Notice of Market Rules Modification

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This paper reviews the publication of information relating to the Temporary Price Cap (TPC) mechanism in the Singapore Wholesale Electricity Market ("SWEM").

Product prices in the SWEM are typically subjected to the primary price caps as set out in Appendix 6J, section J.1.7 of the Market Rules. When the TPC is activated, product prices will be capped at a level lower than said primary price caps until the TPC is de-activated.

When the TPC mechanism was introduced, information on certain product prices that are not subjected to the lower TPC limits when the TPC is activated were not available. This paper assesses a proposal to bridge this gap.

The RCP discussed the matter and supported the addition of the publication of the historical and real-time prices for Primary Reserves, Contingency Reserves, Regulation, and Market Network Nodal that are unaffected by the TPC. EMC had drafted rule changes to give effect to the above.

The RCP discussed the proposed modifications at its 146th meeting and the panel **unanimously supported** the proposed modifications.

Date considered by Rules Change Panel:	13 March 2025
Date considered by EMC Board:	11 May 2025
Date considered by Energy Market Authority:	5 June 2025
Proposed rule modification:	See attached paper

Reasons for rejection/referral back to Rules Change Panel (if applicable):

PAPER NO.	:	**EMC/BD/Cir/2025/08**
RCP PAPER NO.	:	**EMC/RCP/146/2025/RC391**
SUBJECT	:	**PUBLICATION OF TPC INFORMATION**
FOR	:	**DECISION**
PREPARED BY	:	**VINCENT WISE** **SENIOR ECONOMIST**
REVIEWED BY	:	**POA TIONG SIAW** **SVP, MARKET ADMINISTRATION**
DATE OF MEETING	:	**13 MARCH 2025**

Executive Summary

This paper reviews the publication of information relating to the Temporary Price Cap (TPC) mechanism in the Singapore Wholesale Electricity Market ("SWEM").

EMC proposes to publish the Primary Reserves prices, Contingency Reserves prices, Regulation prices, and Market Network Nodal prices uncapped by their respective TPC price caps for the Real Time Dispatch Schedule, Short-Term Schedule, and Pre-Dispatch Schedule. In addition, EMC proposes to extend the publication of the Reference Uniform Singapore Energy Price (RUSEP) and Moving Average Prices (MAP) for the Short-Term Schedule and Pre-Dispatch Schedule.

At the 141st RCP meeting, the RCP unanimously supported EMC's recommendations on the scope of TPC-related information to be published and tasked EMC with accessing the approach to do so.

The methodology for real-time and historical TPC-related information is straightforward for RUSEP. EMC will extend the real-time RUSEP methodology to other product prices. However, forecasting TPC information is more complex than computing the real-time RUSEP.

Embedding the TPC mechanism in forecast runs will enable a more comprehensive publication of forecasted TPC-related information but the different frequencies of forecast runs will create inconsistencies. Instead, EMC recommends publishing the projected MAP only. EMC opined that it provides sufficient information for MPs to infer potential TPC activation/de-activation events and estimate any price impacts. Moreover, the information generated is easy to understand and does not create inconsistencies. This approach is more cost-effective compared to embedding the TPC mechanism in forecast runs.

At the 144th RCP meeting, EMC recommended the RCP to support EMC's proposal to:

1. Extend the publication of real-time and historical TPC-related information to include the Primary Reserve prices, Contingency Reserve prices, Regulation prices, and Market Network Nodal prices that are unaffected by the TPC; and

2. On the publication of forecasted TPC-related information, to introduce the publication of forecasted MAP and the MAPT to enable the market to infer when potential TPC activations and de-activations will occur.

The RCP unanimously supported (1) extending the publication of real-time and historical TPC-related information to include the Primary Reserve prices, Contingency Reserve prices, Regulation prices, and Market Network Nodal prices that are unaffected by the TPC, and by majority vote did not support (2) the publication of forecasted TPC-related information.

EMC drafted modifications to the Market Rules to give effect to the RCP's decision above. The proposed modifications are contained in Annex 1.

At the 146th RCP meeting held on 13 March 2025, the RCP **unanimously supported** EMC's recommendations with regards to the proposed rule modifications.

The RCP recommends that the EMC Board:

a. **adopt** the proposed modifications as set out in Annex 1 of the paper; and
b. **seek the EMA's approval** of the proposed modifications as set out in Annex 1 of the paper.

1. Introduction

This paper reviews the proposal to publish information relating to the Temporary Price Cap (TPC) mechanism.

2. Background

In July 2023, the Energy Market Authority (EMA) directed a rule change[1] to introduce the TPC mechanism. It was implemented as one of the "guardrail measures" after high price volatility was observed in the Singapore Wholesale Electricity Market (SWEM) in 4Q2021.

The TPC is a circuit-breaker like mechanism that is activated when energy prices are high over a prolonged period of time. It temporarily lowers the respective price caps on products traded in the SWEM. This lowering is lifted after prices have stabilised.

The EMA has made a final determination regarding the publication of data for the TPC mechanism, which is described in Table 1 below:

Table 1: Publication of TPC Data

Frequency	Currently Published On	Data
For each trading period as per the Dispatch Run	EMC's Website	RUSEP (i.e., uncapped counterfactual USEP during a TPC activation), MAP, MAPT, TPC Status
Bi-weekly or as determined by EMA	EMA's Website	Term LRMC, Spot LRMC, TPC, TPC Reserves Cap, TPC Regulation Cap, Multiplier

An overview of the TPC mechanism and its parameters can be found in Annex 2 and 3.

3. Analysis

During the 2024 Rules Change Work Plan Prioritisation Exercise, EMC received a proposal to publish the prices for Primary Reserves, Contingency Reserves, Regulation, and the Market Network Nodal Prices ("Nodal Prices") that are not capped by the TPC (collectively referred to as "Proposed Prices" in the remainder of this paper).

The remainder of this concept paper discusses the merits of this proposal and any other TPC-related information that should be published.

3.1 Publication of Prices Uncapped by the TPC

3.1.1 Issue Analysis

This section reviews the advantages of disclosing the Proposed Prices.

When the TPC is activated, spot prices are capped at a lower level. Because offers are not capped, the products' cleared prices may exceed the relevant TPC level. While EMC publishes

[1] You can view the EMA determination paper here: https://www.ema.gov.sg/partnerships/consultations/2023/consultation-on-temporary-price-cap

the market prices for energy (RUSEP), the market prices of other products are not published currently. Non-publication of these Proposed Prices creates an information gap when the prices of these products are cleared above the relevant TPC level.

3.1.2 EMC's Recommendation

3.1.2.1 Should the uncapped counterfactual prices (Proposed Prices) of the various products be published, and if so, which ones?

EMC recommends publishing the Proposed Prices, which include all the prices for Primary Reserves, Contingency Reserves, Regulation, and the Nodal Prices that TPC does not cap. Such disclosure can improve transparency on actual real-time market conditions and enhance market efficiency, as discussed in RC355: Publication of Offer Data.

Beyond the general benefits of transparency, there are also specific benefits for various market participants ("MPs") and other stakeholders. MP can optimize their bids and offers with information on the original market-cleared prices of the various products. The publication of uncapped counterfactual prices for all Nodal Prices uncapped by the TPC can also level the playing field for "smaller" MPs relative to "larger" MPs associated with more nodes.

Publishing the Proposed Prices can also enhance market surveillance and monitoring for the Market Surveillance and Compliance Panel ("MSCP") and the regulator. It enables them to distinguish when these products' prices are market-cleared and when they experience revision by the TPC. Determining the gap between the cleared and capped prices enhances their ability to monitor market behaviour and make more nuanced price assessments.

To further quantify the value in publishing the counterfactual price of each product, we review previous TPC activations and examine the price revisions observed.

Analysis on Price Revision due to the TPC

To quantify the information gap, we examine the frequency and the extent of the price revision for each product due to the TPC. The more frequent, or the greater the extent of the price revision, the more significant the information gap, and in turn the more useful it is to publish the product's prices uncapped by the TPC. The data studied is up to the 8th TPC activation starting 4 April 2024 Period 35.

We first review the data for Regulation, Primary Reserves, and Contingency Reserves. Data on USEP revision is also provided for reference. Table 2 summarises the frequency of price revision for these products:

Table 2: Frequency of Price Revision due to TPC for USEP, Regulation, Primary Reserves, and Contingency Reserves

Activation Number	Start		End		TPC Active Periods	Periods of Price Revision			
	Date	Period	Date	Period		USEP	Regulation	Primary Reserves	Contingency Reserves
1	5/7/2023	34	6/7/2023	33	48	4	**31**	**0**	**0**
2	14/8/2023	34	15/8/2023	33	48	2	**21**	**0**	**0**
3	19/9/2023	36	21/9/2023	30	91	8	**41**	**0**	**0**
4	1/3/2024	36	2/3/2024	35	48	2	**8**	**0**	**0**
5	27/3/2024	39	28/3/2024	42	52	14	**37**	**0**	**0**
6	1/4/2024	36	¾/2024	35	48	13	**32**	**0**	**0**
7	2/4/2024	48	¾/2024	47	48	11	**20**	**0**	**0**
8	4/4/2024	35	5/4/2024	34	48	4	**13**	**0**	**0**

There is consistent frequent price revision due to the TPC for USEP and Regulation. This is not observed for Primary and Contingency Reserves. Therefore, when we examine the extent of price revision, we do so only for USEP and Regulation, as summarised by Table 3 below:

Table 3: Extent of Price Revision for USEP and Regulation due to the TPC

Activation Number	USEP Revision (Average)		Regulation Price Revision (Average)	
	$/MWh	% Change	$/MWh	% Change
1	$ 75.50	26.2%	$ 17.19	42.0%
2	$ 26.97	13.7%	$ 23.81	46.6%
3	$ 275.58	54.1%	$ 26.32	50.7%
4	$ 11.14	4.9%	$ 10.27	39.5%
5	$ 366.41	48.8%	$ 64.58	67.1%
6	$ 9.61	2.5%	$ 79.31	72.8%
7	$ 113.04	22.0%	$ 19.39	38.8%
8	$ 7.74	2.2%	$ 6.99	22.9%

Activation Number	Instances of USEP Revision				Instances of Regulation Price Revision		
	Price Revision > 1,000	100 < Price Revision < 999.99	0 < Price Revision < 99.99	Total	100 < Price Revision < 300	0 < Price Revision < 99.99	Total
1	2	0	2	**4**	0	31	**31**
2	1	0	1	**2**	5	16	**21**
3	7	0	1	**8**	9	32	**41**
4	0	2	0	**2**	2	6	**8**
5	7	3	4	**14**	11	26	**37**
6	0	1	12	**13**	24	8	**32**
7	2	2	7	**11**	3	17	**20**
8	0	3	1	**4**	0	13	**13**

The data shows that Regulation prices are frequently and significantly revised by the TPC. Out of 431 periods of TPC activation up to 4 April 2024, Regulation prices were revised 47% of the time (203 periods). The extent of the price revision is also significant – the lowest was a 22.9% revision on average on the 8th TPC activation, with the highest up to 72.8% on the 6th TPC activation. The significant information gap for Regulation prices, particularly due to its frequent price revision, warrants the publication of their prices that are uncapped by the TPC.

In comparison, the quantitative case for Primary and Contingency Reserves is not as strong. The lack of price revision for these two products may be a result of their high TPC levels compared to their usual market-cleared prices.

We turn to examining the case for Nodal Prices. Currently, data on Nodal Prices uncapped by the TPC are not readily available. We therefore use busbar prices[2] that are uncapped by the TPC, which can still illustrate there being different prices in different areas.

Table 4 below depicts the extent and frequency of price revisions caused by the TPC across all busbars on average in the 8 TPC activations thus far.

[2] Busbar prices are prices observed at buses, where each bus can be connected to several generators or loads.

Table 4: Frequency and Extent of Bus Price Revision

Activation Number	Bus Prices Revision (Instances)				
	Total Active Buses in Periods Where Price Revision is Observed	Total Buses Where Prices Were Revised[3]	Price Revision > 1,000	100 < Price Revision <= 1000	0 < Price Revision <= 100
1	3,519	3,519	1,759	0	1,760
2	1,768	1,489	884	0	605
3	7,035	7,035	6,152	0	883
4	1,775	1,775	0	1,775	0
5	12,308	11,517	6,161	2,636	2,720
6	11,454	9,719	0	796	8,923
7	9,643	9,283	1,757	1,700	5,826
8	3,508	3,508	0	2,197	1,311

Activation Number	Bus Price Revision (Average)	
	$/MWh	% Change
1	-$75.18	-26.1%
2	-$26.84	-13.7%
3	-$275.35	-54.1%
4	-$11.05	-4.9%
5	-$365.23	-48.7%
6	-$9.30	-2.4%
7	-$112.53	-21.9%
8	-$7.62	-7.7%

The frequency and extent of bus price revision is similar to that of USEP, which is expected. While the price revision for Bus Prices is not as frequent and extensive as that for Regulation, the information gap remains significant.

Going further, there will be a stronger case to publish the non-TPC capped Nodal Prices should there be significant differences for the uncapped prices across different nodes. In periods where prices are revised by the TPC, Nodal Prices across the board are likely brought down to the TPC level, irrespective of any price differential across nodes. There is another layer of information gap if the original cleared prices are not published.

Again, we examine bus prices to approximate the potential spread across Nodal Prices that are uncapped by the TPC. Table 5 depicts the differences between the maximum and the lowest bus prices observed when there is price revision due to the TPC.

[3] This measures the number of buses where prices are revised across all periods of said TPC activation. The number of buses where prices are revised may differ from period to period. All buses were considered to provide a closer approximation to Nodal Prices.

Table 5: Differences in Maximum and Minimum Bus Prices in Periods with TPC Price Revision

Activation Number	Periods with Bus Price Revision due to the TPC	Periods with Differences Between Max – Min Bus Prices	Average Max – Min Bus Price Difference
1	4	4	$42.85
2	2	2	$33.38
3	8	3	$25.31
4	2	2	$22.32
5	14	14	$55.47
6	13	13	$101.26
7	11	11	$29.91
8	4	4	$18.48

Out of 58 periods where Bus Prices are revised by the TPC, price differentials across buses were observed in 91% of those periods (53 periods). The 5 periods where there are no price differentials between the bus prices was due to energy shortfalls in those periods. On average, the difference between the maximum and minimum non-TPC capped bus prices remains significant. Across 8 activations, the average difference is 51.40 $/MWh. This suggests that there is an information gap that the publication of the Nodal Prices not capped by the TPC will overcome.

In addition to overcoming the information gap, it is necessary to publish all of the Proposed Prices and RUSEP for a more complete picture of market conditions. The co-optimisation technique is employed in the market clearing process, which implies that inputs for all the products traded would affect the solution for the prices and dispatch of energy, reserves and regulation for SWEM. Not publishing the Proposed Prices makes it difficult for MPs to know whether the price is a result of the TPC or other factors, such as a lack of offers or bids for a particular product. Therefore, there is inherent value in publishing the Proposed Prices despite the limited information gap of certain individual products.

Considering the above, EMC recommends publishing all the Proposed Prices[4].

3.1.2.2 Publication Horizon for the Proposed Prices

EMC recommends publishing the Proposed Prices for the Real Time Dispatch Schedule (RTDS), the Short Term Schedule (STS), and the Pre-Dispatch Schedule (PDS), which also includes all the High, Medium, and Low load scenarios for the STS. Please refer to Annex 4 for a description of the various schedules EMC publishes.

By publishing the Proposed Prices, MPs can view the uncapped counterfactual prices up to a day ahead at 6 pm on the preceding day. Information up to a day ahead is helpful as the TPC will be activated for at least 48 periods each time, and TPC activations are likely to continue to the following day, supported by current observations so far. The recommendation also caters to current EMA requirements for generator-class MPs to submit day-ahead offers by 6 pm on the preceding day[5].

EMC does not recommend extending the publication of the Proposed Prices to the Market Outlook Scenario (MOS). Doing so means that data up to 336 periods ahead will be published, compared to 72 periods ahead in EMC's recommendation. This suggestion would

[4] EMC proposes to publish the Nodal Prices uncapped by the TPC alongside where Nodal Prices are currently published on this link: https://www.nems.emcsg.com/nems-prices

[5] For more information, you can view the EMA determination paper here: https://www.ema.gov.sg/partnerships/consultations/2021/modifications-to-electricity-market-rules-in-relation-to-preemptive-direction-to-ensure-secure-and-reliable-electricity-supply

exponentially increase system and infrastructure costs to support the storage and publication of such data. Moreover, the MOS considers input data up to a week ahead, which is prone to change, resulting in less accurate output. The costs likely outweigh the benefits in this case.

3.2 Other TPC Information

3.2.1 Forecast RUSEP, Moving Average Price, and TPC Status

RUSEP is the USEP that the TPC does not cap. The MAP is a rolling average of USEP[6] over a specified number of periods, and it governs the activation and de-activation of TPC. When the MAP exceeds the Moving Average Price Threshold (MAPT is set by EMA and adjusted bi-weekly), the TPC is activated in the next period. Conversely, suppose TPC has been active for at least the Minimum Period, and the MAP is equal to or below the MAPT. In this case, the TPC is deactivated in the next period. EMC also publishes the TPC Status for each period.

Publishing Forecast RUSEP and Forecast MAP would give MPs better visibility of potential TPC activation and de-activation. Forecast MAP would enable generator-class MPs and Demand Response participants to react more effectively to any potential TPC activation as they can see which period the MAP will breach the MAPT.

By allowing MPs to react promptly and contribute positively to supply or demand during high-prices periods, it allows the fulfilment of TPC's policy objective to prevent sustained periods of high prices in a more organic and efficient manner.

Publishing the Forecast TPC Status is useful considering that the TPC is not activated in the period MAP breaches the MAPT, but the period after. It provides clarity on which periods will prices start to experience potential revision by the TPC.

Therefore, EMC recommends publishing the forecast Reference USEP (RUSEP) and Moving Average Prices (MAP) beyond the latest dispatch run. Like the Proposed Prices, EMC recommends extending the publication of the RUSEP and MAP to include the Short-Term Schedule (including over the High, Medium, and Low Demand Scenarios) and the Pre-Dispatch Schedule.

4. Consultation

The proposed enhancements to the publication of TPC-related information were published for consultation on 16 April 2024. We received comments from EMC Markets and Operations, Keppel Merlimau Cogen, Senoko Energy, PaciflicLight Power, and the Market Surveillance and Compliance Panel (MSCP).

A summary of industry comments and EMC responses are provided in Table 6 below.

[6] In the periods where TPC is activated, the RUSEP is used to calculate the MAP.

Table 6: Summary of Industry Comments

S/N	Comment	EMC Response
Comments received from: EMC Markets and Operations		
1	As a market service provider, we recognize the importance of data transparency for market participants. We also recognize the potential advantages of publishing the reserves, regulation, and MNN prices that TPC uncaps. Therefore, we support publishing the "Proposed Price" as set in the concept paper. From the market operation point of view, we have two general comments regarding the proposal in the concept paper: 1. Though publishing the "Proposed Prices" may be straightforward, however, the mechanism to determine the "Proposed Prices" particularly the TPC application to forecast market clearing results maybe complex. The complexity may result in high implementation costs. Hence, the methodology and cost will need to be considered. 2. We are of the view that a review of the asymmetric reserves and regulation price caps under TPC is pressing, given that regulation prices were revised 47% of the time when TPC was activated.	EMC notes the comment on the need to consider the methodology and the potential costs. These will be reviewed in a subsequent paper, after the scope of what is to be published is ascertained in this concept paper. A review of the TPC price caps is not within the scope of this paper.
Comments received from: Keppel Merlimau Cogen		
2	Could EMC clarify on the format of the data publication for TPC information? Currently the RUSEP/MAP/TPC status can only be downloaded for the day itself and at most historical 72 Periods. Past this, the information will no longer be available in excel format to the Market Participants. Keppel suggests that the TPC information should be available to be retrieved similar to the information on "Final Prices and Information on Registered Facilities".	The approach to the publication of TPC information will be reviewed in a subsequent paper, after the scope of what is to be published is ascertained in this concept paper.

Comments received from: Senoko Energy		
3	Senoko strongly agrees with the proposal to publish additional prices as listed in table 6. Market and data transparency will always lead to more efficient market outcomes in the long run. We also appreciate the publication of forecasted moving average prices, reducing the duplication of work for all market participants.	EMC notes Senoko Energy's comments.
Comments received from: PacificLight Power		
4	PLP supports the enhancements to the publication of information related to TPC. This will provide more transparency and will keep the MPs informed of prevailing market conditions in the real time, short term and pre-dispatch schedules. Additionally, we would request for all TPC data to be made available through EMC market systems, particularly the Webservices.	EMC notes PacificLight Power's comments. The approach to the publication of TPC information will be reviewed in a subsequent paper, after the scope of what is to be published is ascertained in this concept paper. .
Comments received from the Market Surveillance and Compliance Panel (MSCP)		
5	The MSCP supports the proposal to publish additional data in relation to the Temporary Price Cap ("TPC") mechanism. The MSCP notes that increasing information disclosure can aid power generation companies and Demand Response participants in responding better to forecasted and real-time market events. Moreover, the provision of more TPC data can enhance market surveillance and monitoring activities, and generate greater insights into market price trends.	EMC notes the MSCP's comments.

5. Conclusion and Recommendation for the 141st RCP Meeting

This paper reviews the proposal to enhance the publication of TPC-related information. These enhancements would overcome an existing information gap with regards to TPC-related information, and further enhance data transparency. The proposed enhancements are summarised in Table 7 below.

Table 7: Proposed Enhancements to Publication of TPC Information

Status	Data	Publication Horizon
New	Reference Primary Reserves Prices	In the Real-Time Dispatch Schedule, Short Term Schedule, and Pre-Dispatch Schedule.
	Reference Contingency Reserves Prices	
	Reference Regulation Prices	
	Reference Market Nodal Prices	
Pre-existing	Reference USEP	To extend to be included in the Short Term Schedule and Pre-Dispatch Schedule.
	Reference MAP	
	TPC Status	

EMC recommends for the RCP to:

1. Support the proposal to enhance the publication of TPC-related information in accordance with Table 7; and
2. Task EMC to assess the approach to implement the above-mentioned enhancements, and the associated costs and timeline.

6. Decision at the 141st RCP Meeting

The concept paper was discussed at the 141st RCP meeting.

The RCP unanimously supported EMC's proposal on the enhancements to the publication of TPC-related information, and tasked EMC to assess the approach to implement the above-mentioned enhancements, and the associated costs and timeline.

7. Implementation Approach

To give effect to the RCP's decision at the 141st RCP meeting, EMC has assessed the implementation approach to enhance the publication of TPC-related information.

Arriving at a sound implementation approach would then require a discussion on the methodology to the information generation and publication. The methodology shapes the context of the information provided, and therefore dictates whether the information is useful.

We first discuss the methodology to publish the real-time and historical TPC-related information, before looking into the forecasted TPC-related information. While the discussion

will be based on the scope of TPC-related information supported by the RCP previously, there may be adjustments to the scope depending on the methodology adopted.

7.1 Methodology for Real-time and Historical TPC Information

Currently, real-time and historical RUSEP are published. The data source is the latest available RTDS produced by the Market Clearing Engine (MCE).

EMC considers that the existing methodology to publish real-time and historical RUSEP is fit for purpose. Extending this treatment to the publication of other real-time and historical TPC information is sufficient for information transparency, in a way that is familiar for MPs. Hence, this existing methodology will be applied to the publication of Primary Reserve prices, Contingency Reserve prices, Regulation prices, and Market Nodal Prices that are uncapped by the TPC.

7.2 Methodology for Forecasted TPC Information

The methodology for forecasted TPC information on the other hand requires more consideration, and there are different ways on how they can be derived and therefore utilised. Two options will be considered, each with varying complexity, and hence expected costs and implementation effort.

7.2.1 Option 1 – Projected MAP

The first option is to only have the publication of the MAP that is projected up to 72 periods ahead, i.e., covering the horizon of the PDS. The aim is to provide the market with up-to-date information on forecasted MAP, facilitating inferences about when the TPC may be activated or de-activated. The data source would be the latest available forecast schedule for a given period. Namely, whenever available, data from the STS will replace data from the PDS.

Option 1 will not embed the TPC mechanism into any of the forecast runs. Hence, Option 1 will not involve publishing the forecasted TPC Status and the “reference” product prices that are not subjected to the TPC. A depiction of Option 1 is provided in Figure 1 below.

Figure 1: Illustration of Option 1 when TPC is Not Applied and when TPC is Applied

Period	USEP ($/MWh)	RUSEP ($/MWh)	MAP ($/MWh)	MAPT ($/MWh)	TPC Applied
P20	125.64	125.64	101.44	581.85	No
P21	121.73	121.73	102.07	581.85	No
P22	104.96	-	102.4492	581.85	-
…					
P33	100.84	-	103.7269	581.85	-
P34	100.31	-	103.8348	581.85	-
Next Day					
P48	91.10	-	102.6408	581.85	-

RTS
STS
PDS

LAST UPDATED: 12 Jul 2024 10:05

Period	USEP ($/MWh)	RUSEP ($/MWh)	MAP ($/MWh)	MAPT ($/MWh)	TPC Applied
P20	4000.00	4000.00	600.00	581.85	No
P21	581.85	4000.00	590.56	581.85	Yes
P22	3000.00	-	588.23	581.85	-
…					
P33	100.84	-	103.7269	581.85	-
P34	100.31	-	103.8348	581.85	-
Next Day					
P48	91.10	-	102.6408	581.85	-

RTS
STS
PDS

LAST UPDATED: 12 Jul 2024 10:05

As of 1005 hours, the data source for the MAP would come from the latest available schedules, namely the RTDS covering Periods 1-21 of the day, the STS covering Periods 22-33, and the PDS covering Periods 34-48. Subsequently, by 1035 hours, the STS covering up to Period 34 would have been run, replacing the PDS-sourced data for Period 34.

The forecasted MAP as described above ensures that at any one time, the most recently available information is used to derive the MAP. This gives the market the most up-to-date information to make inferences on potential TPC activations or de-activations.

While there will be no indication of the forecasted TPC Status in Option 1 as the TPC mechanism is not applied in forecast runs, EMC plans to communicate when it is detected that the MAP breaches the MAPT. One possible way is to do so via an advisory notice.

7.2.2 Option 2 – Embedding the TPC Mechanism in Forecast Runs

Option 2 considers embedding the TPC mechanism in the STS and PDS. In theory, this would enable the derivation and hence publication of forecasted TPC status and the "reference" product prices that are not subjected to the TPC, which are unavailable in Option 1. This is depicted in Figure 2.

Figure 2: Illustration of Option 2 when TPC is Not Applied and when TPC is Applied

Period	USEP ($/MWh)	RUSEP ($/MWh)	MAP ($/MWh)	MAPT ($/MWh)	TPC Applied
P20	125.64	125.64	101.44	581.85	No
P21	121.73	121.73	102.07	581.85	No
P22	104.96	104.96	102.4492	581.85	No
…					
P33	100.84	100.84	103.7269	581.85	No
P34	100.31	100.31	103.8348	581.85	No
Next Day					
P48	91.10	91.10	102.6408	581.85	No

RTS
STS
PDS

LAST UPDATED: 12 Jul 2024 10:05

Period	USEP ($/MWh)	RUSEP ($/MWh)	MAP ($/MWh)	MAPT ($/MWh)	TPC Applied
P20	4000.00	4000.00	600.00	581.85	No
P21	581.85	4000.00	590.56	581.85	Yes
P22	581.85	3000.00	588.23	581.85	Yes
…					
P33	100.84	100.84	103.7269	581.85	Yes
P34	100.31	100.31	103.8348	581.85	Yes
Next Day					
P48	91.10	91.10	102.6408	581.85	No

RTS
STS
PDS

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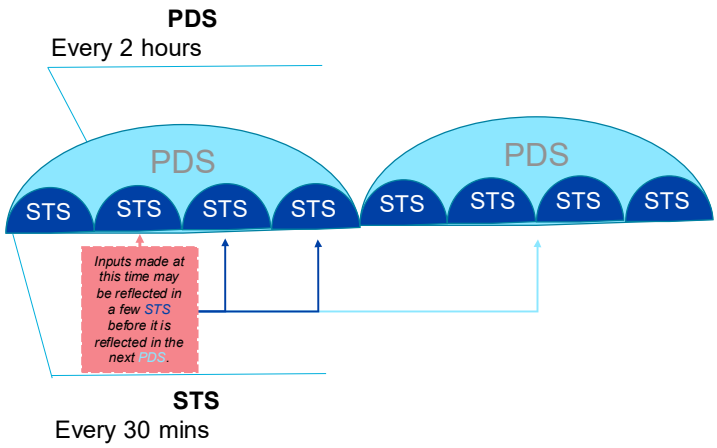
However, Option 2 may result in inconsistent inferences on the published TPC information. Fundamentally, these inconsistencies arise from the different frequencies the forecast runs are generated. An illustration of this is depicted in Figure 3 below.

Figure 3: Illustration of Different Frequencies of Forecast Schedules



Hence, for a particular forecast period, it is possible that the data reflected in the periods only covered the PDS is outdated compared to the more frequently run STS. An example is depicted in the scenario below.

Figure 4: Illustration of Option 2, Before Forced Outages

	STS				PDS			
Period	**RUSEP**	**MAP**	**MAPT**	**TPC Applied**	**RUSEP**	**MAP**	**MAPT**	**TPC Applied**
P21	300	490	600	No	300	490	600	No
P22	300	490	600	No	300	490	600	No
P23	300	495	600	No	300	495	600	No
P24	300	492	600	No	300	492	600	No
P25	300	490	600	No	300	490	600	No
…								
P33	300	495	600	No	300	495	600	No
P34	(N/A for STS)	(N/A for STS)	600	No (implied)	300	495	600	No
Next Day								
P24	(N/A for STS)	(N/A for STS)	600	No (implied)	300	500	600	No

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Consider the scenario as depicted in Figure 4 above. As of 1005 hours, the STS covering Periods 22-33 and the PDS covering Period 25 today up to Period 48 the day after have been run. At this point, it does not seem that the TPC will be activated up until the day after, as at no point is the MAP above the MAPT.

Afterwards, suppose a unit experiences a forced outage, which then results in the unit's offers being withdrawn for Periods 22-25. Suppose this then affects prices as depicted in Figure 5 below.

Figure 5: Illustration of Option 2, After Forced Outages

	STS				PDS			
	RUSEP	**MAP**	**MAPT**	**TPC Applied**	**RUSEP**	**MAP**	**MAPT**	**TPC Applied**
P21	300	490	600	No	300	490	600	No
P22	4000	530	600	No	300	490	600	No
P23	4000	560	600	No	300	495	600	No
P24	4000	610	600	No	300	492	600	No
P25	4000	630	600	Yes	300	490	600	No
…								
P33	500	600	600	Yes	300	495	600	No

P34	510	605	600	Yes	300	495	600	No
Next Day								
P24	(N/A for STS)	(N/A for STS)	600	Yes (implied)	300	500	600	No

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The RUSEP and USEP for Periods 22-25 rise as a result of the withdrawn offers. This is captured in the most recently run RTDS and STS produced by 1035 hours, which detects a potential TPC activation in Period 25, which is implied to be active till at least Period 24 the following day. However, the offer changes are not yet captured in the latest PDS, which will only be produced again by 1205 hours. Therefore, for Period 35 till Period 24 the day after, the forecasted TPC Status will still indicate "No".

This causes some inconsistency between the results in the STS and the PDS. The STS implies the TPC will be activated within the next 48 periods, but not the PDS – causing a dilemma in what ought to be the TPC Status in Period 24 the next day in the above worked example, for instance.

7.2.3 Relative Merits of Options 1 and 2

Both Options 1 and 2 are equally good in facilitating inferences about when the TPC may be activated or de-activated. Both options generate forecasted MAP in a similar way, using input from the latest available real-time and forecast schedules. Neither option has an edge in this regard.

Option 2 appears to have an edge over Option 1 as it can generate more forecasted TPC information, namely the forecasted TPC Status and the forecasted product prices that are capped and uncapped by the TPC. However, Option 2 also results in the inconsistencies depicted in Figures 4 and 5. While EMC champions greater information transparency, it should not be at the expense of accuracy. Information from the market operator ought to be clear, accurate, and maximally intuitive so market participants can rely on them to make decisions.

While it may not be impossible to remedy the inconsistencies in Option 2, any eventual solution will add extensive complexity. For instance, it may be possible to enforce that should there be an inconsistency in the TPC Status for a particular forecasted period, the TPC information in the PDS will be updated using TPC information from the STS. This may result in extensive overriding of the PDS. Before the next PDS is run, up to 4 STS may be generated, implying there can be up to 4 instances of the PDS being overridden for its every run. Extensive information overriding would put additional stress on EMC's systems. Option 2 already costs more to implement than Option 1 (as will be shown in section 7.2.4); any attempt to remedy Option 2's inconsistencies will lead to even more costs.

Moreover, the edge that Option 2 has over Option 1 is mainly relevant when, for forecasted periods, product prices are forecasted to be revised by the TPC, as Option 2 gives a side-by-side comparison of the original market cleared price, and the price capped by the TPC. Option 1 will only publish the uncapped prices for the forecast periods. However, even with Option 1, it remains possible to estimate what the forecasted TPC-capped prices are as the TPC price caps for the real-time products are published by EMA beforehand, and these caps are fixed fortnightly at present. This diminishes the edge Option 2 has over Option 1.

7.2.4 Estimated Costs

This section provides an estimate of the costs to publish the real-time and historical TPC-related information, and the estimate of costs for Option 1 and Option 2 on the publication of forecasted TPC-related information.

Table 8: Implementation Cost Estimate for Publication Real-Time and Historical TPC-related Information

S/N	Cost Item	Extend Publication of Real-Time TPC Information		Publication of Forecasted TPC Information			
				Option 1		Option 2	
		Internal	*External*	*Internal*	*External*	*Internal*	*External*
1	Change Requirement Scoping and Analysis/Documentation	$4,400.00	$24,120.00	$5,150.00	$10,720.00	$8,750.00	$26,800.00
2	Design/Development/Testing/Deployment/ Documentation	$63,500.00	$246,488.00	$62,400.00	$148,860.00	$110,550.00	$274,750.00
3	Project Management	$45,100.00	$0.00	$25,300.00	$0.00	$50,600.00	$0.00
4	Critical Information Infrastructure (CII)	$0.00	$29,480.00	$0.00	$18,760.00	$0.00	$29,480.00
5	Penetration Test by Certified Pen Tester	$0.00	$20,400.00	$0.00	$17,000.00	$0.00	$20,400.00
	Total One-off Costs	$113,000.00	$320,448.00	$92,850.00	$195,340.00	$169,900.00	$351,430.00
		$433,488.00		**$288,190.00**		**$521,330.00**	
	Annual Operating Expenditure	**$0.00**		**$3,600.00**		**$20,664.00**	

The higher costs for Option 2 arise from its greater complexity as compared to Option 1.

7.3 Jurisdictional Scan

To supplement the discussion on the approach to TPC-related information publication, EMC has also conducted a review of practices in jurisdictions that have mechanisms similar to the TPC.

Electric Reliability Council of Texas' ("ERCOT") Scarcity Pricing Mechanism and the more recently introduced Emergency Pricing Program[7] are offer caps instead of price caps, and hence are less applicable.

The Philippine Wholesale Electricity Spot Market's ("WESM") Secondary Price Cap is more similar in design to the NEMS' TPC, but as of time of writing, EMC are yet to observe information on the Secondary Price Cap published in a dashboard-like manner.

Such a dashboard is available for the Australian National Electricity Market ("NEM") however, where they provide a dashboard on recent and projected trends of the cumulative price[8].

The NEM's Cumulative Price Threshold works similarly to the NEMS' TPC. When cumulative prices across 7 days breach a certain threshold, administered pricing is implemented. The Australian Energy Market Operator ("AEMO") recently launched a dashboard that shows the

[7] https://www.puc.texas.gov/agency/rulesnlaws/subrules/electric/25.509/25.509.pdf

[8] https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/data-nem/data-dashboard-nem

current cumulative price, the forecasted cumulative price, and the current status on whether administered pricing is in place. Their dashboard is depicted in Figure 6 below.

Figure 6: NEM's Cumulative Price Threshold Dashboard

The current and forecast cumulative price published by AEMO are very much akin to EMC publishing the current and forecast MAP, as they both determine whether administered pricing or the TPC are triggered respectively. AEMO publishes the current status of whether the cumulative price threshold is breached, which is akin to EMC publishing the current TPC Status. The practice in the Australian NEM appears to be in line with Option 1 as proposed in this paper.

8. Consultation

The proposed methodology to further the publication of TPC-related information was published for consultation on 11 October 2024. We received comments from Keppel Merlimau Cogen, PacificLight Power, and EMC Markets and Operations.

A summary of industry comments and EMC responses are provided in Table 9 below.

Table 9: Summary of Industry Comments

S/N	Comment	EMC Response
Comments received from: Keppel Merlimau Cogen		
1	Considering the advantages of both Option 1 and Option 2, Keppel proposes to adopt Option 2. We are of the opinion that the publication of more forecasted TPC-related information is better for market transparency, and that the inconsistency highlighted by the EMC does not need to be remedied as market participants are generally	EMC notes Keppel's preference for Option 2. However, EMC's view is that Option 1 can provide a comparable level of transparency as MPs can still infer potential TPC activations/de-

S/N	Comment	EMC Response
	familiar with the different frequencies of the STS (LAR) and PDS (DAR).	activations, and can estimate the final settlement price. EMC is also of the view that the inconsistencies associated with Option 2 would need to be addressed, and specific remedies studied, if Option 2 is supported by the RCP.
2	Keppel suggests consolidating related workstreams that involve modifications to the webservices (i.e TPC Phase II enhancements, Publication of TPC Information) to be implemented simultaneously. This would minimize modifications required to be implemented at each MPs end following each update, especially if there is no urgency for implementation.	In principle, EMC always tries to combine synergistic workstreams as much as possible. That said, EMC notes Keppel's comments and will explore internally what is possible.
Comments received from: PacificLight Power		
3	PLP supports the proposal to publish Proposed Prices to enhance market transparency and minimise information gaps for MPs. After reviewing both Options 1 and 2 presented by EMC, PLP recommends adopting Option 2 for the following reasons: 1. The inconsistencies noted for Option 2 stem from the differing update frequencies of the STS and PDS, which would still affect the forecasted MAP under Option 1. 2. While we acknowledge that Option 1 may help MPs infer potential TPC activations and deactivations, MPs would still need to perform further calculations to estimate settlement prices accurately. Therefore, it is more efficient for the MCE to perform these calculations and directly publish the forecasted TPC-related data.	EMC notes PLP's preference for Option 2 and appreciation for Option 2 facilitating more accurate estimations of the settlement prices. While EMC notes that Option 2, in comparison to Option 1, provides readily available settlement prices, even with Option 1 such prices can still be estimated. Accounting for the inconsistencies associated with Option 2, Option 1 provides TPC information in a cleaner manner.
	To address inconsistencies between STS and PDS, we propose resolving this issue at its source by increasing the frequency of PDS runs from the current two-hour interval to a one-hour interval. This adjustment would reduce inconsistencies	While adjusting the PDS' frequency would resolve the underlying issue, the considerations behind adjusting the PDS' frequency are broad and extends beyond this proposal. Should Option 2 be supported, EMC's view is that a more specific remedy for the

S/N	Comment	EMC Response
	across all forecasted information published by the MCE, thereby enhancing data accuracy for MPs.	inconsistencies would need to be studied.
Comments received from: EMC Markets and Operations		
5	Option 1 provides projected MAP and MAPT for inferring TPC status. It has less complexity and a lower implementation cost than Option 2, but the added value to the market might be limited. A more concrete understanding of the market participants' expectation on the forecasted TPC information will be helpful for making the decision.	EMC notes MO's comment. The consultation exercise is aimed at gathering industry feedback on such matters.
6	The inconsistency between STS and PDS described in the paper for Option 2 may not be an issue as the market participants could understand that STS and PDS are generated separately with different frequencies. However, a concern for Option 2 is that the forecasted TPC activation/deactivation could change frequently due to the dynamics in the market or power system conditions. This would cause excessive alerts and price capping/uncapping for the forecast schedules.	EMC notes MO's comment on a concern for Option 2.

9. Conclusion and Recommendation

At its 141st meeting, the RCP discussed the usefulness of publishing additional information related to the TPC. Based on that discussion, an assessment of the methodology for such publication was done.

There is an existing methodology to publish real-time and historical TPC information. This is currently used for RUSEP and is fit for purpose. **EMC recommends extending this existing methodology to the publication of the other product prices uncapped by the TPC**.

For forecasted TPC information, the option to embed the TPC mechanism in forecast runs to enable the publication of more extensive forecasted TPC-related information was explored (as Option 2). On balance, **EMC recommends adopting Option 1**, because:

1. Option 1 provides sufficient information to help MPs infer potential TPC activation/de-activation events, and also estimate any impact on prices;
2. Information generated from Option 1 will be easier to understand and not create inconsistencies; and
3. It is more cost-effective.

EMC therefore recommends the RCP to support EMC's proposal to:

1. Extend the publication of real-time and historical TPC-related information to include the Primary Reserve prices, Contingency Reserve prices, Regulation prices, and Market Network Nodal prices that are unaffected by the TPC; and
2. On the publication of forecasted TPC-related information, to introduce the publication of forecasted MAP and the MAPT to enable the market to infer when potential TPC activations and de-activations will occur.

For avoidance of doubt, with Option 1, the existing practice of publishing forecasted product prices unaffected by the TPC will remain.

10. Decision at the 144th RCP Meeting

The methodology to the publication of TPC-related information was discussed at the 144th RCP meeting.

The RCP unanimously supported EMC's recommendation to extend publication of real-time and historical TPC-related information to include the Primary Reserve prices, Contingency Reserve prices, Regulation prices, and Market Network Nodal prices that are unaffected by the TPC.

The RCP also discussed whether to publish forecasted TPC-related information in the first place. The RCP by majority vote supported not to introduce the publication of forecasted TPC-related information. Therefore, there was no further voting on the options related to the publication of forecasted TPC-related information.

The following Panel members supported the publication of forecasted TPC-related information:

1. Mr. Teo Chin Hau (Representative of Generation Licensees)
2. Mr. Andrew Tan (Representative of Retail Licensees)
3. Mr. Matthijs Guichelaar (Representative of Retail Licensees)
4. Mr. Wong Yew Chung (Person experienced in financial matters in Singapore)

The following Panel did not support the publication of forecasted TPC-related information:

1. Mr. Soh Yap Choon (Representative of PSO)
2. Mr. Sherman Toh (Representative of Transmission Licensee)
3. Mr. Dallon Kay (Representative of Retail Licensees)
4. Mr. Cheong Zhen Siong (Representative of Wholesale Electricity Traders)
5. Mr. YK Fong (Representative of Consumers of Electricity in Singapore)

The following Panel members abstained from voting on whether to have the publication of forecasted TPC information:

1. Mr. Henry Gan (Representative of EMC)

11. Proposed Modifications to the Market Rules

To give effect to the RCP's decision at the 144th RCP meeting, EMC drafted modifications to the Market Rules as set out in Annex 1, also summarised in Table 10 below.

Table 10: Summary of Proposed Modifications

Chapter / Section	Summary of Proposed Modifications
Chapter 6, Section 9.2.4	To add the relevant "reference" prices unaffected by the TPC to the list of things that EMC will publish in the real-time schedule.
Appendix 6D Section D.24	To add explanations or formulas on how the relevant "reference" prices unaffected by the TPC are derived.
Chapter 8	To add new definitions on the relevant "reference" prices unaffected by the TPC, and to edit the current definition for RUSEP.

12. Implementation Costs and Timeline

Following the RCP's decision at the 144th RCP meeting, EMC has also come up with a more precise implementation cost breakdown and timeline.

Table 11: Implementation Cost Estimate for Publication Real-Time and Historical TPC-related Information

<table>
<tr><th rowspan="2">S/N</th><th rowspan="2">Cost/Action Item</th><th colspan="2">Extend Publication of Real-Time TPC Information</th><th rowspan="2">Calendar Weeks Elapsed</th></tr>
<tr><th>Internal</th><th>External</th></tr>
<tr><td>0</td><td>Sourcing</td><td>N/A</td><td>N/A</td><td>12.0</td></tr>
<tr><td>1</td><td>Change Requirement Scoping and Analysis/Documentation</td><td>$4,400.00</td><td>$24,120.00</td><td rowspan="6">43.0</td></tr>
<tr><td>2</td><td>Design/Development/Testing/Deployment/ Documentation</td><td>$63,500.00</td><td>$246,488.00</td></tr>
<tr><td>3</td><td>Project Management</td><td>$45,100.00</td><td>$0.00</td></tr>
<tr><td>4</td><td>Critical Information Infrastructure (CII)</td><td>$0.00</td><td>$36,837.50</td></tr>
<tr><td>5</td><td>Penetration Test by Certified Pen Tester</td><td>$0.00</td><td>$20,400.00</td></tr>
<tr><td rowspan="3"></td><td rowspan="2">Total One-off Costs / Calendar Weeks Elapsed</td><td>$113,000.00</td><td>$327,845.50</td><td rowspan="2">55.0</td></tr>
<tr><td colspan="2">$$440,845.50</td></tr>
<tr><td>Annual Operating Expenditure</td><td colspan="2">$0.00</td><td></td></tr>
</table>

13. Consultation

The proposed rule modifications were published for consultation on 12 February 2025. We received comments from Keppel Merlimau Cogen. The received comments and EMC's response are provided in Table 12 below.

Table 12: Summary of Industry Comments to Proposed Rule Modifications

S/N	Comment	EMC Response
Comments received from: Keppel Merlimau Cogen		
1	Keppel has no objection to the proposed rule changes. To reduce MPs' administrative cost and effort in updating their internal applications that interface with EMC Webservices, we suggest that the additional information should be published as a separate MCR report instead of modifying existing MCR reports. Additionally, the information should also be made available through EMC website to provide more flexibility for information retrieval.	EMC notes that Keppel has no objection to the proposed rule changes. EMC notes Keppel's suggestion on how the additional information can be published and will evaluate the best approach to do so. This additional information is intended to be available from the EMC website.

14. Legal Sign-Off

The text of the proposed rule modifications as set out in Annex 1 has been vetted by EMC's internal legal counsel, whose opinion is that the modifications of the market rules reflect the intent of the proposed modifications as expressed in the third column of the table in Annex 1.

15. Conclusion and Recommendation

With regards to the rules EMC had drafted following the RCP's decision at the 144th RCP meeting on the enhancements to the publication of TPC-related information, EMC recommends that the RCP:

a. Support the proposed modifications as set out in Annex 1; and

b. Recommend that the EMC Board adopts the proposed Market Rules modifications as set out in Annex 1.

16. RCP's Decision at the 146th RCP Meeting

At its 146th RCP meeting, the RCP **unanimously supported** EMC's recommendations.

17. Recommendation

The RCP recommends that the EMC Board:

a. **adopt** the proposed modifications as set out in Annex 1 of the paper; and

b. **seek the EMA's approval** of the proposed modifications as set out in Annex 1 of the paper.

Annex 1: Proposed Rule Modifications

Existing Market Rules (1 Jan 2025)	Proposed Rule Changes (deletions represented by strikethrough text and additions represented by double underlined text)	Reasons for Modification
Chapter 6 – Market Operation	**Chapter 6 – Market Operation**	
9.2 THE REAL-TIME SCHEDULING PROCESS 9.2.4 The *EMC* shall, in accordance with the *market operations timetable*, *publish* the following information as it pertains to each *dispatch period:* 9.2.4.1 total *load;* 9.2.4.1A total *load curtailment* of all *LRFs with REB*; 9.2.4.1B total *solar generation*; 9.2.4.2 total transmission losses; 9.2.4.3 total *reserve* requirements by *reserve class*; 9.2.4.4 total *regulation* requirements; 9.2.4.5 *energy* prices associated with each *market network node* at which a *generation registered facility*, *import registered facility* or *generation settlement facility* is located, determined	**9.2 THE REAL-TIME SCHEDULING PROCESS** 9.2.4 The *EMC* shall, in accordance with the *market operations timetable*, *publish* the following information as it pertains to each *dispatch period:* 9.2.4.1 total *load;* 9.2.4.1A total *load curtailment* of all *LRFs with REB*; 9.2.4.1B total *solar generation*; 9.2.4.2 total transmission losses; 9.2.4.3 total *reserve* requirements by *reserve class*; 9.2.4.4 total *regulation* requirements; 9.2.4.5 *energy* prices associated with each *market network node* at which a *generation registered facility*, *import registered facility* or *generation settlement facility* is located, determined	To establish that the EMC, for each real-time dispatch period, shall also publish "reference" product prices that will not be subjected to the temporary price cap.

Existing Market Rules (1 Jan 2025)		Proposed Rule Changes (deletions represented by strikethrough text and additions represented by double underlined text)		Reasons for Modification
	in accordance with sections D.24.1 and D.24.5 of Appendix 6D;		in accordance with sections D.24.1 ~~and D.24.5 of Appendix 6D~~;	
9.2.4.6	the *uniform Singapore energy price,* determined in accordance with section D.24.6 of Appendix 6D;	9.2.4.5A	*reference market energy prices* or *RMEP* associated with each *market network node* at which a *generation registered facility*, *import registered facility* or *generation settlement facility* is located, determined in accordance with section D.24.1A of Appendix 6D;	
9.2.4.6A	the *load curtailment price*, determined in accordance with section D.24.10 of Appendix 6D;	9.2.4.6	the *uniform Singapore energy price,* determined in accordance with section D.24.6 of Appendix 6D;	
9.2.4.6B	the counterfactual *uniform Singapore energy price*, determined in accordance with sections D.24.8 and D.24.9 of Appendix 6D;	9.2.4.6A	the *load curtailment price*, determined in accordance with section D.24.10 of Appendix 6D;	
9.2.4.7	*reserve prices* for each *reserve class* and *reserve provider group*, determined in accordance with sections D.24.3, D.24.5 and D.24.7 of Appendix 6D;	9.2.4.6B	the counterfactual *uniform Singapore energy price*, determined in accordance with sections D.24.8 and D.24.9 of Appendix 6D;	
9.2.4.8	*regulation prices,* determined in accordance with sections D.24.4 and D.24.5 of Appendix 6D;	9.2.4.6C	the *reference uniform Singapore energy price,* determined in accordance with section D.24.6A of Appendix 6D;	
9.2.4.9	any system *energy* shortfalls reported by the *market clearing engine*;	9.2.4.7	*reserve prices* for each *reserve class* and *reserve provider group*, determined in	
9.2.4.10	any system *reserve* shortfalls, by *reserve class*, reported by the *market clearing engine*;			

Existing Market Rules (1 Jan 2025)	Proposed Rule Changes (deletions represented by strikethrough text and additions represented by double underlined text)	Reasons for Modification
9.2.4.11 any system *regulation* shortfalls reported by the *market clearing engine*; 9.2.4.12 a list of *security constraints* and *generation fixing constraints* applied; and 9.2.4.13 the estimated hourly *energy* uplift rebate, determined in accordance with section D.25.1.13 of Appendix 6D.	accordance with sections D.24.3~~, D.24.5~~ and D.24.7 of Appendix 6D; 9.2.4.7A *reference reserve prices* for each *reserve class*, determined in accordance with sections D.24.3A of Appendix 6D; 9.2.4.8 *regulation prices,* determined in accordance with sections D.24.4 ~~and D.24.5~~ of Appendix 6D; 9.2.4.8A *reference regulation prices,* determined in accordance with sections D.24.4A of Appendix 6D; 9.2.4.9 any system *energy* shortfalls reported by the *market clearing engine*; 9.2.4.10 any system *reserve* shortfalls, by *reserve class*, reported by the *market clearing engine*; 9.2.4.11 any system *regulation* shortfalls reported by the *market clearing engine*; 9.2.4.12 a list of *security constraints* and *generation fixing constraints* applied; and	

Existing Market Rules (1 Jan 2025)	Proposed Rule Changes (deletions represented by strikethrough text and additions represented by double underlined text)		Reasons for Modification
	9.2.4.13	the estimated hourly *energy* uplift rebate, determined in accordance with section D.25.1.13 of Appendix 6D.	

Existing Market Rules (1 Jan 2025)	Proposed Rule Changes (deletions represented by strikethrough text and additions represented by double underlined text)	Reasons for Modification
Appendix 6D – Market Clearing Formulation	**Appendix 6D – Market Clearing Formulation**	
D.24 PRICE FORMATION D.24.1 The *market energy price* or *MEP* for each *market network node* shall be calculated as follows: D.24.1.1 For *generation registered facilities* that are not *multi-unit facilities*, and for *generation settlement facilities* that are not *pseudo generation settlement facilities*, represented as *synchronised* in the *dispatch network data* or connected to the dispatch network in accordance with section D.6.5 in the *dispatch period*, the *market energy price* shall be calculated as follows: $MEP^{m(g)} = EnergyPrice_{n(m)}$ where: $EnergyPrice_{n(m)}$ is the dual variable corresponding to constraint D.16.1.2 for the *dispatch network node n* corresponding to the *market network node m*	**D.24 PRICE FORMATION** D.24.1 The *market energy price* or *MEP* for each *market network node* shall be calculated as follows: D.24.1.1 For *generation registered facilities* that are not *multi-unit facilities*, and for *generation settlement facilities* that are not *pseudo generation settlement facilities*, represented as *synchronised* in the *dispatch network data* or connected to the dispatch network in accordance with section D.6.5 in the *dispatch period*, the *market energy price* shall be calculated as follows: $MEP^{m(g)} = EnergyPrice_{n(m)}$ where: $EnergyPrice_{n(m)}$ is the dual variable corresponding to constraint D.16.1.2 for the *dispatch network node n* corresponding to the *market network node m*	To establish how the reference market energy price, reference reserve prices, and reference regulation prices will be calculated, and how they will only be subjected to the primary price caps in accordance with section D.24.5.

Existing Market Rules (1 Jan 2025)	Proposed Rule Changes (deletions represented by strikethrough text and additions represented by double underlined text)	Reasons for Modification
The price MEP^{m} shall then be further modified in accordance with section D.24.5 for *dispatch periods* where the *temporary price cap* is not in effect, or in accordance with section D.24.5A for *dispatch periods* where the *temporary price cap* is in effect.	The price MEP^{m} shall then be further modified in accordance with section D.24.5 for *dispatch periods* where the *temporary price cap* is not in effect, or in accordance with section D.24.5A for *dispatch periods* where the *temporary price cap* is in effect.	
D.24.1.2 For *generation registered facilities* that are *multi-unit facilities* represented as *synchronised* in the *dispatch network data* or connected to the dispatch network in accordance with section D.6.5 in the *dispatch period*, the *market energy prices* shall be calculated as follows: $$MEP^{m(g)} = \frac{\sum_{u \in CONNECTEDUNITS_g} \left(Proportion_u \times EnergyPrice_{n(u)}\right)}{\sum_{u \in CONNECTEDUNITS_g} Proportion_u}$$ where: $Proportion_u$ is the relevant proportion of generation for *generating unit u* of a *multi-unit facility* associated with *energy*	D.24.1.2 For *generation registered facilities* that are *multi-unit facilities* represented as *synchronised* in the *dispatch network data* or connected to the dispatch network in accordance with section D.6.5 in the *dispatch period*, the *market energy prices* shall be calculated as follows: $$MEP^{m(g)} = \frac{\sum_{u \in CONNECTEDUNITS_g} \left(Proportion_u \times EnergyPrice_{n(u)}\right)}{\sum_{u \in CONNECTEDUNITS_g} Proportion_u}$$ where: $Proportion_u$ is the relevant proportion of generation for *generating unit u* of a *multi-unit facility* associated with *energy offer g*	

Existing Market Rules (1 Jan 2025)	Proposed Rule Changes (deletions represented by strikethrough text and additions represented by double underlined text)	Reasons for Modification
offer g specified by the *EMC* in accordance with section D.7.3; $\text{EnergyPrice}_{n(u)}$ is the dual variable corresponding to constraint D.16.1.2 for the *dispatch network node n* corresponding to the *market network node m*; and The price MEP^{m} shall then be further modified in accordance with section D.24.5 for *dispatch periods* where the *temporary price cap* is not in effect, or in accordance with section D.24.5A for *dispatch periods* where the *temporary price cap* is in effect.	specified by the *EMC* in accordance with section D.7.3; $\text{EnergyPrice}_{n(u)}$ is the dual variable corresponding to constraint D.16.1.2 for the *dispatch network node n* corresponding to the *market network node m*; and The price MEP^{m} shall then be further modified in accordance with section D.24.5 for *dispatch periods* where the *temporary price cap* is not in effect, or in accordance with section D.24.5A for *dispatch periods* where the accordance with section D.24.5A for *dispatch periods* where the *temporary price cap* is in effect.	
D.24.1.3 For *pseudo generation settlement facilities*, the *market energy price* shall be calculated as follows: $$\text{MEP}^{m(g)} = \frac{\sum_{g \in \text{ENERGYOFFERS}} \left(\text{Generation}_{g} \times \text{MEP}^{m(g)}\right)}{\sum_{g \in \text{ENERGYOFFERS}} \text{Generation}_{g}}$$ where:	D.24.1.3 For *pseudo generation settlement facilities*, the *market energy price* shall be calculated as follows: $$\text{MEP}^{m(g)} = \frac{\sum_{g \in \text{ENERGYOFFERS}} \left(\text{Generation}_{g} \times \text{MEP}^{m(g)}\right)}{\sum_{g \in \text{ENERGYOFFERS}} \text{Generation}_{g}}$$ where:	

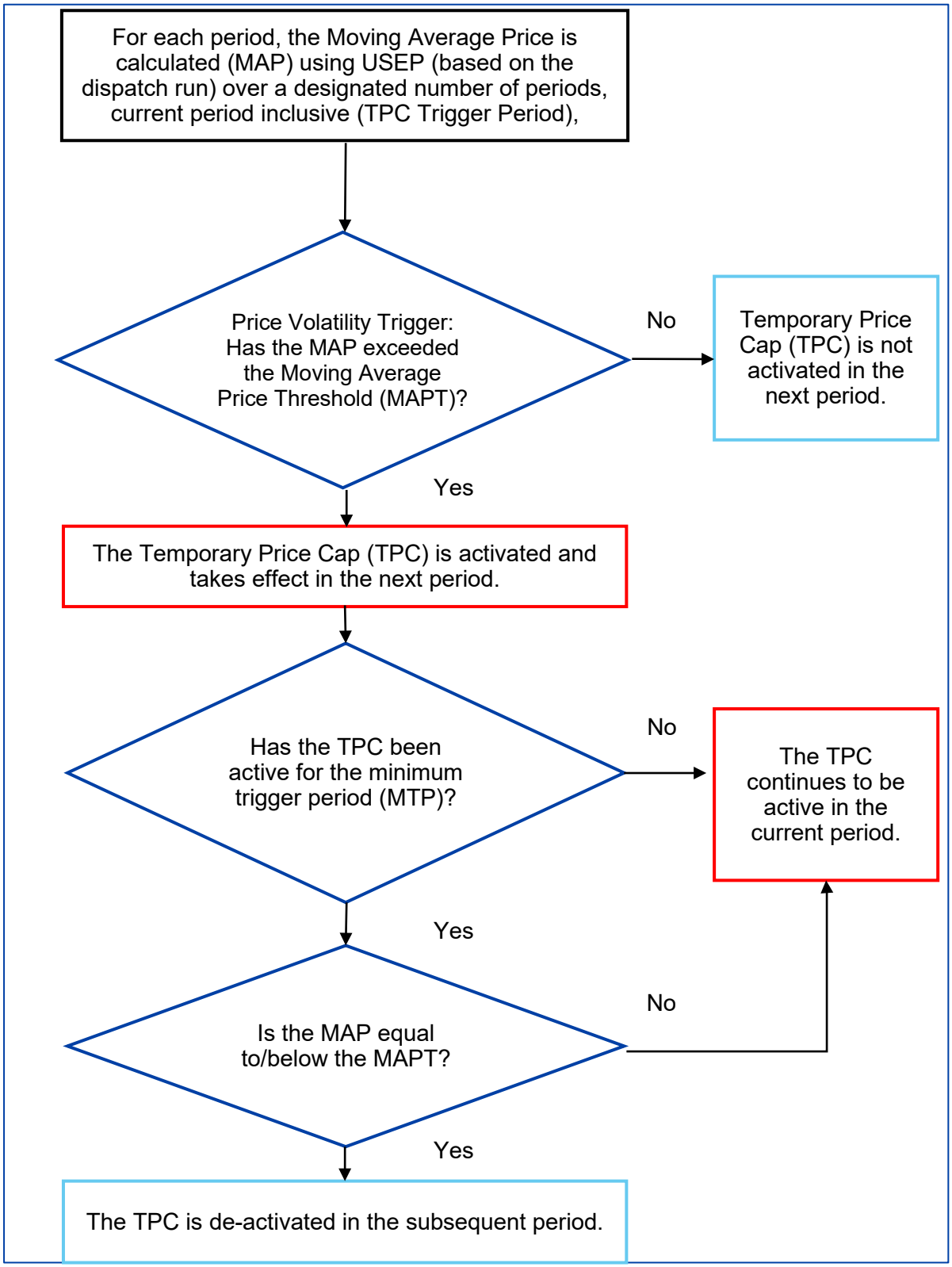
Existing Market Rules (1 Jan 2025)	Proposed Rule Changes (deletions represented by strikethrough text and additions represented by double underlined text)	Reasons for Modification
$MEP^{m(g)}$ is the *market energy price* for *market network node m* corresponding to the *generation registered facility* that *energy offer g* is for calculated in sections D.24.1.1 or D.24.1.2 after it has been modified in accordance with section D.24.5 for *dispatch periods* where the *temporary price cap* is not in effect, or in accordance with section D.24.5A for *dispatch periods* where the *temporary price cap* is in effect.	$MEP^{m(g)}$ is the *market energy price* for *market network node m* corresponding to the *generation registered facility* that *energy offer g* is for calculated in sections D.24.1.1 or D.24.1.2 after it has been modified in accordance with section D.24.5 for *dispatch periods* where the *temporary price cap* is not in effect, or in accordance with section D.24.5A for *dispatch periods* where the *temporary price cap* is in effect.	
D.24.2 Nodal spot prices for *dispatch network nodes* or NSP_n shall be calculated from the values of $EnergyPrice_n$, the dual variables corresponding to constraint D.16.1.2 for the relevant *dispatch network node*, and then further modified in accordance with section D.24.5 for *dispatch periods* where the *temporary price cap* is not in effect, or in accordance with section D.24.5A for *dispatch periods* where the *temporary price cap* is in effect.	D.24.1A <u>The *reference market energy prices* or *RMEP* for each *market network node* shall be calculated as follows:</u> <u>$RMEP^m = MEP^m$</u> <u>where:</u> <u>MEP^m is as calculated in sections D.24.1 and its subsections, and then further modified in accordance with section D.24.5. For avoidance of doubt, the MEP^m for the calculation of the $RMEP^m$ will not be modified in accordance with section D.24.5A.</u>	
D.24.2A Reference nodal spot prices for *dispatch network nodes* or $RNSP_n$ shall be calculated from the values of $EnergyPrice_n$, the dual variables corresponding to constraint D.16.1.2 for the relevant *dispatch network node*, and then further modified in accordance with section D.24.5.	D.24.2 Nodal spot prices for *dispatch network nodes* or NSP_n shall be calculated from the values of $EnergyPrice_n$, the dual variables corresponding to constraint D.16.1.2 for the	

Existing Market Rules (1 Jan 2025)	Proposed Rule Changes (deletions represented by strikethrough text and additions represented by double underlined text)	Reasons for Modification
D.24.3 *Reserve* prices for each *reserve* class shall be calculated from the values of ReservePrice_c, the dual variables corresponding to constraint D.17.3.4, and then further modified in accordance with section D.24.5 for *dispatch periods* where the *temporary price cap* is not in effect, or in accordance with section D.24.5A for *dispatch periods* where the *temporary price cap* is in effect. D.24.4 The *market regulation price* or *MFP* shall be calculated from the values of RegulationPrice, the dual variable corresponding to constraint D.18.2.1, and then further modified in accordance with section D.24.5 for *dispatch periods* where the *temporary price cap* is not in effect, or in accordance with section D.24.5A for *dispatch periods* where the *temporary price cap* is in effect.	relevant *dispatch network node*, and then further modified in accordance with section D.24.5 for *dispatch periods* where the *temporary price cap* is not in effect, or in accordance with section D.24.5A for *dispatch periods* where the *temporary price cap* is in effect. D.24.2A Reference nodal spot prices for *dispatch network nodes* or RNSP_n shall be calculated from the values of EnergyPrice_n, the dual variables corresponding to constraint D.16.1.2 for the relevant *dispatch network node*, and then further modified in accordance with section D.24.5. D.24.3 *Reserve* prices for each *reserve* class shall be calculated from the values of ReservePrice_c, the dual variables corresponding to constraint D.17.3.4, and then further modified in accordance with section D.24.5 for *dispatch periods* where the *temporary price cap* is not in effect, or in accordance with section D.24.5A for *dispatch periods* where the *temporary price cap* is in effect. D.24.3A <u>*Reference reserve prices* for each *reserve* class shall be calculated from the values of ReservePrice_c, the dual variables corresponding to constraint D.17.3.4, and then further modified in accordance with section D.24.5. For the avoidance of doubt, *reference reserve prices* will not be modified in accordance with section D.24.5A.</u>	

Existing Market Rules (1 Jan 2025)	Proposed Rule Changes (deletions represented by strikethrough text and additions represented by double underlined text)	Reasons for Modification
	D.24.4 The *market regulation price* or *MFP* shall be calculated from the values of RegulationPrice, the dual variable corresponding to constraint D.18.2.1, and then further modified in accordance with section D.24.5 for *dispatch periods* where the *temporary price cap* is not in effect, or in accordance with section D.24.5A for *dispatch periods* where the *temporary price cap* is in effect. D.24.4A <u>The *reference regulation price* shall be calculated from the values of RegulationPrice, the dual variable corresponding to constraint D.18.2.1, and then further modified in accordance with section D.24.5. For the avoidance of doubt, the *reference regulation price* will not be modified in accordance with section D.24.5A.</u>	

Existing Market Rules (1 Jan 2025)	Proposed Rule Changes (deletions represented by strikethrough text and additions represented by double underlined text)	Reasons for Modification
Chapter 8 – Definitions	**Chapter 8 – Definitions**	
[New sections] 1.1.238 *reference uniform Singapore energy price* or *RUSEP* means the uniform price of energy that applies for the calculation of the *moving average price* and the counterfactual *uniform Singapore energy price* when the *temporary price cap* is in effect;	1.1.XXX *reference market energy price* or *RMEP* means the market price for *energy* for a *dispatch period* for a *market network node* determined in accordance with section D.24.1A of Appendix 6D; 1.1.XXX *reference regulation price* means the price of *regulation* determined by the *market clearing engine* for a given *dispatch period* in accordance with section D.24.4A of Appendix 6D; 1.1.XXX *reference reserve prices* means the price of *reserve* for a given *reserve class* determined by the *market clearing engine* for a given *dispatch period* in accordance with section D.24.3A of Appendix 6D; 1.1.XXX *reference uniform Singapore energy price* or *RUSEP* means the uniform price of energy that applies for the calculation of the *moving average price* and ~~the counterfactual *uniform Singapore energy price* when the *temporary price cap* is in effect~~ determined in accordance with section D.24.6A of Appendix 6D.	To create new definitions for reference market energy price, reference reserve price, and reference regulation price. To edit the definition of reference uniform Singapore energy price for better clarity.

Annex 2: Overview of the TPC Mechanism



Annex 3: Prevailing TPC Parameters

TPC	MAPT	MAP Period	MTP
Multiplier x CCGT LRMC The multiplier will be set in accordance with Table VI below.		48 periods	48 periods

The TPC Multiplier will be set depending on the Gas Spread, which is the difference between Spot LRMC and Term LRMC, as per the table below:

Multiplier	Gas Spread (S$/mmbtu)
3x	Gas Spread ≤ 2.31
2.5x	2.31 < Gas Spread ≤ 14.39
2x	14.39 < Gas Spread ≤ 29.54
1.5x	29.54 < Gas Spread

For example, here are the parameters effective from 16 April 2024 up to 30 April 2024[9].

Item	**Value**	Remarks
Spot LRMC	**$164.16/MWh**	Based on JKM Prices
Term LRMC	**$188.20/MWh**	Based on term gas contract prices
Multiplier	**3.0**	Based on gas spread
CCGT LRMC (also referred to as TPC Price Parameter)	**$188.20/MWh**	= Max[Spot LRMC, Term LRMC]
MAPT	**$564.60/MWh**	= 3 * 188.20
TPC (Energy)	**$564.60/MWh**	= 3 * 188.20
TPC (Primary Reserves)	**$533.23/MWh**	= 564.60 * 4250/4500 (4250 is the primary price cap for primary reserves)
TPC (Contingency Reserves)	**$407.77/MWh**	= 564.60 * 3250/4500 (3250 is the primary price cap for contingency reserves)
TPC (Regulation)	**$37.64/MWh**	= 564.60 * 300/4500 (300 is the primary price cap for frequency regulation)

[9] Historical TPC parameter figures can be found on EMA's website here: https://www.ema.gov.sg/resources/statistics/data-for-the-temporary-price-cap-mechanism

Annex 4: Schedules Published by EMC

Type of Schedule	Real Time Schedule (RTS)	Short Term Schedule (STS)	Pre-Dispatch Schedule (PDS)	Market Outlook Scenario (MOS)
Also known as	Dispatch Run (DPR)	Look Ahead Run (LAR)	Day Ahead Run (DAR)	Week Ahead Run (WAR)
Frequency of publication	Every Period	Every Period	Every 2 hours	Every Day
Published by	T-30 seconds	T+5 Mins	15 Mins before each 2-hour block, starting from 0000 hrs	9am of each day
Coverage	Upcoming period T	Upcoming periods from T+1 to T+12 excluding upcoming period T which is covered under RTS	Covers at least 24 periods and not more than 72 periods	All periods from the start of the next day for 6 consecutive days.
Comments	Binding dispatch schedule	Forecast Schedule	Forecast Schedule	Forecast Schedule