

RCP PAPER NO. : **EMC/RCP/XXX/2024/CP96**

SUBJECT : **PUBLICATION OF TPC INFORMATION**

FOR : **CONSULTATION**

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DATE OF MEETING : **TBC**

Executive Summary

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

The TPC is a circuit breaker-like mechanism that temporarily lowers the relevant product’s existing price cap when energy prices remain high for a prolonged period. This paper reviews the proposal to expand the TPC-related information published to include the Primary Reserves, Contingency Reserves, Regulation, and Market Network Nodal Prices uncapped by their respective TPC price caps. It also reviews other potential TPC-related information that could benefit SWEM stakeholders.

EMC recommends to:

- 1) Publish the Primary Reserves, Contingency Reserves, Regulation, 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; and
- 2) 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.

EMC seeks industry views on the proposed enhancements to TPC’s information publication. EMC would appreciate receiving comments by **3 May 2024**.

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 change¹ 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 cap on products traded in the SWEM, such as energy. 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 1 and 2.

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, prices are capped at a lower level, but offers are not. Therefore, the products’ cleared prices may exceed the relevant TPC level. While EMC publishes the market prices for energy (RUSEP), the market prices of other products are not published currently. The

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

non-disclosure of the 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 of the various products be published, and if so, which ones?

EMC recommends publishing the Proposed Prices, which includes 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 absolute extent of the price revision for each product due to the TPC. The more often, 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	3/4/2024	35	48	13	32	0	0
7	2/4/2024	48	3/4/2024	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 prices² 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 Prices⁴.

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 3 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 day⁵.

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 exponentially increase system and infrastructure costs to support the storage and publication of such data. Moreover,

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>

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 USEP⁶ 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.

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

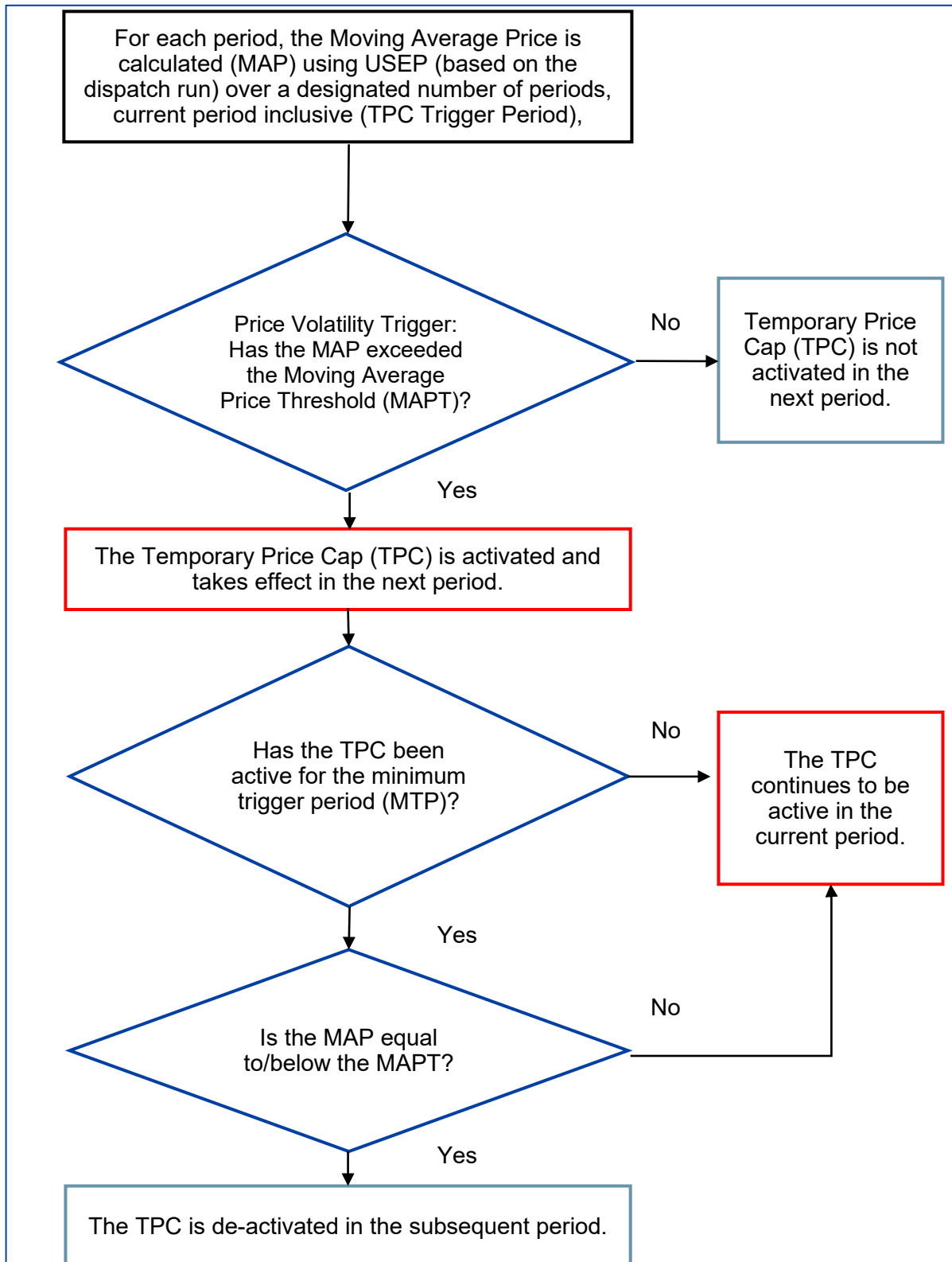
4. Consultation

EMC would like to seek industry views on the proposed enhancements to the publication of information related to the TPC, which are summarised in Table 6 below. EMC appreciates receiving comments by **3 May 2024**.

Table 6: 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	

Annex 1: Overview of the TPC Mechanism



Annex 2: 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 \leq 2.31
2.5x	2.31 < Gas Spread \leq 14.39
2x	14.39 < Gas Spread \leq 29.54
1.5x	29.54 < Gas Spread

For example, here are the parameters effective from 16 April 2024 up to 30 April 2024⁷.

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)

⁷ 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 3: 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