ELEXON

P410 ‘Changing imbalance price calculations to comply with the Imbalance Settlement Harmonisation regulations’

Workgroup 3

17 December 2020

Agenda and meeting objectives

1. Welcome and Objectives
2. Update on actions
3. Review of legal questions
4. Discussion of Workgroup areas of concern in the regulations
5. Analysis to inform a suitable solution
6. Walkthrough of Proposed Solution
7. Initial Workgroup views
8. Next steps

ACTION UPDATES

Matt Woolliscroft

Actions

#	Action	Update
1	Elexon and NGESO will investigate how dynamic data can be used to cleanse the data set of actions to be fed into the VOAA calculations. Both for the purposes of initial analysis and operationally once the solution has been implemented.	We will cover this in the analysis update
2	Seek further legal advice on some clarification points: a) What constitutes an 'available action'. E.g. can/should constrained actions be used in VOAA calculations and can actions taken for system reasons be used? b) Can the MIP be used as a validation tool for a VOAA algorithm? c) Can NIV, MIP or historic prices be used in any way in the VOAA calculations e.g. to train machine learning?	We will cover these in today's meeting

Actions

#	Action	Update
3	Rerun the analysis for a longer period. Also investigate how other filters can make the VOAA better correlated with the imbalance price. Filters for consideration could include: a) Removal of infeasible actions b) Removal of actions with a volume below a threshold	We will cover this in the analysis update
4	NGESO will confirm what TERRE data and algorithms it has visibility of	We do not believe that GB will have access to the TERRE Algorithms.
5	Elexon will engage with Ofgem for guidance on the balance between a compliant and timely delivery of a complete solution	
6	The Workgroup will familiarise themselves with the regulations and highlight any areas of concern of discussion for the next Workgroup.	We have not received any points for discussion ahead of the meeting

Actions

#	Action	Update
7	Elexon to consider how benefits could be assessed for the P410 solution	The major benefit of P410 is compliance with the EBGL. It is not clear whether a VOAA based on available balancing actions better reflects the real time cost of energy.
8	Elexon to clarify costs associated with calculation and publication of the MIP	The P305 Modification Report noted that historically the cost of producing the MIP has been £330,000 per year.

REVIEW OF LEGAL QUESTIONS

Peter Frampton

ELEXON

P410 Legal Queries

After the last workgroup, there were a number of legal queries which we have discussed internally. These queries are material to the development of the P410 solution. These slides set out the queries, prevailing Elexon opinion, and the effect on the solution.

If the workgroup feels that some these questions would benefit from third-party legal advice Elexon can arrange for that to be provided.

Question: Can we use the actual Net Imbalance Volume (NIV) as a component in the VOAA calculation?

Answer: This should be OK. The regulation mentions only which prices may be used and is silent on volumes. Elexon participated in the regulation drafting, and believes the intent of the drafting was only to restrict which prices may contribute to the calculation of the VOAA, not volumes.
The all TSO explanatory document attached to the original draft regulation to ACER is also silent on the use of volumes, and describes using the average of cheapest available bids as an example and not a necessity.

Impact: The NIV can be used to select either a Bid price or an Offer price from the stack of available actions. This reduces the potential for a 'mid-point' calculation resulting in distortions to the imbalance price. It would also be possible to utilise the NIV to move up or down the stack of available Bids/Offers to select one which would represent a 'marginal' price if balancing energy had been activated. There would still need to be a calculation to account for the rare scenario where NIV=0, in which case the mid-point calculation may still be necessary.

P410 Legal Queries (Cont.)

Question: Can we use the Market Index Price MIP to 'train' an algorithm to pick Bid or Offer prices most likely to be near what the MIP would be in a given scenario?

Answer: This is probably not OK. The calculation would still substantively depend on the MIP, which is not allowed per the regulation. The only prices which can contribute to the calculation remain the available Bid/Offer prices.
The all TSO explanatory document attached to the original draft regulation to ACER explicitly discounts the use of intraday (and day ahead) market prices in the calculation of the VOAA. As the MIP is constructed from intraday market prices, the intent of the regulation is to preclude its use.

Impact: We cannot train a VOAA algorithm using the MIP, or utilise the MIP in any way in the calculation.

Question: Can the calculation volume-weight based on historic utilisation of products?

Answer: This is OK. The calculation would still only be using prices from RR/FRR Bids and Offers, but weighting based on volumes which do not appear to be prohibited (see previous answer).

Impact: We can include a volume-weighting based on historic utilisation in the calculation of the VOAA (i.e. if there is a derived price for product A (£pA) which is used for 80% of balancing energy needs and a derived price for product B (£pB) then VOAA = 0.8£pA + 0.2£pB)

P410 Legal Queries (Cont.)

Question: What is the extent of what could be covered by the word ‘available’ in the regulation text? Does it include taking into account constraints?
‘the bid price or bid prices, per direction, for balancing energy for frequency restoration process **available** *to this TSO for this ISP’*

Answer: A purposive approach suggests we can use this qualifier to remove Bids/Offers which would result in a distortion to the final price inasmuch as they could not be activated for energy balancing purposes.

Impact: We can remove Bid/Offer prices from the calculation if the unit providing them is behind a constraint, or if the activation of the Bid/Offer is not possible due to operating constraints of the unit (as determined by dynamic parameters and prevailing operating conditions)

Question: Can we apply a filter to Bids/Offers to remove ‘junk’ prices and avoid distortions

Answer: As with the response above, a purposive approach suggests we can remove Bids/Offers which would result in a distortion to the final price. This includes Bids/Offers which are present in the system, but which deem not to be ‘available’ by virtue of them not having been instructed by NGESO for some period of time prior to the settlement period in question.

Impact: We can remove Bid/Offer prices from the calculation if they have not been utilised by NGESO as balancing energy. This means we do not need to include ‘sleeper’ prices or prices from other units which are manifestly unusable by virtue of them not having been activated when that might otherwise have been expected. We believe that this can also be applied to BOAs from within the settlement period, which means we can work with the actions in the price stack for the settlement period in question.

DISCUSSION OF AREAS OF CONCERN IN ISH REGULATIONS

Discussion of Workgroup review of ISH Regulation

The Workgroup agreed to familiarise themselves with the Imbalance Settlement Harmonisation Regulation and highlight any areas for discussion that members did not believe the P410 solution to implement a VOAA would address.

We have not received any points for discussion ahead of the Workgroup meeting.

ANALYSIS OF VOAA CALCULATION OPTIONS

Angus Fairbairn

ELEXON

Data for Available Actions

Elexon reviewed the ISHP and determined using Bid-Offer Acceptance (BOA) Data meets compliance requirements.

BOA data contains the prices, volumes, tags and flags of Balancing Actions taken by the National Electricity Transmission System Operator (NETSO) in a Settlement Period. As these actions were taken during the Settlement Period they are deemed as being available to the NETSO and can be used in the VOAA.

As the BOAs have actually been used, they are more representative of the real price of balancing energy during a Settlement Period.

The BOAs are the starting point of the System Price calculation so calculating a VOAA more in line with System Prices and the MIP is simpler.

VOAA METHODOLOGY OPTIONS

VOAA Methodology Options from BOA data

I have analysed six possible Options for a VOAA using the period 1 May 2020 to 31 July 2020:

Option 1: A straight average of BOA prices during the Settlement Period.

Option 2: Using the midpoint of the cheapest accepted Bid and Offer during the Settlement Period.

Option 3: Using an average of the Bid stack if the System is Long and an average of the Offer stack if the System is Short.

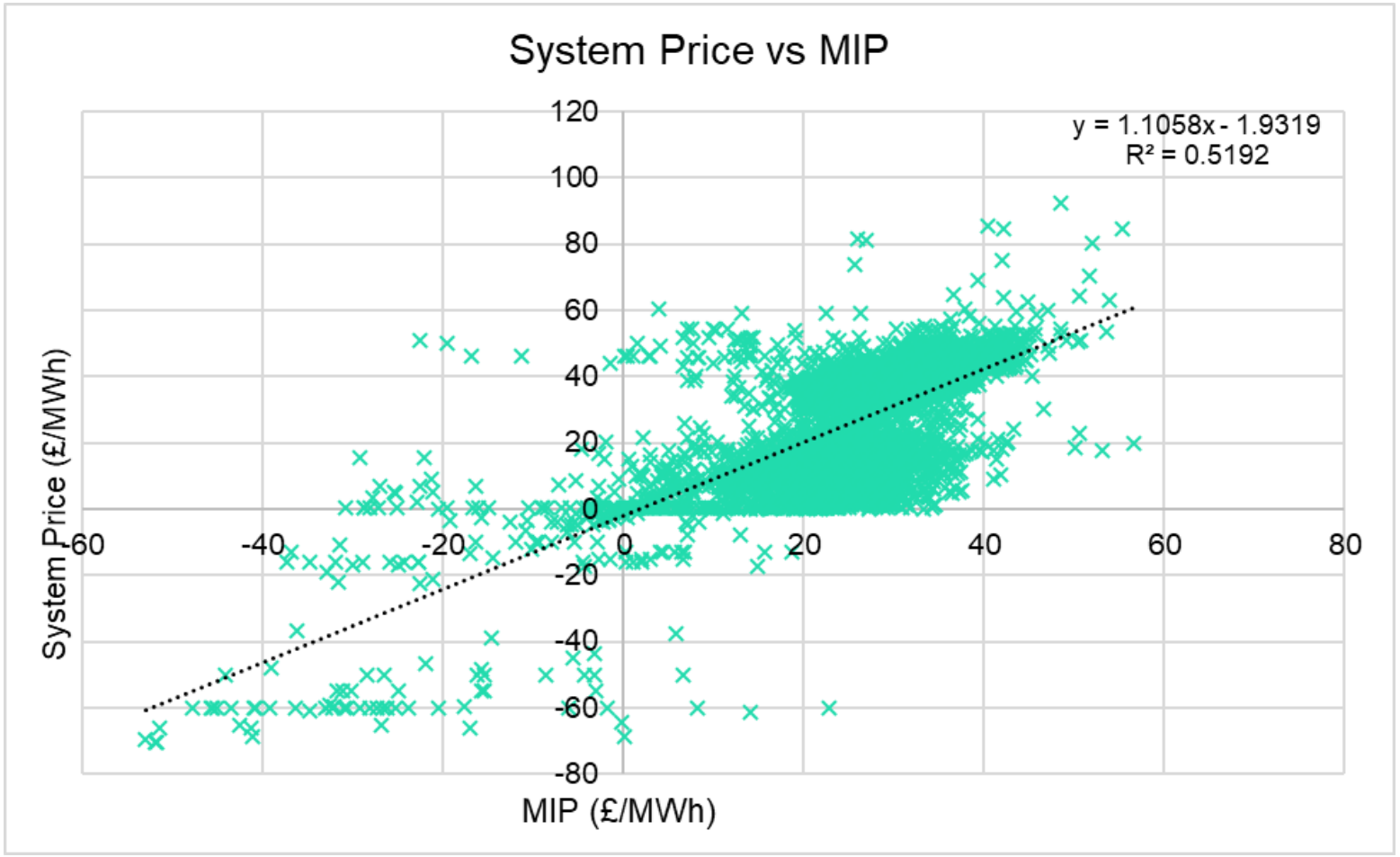
Option 4: Using the cheapest Bid in Long Settlement Periods and the cheapest Offer in Short Settlement Periods.

Option 5: Midpoint of Bid Volume Weighted Average Price (VWAP) and Offer VWAP.

Option 6: VWAP of Bids if the System is Long, VWAP of Offers if the System is Short.

System Prices vs MIP

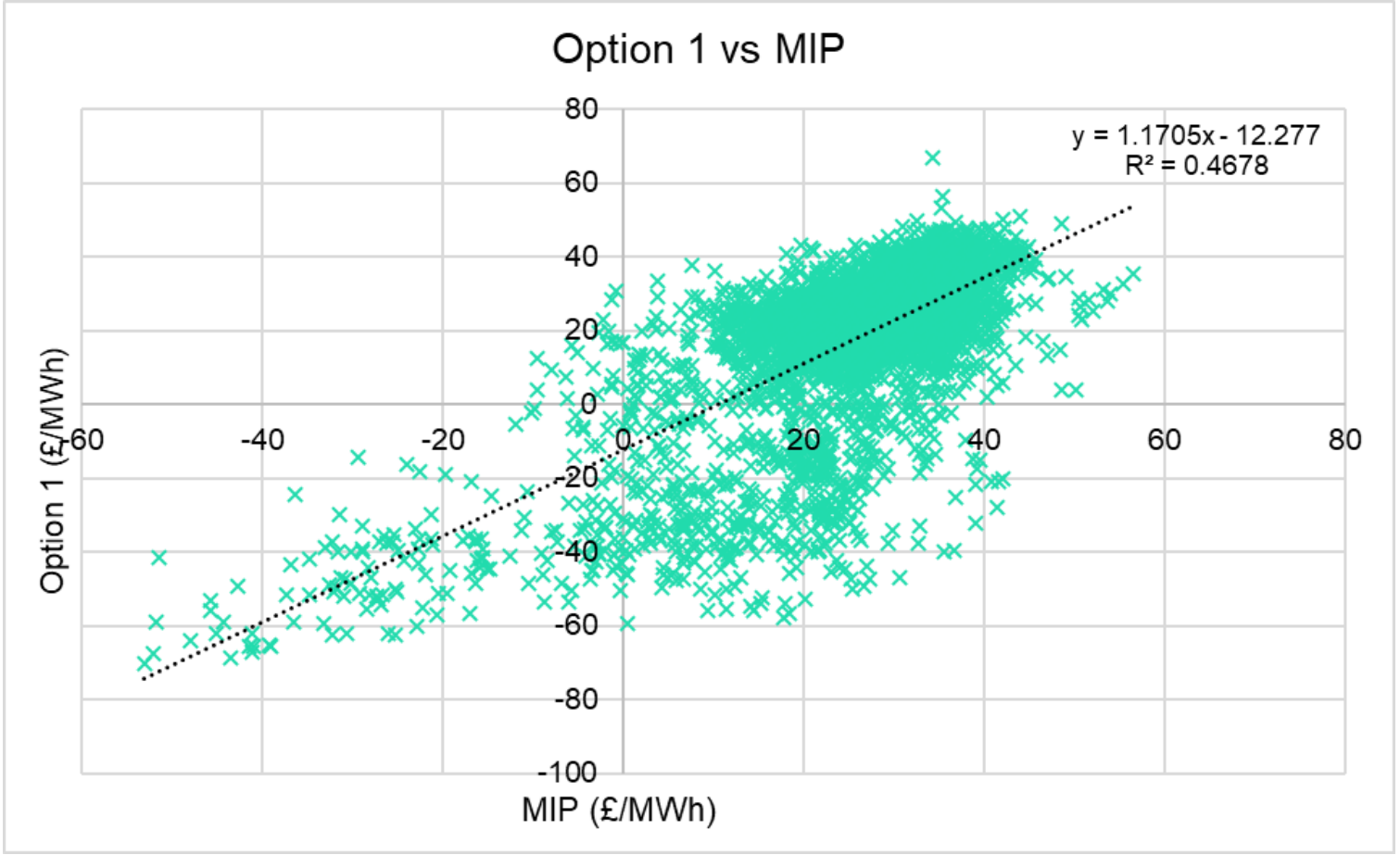
Comparator	Mean	Max	Min	St.Dev
System Price	25.85	92.14	-70.49	18.98
MIP	25.12	56.61	-53.02	12.37



VOAA Option 1

Option 1: A straight average with no volume weighting of BOA prices during the Settlement Period.

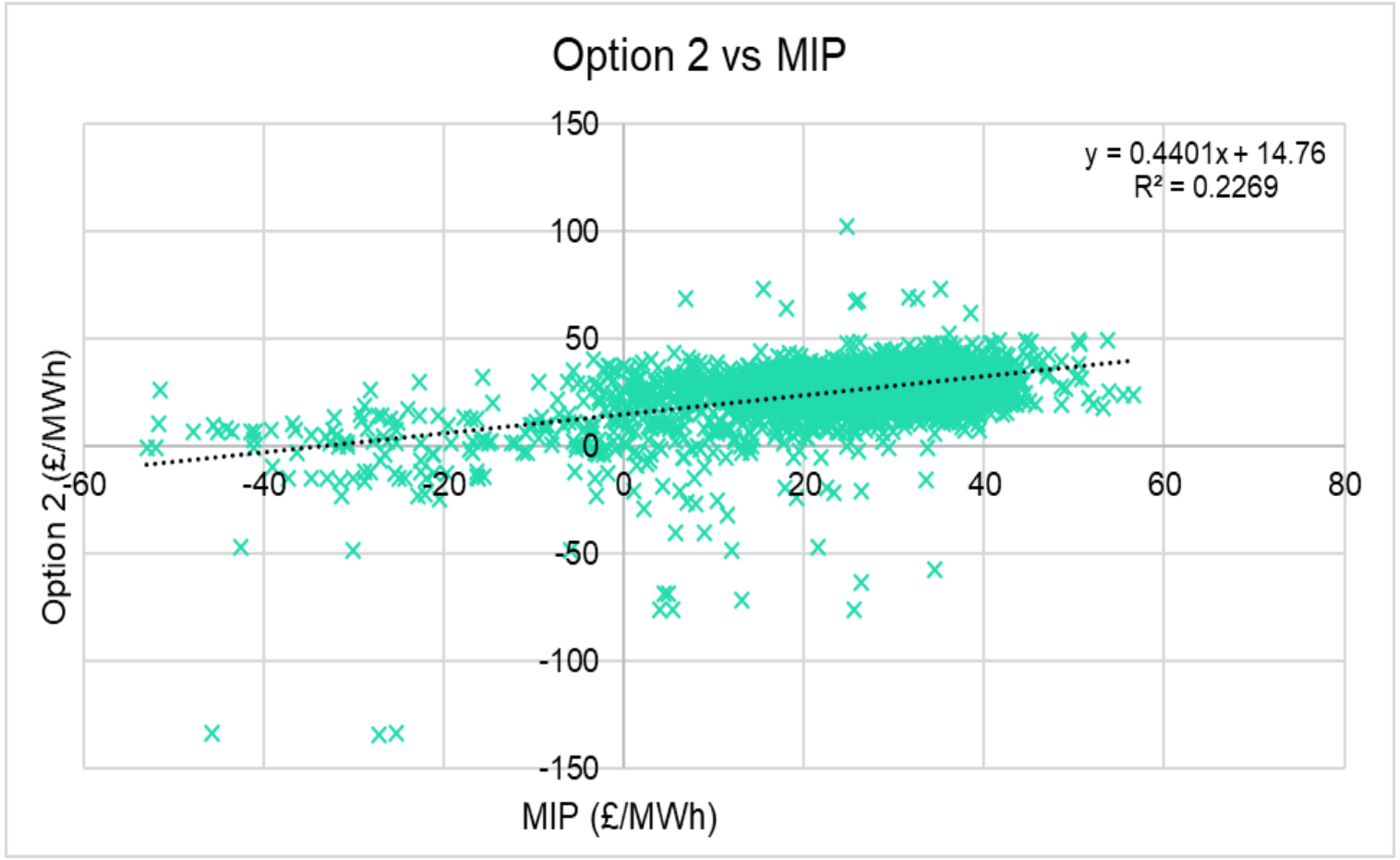
Option 1	Mean	Max	Min	St.Dev
System Price	25.85	92.14	-70.49	18.98
MIP	25.12	56.61	-53.02	12.37
Option 1 in All SPs	17.13	66.84	-70.08	21.17
Option 1 in MIP SPs	16.182	41.526	-49.96	21.691



VOAA Option 2

Option 2: Using the midpoint of the cheapest accepted Bid and Offer during the Settlement Period.

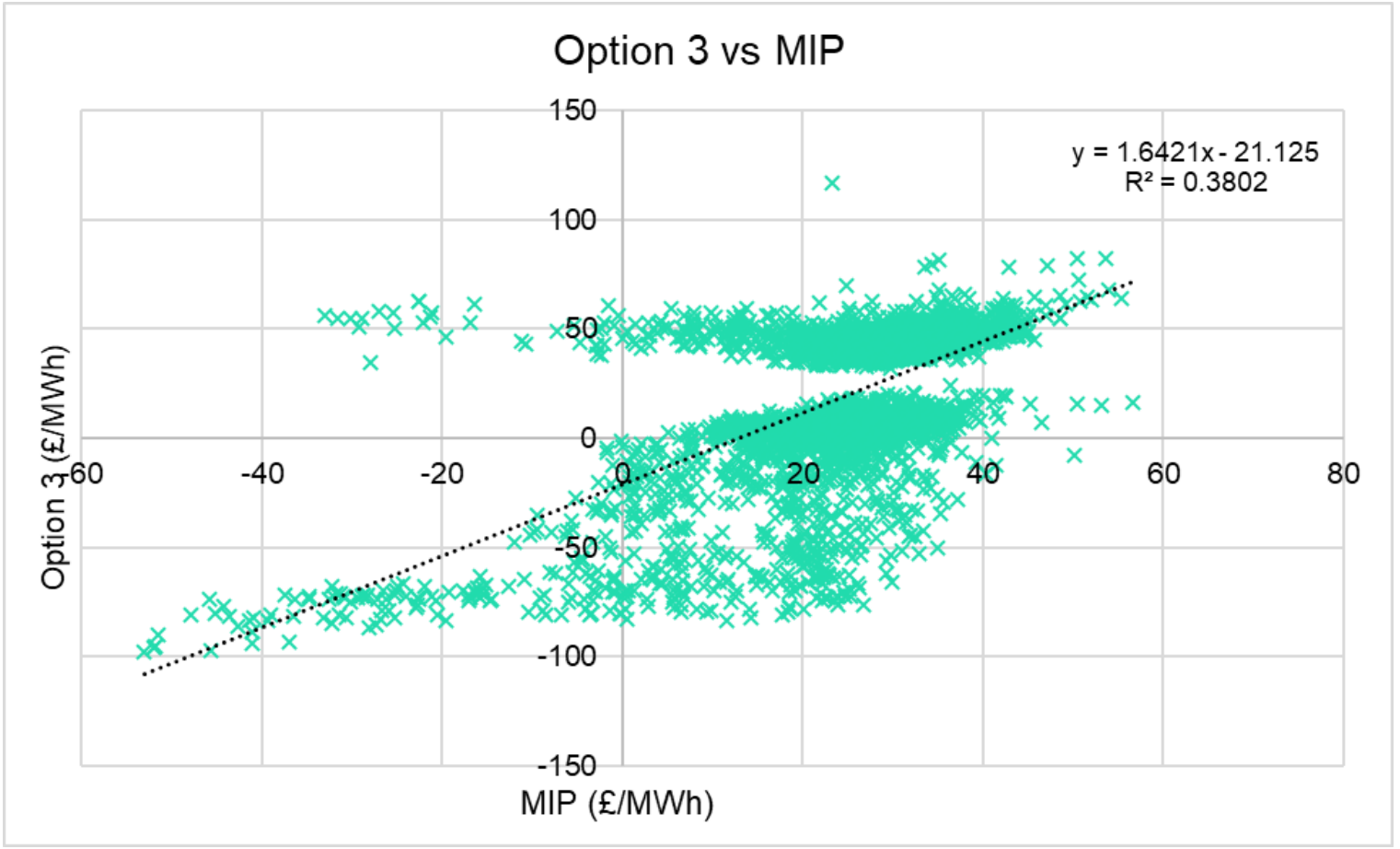
Option 2	Mean	Max	Min	St.Dev
System Price	26.07	92.14	-70.49	18.92
MIP	25.27	56.61	-53.02	12.26
Option 2 in All SPs	25.82	102.40	-134.24	11.43
Option 2 in MIP SPs	26.74	49.15	-5.50	8.47



VOAA Option 3

Option 3: Using an average of the Bid stack if the System is Long and an average of the Offer stack if the System is Short.

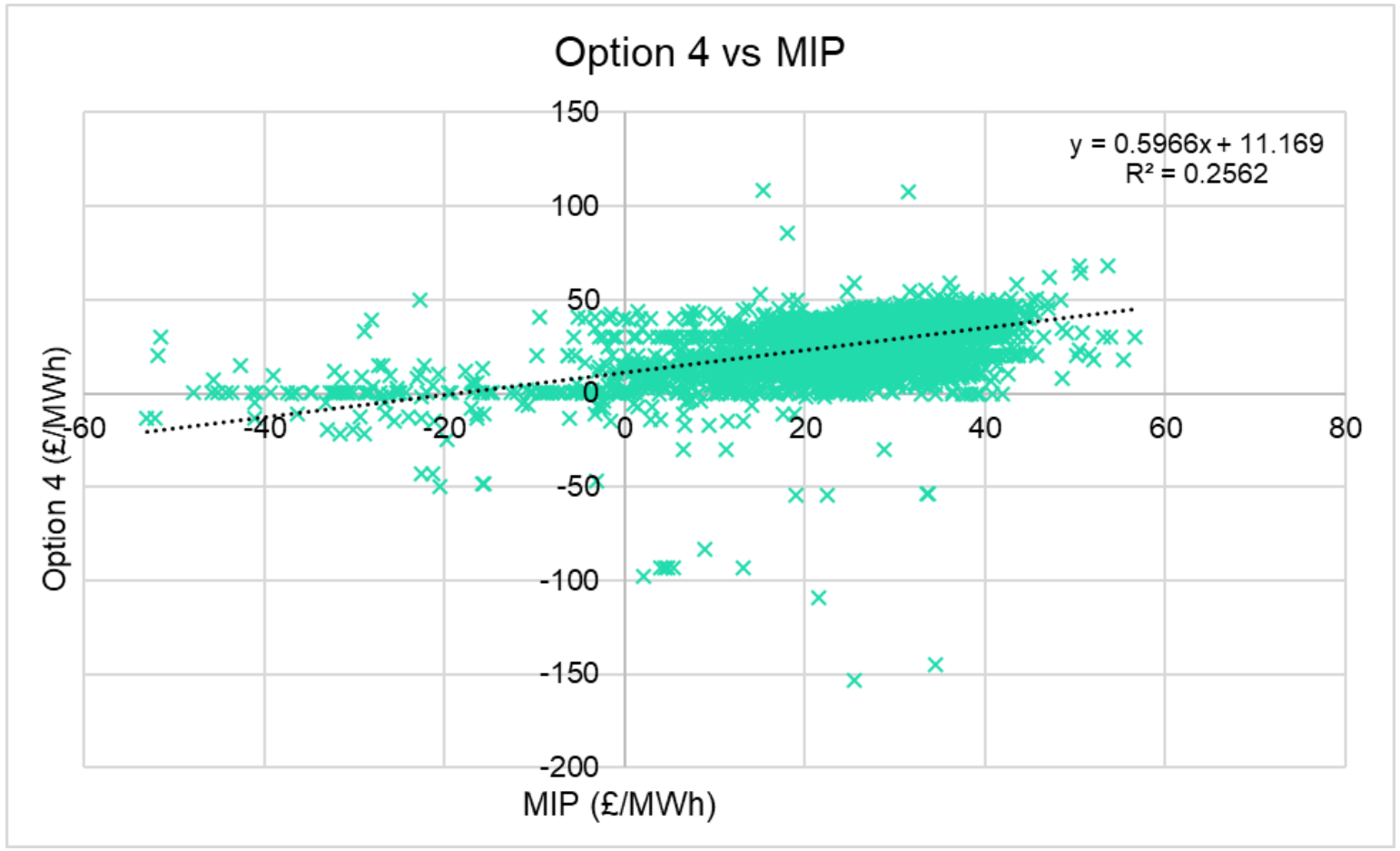
Option 3	Mean	Max	Min	St.Dev
System Price	26.07	92.14	-70.49	18.92
MIP	25.27	56.61	-53.02	12.26
Option 3 in All SPs	20.13	116.59	-97.94	32.94
Option 3 in MIP SPs	4.92	82.10	-79.06	37.54



VOAA Option 4

Option 4: Using the cheapest Bid in Long Settlement Periods and the cheapest Offer in Short Settlement Periods.

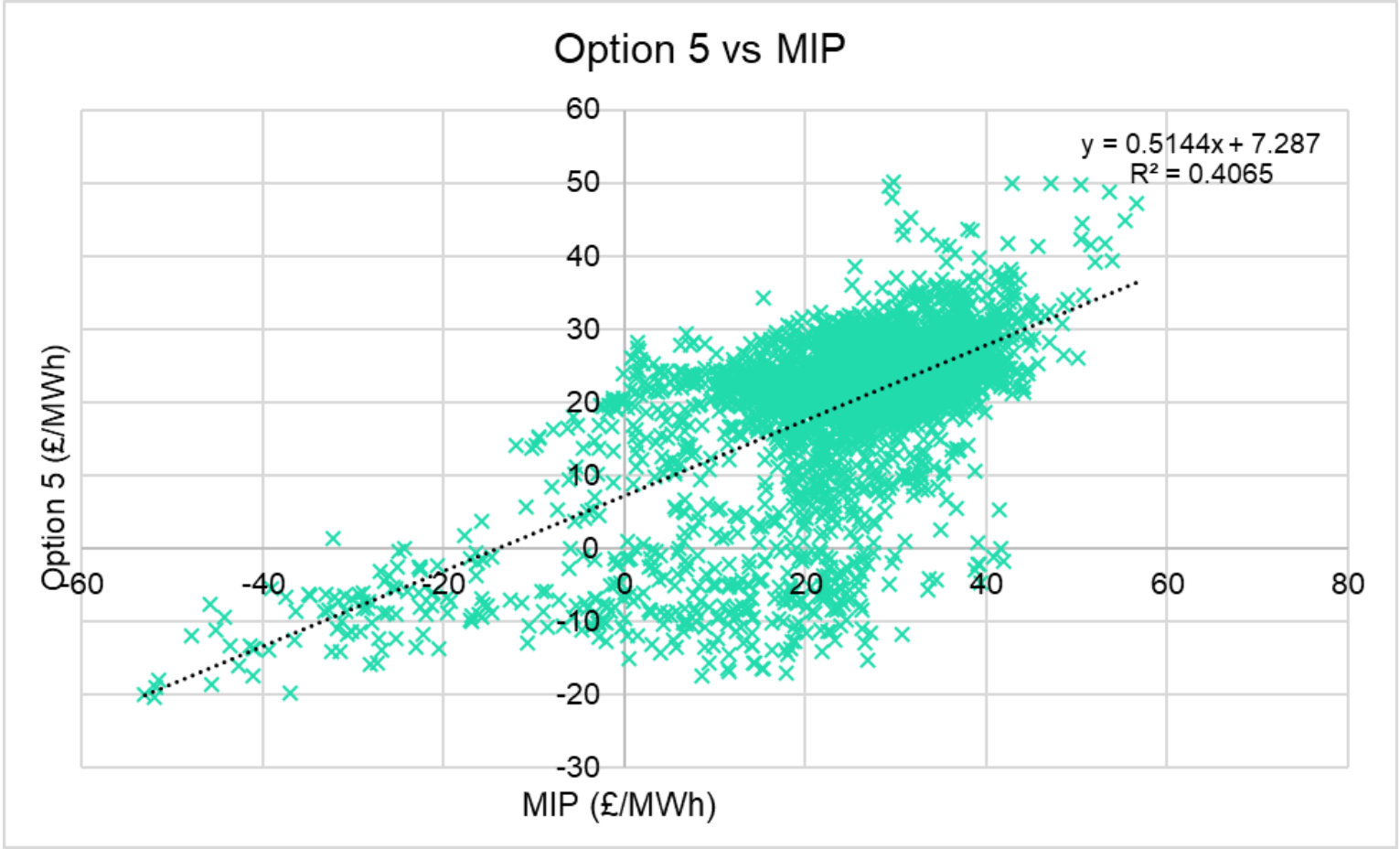
Option 4	Mean	Max	Min	St.Dev
System Price	26.07	92.14	-70.49	18.92
MIP	25.27	56.61	-53.02	12.26
Option 4 in All SPs	26.16	108.29	-153.17	14.58
Option 4 in MIP SPs	22.44	68.29	-43.19	16.09



VOAA Option 5

Option 5: Midpoint of Bid Volume Weighted Average Price (VWAP) and Offer VWAP.

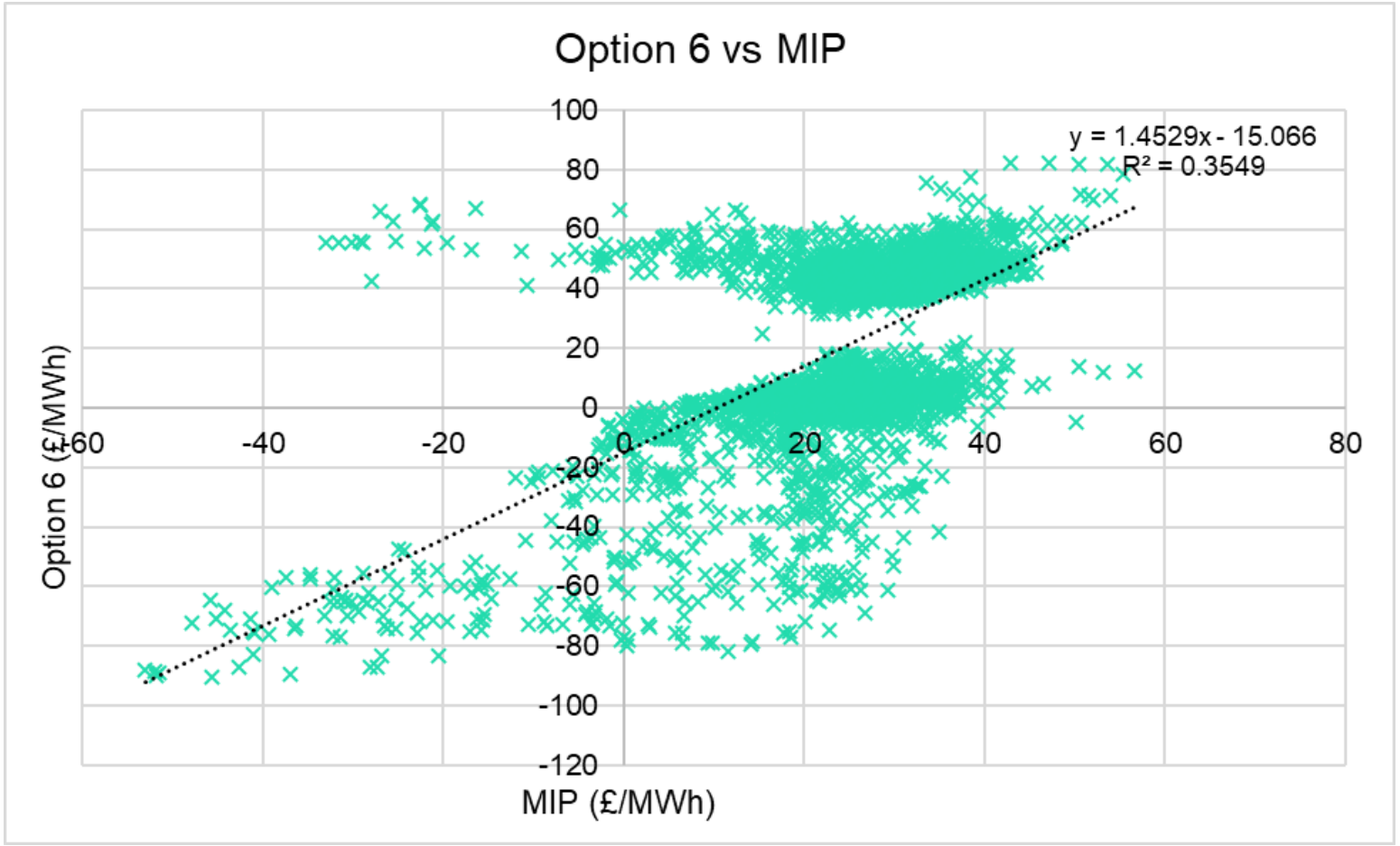
Option 5	Mean	Max	Min	St.Dev
System Price	26.07	92.14	-70.49	18.92
MIP	25.27	56.61	-53.02	12.26
Option 5 in All SPs	20.21	50.07	-20.38	9.98
Option 5 in MIP SPs	19.73	50.02	-13.31	12.44



VOAA Option 6

Option 6: VWAP of Bids if the System is Long, VWAP of Offers if the System is Short.

Option 6	Mean	Max	Min	St.Dev
System Price	26.07	92.14	-70.49	18.92
MIP	25.27	56.61	-53.02	12.26
Option 6 in All SPs	21.44	82.31	-90.21	30.17
Option 6 in MIP SPs	7.03	82.31	-79.04	33.55



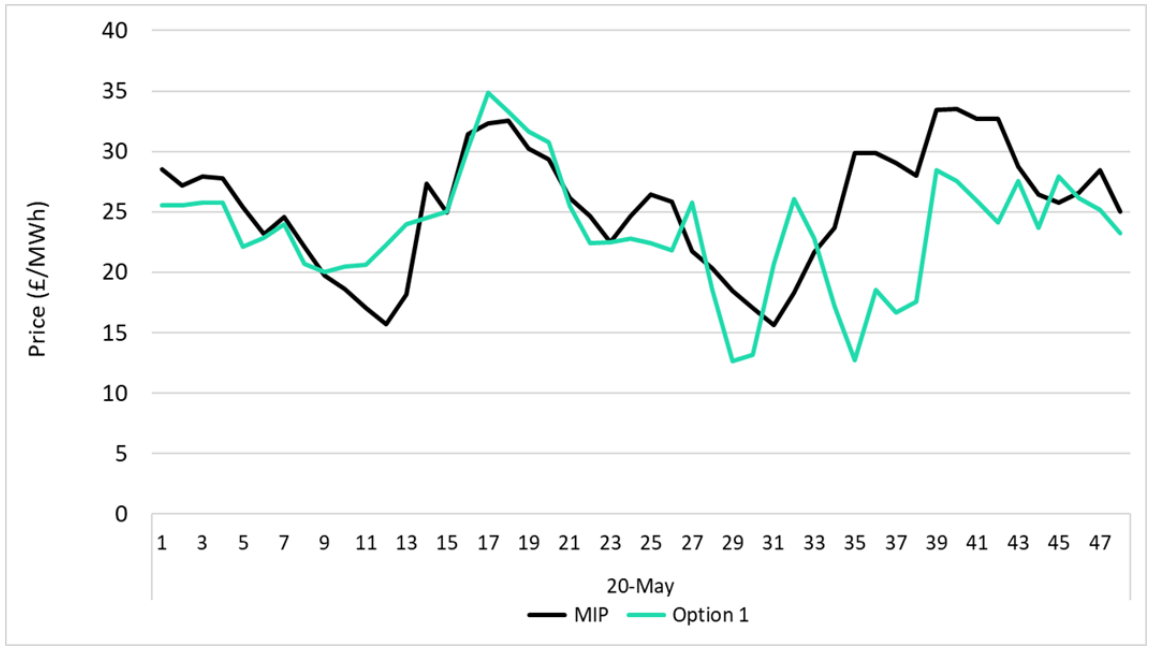
DAY PROFILE EXAMPLES

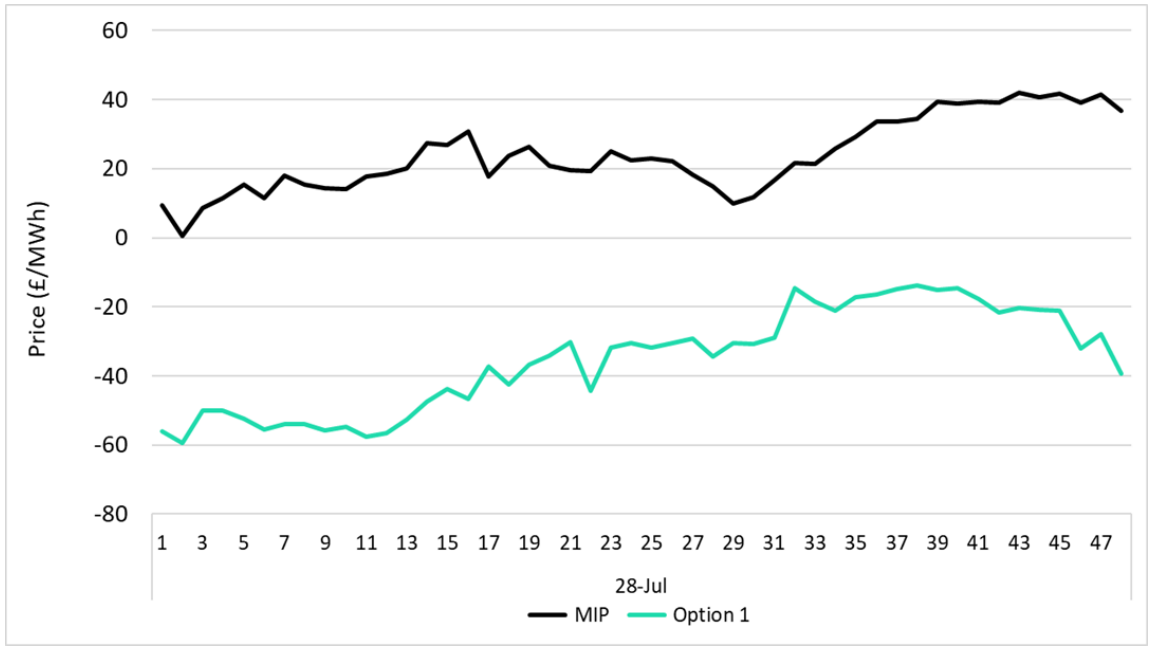
Day Examples

The summary figures and correlation give a good idea as to the consistency of the Options and how the overall shape can be compared.

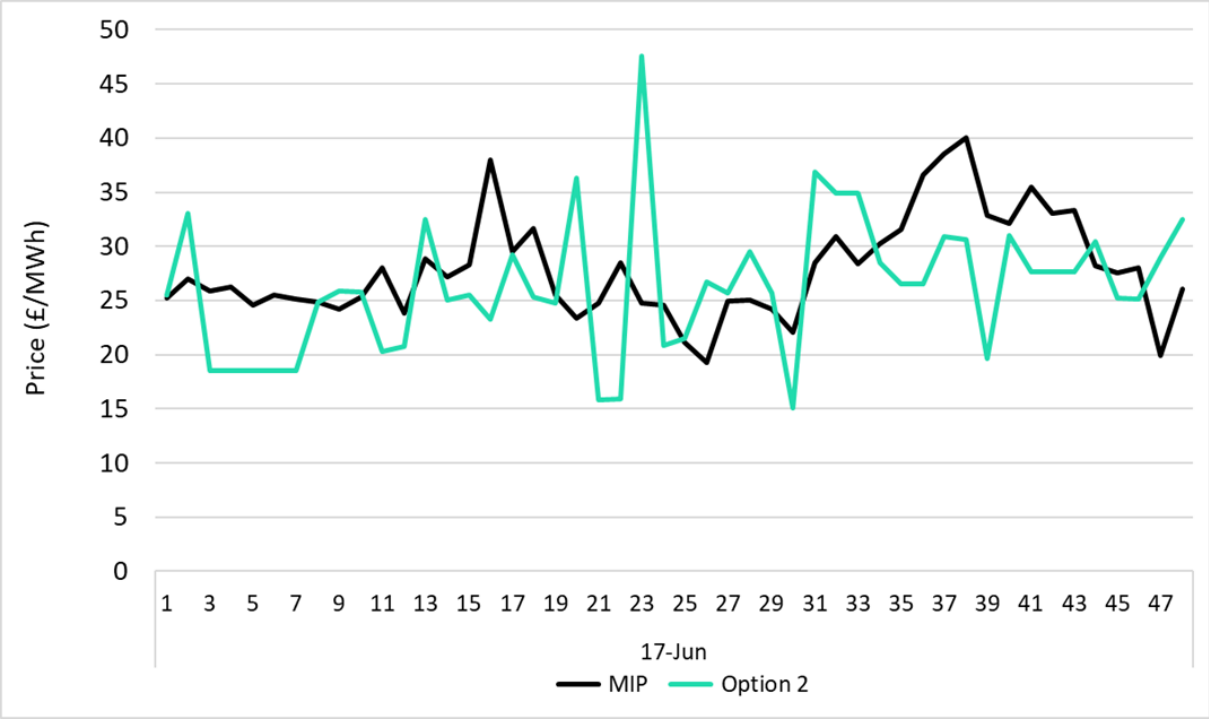
To inform decisions on a VOAA, it is also important to consider the daily profiles of the pricing.

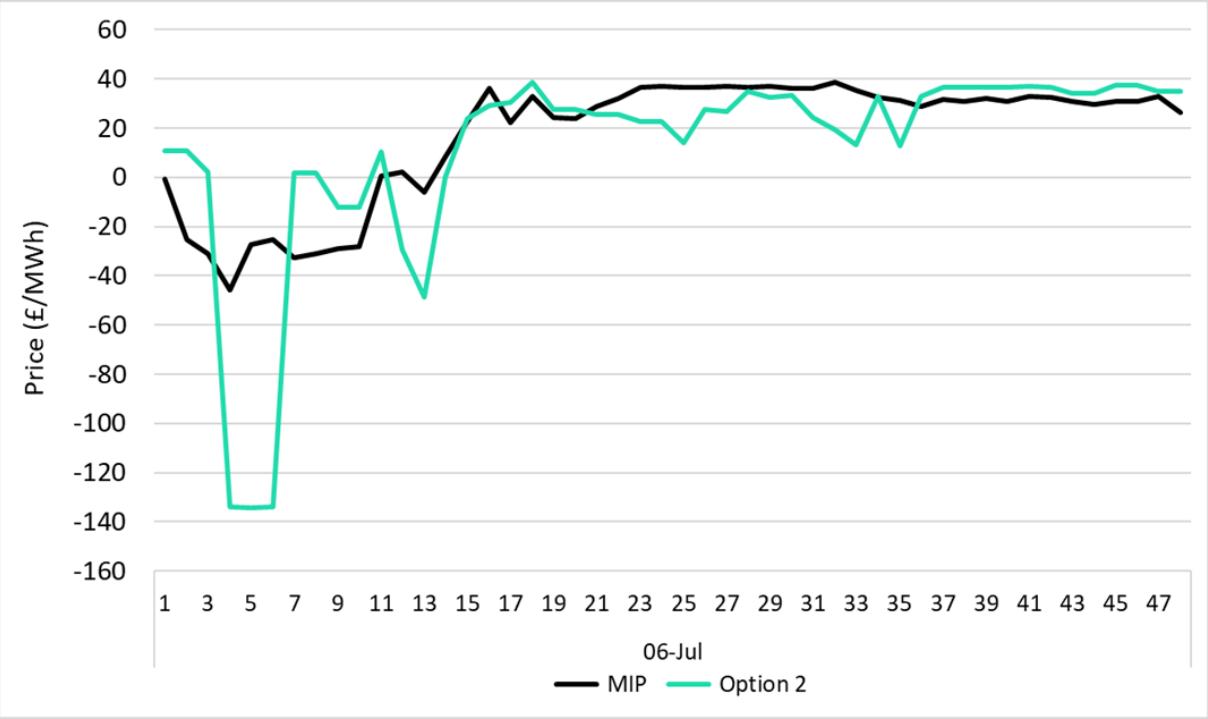
Option 1 Well Matched vs Day with Greatest Difference



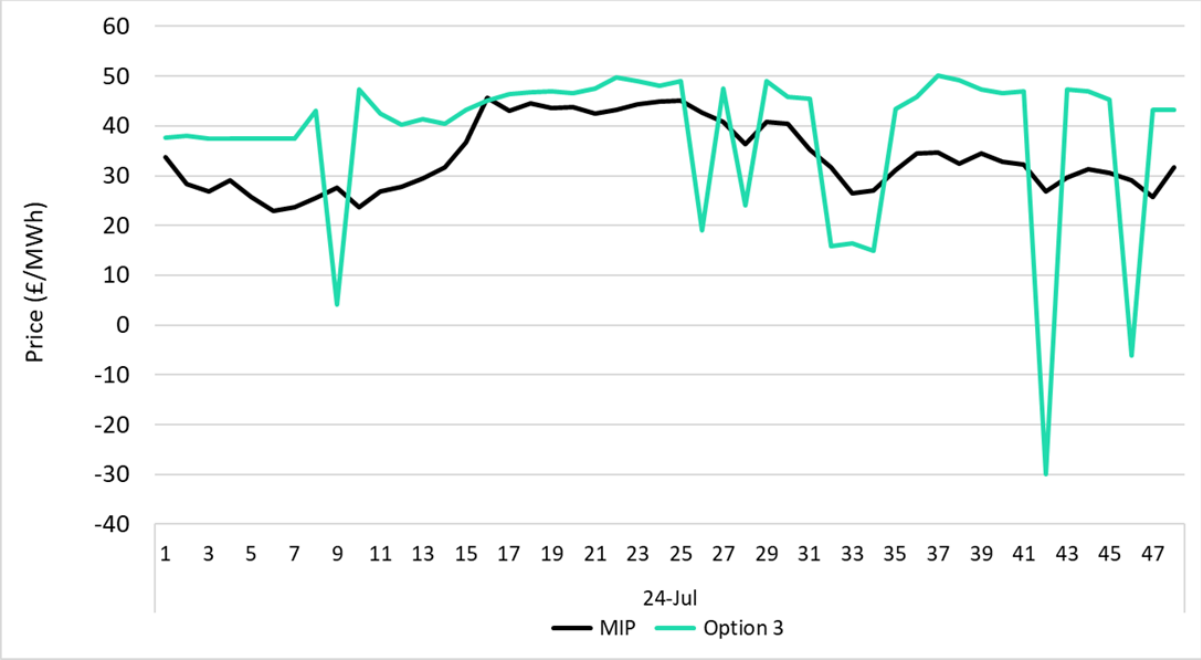


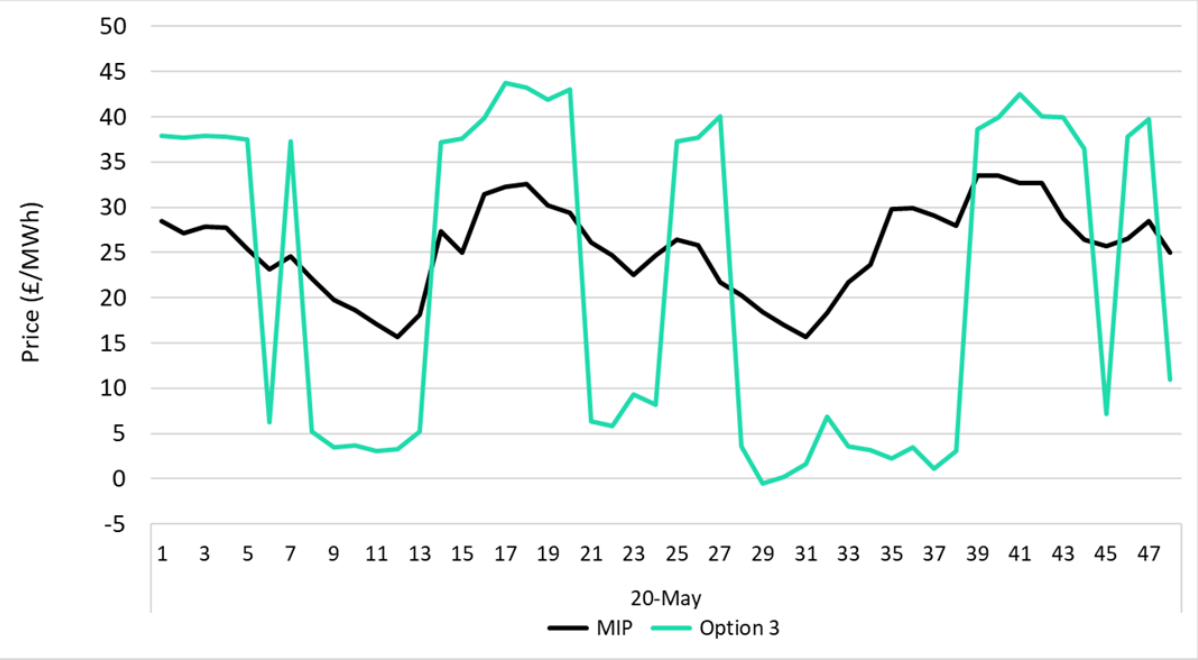
Option 2 Well Matched vs Day with Greatest Difference



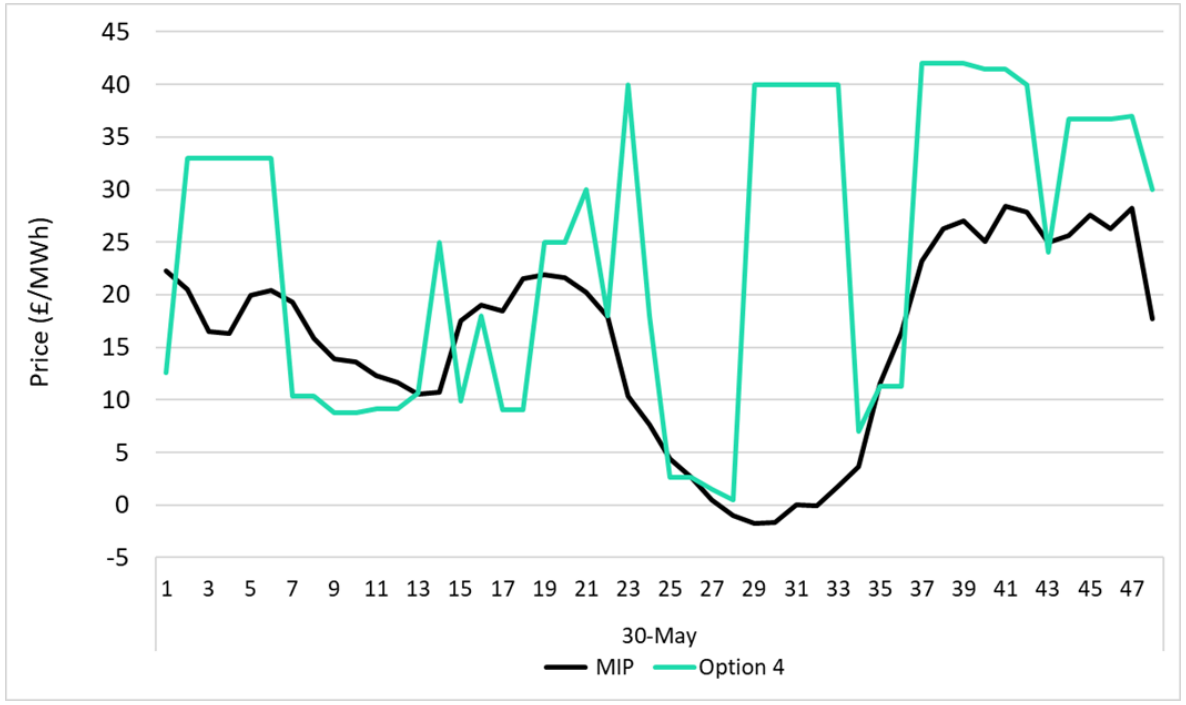


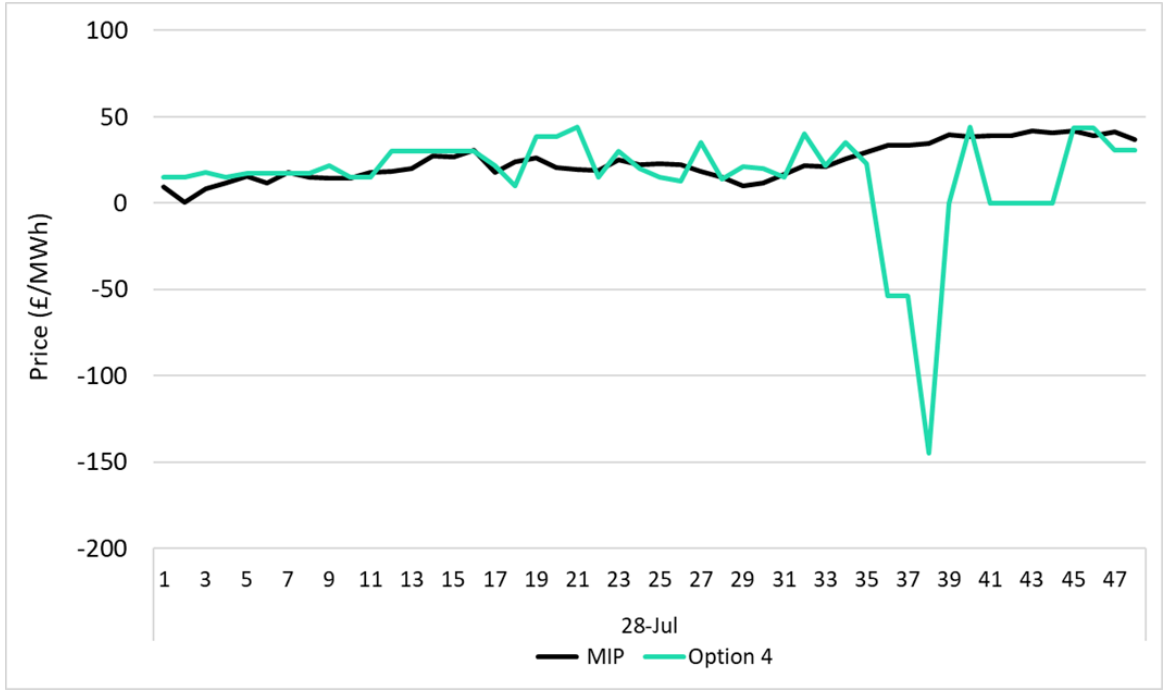
Option 3 Well Matched vs Day with Greatest Difference



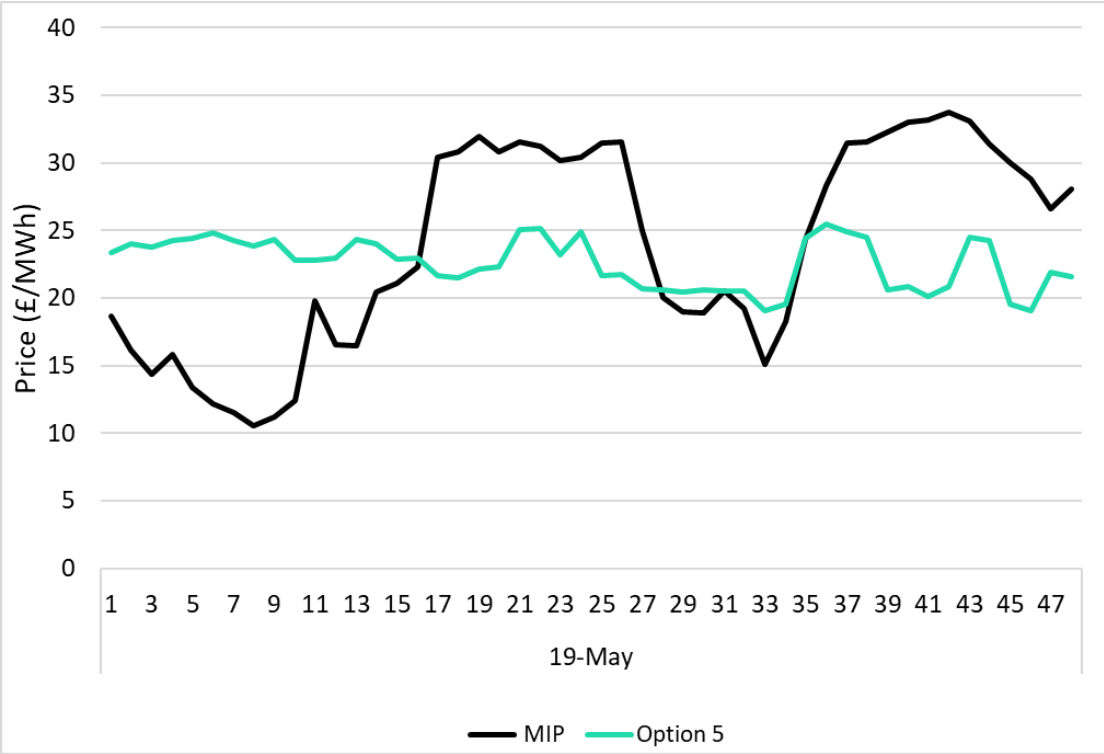


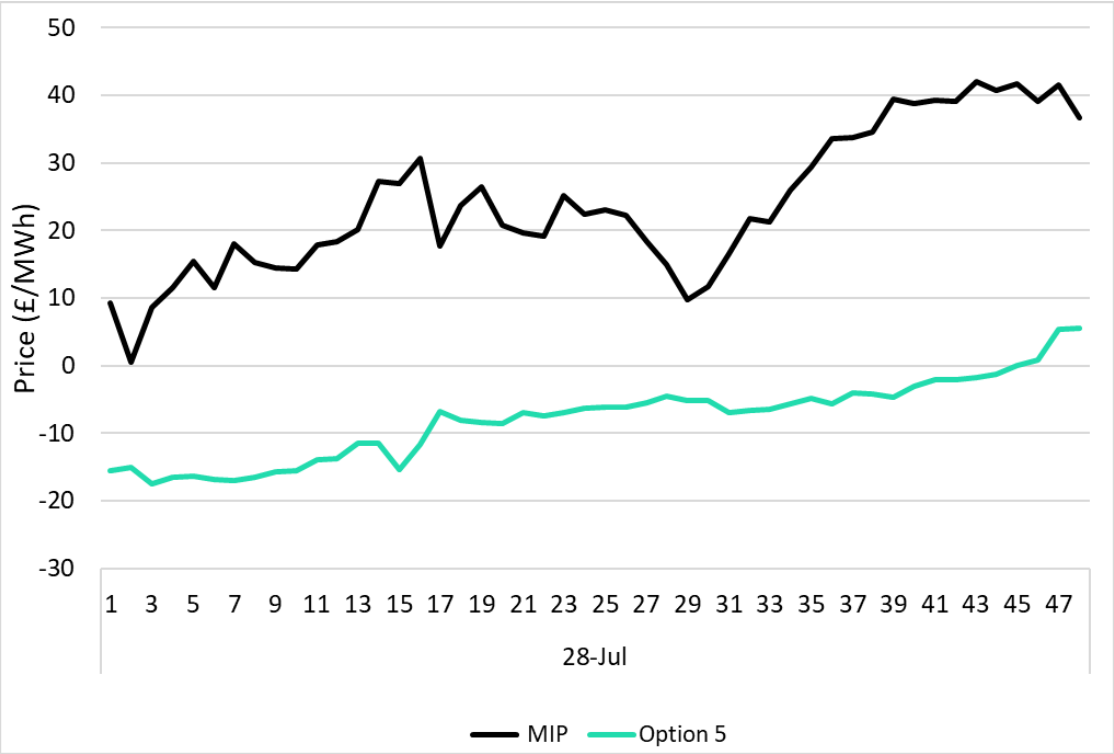
Option 4 Well Matched vs Day with Greatest Difference



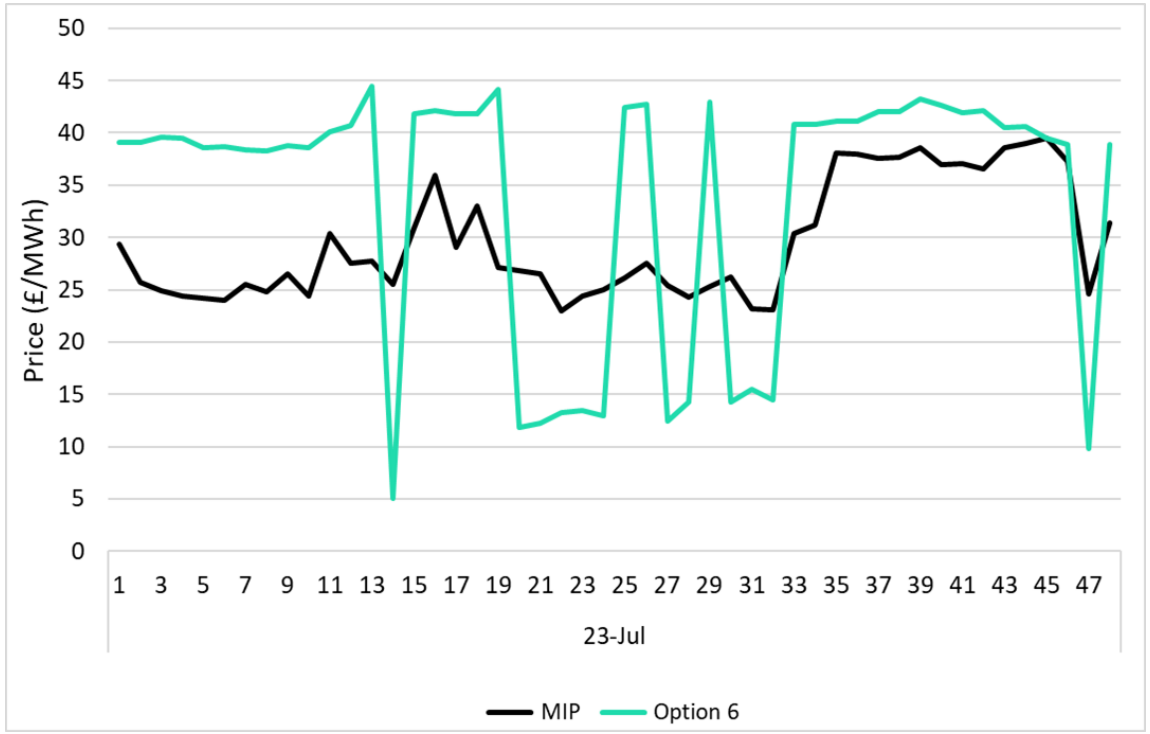


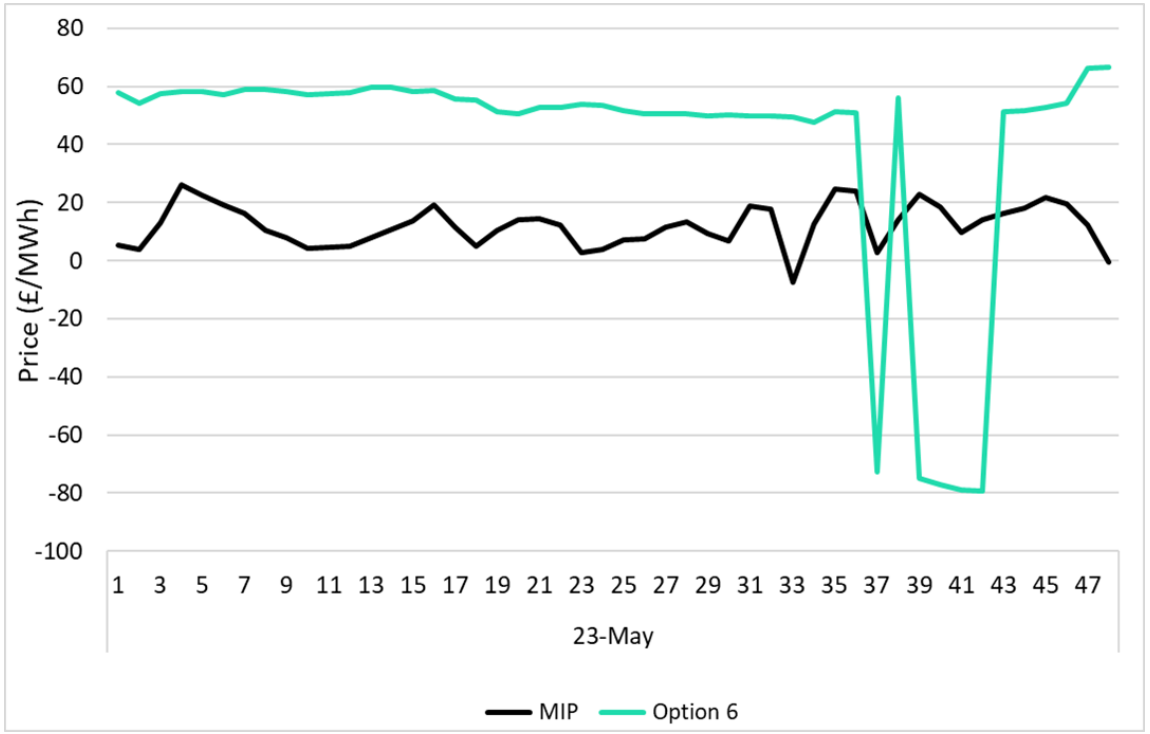
Option 5 Well Matched vs Day with Greatest Difference





Option 6 Well Matched vs Day with Greatest Difference





FURTHER FILTERING OPTION 1 & 2

Further Filtering

To minimise the deviation of the VOAA within Options 1 and 2, I looked at the Settlement Periods with the larges deviation to see if there were any common themes:

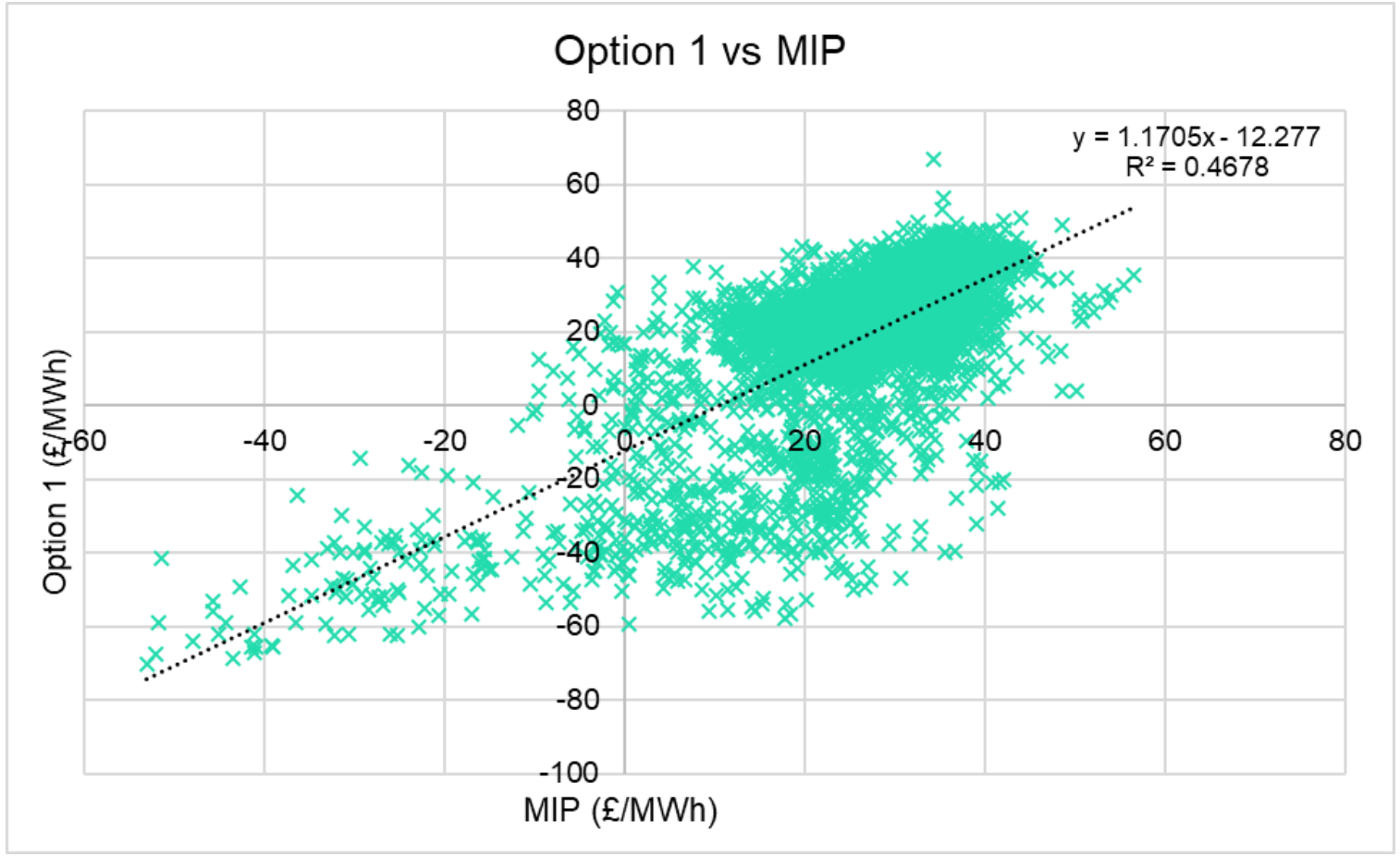
Three themes were present:

- The cheapest actions were usually Arbitrage tagged from the System Price calculation
- DMAT tagged actions often present in the cheapest actions

VOAA Option 1

Option 1: A straight average with no volume weighting of BOA prices during the Settlement Period.

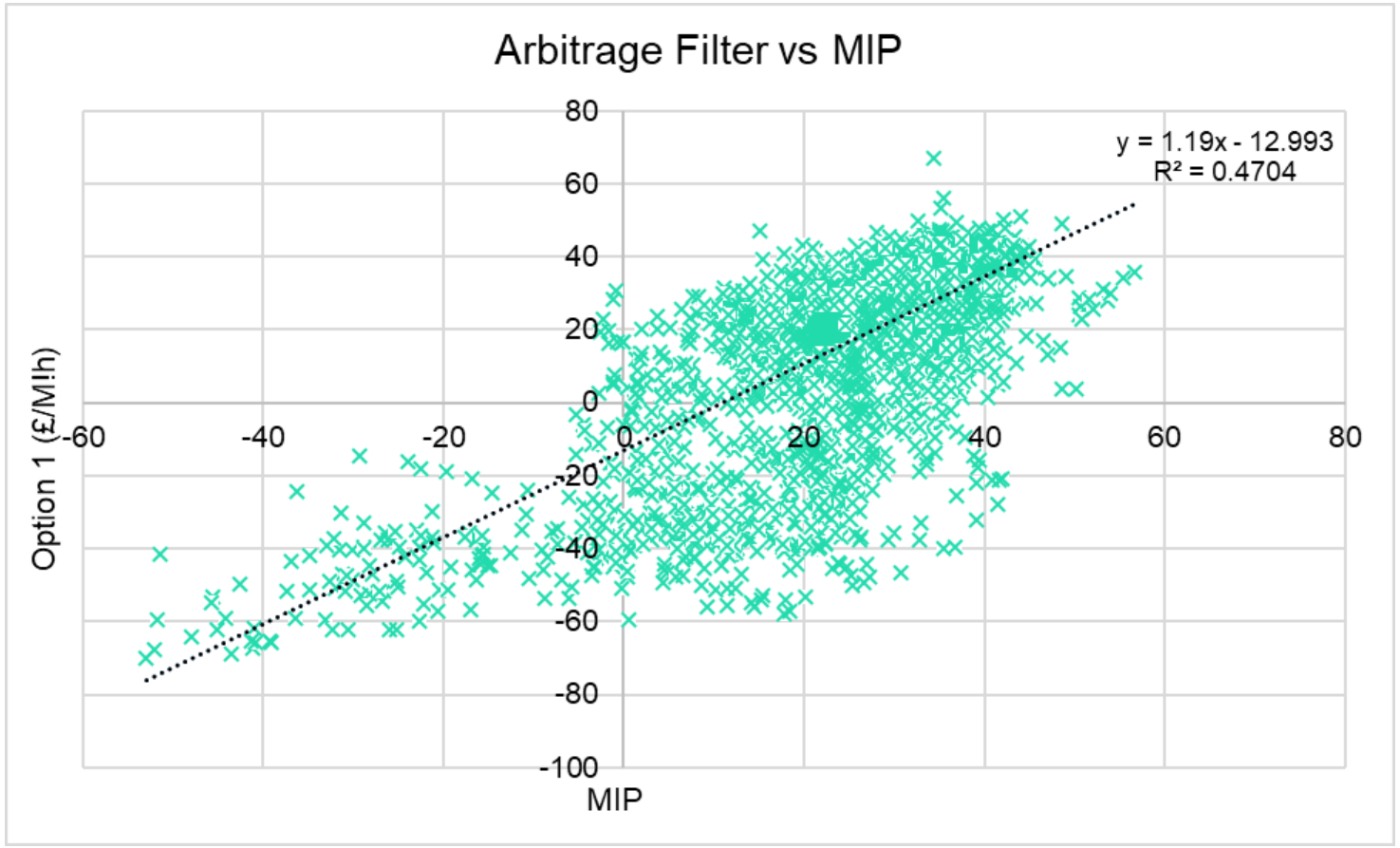
Option 1	Mean	Max	Min	St.Dev
System Price	25.85	92.14	-70.49	18.98
MIP	25.12	56.61	-53.02	12.37
Option 1 in All SPs	17.13	66.84	-70.08	21.17
Option 1 in MIP SPs	16.182	41.526	-49.96	21.691



VOAA Option 1 Arbitrage Filter

The Arbitrage filter removes any actions that are fully Arbitrage tagged in the System Price calculation

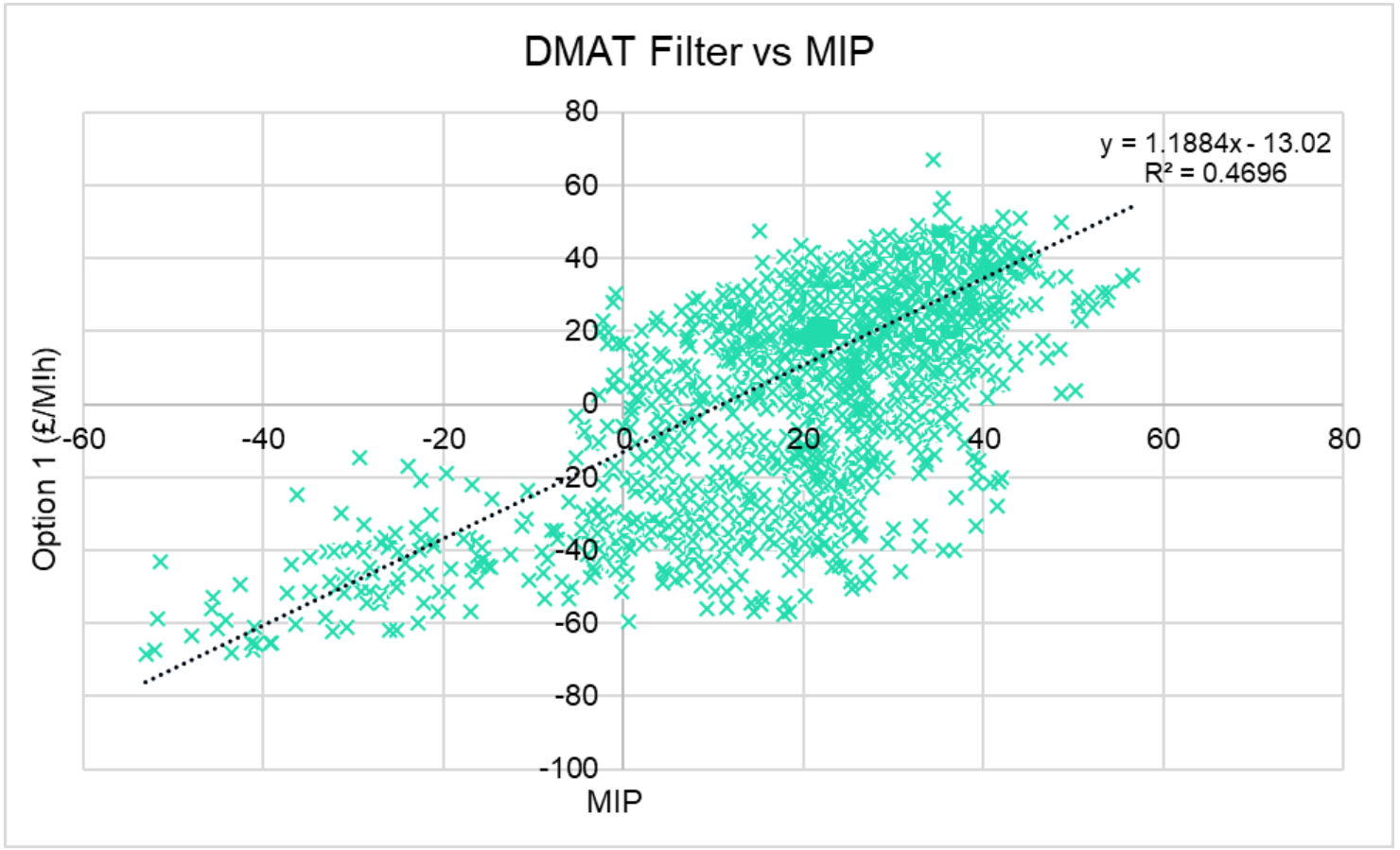
Option 1 Arbitrage	Mean	Max	Min	St.Dev
System Price	26.07	92.14	-70.49	18.92
MIP	25.27	56.61	-53.02	12.26
Arbitrage Filter	17.08	66.84	-70.077	21.266
Arbitrage Filter compared to MIP	-8.19	32.48	-77.483	15.651
Arbitrage Filter compared to System Price	-8.99	45.61	-97.90	19.76



VOAA Option 1 DMAT Filter

The DMAT filter removes any actions that are fully DMAT tagged in the System Price calculation

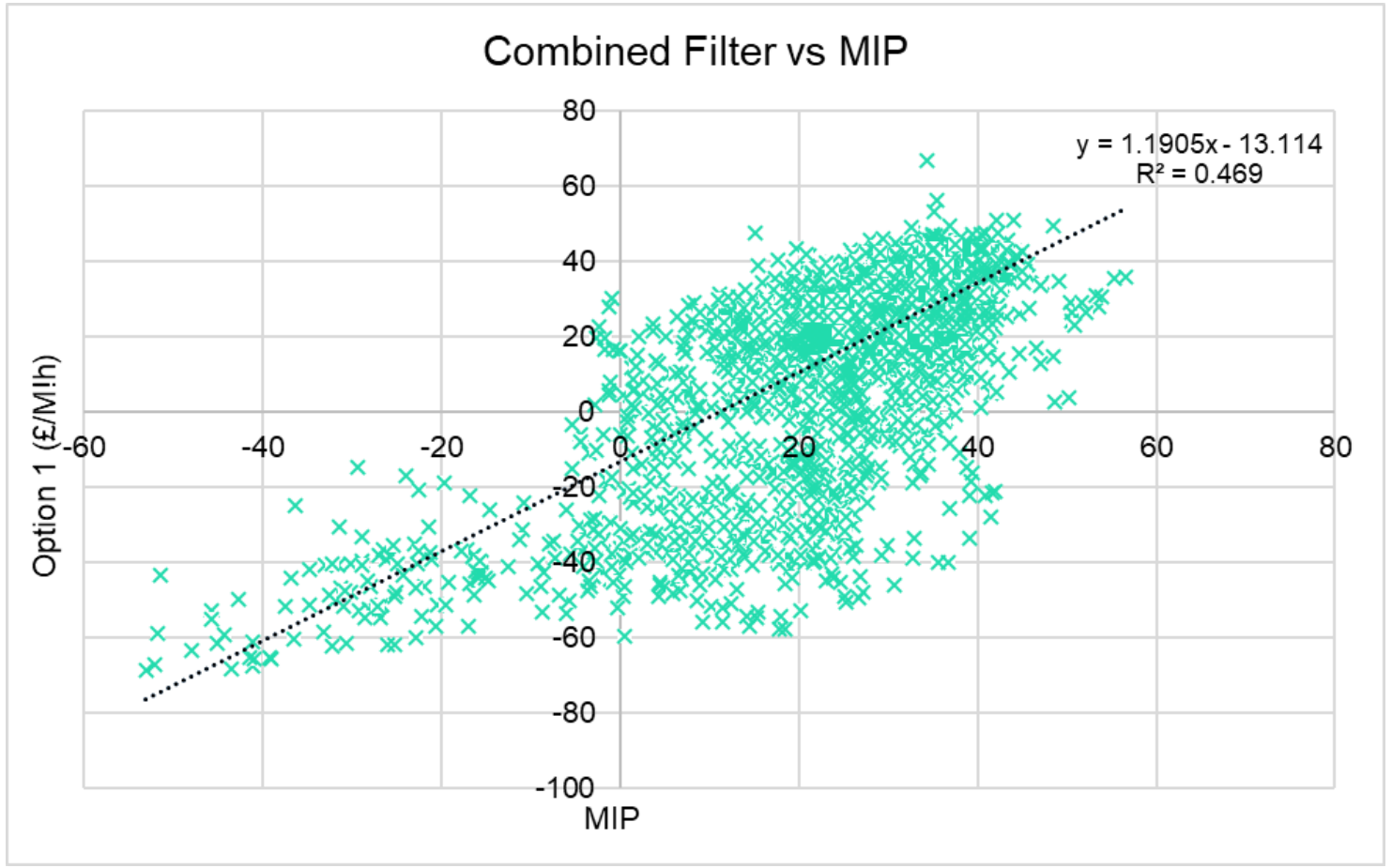
Option 1 DMAT	Mean	Max	Min	St.Dev
System Price	26.07	92.14	-70.49	18.92
MIP	25.27	56.61	-53.02	12.26
DMAT Filter	17.01	66.84	-68.48	21.25
DMAT Filter compared to MIP	-8.26	32.48	-76.74	15.65
DMAT Filter compared to System Price	-9.06	45.52	-98.15	19.72



VOAA Option 1 Combined Filter

The Combined filter removes any actions that are fully DMAT or Arbitrage tagged in the System Price calculation

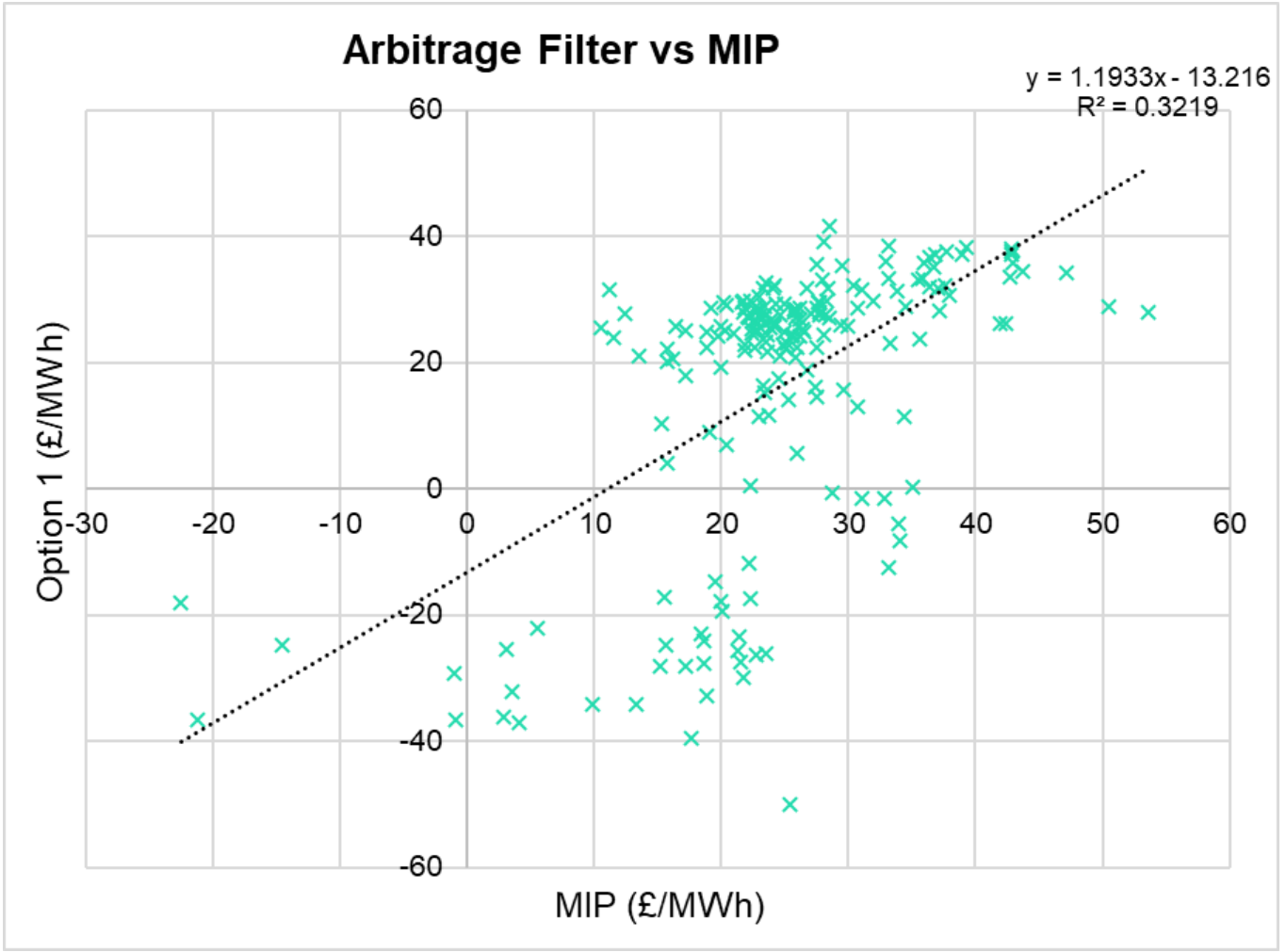
Option 1 Combined	Mean	Max	Min	St.Dev
System Price	26.07	92.14	-70.49	18.92
MIP	25.27	56.61	-53.02	12.26
Combined Filter	16.97	66.84	-68.48	21.31
Combined Filter compared to MIP	-8.30	32.48	-76.74	15.70
Combined Filter compared to System Price	-9.10	45.52	-98.15	19.77



VOAA Option 1 Arbitrage Filter (MIP SPs)

The Arbitrage filter removes any actions that are fully Arbitrage tagged in the System Price calculation

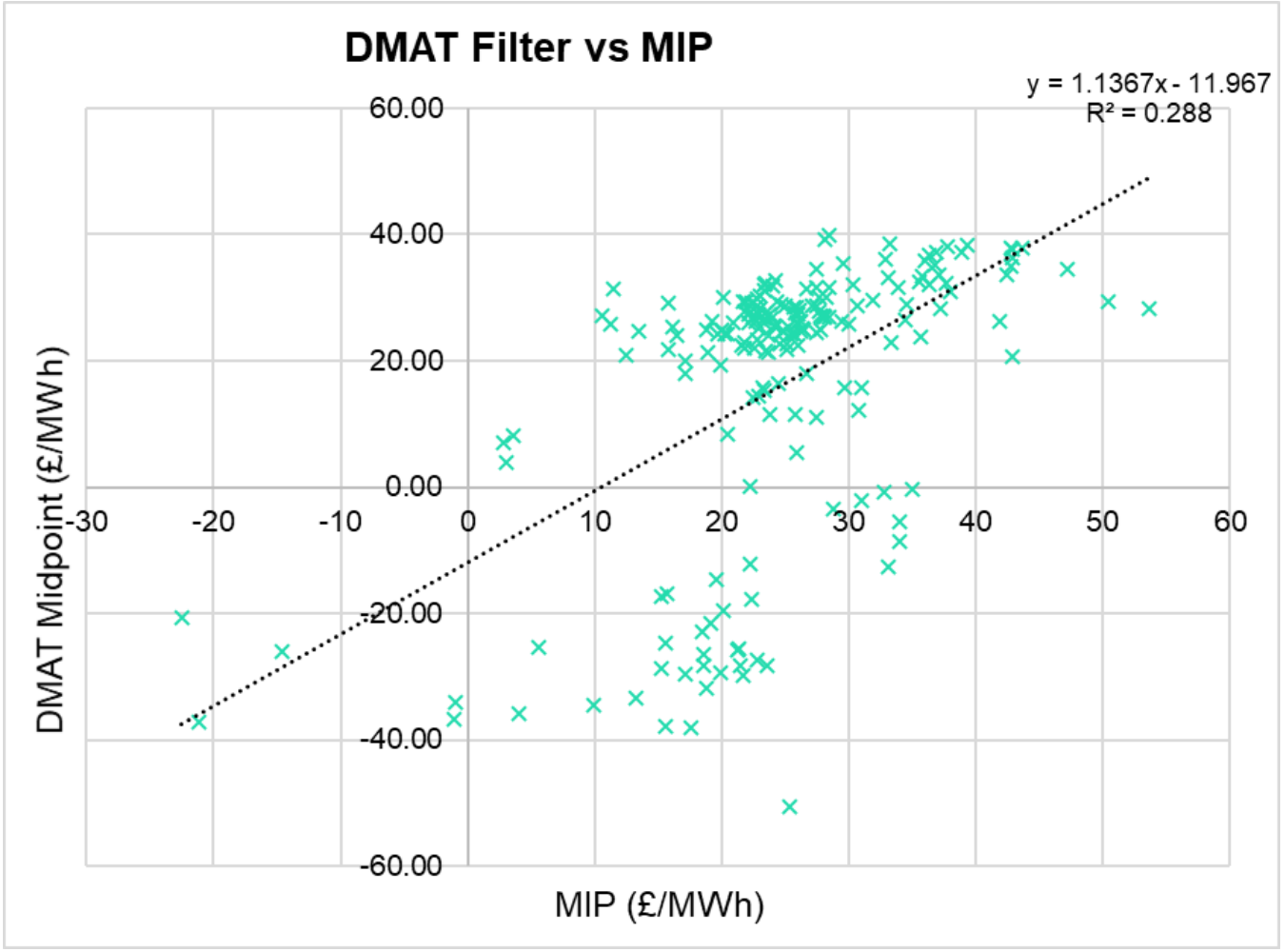
Option 1 Arbitrage	Mean	Max	Min	St.Dev
System Price	24.60	53.62	-22.54	10.35
MIP	24.60	53.62	-22.54	10.35
Arbitrage Filter	16.14	41.53	-49.96	21.78
Arbitrage Filter compared to MIP/System Price	-8.46	20.21	-75.33	18.05



VOAA Option 1 DMAT Filter (MIP SPs)

The DMAT filter removes any actions that are fully DMAT tagged in the System Price calculation

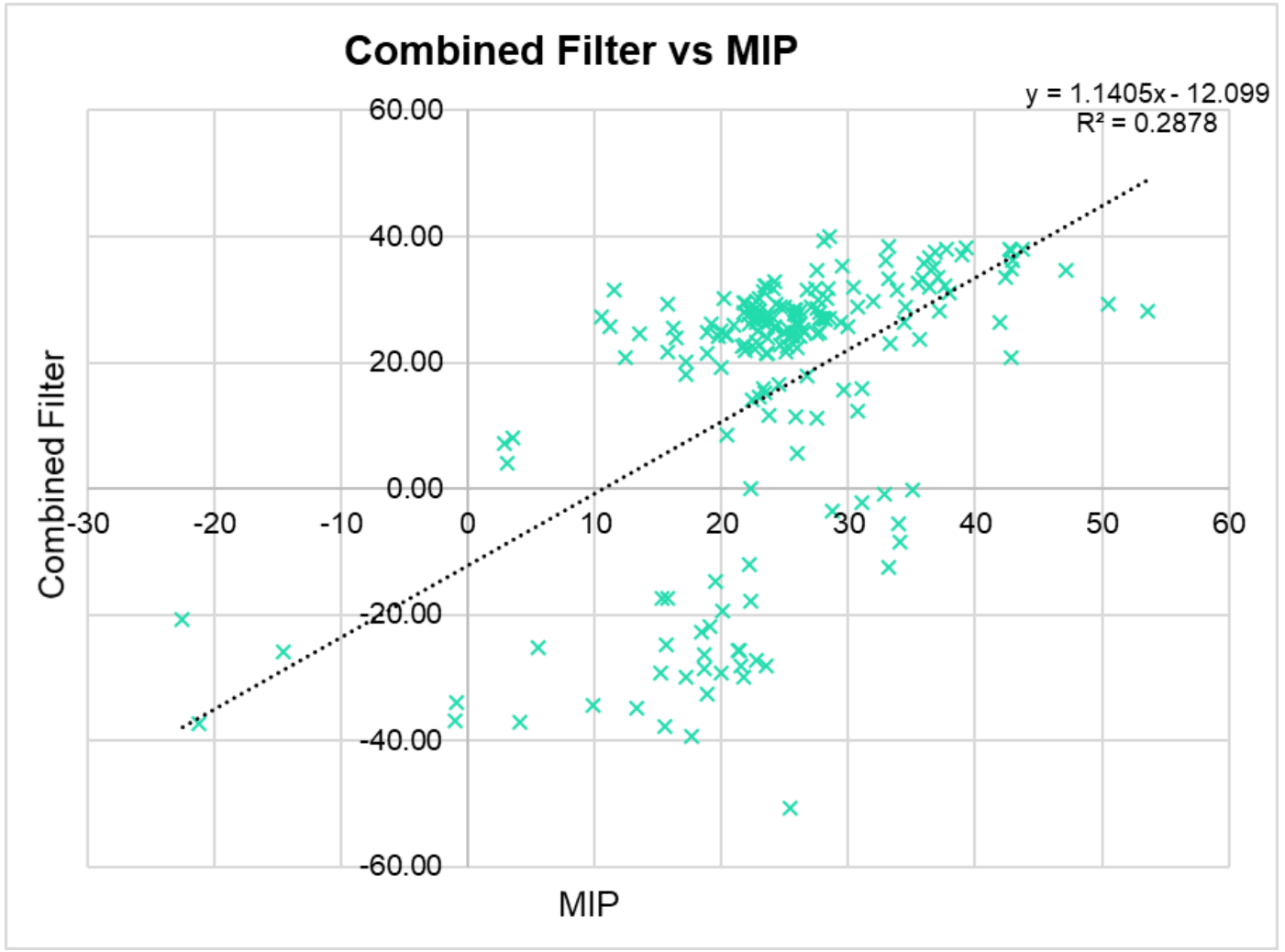
Option 1 DMAT	Mean	Max	Min	St.Dev
System Price	24.60	53.62	-22.54	10.35
MIP	24.60	53.62	-22.54	10.35
DMAT Filter	16.00	39.97	-50.62	21.93
DMAT Filter compared to MIP/System Price	-8.60	19.92	-75.99	18.56



VOAA Option 1 Combined Filter (MIP SPs)

The Combined filter removes any actions that are fully DMAT or Arbitrage tagged in the System Price calculation

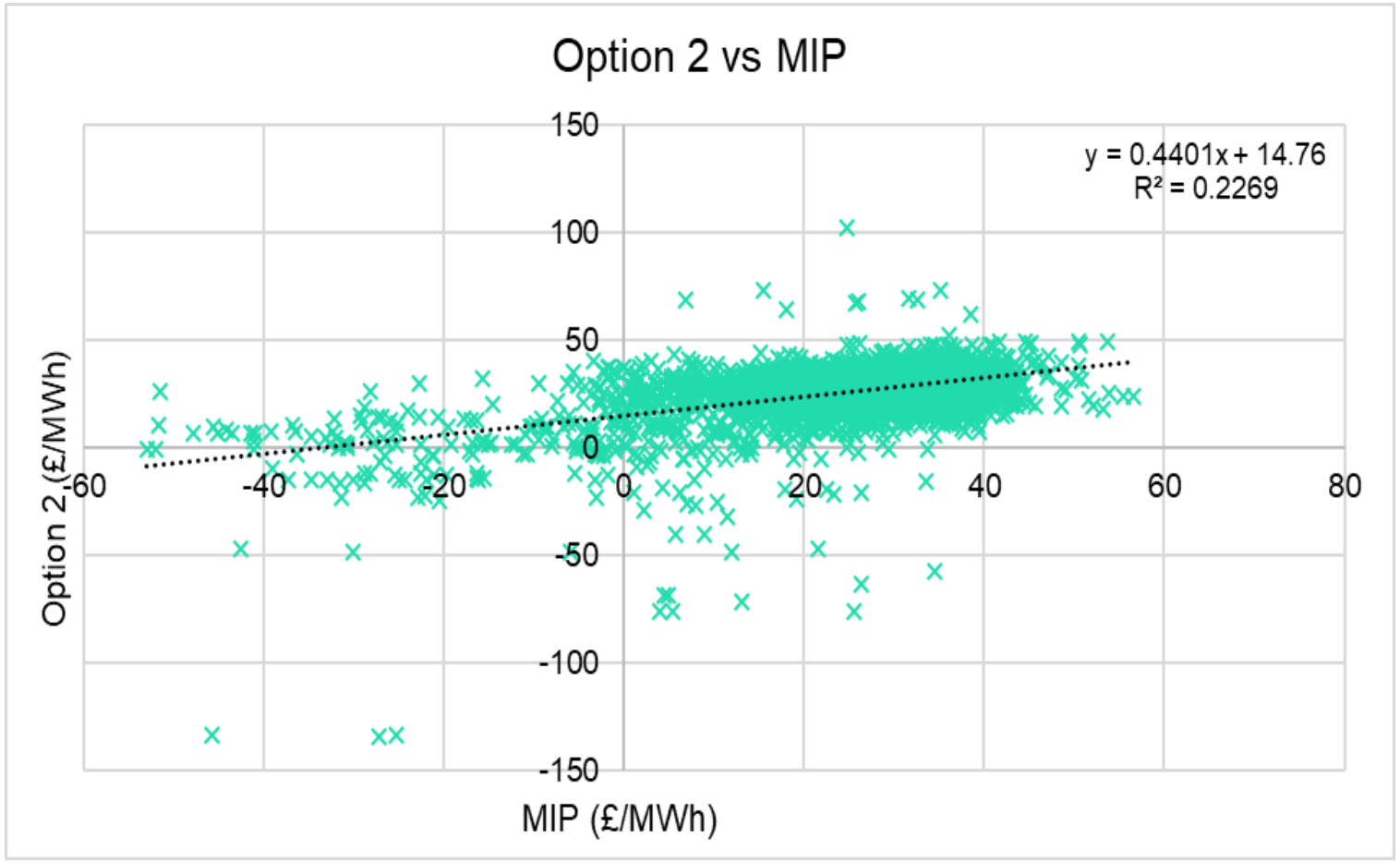
Option 1 Combined	Mean	Max	Min	St.Dev
System Price	24.60	53.62	-22.54	10.35
MIP	24.60	53.62	-22.54	10.35
Combined Filter	15.96	39.97	-50.62	22.01
Combined Filter compared to MIP/System Price	-8.64	19.92	-75.99	18.64



VOAA Option 2

Option 2: Using the midpoint of the cheapest accepted Bid and Offer during the Settlement Period.

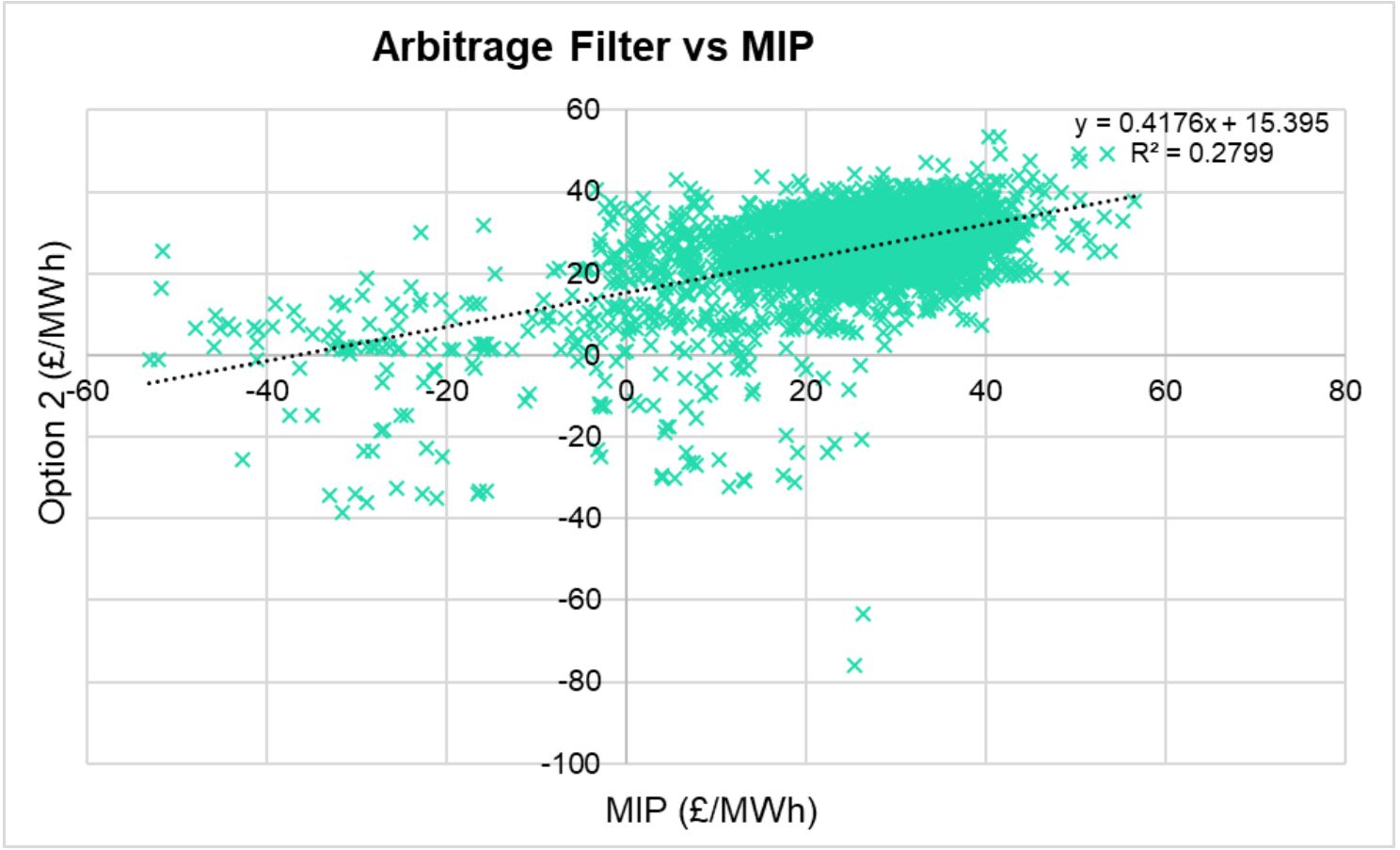
Option 2	Mean	Max	Min	St.Dev
System Price	26.07	92.14	-70.49	18.92
MIP	25.27	56.61	-53.02	12.26
Option 2 in All SPs	25.82	102.40	-134.24	11.43
Option 2 in MIP SPs	26.74	49.15	-5.50	8.47



VOAA Option 2 Arbitrage Filter

The Arbitrage filter removes any actions that are fully Arbitrage tagged in the System Price calculation

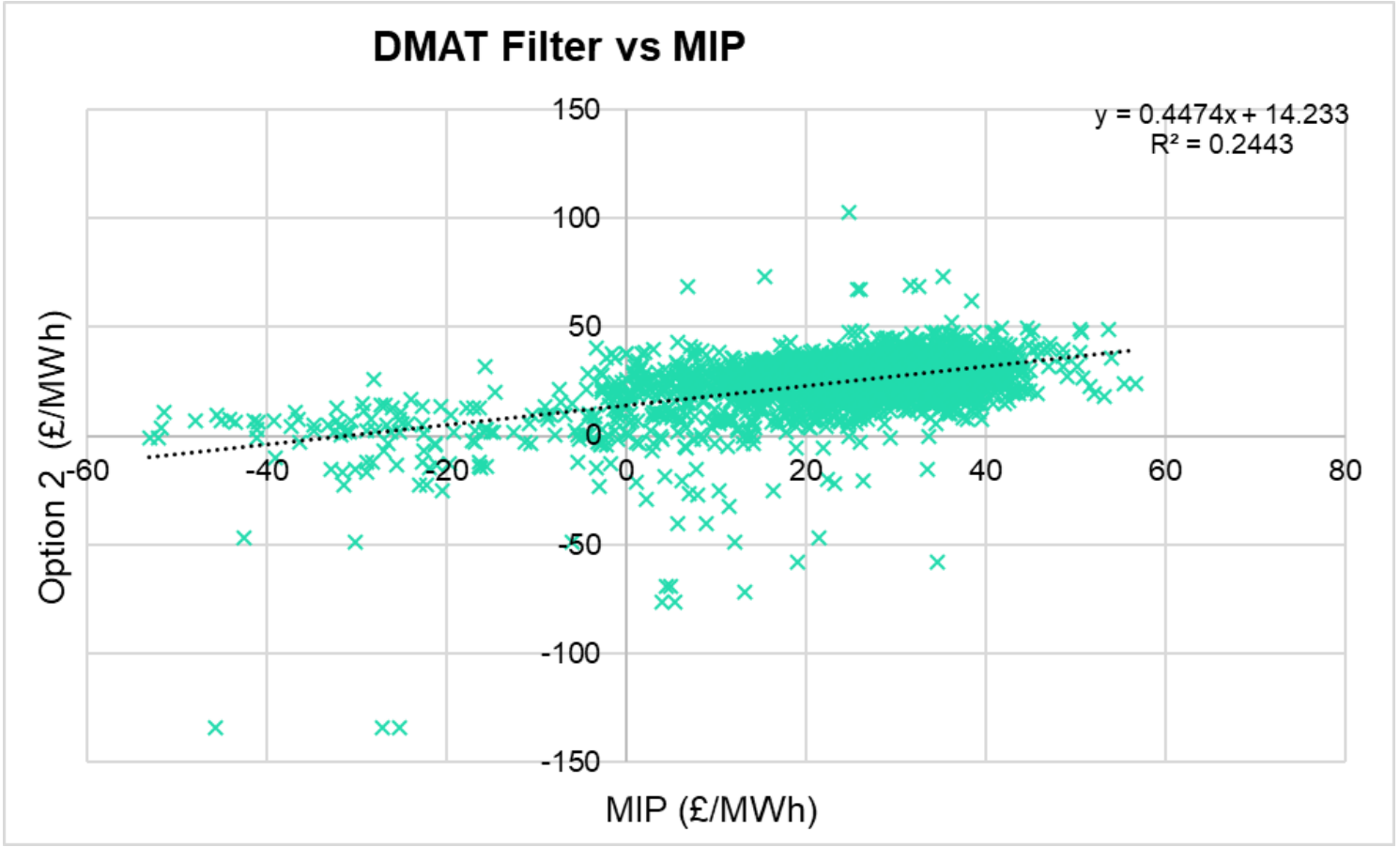
Option 2 Arbitrage	Mean	Max	Min	St.Dev
System Price	26.07	92.14	-70.49	18.92
MIP	25.27	56.61	-53.02	12.26
Arbitrage Filter	25.95	53.36	-76.06	9.674
Arbitrage Filter compared to MIP	0.68	77.135	-101.6	10.879
Arbitrage Filter compared to System Price	-0.12	92.00	-112.22	18.41



VOAA Option 2 DMAT Filter

The DMAT filter removes any actions that are fully DMAT tagged in the System Price calculation

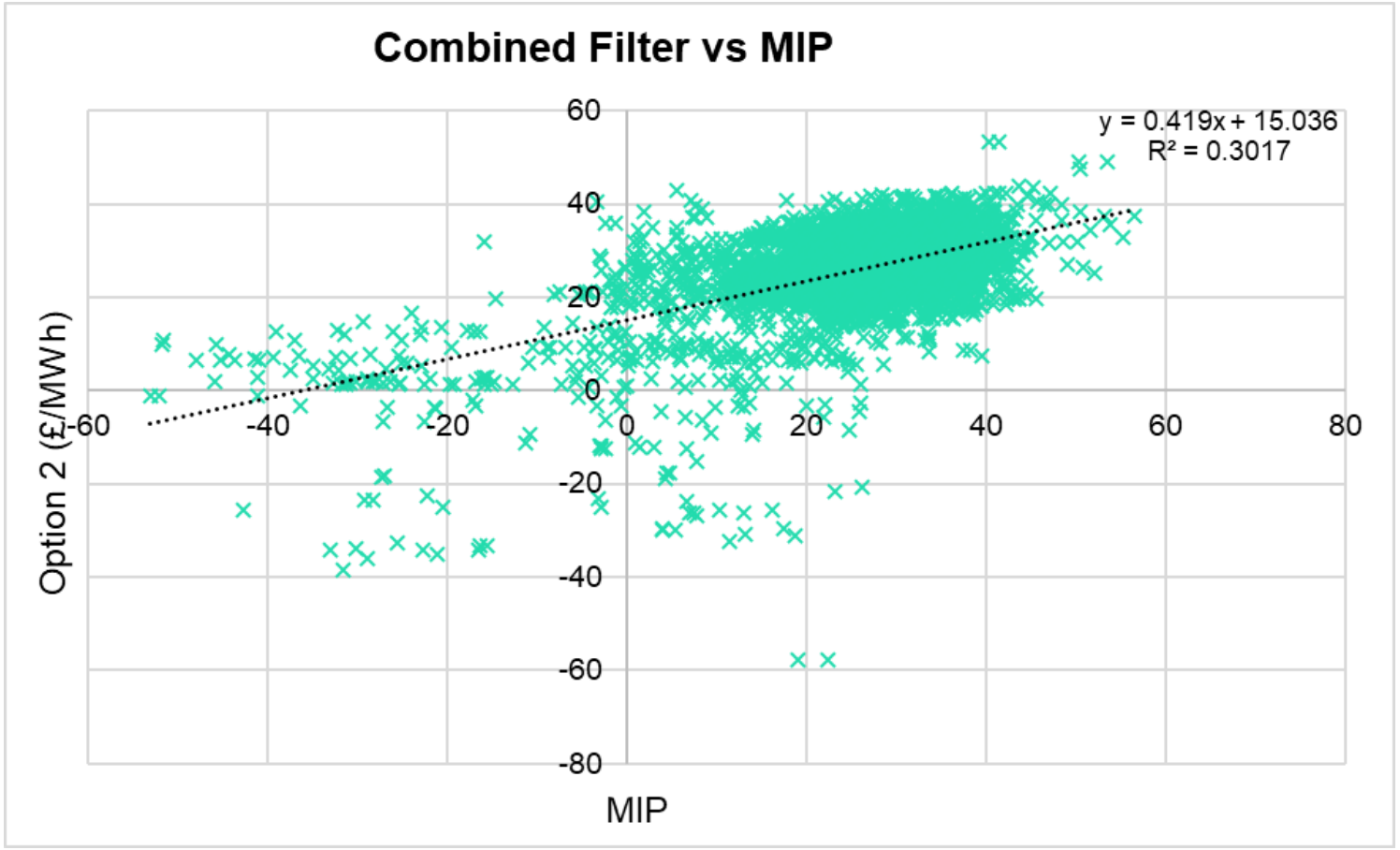
Option 2 DMAT	Mean	Max	Min	St.Dev
System Price	26.07	92.14	-70.49	18.92
MIP	25.27	56.61	-53.02	12.26
DMAT Filter	25.54	102.40	-134.24	11.10
DMAT Filter compared to MIP	0.27	77.61	-108.56	11.79
DMAT Filter compared to System Price	-0.53	86.81	-134.74	19.13



VOAA Option 2 Combined Filter

The Combined filter removes any actions that are fully DMAT or Arbitrage tagged in the System Price calculation

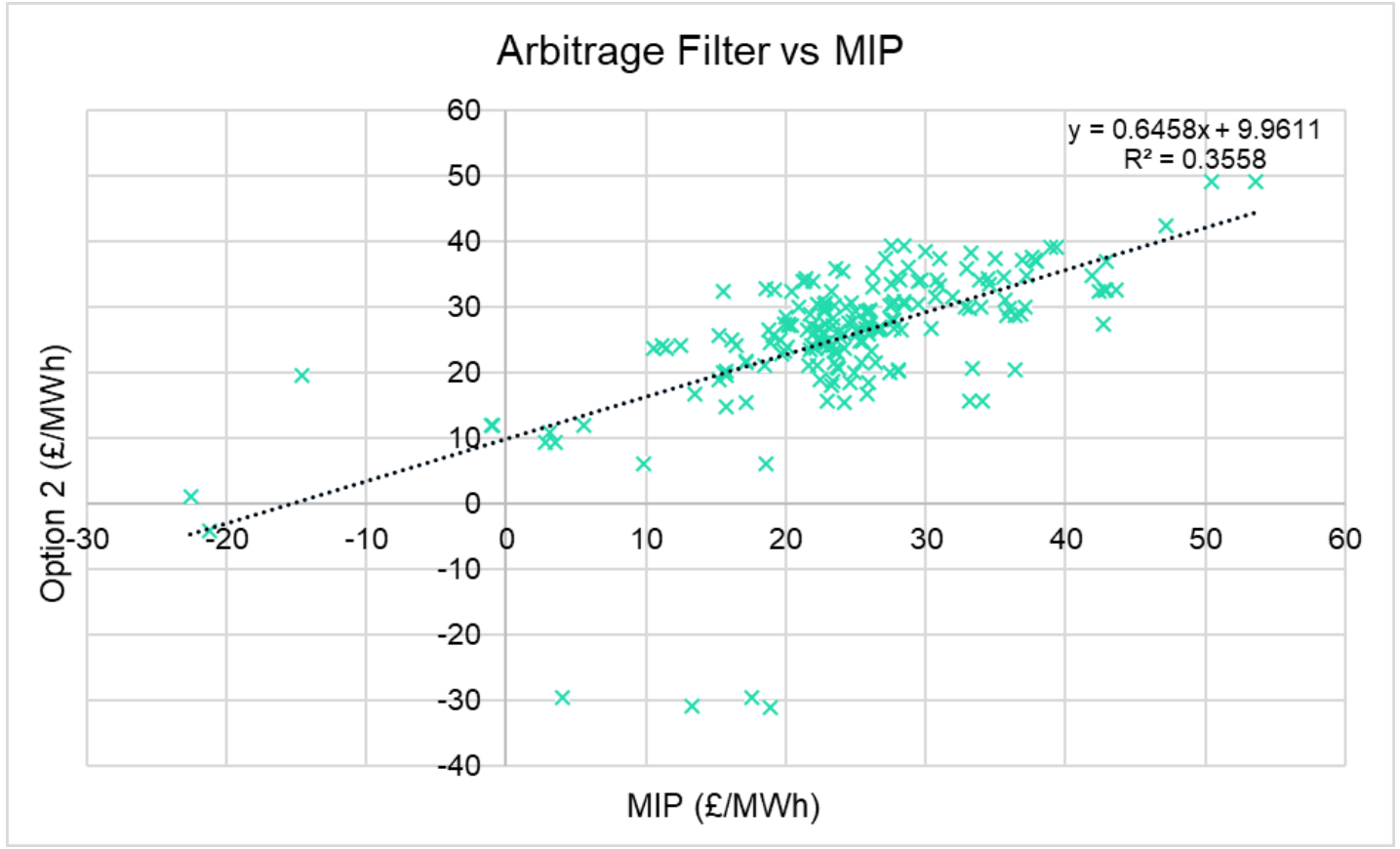
Option 2 Combined	Mean	Max	Min	St.Dev
System Price	26.07	92.14	-70.49	18.92
MIP	25.27	56.61	-53.02	12.26
Combined Filter	25.62	53.36	-57.86	9.35
Combined Filter compared to MIP	0.35	62.14	-80.32	10.57
Combined Filter compared to System Price	-0.44	91.17	-116.86	18.41



VOAA Option 2 Arbitrage Filter (MIP SPs)

The Arbitrage filter removes any actions that are fully Arbitrage tagged in the System Price calculation

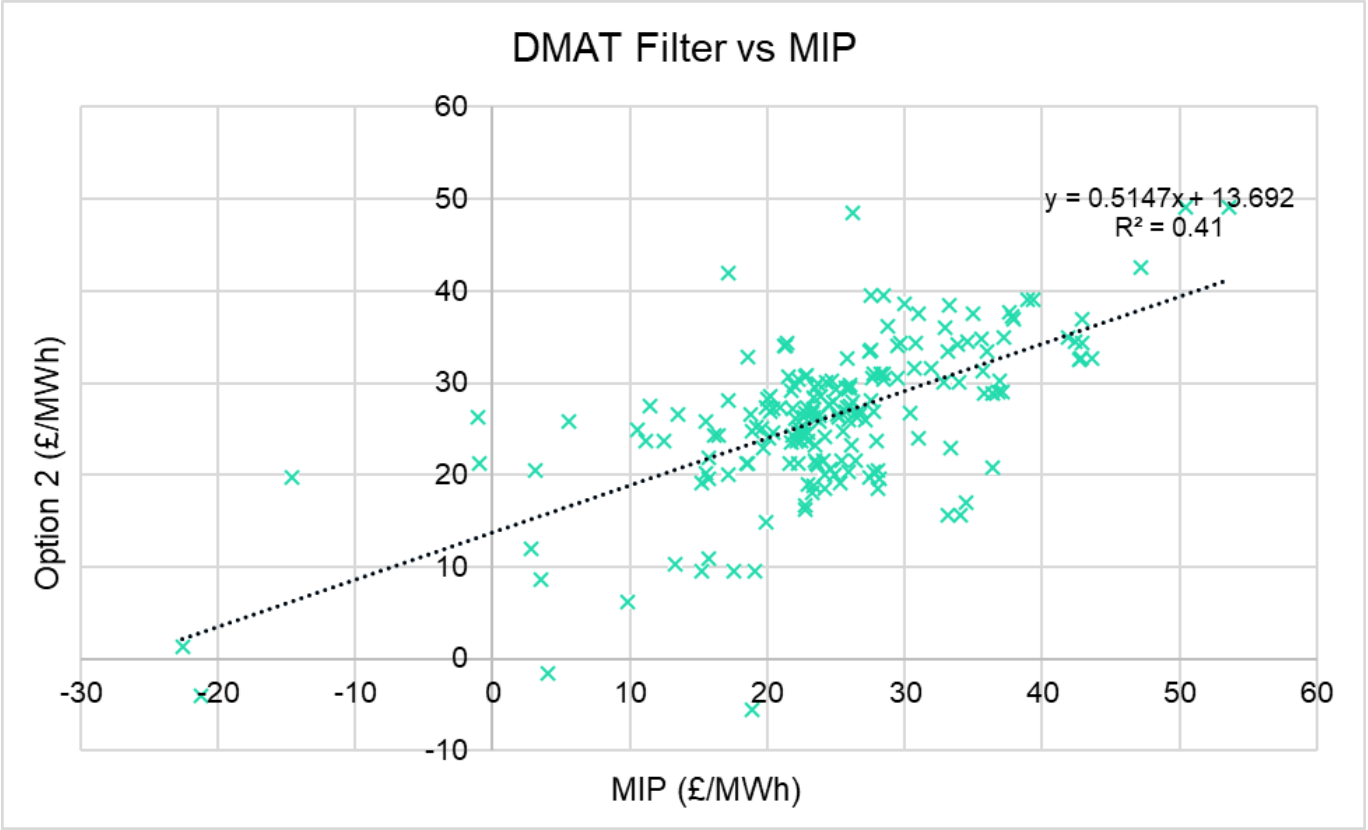
Option 1 Arbitrage	Mean	Max	Min	St.Dev
System Price	24.60	53.62	-22.54	10.35
MIP	24.60	53.62	-22.54	10.35
Arbitrage Filter	25.85	49.15	-31.13	11.21
Arbitrage Filter compared to MIP/System Price	1.25	34.32	-49.99	9.72



VOAA Option 2 DMAT Filter (MIP SPs)

The DMAT filter removes any actions that are fully DMAT tagged in the System Price calculation

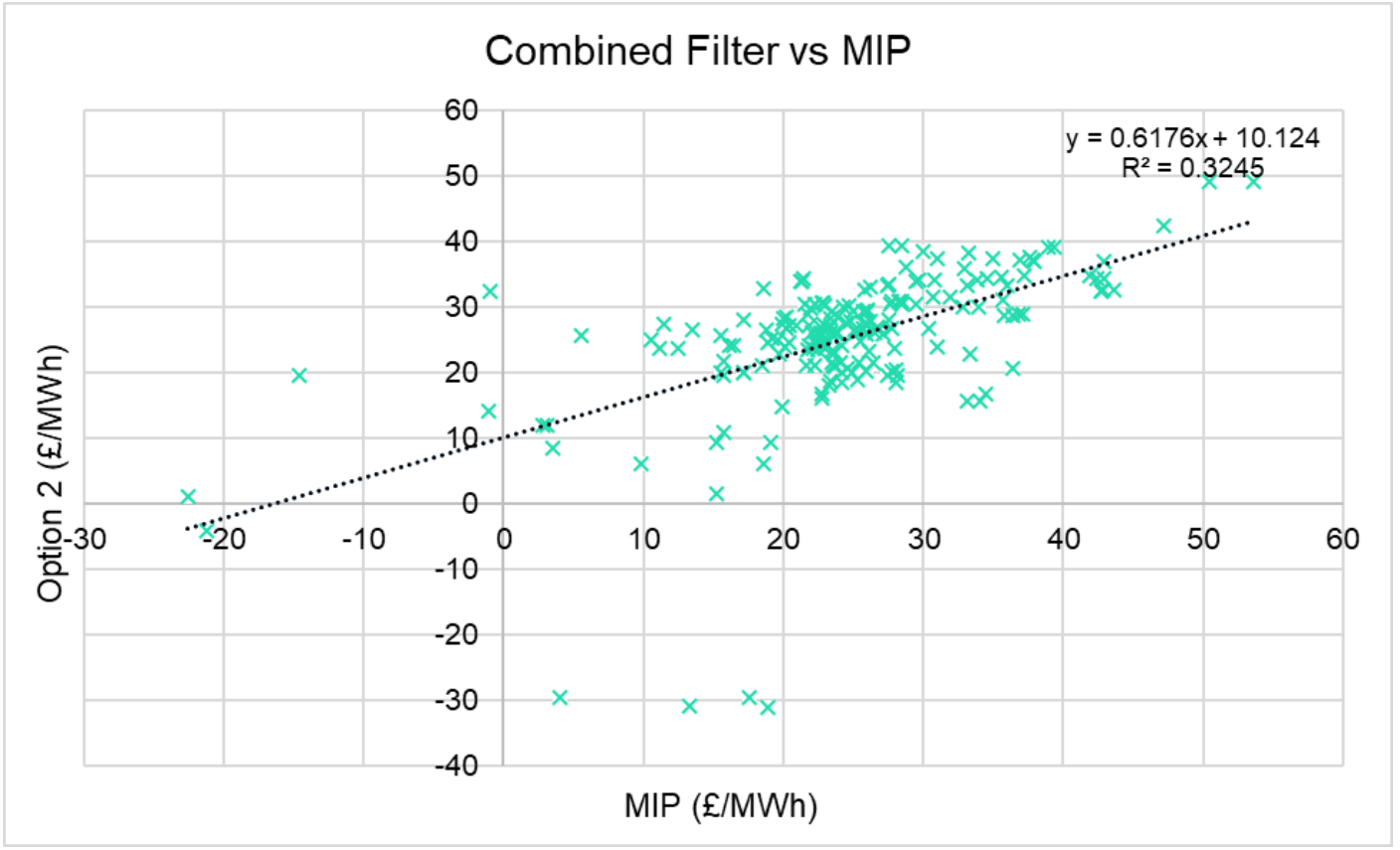
Option 1 DMAT	Mean	Max	Min	St.Dev
System Price	24.60	53.62	-22.54	10.35
MIP	24.60	53.62	-22.54	10.35
DMAT Filter	26.35	49.15	-5.5	8.32
DMAT Filter compared to MIP/System Price	1.75	34.32	-24.36	7.38



VOAA Option 2 Combined Filter (MIP SPs)

The Combined filter removes any actions that are fully DMAT or Arbitrage tagged in the System Price calculation

Option 1 Combined	Mean	Max	Min	St.Dev
System Price	24.60	53.62	-22.54	10.35
MIP	24.60	53.62	-22.54	10.35
Combined Filter	25.32	49.15	-31.13	11.23
Combined Filter compared to MIP/System Price	0.72	34.32	-49.99	9.46



CONCLUSIONS

Conclusions

Options 1 and 2 were further analysed as appeared the most suitable from initial analysis.

Option 2:
The average price is very similar to both the MIP and System Price over the 3 month period.
With no Arbitrage or DMAT filter, the price differences between the Option and MIP can spike.
Applying DMAT and Arbitrage filters on the data dampens these spikes, most effectively when both are used.
From the Day Examples, when Option 2 deviates from the MIP, it bounces back to inline quickly.
Note, during the three month period, Bid and Offer volume was present. With the midpoint methodology, if all balancing is one-sided, the VOAA will fall on the cheapest Bid or Offer.

Option 1:
The patterns identified in the scatter graph show a strong correlation with the MIP with less extreme deviations compared to Option 2. However, the average price compared is considerably lower than the MIP and the average deviation from the MIP is greater on average.

I would recommend **Option 2** the most suitable option of those tested.

When no balancing actions are taken?

Despite the rarity of this occurrence, a default for when no balancing actions are taken should be agreed.

A possible compliant option for a VOAA in this situation would be filtering for BMUs that had a Bid or Offer Accepted in the last Settlement Period with any Bid or Offer (respectively), looking at the cheapest submitted Bid and Offer prices within the Settlement Period with no balancing actions and taking a midpoint of those prices.

For example, where SP01 has accepted Bids and Offers and SP02 does not;

SP 01 Offers			SP 01 Bids		
BMU	Price	Acc	BMU	Price	Acc
01	£30	A	01	£0	A
02	£35		02	£5	A
03	£32	A	03	£-5	A
04	£40		04	£-10	

SP 02 Offers			SP 02 Bids		
BMU	Price	Inc	BMU	Price	Inc
01	£32	Y	01	£2	Y
02	£31	N	02	£8	Y
03	£37	Y	03	£-7	Y
04	£45	N	04	£-10	N

In this example, the cheapest included offer price for SP02 is £32 and the cheapest included bid price is £8, as the cheapest prices from units which had prices taken in the previous SP. The VOAA would be £20.

WALKTHROUGH OF PROPOSED SOLUTION

Peter Frampton

Overview of proposed solution

We propose that the P410 solution contains the following elements;

- VOAA Calculated based on the preferred Option for filtering following Elexon analysis
  - Per analysis agreed best option
- Calculation provided for in BSC Section T
- **Governance that enables introduction of new products if not represented in BOA data in future**
- Contingency for SPs where no balancing actions have been taken
  - Per earlier slide

Governance of solution

Currently, we can only perform analysis on RR/FRR products contained within the BOA data. We anticipate that other RR/FRR products will be traded in GB balancing markets in the future (e.g. TERRE/MARI), but we cannot make an assessment of how they will be priced.

The first proposed solution attempted to provide for the inclusion of these products in the calculations, when they became available. Given the importance of the analysis in determining the correct treatment for BOA data, it may be prudent to consider future products once more data is available on their pricing, such that a workgroup can design a solution that takes them into account in the most effective way.

The solution described in the analysis can be applied to BSAA (Balancing Services Adjustment Actions) and VGB (volume of GB need met by TERRE actions) prices in the NIV stack, if required.

There are two options to achieve this;
Have all calculations in the BSC, with additional products to be updated by Modification in the event industry want them to be included in the VOAA calculation
Have provisions for the calculations in the BSC, with the calculations defined in a CSD with Panel or ISG/SVG control, providing for the ability to convene a workgroup for the purpose of adding or removing products from the VOAA calculation.

INITIAL WORKGROUP VIEWS

Matthew Woolliscroft

ELEXON

Terms of Reference

Areas to consider	
How can a VOAA be calculated in compliance with the ISHP?	We believe the solution proposed by P410 give a compliant way to calculate a VOAA
Is there any value to keeping references to the MIP in the BSC?	Yes, industry value the visibility of the MIP and believe it has value outside of the imbalance calculations
Is the BPA permissible in its current form?	Yes
Is the use of PAR1 compliant with the ISHP and it optimal?	Yes
Do components of the BPA need to change, or should a new parameter be introduced to account for relevant costs?	This is not required to maintain compliance with the ISHP – Issue 83 can continue to assess the principles of the BPA
How will P410 impact the BSC Settlement Risks?	We do not believe P410 will impact on any Settlement Risks
assess the impacts of changing the Market Index Price for an Imbalance Settlement Harmonisation Regulation and compliant Value of Avoided Activation	This is ongoing.

Terms of Reference

Areas to consider	
What changes are needed to BSC documents, systems and processes to support P410 and what are the related costs and lead times? When will any required changes to subsidiary documents be developed and consulted on?	Will be assessed through a Service Provider Impact Assessment
Are there any Alternative Modifications?	We have not identified any Alternative Modifications
Should P410 be progressed as a Self-Governance Modification?	No
Does P410 better facilitate the Applicable BSC Objectives than the current baseline?	P410 better facilitates Objectives (c) and (e)
Does P410 impact the EBGL provisions held within the BSC, and if so, what is the impact on the EBGL objectives?	Yes. It is consistent with the EBGL objectives

Applicable BSC Objectives – Proposer views

Obj	Impact	Rationale
(a)	Neutral	
(b)	Neutral	P410 also ensure efficient operation of the National Electricity Transmission System, we do not consider that it results in a more efficient outcome than the existing baseline. This is because we believe the MIP continues to be a reasonable proxy where it is used. We would not recommend any change to the existing calculations if the MIP continued to be compliant with the ISHP
(c)	Positive	P410 harmonises the imbalance settlement approach with other markets across the EU, improving competition and access to markets
(d)	Neutral	
(e)	Positive	P410 will ensure compliance with the ISHP, as per the EBGL
(f)	Neutral	
(g)	Neutral	

EBGL impact

P410 will require changes to BSC sections which constitute EBGL Article 18 Terms and Conditions. The impact of this will be determined during the Assessment Procedure.

Implementation of the ISHP into GB arrangements will:

- foster effective completion on balancing markets;
- Integrate balancing markets and promote possibility of for exchange of balancing services; and
- Ensure procurement of balancing services is fair and market based

We therefore believe that P410 is consistent with the EBGL objectives

Self-Governance

Not self-Governance:

- will result in a change in the way the imbalance price is calculated in some scenarios
- will therefore impact competition
- Will also require changes to ENGL Article 18 Terms and Conditions

Implementation Date

The changes must be delivered by 15 January 2022 (18 months after the ISHP was approved.
We therefore recommend P410 is implemented in the previous scheduled BSC Release on:

- 4 November 2021

NEXT STEPS

Matthew Woolliscroft

ELEXON

Next steps

- Draft Business requirements and circulate for Workgroup approval – Early January 2021
- Workgroup review of Business Requirements – 5WD
- Issue Service Provider Impact Assessment to identify system changes and costs – by end of January 2021
- Follow up Workgroup and consider system costs and analysis – February 2021
- Assessment Procedure Consultation – end of February 2021

A.O.B.

ELEXON

THANK YOU

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