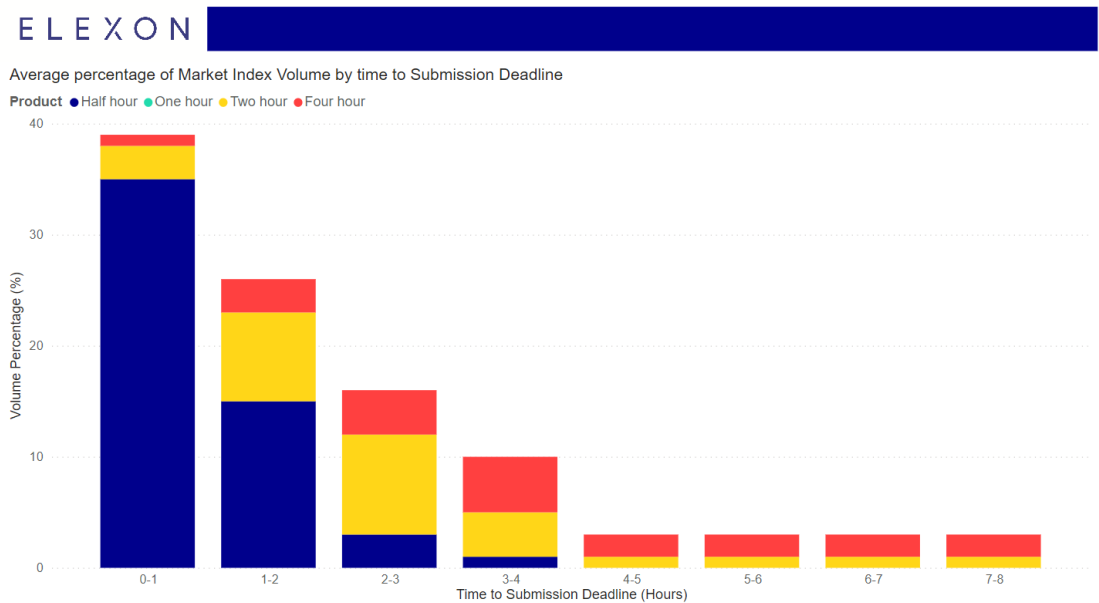**Product** ● Half hour ● One hour ● Two hour ● Four hour

Review Period ⌄
- ○ 2017/2018
- ○ 2018/2019
- ○ 2019/2020
- ○ 2020/2021
- ● 2021/2022

Weghted Average Price by Product and Review Period

Product name	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021
Half hour	49.70	50.02	31.98	58.98
One hour	72.68	58.03	21.99	45.69
Two hour	53.04	52.13	33.00	59.94
Four hour	54.29	54.10	35.06	62.94

The graph below displays again the percentage of MIV by Product, but with the x-axis set to an hourly scale. The volumes for the longer timeband 5 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 the Submission Deadline. With the Half Hour Product peaking in the hour before the Submission Deadline, the Two Hour Product peaking two to three hours before the Submission Deadline and so forth. Trades made within four hours of a Settlement Period (timebands 1 to 4) make up 90% of the MIV.

Average percentage of Market Index Volume by time to Submission Deadline

Product ● Half hour ● One hour ● Two hour ● Four hour

Analysis of all Products and Timebands

All of the MIDS Products are detailed in **Table 6.1.1,** the products included in the MIV are the Half Hour, One Hour, Two Hour and Four Hour Blocks. The analysis considers all of the products listed below:

Table 6.1.1. Available Products

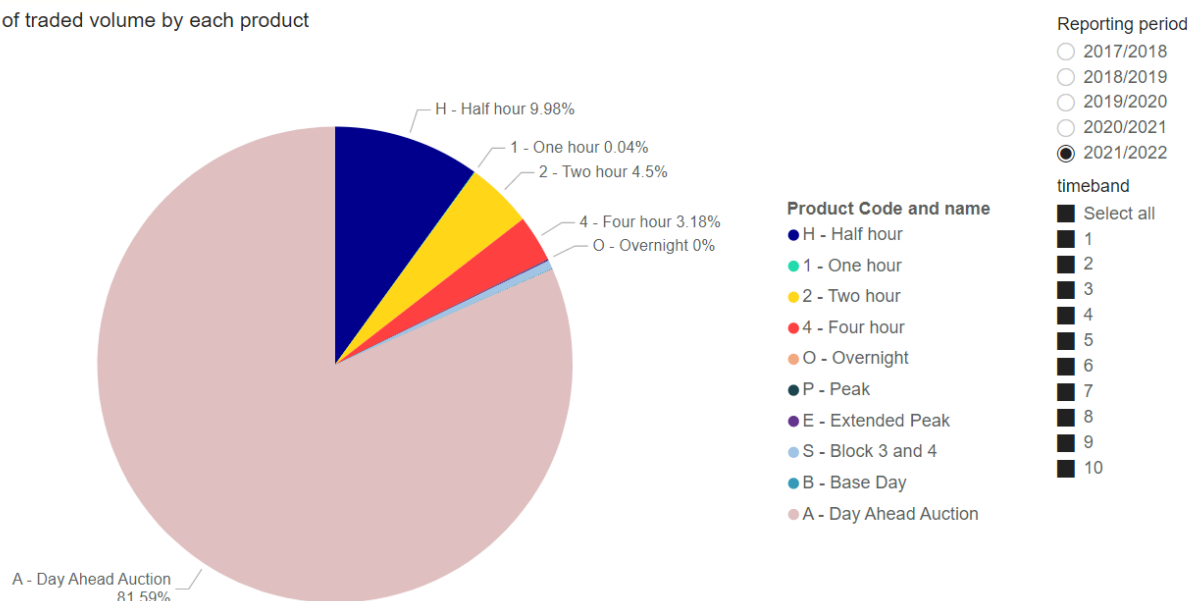| Product	Identifier	Duration (hours)
Half-Hour	H	0.5
1 Hour Block	1	1
2 Hour Block	2	2
4 Hour Block	4	4
Overnight	O	8
Peak	P	12
Extended Peak	E	16
Block 3 and 4	S	8
Off Peak	N	8
Base Day	B	24
Day Ahead Auction	A	1

We have reviewed data for the two Market Index Data Providers' trades up to three Calendar Days ahead of the Submission Deadline and this period is broken down into 12 timebands. Timebands 1-5 which cover trades made up to 8 hours ahead of the Submission Deadline are included in the MIV. Timebands 6-12 are also considered to confirm the relevance of the current weightings. Note that zero trades were made in timebands 11 and 12 during the review period.

Proportion of traded products

This pie chart shows the proportion of traded volume across all timebands by product. The data can be filtered by timeband and by reporting period. Over the three days analysed the day ahead auction product represents 82% of traded volume. The second most traded product, the half hour product, represents 10% of traded volume.
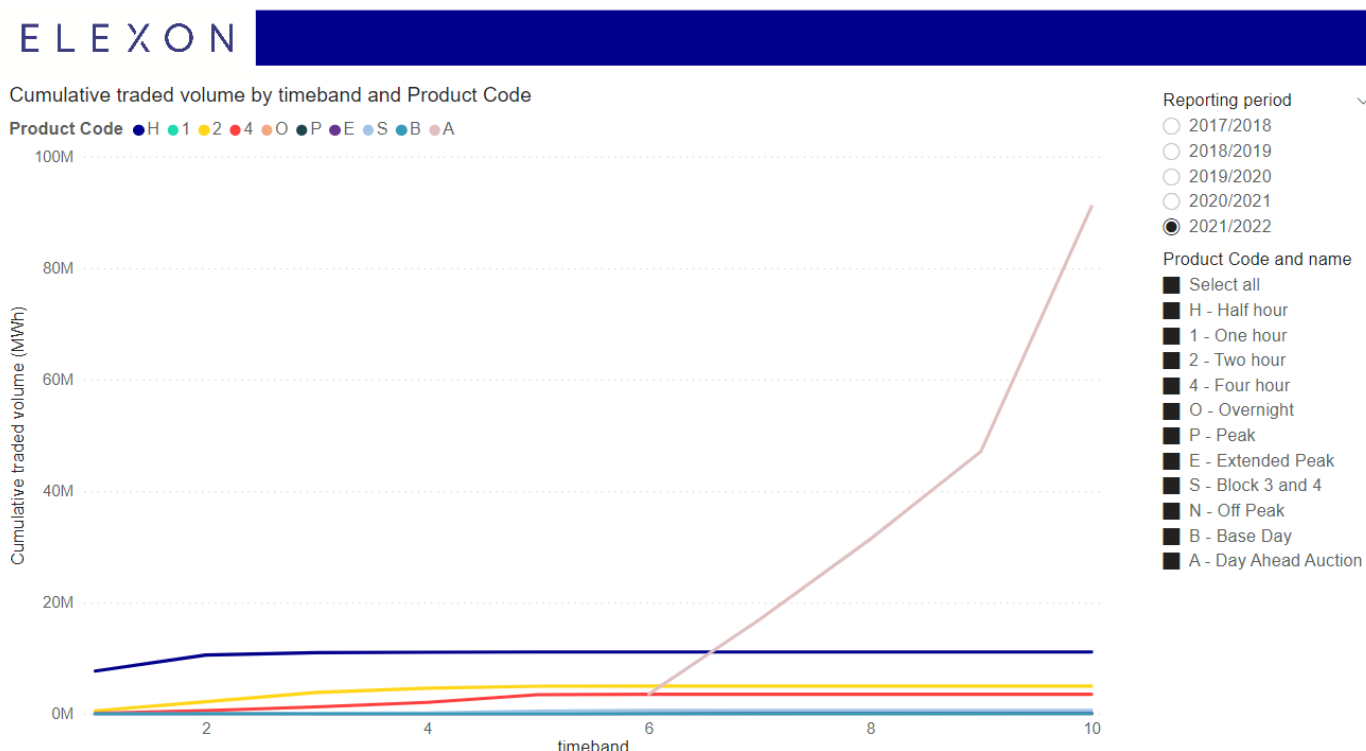

By filtering to show the proportion of traded product within the 8 hour period included in the MIV (timebands 1 to 5) the proportion of traded half hour product volume increases to 55%. The products currently included in the MIV represent

97% of the traded volume 8 hours ahead of the Settlement Period. The remaining 3% of traded volume is from block 3 and 4 (2.5%), the overnight, peak, extended peak, and base day products.

There is no day ahead product traded during the 8 hour period included in the MIV. However there is a large volume of the Day Ahead Auction product, traded between timebands 6 and 10. 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 that evening to 23:00 the next day. 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.

Cumulative traded volume by timeband

This graph shows the cumulative volume traded on all products in all timebands between 1 August 2021 and 31 July 2022. The filters on the right hand side of the graph allow you to switch between review years and to choose which products are shown on the graph.
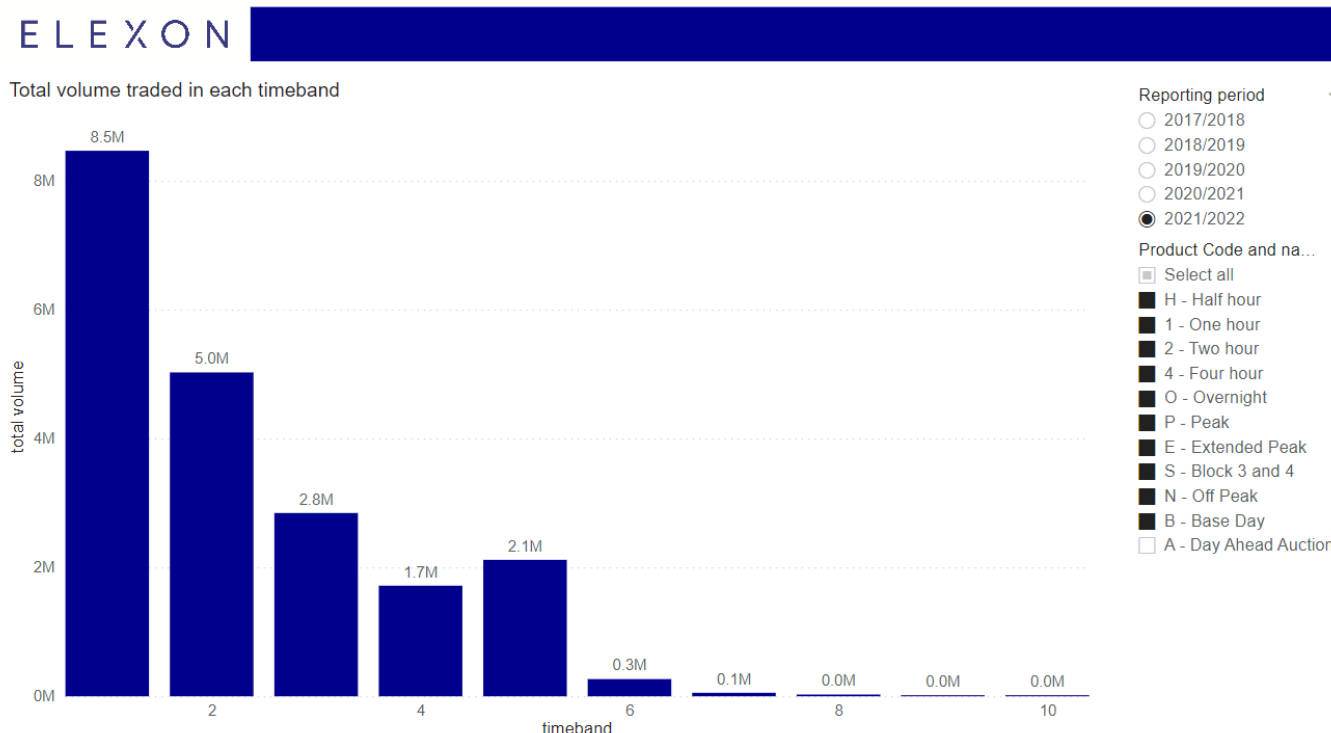

In the earlier timebands, a much higher percentage of volume is traded on the Half Hour, Two Hour and Four hour products. This suggests that the current products remain suitable as they are traded close to the Submission Deadline (principle **f)**) and represent a significant percentage of the total volume.

Unlike the other products the day ahead auction is not traded in the weighted timebands 1 to 5 that are closer to the Submission Deadline. This product has been given '0' weighting and the ISG recommended that this product should be monitored considering its large traded volume on the market.

Considering the current market liquidity, which has increased since the last review period, and weighting principle **f)**, the current product weightings remain suitable.

Volume traded in each timeband

This graph shows the total volume traded in each timeband, by default the day ahead auction product is excluded from the graph. However, by using the filters on the right hand side of the graph you can control which products are shown and for which reporting periods.

The largest volumes were traded at timeband 1 (accounting for 41% of the total trade). 66% of traded volume (excluding Product A) is now traded within two hours of a Settlement Period, in the previous reporting period this was 62%. Without Product A, 98% of the traded volume from the other products occurs within the weighted timebands, which represent 0-8 hours prior to the start of a Settlement Period.

Recommendations

We invite the ISG to:

a) **NOTE** the analysis presented in this paper;

b) **COMMENT** on the analysis in this paper which we will present in our industry consultation; and

c) **APPROVE** the consultation questions provided in Attachment A of this paper, suggest any additional questions.