Comments on Price Formation Enhancements:

Rules for Bidding above the Soft Offer Cap Draft Final Proposal

Department of Market Monitoring

May 8, 2024

Summary

The ISO's Draft Final Proposal outlines a short-term solution to allow storage and hydro resources with daily energy limitations to bid above the $1,000/MWh soft offer cap when their intra-day opportunity costs may exceed $1,000/MWh. The ISO sought to implement a solution by summer 2024. However, the ISO has indicated that a number of technical limitations significantly limited the solutions that could be implemented in this timeframe. The ISO proposes two changes that have been deemed feasible to implement in summer 2024:

- Raise the cap on all default energy bids from $1,000/MWh to $2,000/MWh.
- Temporarily modify the bid cap for storage resources to be the maximum of the following three values:

  (1) $1,000/MWh,

  (2) the fourth highest maximum import bid price of the day, or

  (3) the highest cost-verified bid in a given hour.

In previous comments, DMM supported an hourly solution for storage resources that targeted specific hours where intra-day opportunity costs may exceed $1,000/MWh. Specifically, these would include a subset of hours prior to the highest priced hours of the day.[1] However, the ISO has indicated that it would be infeasible to make significant changes to the reference level change request process, or the software logic that allows hourly variation of bid caps, by summer 2024.

DMM's analysis of a recent sample of high priced days also indicates that the current bid cap of $1,000/MWh has not been binding for a significant portion of storage capacity.[2] In light of these points, DMM suggested that it may be appropriate to defer the development of a short-term solution for storage resources in summer 2024, and focus specifically on the handful of hydro resources that DMM understands have significant daily energy limitations.[3] Focusing on this small number of resources would

[1] *Comments on Price Formation Enhancements: Rules for Bidding above the Soft Offer Cap Issue Paper,* Department of Market Monitoring, April 22, 2024: https://www.caiso.com/Documents/dmm-comments-on-price-formation-enhancements-rules-for-bidding-above-the-soft-offer-cap-issue-paper-apr-22-2024.pdf

[2] *Comments on Price Formation Enhancements: Rules for Bidding above the Soft Offer Cap Straw Proposal,* Department of Market Monitoring, April 30, 2024, pp 3-6: https://www.caiso.com/Documents/DMM-Comments-on-PFE-Rules-for-Bidding-Above-the-Soft-Offer-Cap-Straw-Proposal-Apr-30-2024.pdf

[3] *Ibid* pp 2-3.

allow for a manual short-term solution that would apply specifically to the hydro resources with daily energy limitations.

DMM supports the ISO's proposal to increase the cap on default energy bids (DEBs) to $2,000/MWh, given that DEB calculations are accurate cost-estimates. DMM does not oppose the proposal to increase the bid cap for storage resources as an interim solution if it is not feasible to implement an approach similar to those suggested by DMM. Hopefully, a more targeted option that allows bids based on intra-day opportunity costs to vary by hour could be implemented by summer 2025.

The ISO proposes to implement both of these changes in both the day-ahead and real-time markets. DMM supports having the same bidding flexibility in the day-ahead and real-time markets to avoid inconsistencies across the markets, and promote convergence between markets.

However, DMM does have concerns about the current calculation of the maximum import bid price (MIBP), which the ISO proposes to use as a proxy for intra-day opportunity costs. Given the significant impact this calculation can have on the ISO and WEIM markets, DMM recommends that the ISO address this issue prior to the coming peak summer periods.

These comments provide additional details on the ISO's proposals, as well as DMM's concerns about the current MIBP calculation.

Raising the DEB cap

DMM agrees conceptually that DEBs which reflect estimates of a resource's marginal cost should not be capped at the $1,000/MWh bid cap. If DEB calculations are an accurate representation of marginal costs, then submitting a reference level change request seems an unnecessary step to allow the resource to bid up to its calculated DEB. In addition, there appears to be technical limitations that prevent certain resource types from submitting these reference level change requests.

DMM supports raising the cap on DEBs from $1,000/MWh to $2,000, given these DEB calculations are an accurate reflection of marginal costs. However, since intra-day opportunity costs can vary hourly, DEBs designed to reflect intra-day opportunity costs should also vary hourly. Therefore, the ISO's proposal to remove the $1,000/MWh DEB cap and allow hydro resources to bid up to that uncapped DEB all day represents a policy tradeoff. The proposal may increase the amount of supply voluntarily offered into the market by hydro resources with estimated costs exceeding $1,000/MWh, but also increases the ability of some hydro resources to exercise market power. By increasing DEBs, which are static throughout the day, this policy proposal could allow for the exercise of market power up to these high DEBs in hours where the DEB may overstate marginal costs of resources with changing intra-day opportunity costs. In hours where the DEB overestimates costs, resources will not be mitigated below their DEB values.

DMM recommends that in a future initiative, the ISO develop a DEB formulation specifically for hydro resources that have daily limitations, similar to the new hourly DEB that DMM recommends developing for storage resources. Currently, the hydro DEB is static across the day, as this is meant to reflect the inter-day or geographic opportunity costs of hydro resources. Resources with opportunity costs that are static throughout the day should be able to bid up to this potentially high DEB all day, given that the DEB is an accurate representation of a cost that does not vary across the day. However, hydro resources with daily limitations that are bidding to reflect intra-day opportunity costs may not face similarly static

opportunity costs across the day. DMM recommends prioritizing policy development aimed at implementing hourly DEBs, which more accurately reflect intra-day opportunity costs that are not static across the day.

Modifying bid cap for storage resources

DMM supported increasing the bid cap for resources with intra-day opportunity costs in certain hours as an interim solution, until the ISO can begin an initiative to design hourly DEBs that reflect variable intra-day opportunity costs. However, DMM recommended only raising this bid cap to allow for bidding over $1,000/MWh in a limited number of hours where intra-day opportunity costs are most likely to exceed $1,000/MWh.

On days where there are hours in which the $2,000/MWh bid cap is in effect, resources with daily energy limitations may have intra-day opportunity costs higher than $1,000/MWh in the hours proceeding the highest priced hours. These specific hours depend on the number of hours where prices are higher than $1,000/MWh and the ability of the resource to replenish throughout the day. However, regardless of whether a resource can recharge, during and after the highest priced hours the intra-day opportunity costs approach zero.

DMM does not oppose the interim approach of raising the bid cap all day, but cautions that this will allow storage resources to submit bids over $1,000/MWh during hours in which their intra-day opportunity costs are less than $1,000/MWh. This will increase the ability of storage resources to exercise market power in some hours, particularly in the highest priced hours of the day where intra-day opportunity costs are significantly diminished.

However, some of this risk is mitigated because the ISO does not propose to change the storage DEB calculation used when resources are mitigated for local market power. While the current DEB calculation may overstate the intra-day opportunity cost for storage during many hours of the day, to the extent these DEBs are less than the proposed bid cap for storage resources, there will be some degree of market power mitigation for these resources.

Allowing for higher bids from storage resources may impact the bid cost recovery payments to storage resources. There are a number of situations where batteries may receive inappropriate or inefficient bid cost recovery payments. DMM has recommended enhancing bid cost recovery rules for storage resources to consider state-of-charge limitations and other attributes unique to storage resources. Until these issues are addressed, allowing storage resources to submit higher energy bids – even when aligned with intra-day opportunity costs – could further increase unwarranted BCR payments to storage resources on days when the $2,000/MWh hard cap is in effect.[4]

As a long-term solution, DMM recommends the ISO begin a stakeholder initiative focused on improving the storage DEB to allow for an hourly value that includes intra-day opportunity costs appropriate for

[4] *Comments on Price Formation Enhancements Working Group Session 15*, Department of Market Monitoring, March 22, 2024: https://www.caiso.com/Documents/DMM-Comments-on-Price-Formation-Enhancements-Working-Group-15-Mar-21-2024.pdf

each hour. This hourly value could then be used to allow bids over $1,000/MWh in appropriate hours when the calculated hourly DEB exceeds $1,000/MWh.

The ISO proposes using the higher of (1) the fourth highest MIBP or (2) the highest cost-verified bid as a proxy for intra-day opportunity costs. The highest cost-verified bid is a parameter that changes hourly. Bid prices in a particular hour do not impact the intra-day opportunity cost of daily limited resources in that same hour. Using the highest cost-verified bid as a proxy for intra-day opportunity costs assumes that these bids are constant throughout the day. While this may be a valid assumption for some hydro resources or conventional generators whose costs are the same across the day, it may not hold for daily limited resources who have intra-day opportunity costs. Thus, if the highest cost-verified bid is set by a hydro resource with daily limitations, this may not serve as an accurate proxy for intra-day opportunity costs of storage resources in that same hour.

While the MIBP is not a perfect reflection of intra-day opportunity costs, it may serve as a reasonable proxy as it does have the potential to set prices in the hours that drive intra-day opportunity costs. DMM supports using the fourth highest MIBP as opposed to an alternative – such as the highest MIBP of the day. This formulation is similar to the logic that approximates the simplified intra-day opportunity costs in the storage DEB. However, DMM does have some concerns with the current calculation of the MIBP, which are explained in the following section.

MIBP formulation

DMM has concerns about the implementation of the hourly shaping factor component of the MIBP calculation. The MIBP multiplies the maximum bilateral block price from either Mid-Columbia or Palo Verde by an hourly shaping factor to transform these block prices to hourly prices, and then multiplies this value by a 110 percent multiplier.

The hourly shaping factor is defined in the BPM as:

$$= 1 + \frac{CAISO\ Hourly\ DA\ SMEC - CAISO\ Average\ DA\ SMEC_{on\ or\ off\ peak\ hours}}{CAISO\ Average\ DA\ SMEC_{on\ or\ off\ peak\ hours}}$$

Which is mathematically equivalent to:

$$\frac{CAISO\ Hourly\ DA\ SMEC}{CAISO\ Average\ DA\ SMEC_{on\ or\ off\ peak\ hours}}$$

Currently, the numerator of this equation pulls the hourly day-ahead (DA) system marginal energy cost (SMEC) from the previous day, while the denominator reflects the average DA SMEC from the last high

priced day.[5] By using the hourly SMEC from the previous day, this ratio does not shape the bilateral prices to the last high priced day, unless the previous day also happens to be the last high priced day.

In addition, the average of these shaping factors across the day generally does not equal one. The purpose of the shaping factors is to transform the 8-hour (off-peak) or 16-hour (on-peak) bilateral block prices to an hourly shape. This should increase the MIBP in hours where the SMEC tends to be higher than the daily average, and lower the MIBP in the hours where the SMEC tends to be lower than the daily average.

When the MIBP was being designed, the ISO was initially proposing to shape bilateral prices based on the pattern of prices on the previous day.[6] However, the Market Surveillance Committee noted the disparity between peak hour prices and the daily average prices is larger on days where the ISO has higher peak prices, and thus suggested using the last high priced day as a basis for the shaping factor.[7]

DMM believes instead of the current implementation (which divides the hourly SMEC in the previous day by the average SMEC of the last high priced day), that the shaping factor should divide the hourly SMEC in the last high priced day by the average SMEC of that same last high priced day. The tariff describes the shaping factor as dividing the DA SMEC in that hour of a previous representative trading day by the average DA SMEC of the same previous representative trading day.[8] This formulation results in an hourly shaping factor that averages to one across the day and shapes bilateral prices to the pattern of prices on the last high priced day. The current implementation can yield the same result in some cases, but only if the previous day also happens to be the last high priced day.

In the appendix at the end of these comments, DMM provides two examples of how the shaping factor (and therefore the MIBP) is currently calculated, versus how DMM believes the shaping factor should be calculated. These examples highlight how the shaping factor DMM recommends, which divides hourly price on the last high priced day by the average prices on that same high priced day, produces shaping factors that average to one across the day and more accurately shapes prices to the hourly pattern of prices on the last high priced day. DMM recommends the ISO update the shaping factor calculation to consistently use the hourly and average prices from the same last high priced day before the summer to ensure the MIBP is accurately shaping the bilateral prices.

DMM replicated what the MIBP would have been from June 2021 to April 2024 if dividing the hour in the last high priced day by the average on/off-peak SMEC during the same high priced day. Overall, the current MIBP calculation tends to under-estimate the peak prices during high priced days. The table below shows instances where one MIBP calculation exceeded the $1,000/MWh trigger while the other did not. This analysis highlights that during high priced days, the current MIBP calculation tends to underestimate compared to the MIBP calculation DMM is recommending.

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[5] Market Instruments BPM, pp 487-489.

[6] *Revised Draft Final Proposal – FERC Order 831 Import Bidding and Market Parameters,* California ISO, July 22, 2020, pp 27-29: https://www.caiso.com/InitiativeDocuments/RevisedDraftFinalProposal-FERCOrder831-ImportBidding-MarketParameters.pdf

[7] Opinion on FERC 831 Import and Market Parameters, *Market Surveillance Committee,* September 9, 2020, p 7: https://www.caiso.com/Documents/MSC-OpinionFERC831ImportBiddingandMarketParameters-Sep9_2020.pdf

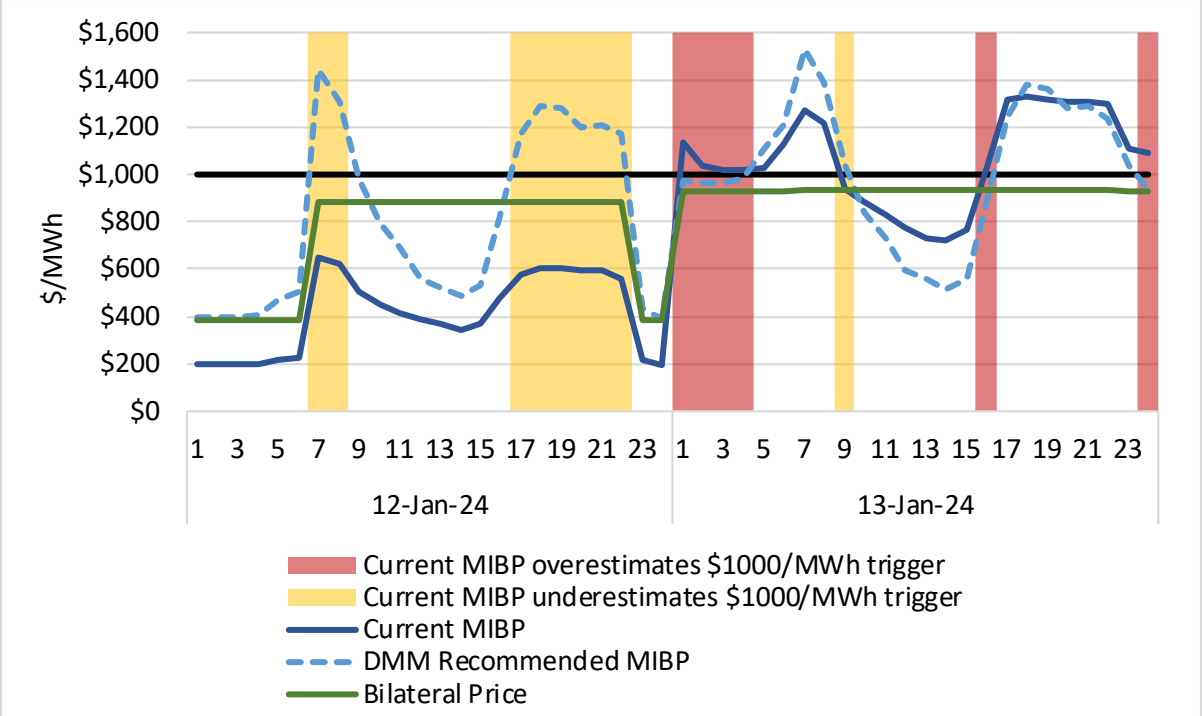
[8] Tariff Section 30.7.12.5.3

Table 1: Current MIBP calculation over- and under-estimating $1,000/MWh trigger

	Number of Hours	
	Day-Ahead	Real-Time
Current MIBP overestimates:		
Current MIBP >= $1,000, Recommended MIBP < $1,000	5	6
Current MIBP underestimates:		
Current MIBP < $1,000, Recommended MIBP >= $1,000	33	19
Total Hours	24,956	25,130

Figure 1 below depicts the current MIBP calculation and the DMM-recommended MIBP calculation across all hours in the real-time on January 12-13, 2024. These days were during an unseasonably cold storm in the northwest, which led to high bilateral prices, triggering the MIBP to exceed $1,000/MWh in a number of hours.

Figure 1: Real-Time MIBP Calculations for January 12-13, 2024



The hours shaded in yellow in Figure 1 represent hours when the current MIBP underestimated the DMM-recommended MIBP and the $2,000/MWh bid cap was not in effect. This was primarily during the morning and evening peaks of January 12, which was the first day of the high bilateral prices. The

Market Surveillance Committee raised concerns about the shaping factor understating the true extremity of prices during the beginning of a period of very high prices.[9] This example indicates that the current formulation does underestimate the MIBP on the first day of a high priced period.

In addition, the red shaded hours represent when the current MIBP overestimated the DMM-recommended MIBP, which incorrectly triggered the $2,000/MWh bid cap. This was primarily from midnight to 4am on the morning of January 13, a time during which it was likely unnecessary to have the $2,000/MWh bid cap in place.

Future policy recommendations

This draft proposal outlines two approaches to address the issue of resources with daily limitations being unable to reflect their intra-day opportunity costs on days where the hard bid cap of $2,000/MWh is in effect.

While the first proposal to raise the DEB cap is a long-term change, it is meant to allow more bidding flexibility for hydro resources. DMM supports raising the DEB cap to $2,000/MWh. However, it is important that the ISO prioritize addressing differences between inter-day and geographic opportunity costs reflected in the current hydro DEB, and intra-day opportunity costs for hydro resources with daily limitations, and reflects these costs accurately in resources' DEBs.

The other proposal is an interim solution that raises the bid cap for storage resources on days where the $2,000/MWh hard bid cap is in effect. Because the proposed bid cap is static throughout the day, this solution allows bids to exceed $1,000/MWh during hours where the intra-day opportunity may not exceed $1,000/MWh, and may even be zero. As DMM has noted before, if there are a few hours of the day where prices exceed $1,000/MWh, then the intra-day opportunity costs for storage resources will only exceed $1,000/MWh in a small number of hours prior to hours with these high prices.

DMM highly recommends that the ISO start an initiative focused on re-designed hourly DEBs for storage resources that accurately reflects the variability in intra-day opportunity costs for these resources rather than relying on this interim solution past summer 2024. DMM also recommends the ISO consider a similar hourly formulation of DEBs for the hydro resources with daily energy limitations.

[9] *Opinion on FERC 831 Import Bidding and Market Parameters*, Market Surveillance Committee, September 9, 2020, p 7: https://www.caiso.com/Documents/MSC-OpinionFERC831ImportBiddingandMarketParameters-Sep9_2020.pdf

Appendix

Example: Day-Ahead MIBP on October 18, 2023

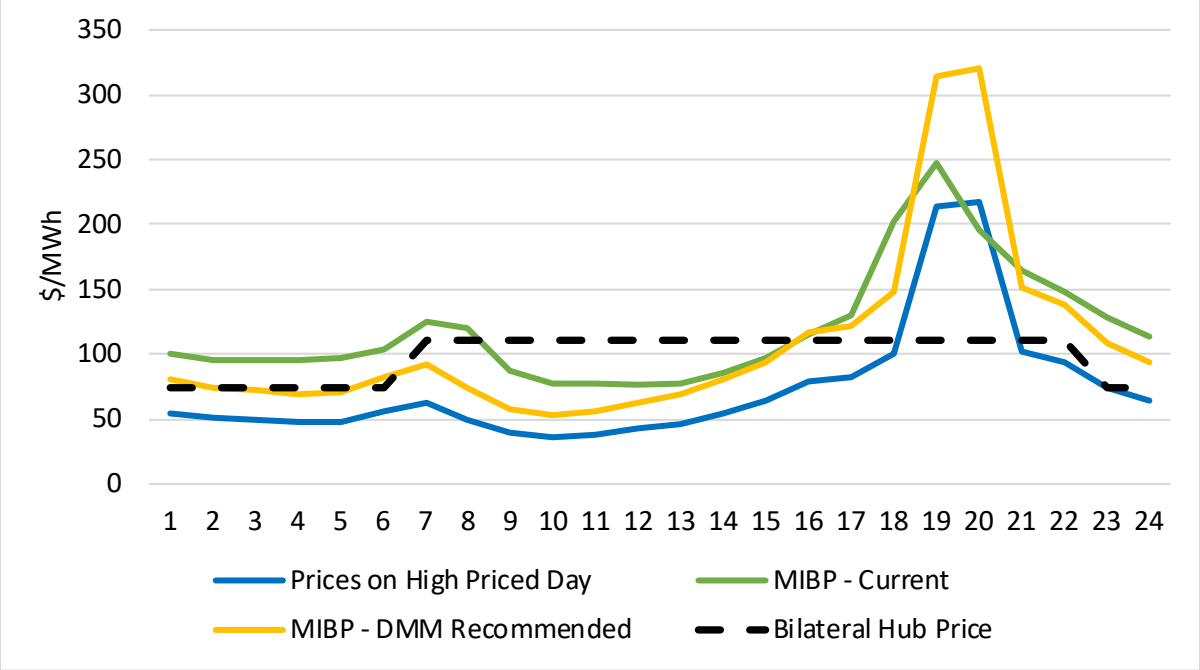
The last high priced day was August 30, 2023 where DA prices exceeded $200/MWh in hours 19-20. As calculated under the ISO's current approach, shaping factors for peak hours for this day are calculated as the ratio of each hourly DA SMEC from Oct 17, 2023 (prior day) to the average DA SMEC of Aug 30, 2023 (last high priced day) for peak hours. Similar for off-peak hours. Under DMM's recommended approach, the shaping factors would be calculated as the ratio of each hourly DA SMEC from Aug 30, 2023 to the average DA SMEC of Aug 30, 2023 for peak hours, and similar for off-peak hours.

Table 2: Inputs for day-ahead MIBP calculations for October 18, 2023

Trade Hour	DA SMEC Oct 17, 2023	DA SMEC Aug 30, 2023	Peak /Off-Peak	Average DA SMEC Aug 30, 2023	Shaping Factor (current)	Shaping Factor (DMM recommended)	Bilateral Price
1	68.00	55.08	OPK	55.67	1.22	0.99	74.17
2	65.61	50.41	OPK	55.67	1.18	0.91	74.17
3	65.11	49.82	OPK	55.67	1.17	0.89	74.17
4	65.10	47.37	OPK	55.67	1.17	0.85	74.17
5	65.81	47.89	OPK	55.67	1.18	0.86	74.17
6	70.89	56.30	OPK	55.67	1.27	1.01	74.17
7	84.36	63.05	PK	82.64	1.02	0.76	110.74
8	80.97	49.75	PK	82.64	0.98	0.60	110.74
9	59.20	39.37	PK	82.64	0.72	0.48	110.74
10	52.64	35.98	PK	82.64	0.64	0.44	110.74
11	52.38	37.96	PK	82.64	0.63	0.46	110.74
12	51.90	42.59	PK	82.64	0.63	0.52	110.74
13	52.66	46.38	PK	82.64	0.64	0.56	110.74
14	57.97	54.60	PK	82.64	0.70	0.66	110.74
15	65.50	63.88	PK	82.64	0.79	0.77	110.74
16	77.75	79.06	PK	82.64	0.94	0.96	110.74
17	88.01	82.33	PK	82.64	1.06	1.00	110.74
18	137.53	100.48	PK	82.64	1.66	1.22	110.74
19	167.81	213.34	PK	82.64	2.03	2.58	110.74
20	132.65	217.35	PK	82.64	1.61	2.63	110.74
21	112.12	102.42	PK	82.64	1.36	1.24	110.74
22	100.03	93.69	PK	82.64	1.21	1.13	110.74
23	87.68	74.47	OPK	55.67	1.57	1.34	74.17
24	76.95	64.02	OPK	55.67	1.38	1.15	74.17
				Average Shaping Factor	1.12	1.00	

Figure 2 shows how the two shaping factors shape the bilateral prices to hourly values. The blue line shows the prices on the last high priced day, August 30, 2023. It is clear that the yellow line, which calculates the MIBP using the shaping factor DMM recommends, shapes the bilateral prices (black dashed line) to the same shape as the last high priced day. The green line, which calculates the MIBP using the current shaping factor, does not result in an MIBP that follows the shape of prices on August 30, 2023 and may not result in high enough peak prices.

Figure 2: MIBP calculations on October 18, 2023



Example: Day-Ahead MIBP on February 20, 2024

The last high priced day was January 16, 2024 where DA prices exceeded $200/MWh in several hours throughout the day. As calculated under the ISO's current approach, shaping factors for this day are calculated as the ratio of each hourly DA SMEC from Feb 19, 2024 (prior day) to the average DA SMEC of Jan 16, 2024 (last high priced day) for peak hours. Similar for off-peak hours. Under DMM's recommended approach, the shaping factors would be calculated as the ratio of each hourly DA SMEC from Jan 16, 2024 to the average DA SMEC of Jan 16, 2024 for peak hours, and similar for off-peak hours.

Table 3: Inputs for day-ahead MIBP calculations for February 20, 2024

Trade Hour	DA SMEC Feb 19, 2024	DA SMEC Jan 16, 2024	Peak /Off-Peak	Average DA SMEC Jan 16, 2024	Shaping Factor (current)	Shaping factor (recommended by DMM)	Bilateral Price
1	46.03	210.30	OPK	210.15	0.22	1.00	59.29
2	44.09	207.12	OPK	210.15	0.21	0.99	59.29
3	43.89	208.81	OPK	210.15	0.21	0.99	59.29
4	44.06	208.30	OPK	210.15	0.21	0.99	59.29
5	45.44	212.81	OPK	210.15	0.22	1.01	59.29
6	50.91	217.47	OPK	210.15	0.24	1.03	59.29
7	52.73	224.28	PK	189.18	0.28	1.19	60.42
8	45.87	220.07	PK	189.18	0.24	1.16	60.42
9	37.07	181.17	PK	189.18	0.20	0.96	60.42
10	35.04	160.02	PK	189.18	0.19	0.85	60.42
11	34.24	146.76	PK	189.18	0.18	0.78	60.42
12	33.94	147.35	PK	189.18	0.18	0.78	60.42
13	32.58	137.69	PK	189.18	0.17	0.73	60.42
14	32.58	135.09	PK	189.18	0.17	0.71	60.42
15	33.56	144.73	PK	189.18	0.18	0.77	60.42
16	36.79	162.07	PK	189.18	0.19	0.86	60.42
17	51.31	226.97	PK	189.18	0.27	1.20	60.42
18	58.28	224.96	PK	189.18	0.31	1.19	60.42
19	58.64	231.39	PK	189.18	0.31	1.22	60.42
20	57.83	232.44	PK	189.18	0.31	1.23	60.42
21	56.85	229.46	PK	189.18	0.30	1.21	60.42
22	55.33	222.42	PK	189.18	0.29	1.18	60.42
23	46.33	210.79	OPK	210.15	0.22	1.00	59.29
24	43.13	205.62	OPK	210.15	0.21	0.98	59.29
Average Shaping Factor					0.23	1.00	

Figure 3 shows how the two shaping factors shape the bilateral prices to hourly values. The blue line depicts the prices on the last high priced day, January 16, 2024. Using the MIBP shaping factor DMM recommends, the yellow line shows how the bilateral prices (black dashed line) are shaped to follow a pattern similar to prices on January 16. The current hourly shaping factors, however, lead to an MIBP that is lower than the bilateral prices all day long, denoted by the green line. DMM does not believe this is the intention of the hourly shaping factor. Instead, the shaping factors should average to 1 such that the MIBP across the day would average to 1.1*applicable bilateral hub price.

Figure 3: MIBP calculations on February 20, 2024