



TEMPORARY PRICE CAP MECHANISM

CONSULTATION PAPER

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Background

1 In the changing energy landscape, new sources of supply risks and volatility have emerged:

- a. **Risks of gas supply disruptions and price shocks.** The global energy market is becoming more volatile amidst geopolitical tensions and the global energy transition. This is particularly salient for Singapore as we rely on imported natural gas for almost all our electricity production. As fuel prices surged in 4Q 2021, the domestic electricity market was severely tested – generation companies (“Gencos”) were reluctant to contract for term gas, for fear that they would be left holding on to expensive gas should prices moderate subsequently. This in turn increased the risks of gas shortfalls and contributed to wholesale electricity price volatility.
- b. **Risk of insufficient generation capacity.** Today, investments in new generation capacity are driven by each Genco’s commercial considerations. This can lead to prolonged periods of over- and under-supply (since it takes ~four to five years to plant a new generation unit) and in turn lead to highly volatile electricity prices. These cyclical mismatches in supply and demand could worsen with the global climate imperative, as rising carbon taxes and the energy transition could discourage investments in thermal generation units which will still be needed to meet electricity demand in the near and medium-term.
- c. **Risks of market failure.** As observed in the ongoing global energy crisis, Gencos’ risk aversion inhibited the self-equilibrating mechanisms in the power market which led to a vicious cycle of more volatile conditions and extreme electricity price movements. This led to six electricity retailers exiting the market in 4Q 2021 as they were not sufficiently prepared to deal with the extreme market volatilities. While affected consumers did not experience any disruption to their power supply, some of them experienced inconvenience and a sharp rise in electricity cost when sourcing for alternative electricity retail contracts.

2 Governments around the world are reviewing their approach towards energy markets to ensure energy security and stability. In Oct 2022, the Ministry of Trade and Industry (“MTI”) announced that the Energy Market Authority (“EMA”) will be introducing guardrails to strengthen the existing competitive market structure and ensure that Singapore is well-positioned to navigate the energy transition.

3 EMA will be launching industry and public consultations on the various guardrails. This consultation paper sets out EMA’s plan to introduce a guardrail to mitigate extreme price volatility in the Singapore Wholesale Electricity Market (“SWEM”).

Need for Guardrail to Mitigate Wholesale Electricity Price Volatility

4 The SWEM determines the least-cost dispatch of generation units to supply energy, reserves and regulation, every half-hour, based on competitive supply offers from Market Participants (“MPs”) such as Gencos. The offer needed to meet marginal energy demand will set the market-clearing price, referred to as the Uniform Singapore Energy Price (“USEP”), and offers below the market-clearing price would be dispatched.

5 There is an existing Energy Price Cap of \$4,500/MWh in the SWEM. The \$4,500/MWh price cap is determined based on the Value of Loss Load (“VoLL”) which reflects the economic cost of any energy supply shortfall to meet system demand. The USEP may fluctuate up to the Energy Price Cap during system stress events to incentivise the supply-side (e.g. Gencos) to increase supply, and the demand-side to reduce demand. However, during recent periods of extreme USEP volatility, instead of inducing more electricity supply, Gencos were observed to reduce supply to preserve spare generation capacity to serve their contractual demand should their generation units experience unanticipated outages or gas supply disruptions. This further drove up SWEM prices and gave rise to a vicious cycle of volatility and risk aversion.

6 Extreme SWEM volatility also made the Gencos hesitant to enter into retail contracts, especially with larger consumers, as they would need to buy from the SWEM at volatile prices should they experience unanticipated outages or gas supply disruptions. Independent Retailers (“IRs”) were especially affected by the extreme price volatility in the SWEM. Since 4Q 2021, six IRs had exited the market as they were no longer able to sustain their operations. Consumers faced difficulties securing electricity contracts, especially those who used to buy directly from the SWEM.

7 In view of the above, EMA intends to introduce a guardrail in the form of a **Temporary Price Cap (“TPC”) mechanism** to mitigate extreme energy price volatility in the SWEM and prevent the vicious cycle of sustained volatility and risk aversion, and restore the orderly functioning of the market. Similar mechanisms have been implemented in other jurisdictions, such as Australia, Philippines, and Texas. Refer to **Appendix 1** for more details. The proposed TPC mechanism, taking into account the characteristics of our domestic energy sector, is set out below.

Proposed TPC Mechanism

Overall Design Intent and Framework

8 The TPC mechanism is intended to act as a short-term measure to calm the SWEM and stop the vicious cycle of volatility and risk aversion, and allow time to identify and address the causes of the extreme price volatility, by temporarily capping the USEP at a level lower than the existing Energy Price Cap. When activated in times of extreme price volatility, it will mitigate excessive risks to all SWEM participants including Gencos, retailers and consumers buying from the SWEM, while allowing the USEP to fluctuate and reflect demand and supply conditions.

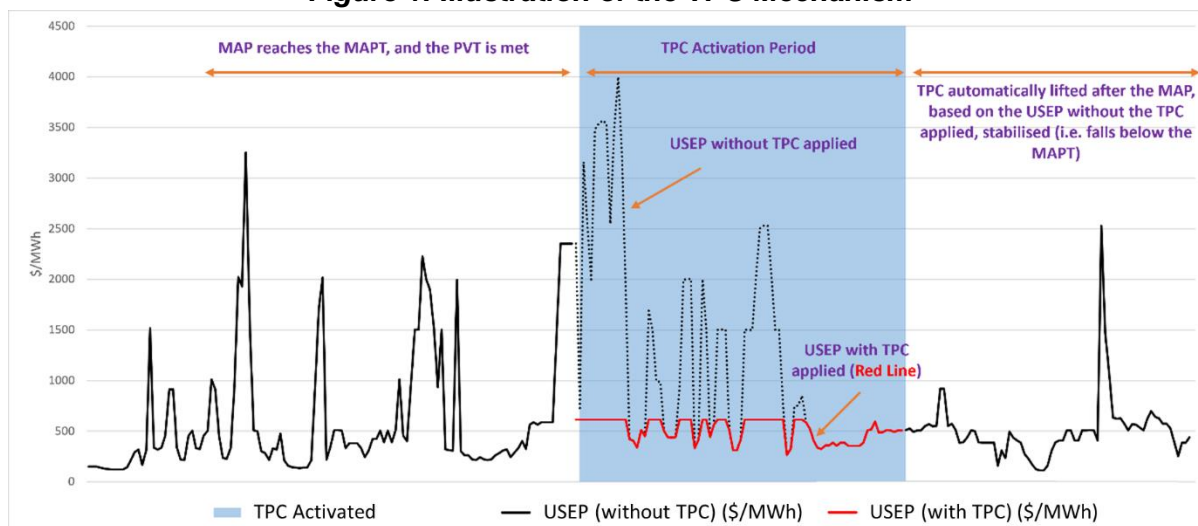
9 The TPC will be activated in response to a Price Volatility Trigger (“PVT”) which will be set based on the following parameters: (a) the average USEP over a specified number of consecutive half-hour periods (“TPs”) referred to as the Moving Average Price (“MAP”); and (b) a specified threshold referred to as the Moving Average Price Threshold (“MAPT”). Specifically, the TPC will be effected for the next and subsequent TPs in the SWEM when the MAP (based on the USEP in the current and preceding TPs) exceeds the MAPT.

10 For a given TP (‘T’) when the TPC is in place:

- a. All energy suppliers such as the Gencos can continue to submit energy offer prices up to the Energy Price Cap of \$4,500/MWh.
- b. If the marginal energy offer price (i.e. the highest energy offer price needed to meet system demand) is below the TPC, the USEP will continue to be set based on the marginal energy offer price. If the marginal energy offer price is at or above the TPC, the USEP will be capped at the TPC.

11 The TPC will be automatically lifted for the next TP (i.e. ‘T+1’) if the MAP up to and including the TP ‘T’ based on the counterfactual USEP (i.e. the marginal energy offer price up to the \$4,500/MWh Energy Price Cap) has normalised at or below the MAPT (“Off-Trigger”), subject to keeping the TPC in place for a specified minimum number of TPs after being triggered (“Minimum Trigger Period” or “MTP”). See **Figure 1** below for an illustration.

Figure 1: Illustration of the TPC Mechanism



Level of the TPC

12 The TPC level should be set appropriately – to allow the recovery of long-run marginal cost (“LRMC”) for the majority of the generation capacity in the system, while allowing the USEP to fluctuate and reflect the prevailing demand and supply conditions, and at a suitably low level to mitigate the vicious cycle of sustained price volatility and risk aversion.

13 On balance, EMA intends to set the TPC at 1.5 times (“1.5x”) the LRMC of combined cycle gas turbine (“CCGT”) generation units (“CCGT LRMC”). More specifically, the TPC will be set at the CCGT LRMC based on the prevailing vesting price parameters, which are benchmarked to the most efficient CCGT technology that accounts for at least 25% of the system demand in Singapore. To account for the prevailing marginal cost of fuel, EMA will on a bi-weekly basis, update the fuel cost component of the CCGT LRMC using the higher of either: (a) spot gas prices based on published Japan-Korea Marker (“JKM”) prices (“Spot LRMC”), or (b) the term gas price under the vesting contracts for setting the regulated electricity tariff (“Vesting LRMC”).

14 Should any energy supplier in the SWEM be dispatched to supply energy when the TPC is in place and is unable to recover its actual costs of supply, it will be allowed to seek compensation under the Market Rules.

PVT

15 The TPC will be activated when there is extreme USEP volatility as reflected by the PVT which consists of two key parameters, viz. the MAP and MAPT, working collectively. A shorter period for averaging the USEP to compute the MAP, and/or a lower MAPT, will increase the likelihood of activating the TPC, *ceteris paribus*. The MAP and MAPT will be calibrated to avoid activating the TPC for relatively isolated

and short system stress events, such as the tripping of a generation unit resulting in a transient increase in USEP volatility which is part of the normal functioning of the SWEM to signal the need for more supply and/or demand response to re-balance the power system.

16 To calibrate the MAP and MAPT, EMA examined the standard deviation (“SD”) of the USEP as a measure of volatility and worked with the Energy Market Company (“EMC”) to conduct market simulations to study the impact of various combinations of MAP and MAPT for the period from Jan 2021 to Sep 2022, which covers the market situation before and during the ongoing energy crunch. Within this period, the USEP SD recorded was between \$183/MWh and \$1,349/MWh in months with significant projected supply shortfalls, largely during the ongoing energy crunch as the risk aversion behaviour materialised.¹ This is significantly higher than the SD (average of \$34/MWh) in 1H 2021. For the market simulations, we have considered an averaging period of 48 half-hour TPs and 336 half-hour TPs (equivalent to a rolling 1-day and 7-day average respectively) for the MAP, and a MAPT that is 1.5x and 2x of the prevailing CCGT LRMC (see paragraph 13 for the definition) as shown in **Table 1**.

Table 1: Simulation Scenarios

Scenario (Probability of TPC being activated)	Averaging Period for MAP	MAPT
1 (Highest)	48 TPs	1.5x CCGT LRMC
2	48 TPs	2x CCGT LRMC
3 (Lowest)	336 TPs	2x CCGT LRMC

17 **Figure 2, Figure 3, Table 2 and Table 3** respectively shows the simulation results for each scenario in terms of the frequency/number of TPC activations including the impact on USEP (refer to **Appendix 2** for more details of the simulation results) and USEP volatility. Across all the three scenarios, simulated TPC activations were concentrated around 4Q 2021 with the onset of the energy crunch, with fewer activations thereafter up to Jul 2022 as the power system and market became more stable due to the measures put in place by EMA.

¹ Specifically, the months of Jul 2021, Nov-Dec 2021, Jan-May 2022, and July-Aug 2022 were observed to have projected supply shortfall above the median level in Jan 2021 to Sep 2022, based on the Day-Ahead Run (“DAR”) published by EMC.

Figure 2: Simulation Results for Jan 2021 to Sep 2022 – Time Series

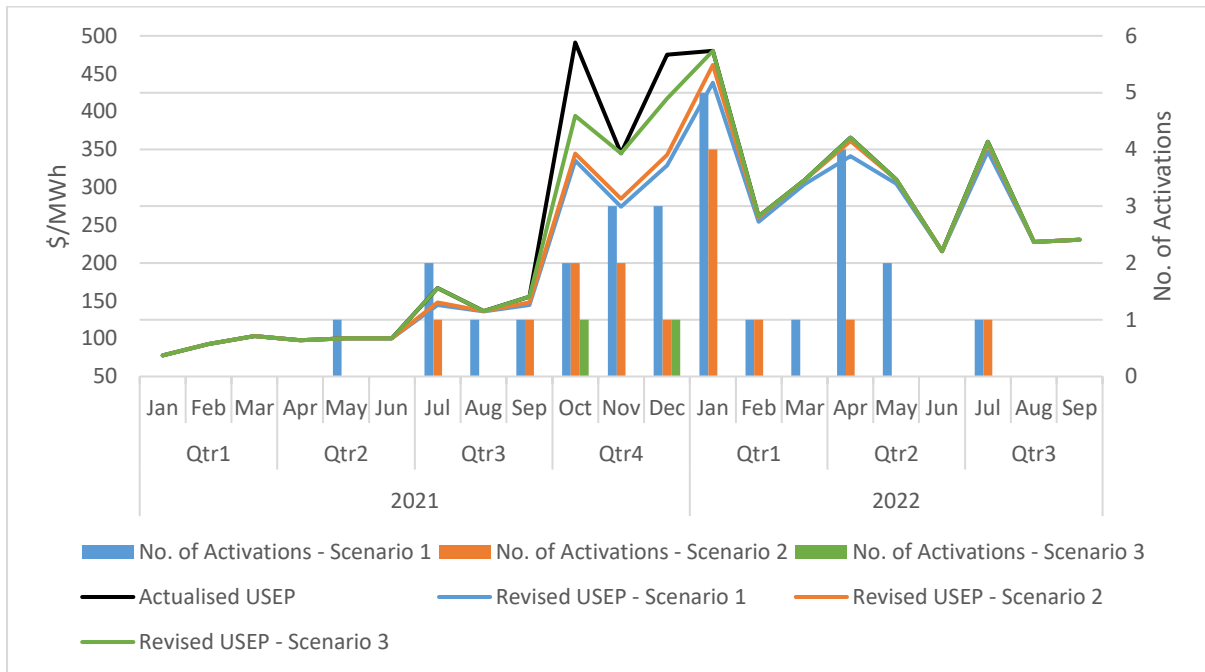


Table 2: Simulation Results for Jan 2021 to Sep 2022 – Summary Statistics

Scenario	No. of Activations	TPs with TPC in place		TPs with USEP above (i.e. capped at) TPC when TPC is in place		SD of USEP across Activations** (\$/MWh)		Average % reduction in USEP due to TPC ***	Activation before 2H 2021
		No. of TPs	% of total TPs *	No. of TPs	% of total TPs *	Without TPC	With TPC in place		
1	27	1,896	6.2%	719	2.3%	616	387	10%	Yes
2	14	1,113	3.6%	487	1.6%	801	591	7.8%	No
3	2	384	1.3%	187	0.6%	1,018	828	3.1%	No

* Based on total number of TPs from Jan 2021 to Sep 2022 (i.e. 30,624 TPs).

** Based on the SD of USEP in the periods with TPC activated.

*** Based on the % reduction in average USEP from Jan 2021 to Sep 2022 due to the effect of the proposed TPC mechanism.

Figure 3: Simulation Results for Jan 2021 to Sep 2022 - Standard Deviation

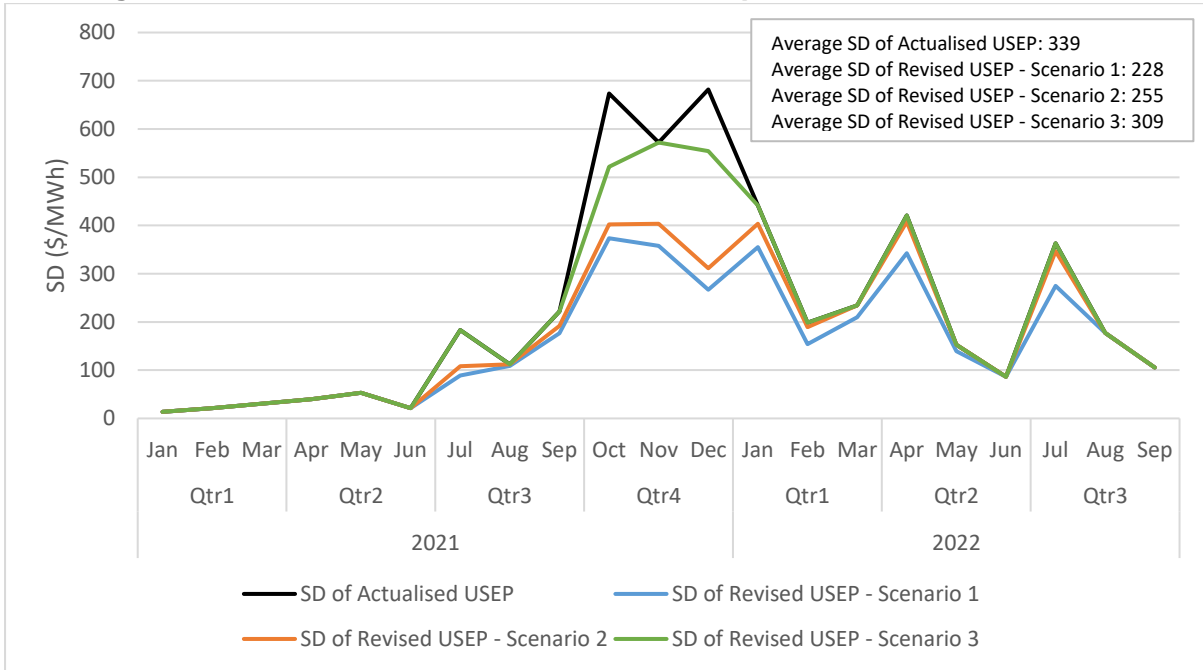


Table 3: Comparison of Average Actual USEP, Average USEP with TPC, and Vesting LRM C across simulation period

Simulation Period	Average Actual USEP (\$/MWh)	Average Simulated USEP with TPC (\$/MWh)			Average Vesting LRM C (\$/MWh)
		Scenario 1	Scenario 2	Scenario 3	
Jan 2021 to Sep 2022	244.0	219.7	225.0	236.5	181.9

18 The simulation results for Scenario 1 show that that the combination of MAP with averaging period for 48 TPs and MAPT at 1.5x the prevailing CCGT LRM C resulted in an activation in May 2021, where the USEP only experienced transient volatility attributable to a tighter supply cushion on account of higher than expected demand and plant maintenances, which are typical occasional system stress events that do not warrant a TPC activation.² Furthermore, the SD of the USEP over the activation episode in May 2021 was \$177/MWh, below the lower bound volatility in the months when significant risk averse behaviours were observed.

19 In contrast, the simulation results for Scenario 3 show that that the combination of MAP with an averaging period of 336 TPs (i.e. seven days) and MAPT at 2x the prevailing CCGT LRM C would activate the TPC only twice in 4Q 2021 despite USEP recording a SD of \$648/MWh.³ Scenario 3 would not have activations during

² During the period around the May activation, there were transient price spikes of ~\$1,000/MWh across only two TPs observed on 11 May 2021 with majority of the TPs recording USEP below CCGT LRM C.

³ The SD in 4Q 2021 was 3.5 times of \$183/MWh (i.e. the lower bound of SD for months with significant projected supply shortfalls).

episodes of sustained USEP volatility, including for the period 26 – 27 Nov 2021 where USEP SD was \$1,261/MWh on the back of PNG curtailment and forced outage of a baseload generating unit. Furthermore, Scenario 3 also excluded activation episodes in 1Q 2022 through 3Q 2022 where the USEP SD averaged \$718/MWh, which is around the average volatility in months with significant projected supply shortfalls in the SWEM.

20 ***On balance, EMA recommends Scenario 2 with the PVT comprising the MAP with an averaging period of 48 TPs (i.e. one day) and MAPT at 2x the prevailing CCGT LRMC.*** This combination would, for example, activate the TPC when the USEP reached the Energy Price Cap of \$4,500/MWh for five out of the 48 TPs, with the remaining 43 TPs averaging at CCGT LRMC in Nov 2021. Scenario 2 would capture the high USEP SD episodes highlighted in para 19. For the period from Jan 2021 to Sep 2022, there would have been a total of 14 activations with an average activation period of 1.7 days per activation. During the TPC activations, 44% of the TPs with TPC in place would have the USEP above, and therefore capped at, the TPC to reduce USEP volatility. Overall, Scenario 2 would reduce the USEP SD in the simulation period from \$339/MWh to \$255/MWh, or from \$413/MWh to \$302/MWh during the energy crunch from 4Q 2021 to 3Q 2022.

Off-Trigger

21 After the TPC is activated, it will be automatically deactivated for the next TP 'T+1' if the MAP up to and including the current TP 'T' based on the counterfactual USEP (i.e. the marginal energy offer price up to the \$4,500/MWh Energy Price Cap) has normalised at or below the MAPT ("Off-Trigger"). To provide adequate time for the market to stabilise and prevent the Energy Price Cap from oscillating between the TPC and \$4,500/MWh intra-day, the TPC once activated should be in place for a Minimum Trigger Period ("MTP") of 48 consecutive TPs including the first TP of activation.

Adjustments to the Price Caps for Reserves and Regulation

22 When the TPC is triggered, the corresponding price caps for online reserves (i.e. primary and contingency reserves) and regulation services will need to be adjusted proportionately to ensure that market-clearing under the Market Rules maintains the same priority of dispatch for the products as before, in particular to prioritise scheduling the provision of energy relative to online reserves and regulation services. The TPC when activated should not be applied to the Demand Response Scheme so as to encourage demand response providers to continue to offer their services which will help to normalise the market and facilitate deactivation of the TPC. The adjustments are shown in **Table 4** below.

Table 4: Adjusted Price Caps for Energy, Reserves and Regulation during TPC activation

Item	Adjusted Price Caps
Nodal Price	Capped at TPC
USEP	Capped at TPC
Primary and Contingency Reserve prices	Capped at the ratio between the prevailing TPC and Energy Price Cap of \$4,500/MWh.
Regulation price	Capped at the ratio between the prevailing TPC and Energy Price Cap of \$4,500/MWh.

23 The proposed TPC parameters are set based on historical data over the last 2 years. However, there may be future periods of sustained and extreme volatility observed in the SWEM which may not be sufficiently addressed through the prevailing TPC parameters. To enable EMA to mitigate the extreme price volatility and restore the orderly functioning of the market in a timely manner, EMA reserves the right to conduct consultations on modifications to the TPC mechanisms and effect the modifications, in an expedited manner.

Market Rules Amendments and Market Information

24 EMA/EMC will separately publish the Market Rules amendments required to incorporate the proposed TPC mechanism set out in this Consultation Paper. EMC will also be required to publish real-time information and advisory notices for and in relation to the TPC mechanism, such as the USEP with and without the TPC applied.⁴ More details will be released subsequently, together with the Market Rules amendments to effect the proposed TPC mechanism.

Request for Comments

25 EMA would like to invite written comments on the proposed Temporary Price Cap Mechanism. While this paper sets out the proposed TPC parameters, EMA will monitor the market situation to review and adjust the TPC parameters where necessary.

26 Please submit all written comments via email to: ema_mdscd@ema.gov.sg

27 All submissions should reach EMA by 5pm on 14 Feb 2023 in the format shown in **Appendix 3**. You are requested to include a soft-copy of your submission in both PDF and Microsoft Word Format. EMA will acknowledge receipt of all submissions via email within two business days.

⁴ EMC will issue an advisory notice to Market Participants when the TPC is activated or de-activated.

28 For clarifications, please address to Ms Chloe Wang at: ema_mdspd@ema.gov.sg

29 Please note that EMA will not consider anonymous submissions. EMA reserves the right to make public all or part of any written submissions made in response to this Consultation Paper and to disclose the identity of the source. Any part of the submission, which is considered by respondents to be confidential, should be clearly marked as “Confidential”. Such comments, together with justification on the need to maintain confidentiality, should be separately attached as an appendix. EMA will take this into account in the disclosure of the information submitted.

Appendix 1 – Jurisdiction Scan

	Australia National Electricity Market (“NEM”)	Philippines Wholesale Electricity Spot Market (“WESM”)	Texas Electric Reliability Council of Texas (“ERCOT”)
Description	Australia’s NEM has a default market price cap and a cumulative price threshold mechanism that caps prices at the lower administered price cap if prices over seven days breach said threshold.	The Philippines’ WESM has a default primary offer cap that limits offer prices and a secondary price cap that limits the resulting market prices when the rolling average price over 3 days breaches the cumulative price threshold.	Texas’ ERCOT operates the Scarcity Pricing Mechanism (“SPM”). The SPM is a two-tiered price mitigation measure; the high system-wide offer cap is a year-long default cap, and the lower system-wide offer cap is activated when prices breach a threshold.
Current Parameters			
Price Cap ⁵	Market Price Cap: 15,500 AUD/MWh (~13,950 SGD/MWh) Administered Price Cap: 600 AUD/MWh (~540 SGD/MWh)	Primary Offer Cap PhP32,000/MWh (~768 SGD/MWh) Secondary Price Cap: PhP6,245/MWh (~150 SGD/MWh)	High system-wide offer cap: 5,000USD/MWh (~7,000 SGD/MWh) Low system-wide offer cap: 2,000USD/MWh (~2,800 SGD/MWh)
Trigger for Secondary Price/Offer Cap	The administered price cap will be triggered once spot prices breach 1,398,100 AUD or 693.50 AUD/MWh over the previous 7 days.	The secondary price cap will be triggered once they breach a PhP9,000/MWh rolling average price over a 3-day period.	The system-wide offer cap will be set equal to the HCAP at the beginning of each calendar year and maintained at this level until the peaker net margin ⁶ exceeds a

⁵ The currency conversion are based on 1 AUD = 0.90 SGD, 1 PhP = 0.024 SGD, 1 USD = 1.4 SGD.

⁶ Peaker Net Margin is defined [here](#) as the amount of net revenue a hypothetical peaking unit might have earned in a year, given real-time power prices and spot gas prices.

			threshold of three times the cost of new entry of new generation plants.
Links	<ul style="list-style-type: none"> • Operation of Administered Price Cap • 2022-2023 Market Price Cap and Cumulative Price Threshold • Evolution of the Market Price Cap • Recent Urgent Rule Change to Revise the Administered Price Cap, dated 17 November 2022 	<ul style="list-style-type: none"> • Latest mention of current WESM Price Cap (footnote in pg 28 of report)⁷ • Philippines' Energy Regulatory Commission's Resolution No 20, Series of 2014 on the Secondary Price Cap as a Price Mitigation Measure • Decision to reduce rolling average to 3 days from 5 days in 2021 	<ul style="list-style-type: none"> • ERCOT Rules Regarding its Scarcity Pricing Mechanism • Consultation and Considerations on the Caps used in the SPM by the Public Utility Commission of Texas

⁷ The current Primary Offer Cap level is determined in the WESM Tripartite Resolution Joint Resolution No.3, series of 2015.

Appendix 2 – Simulations for Scenarios 1 to 3

Figure 2-1: Scenario 1

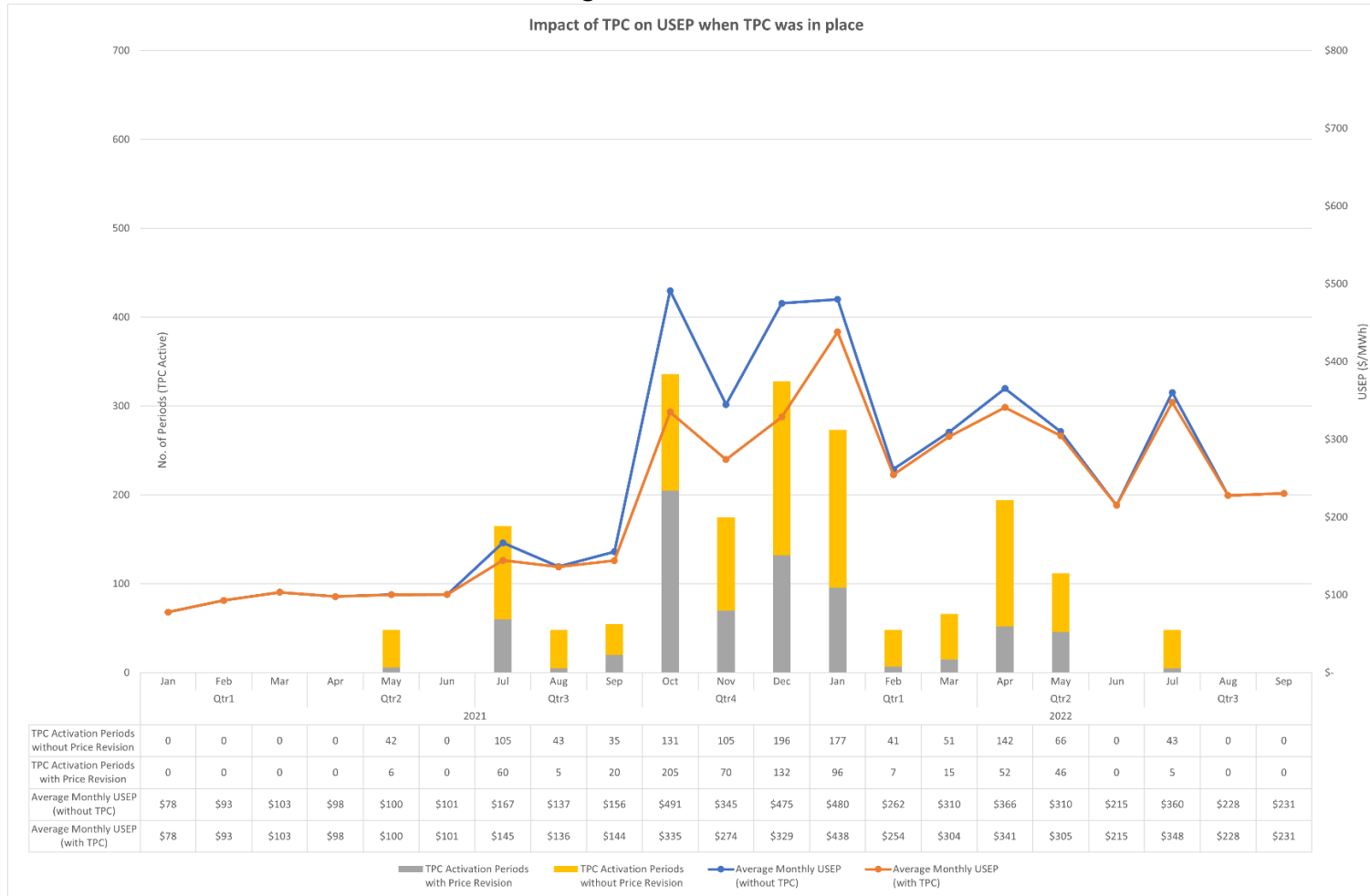


Figure 2-2: Scenario 2

Impact of TPC on USEP when TPC was in place

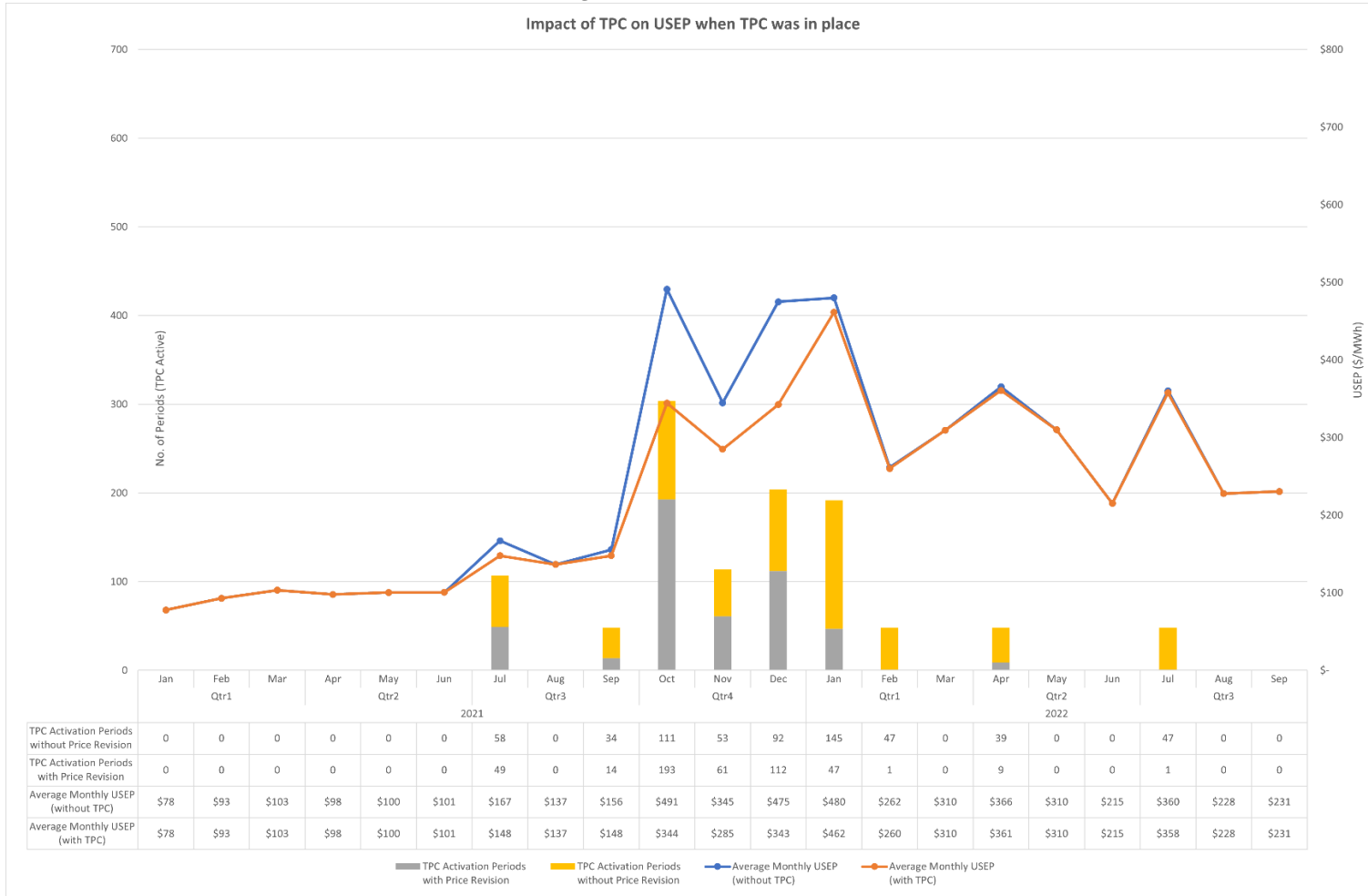


Figure 2-3: Scenario 3

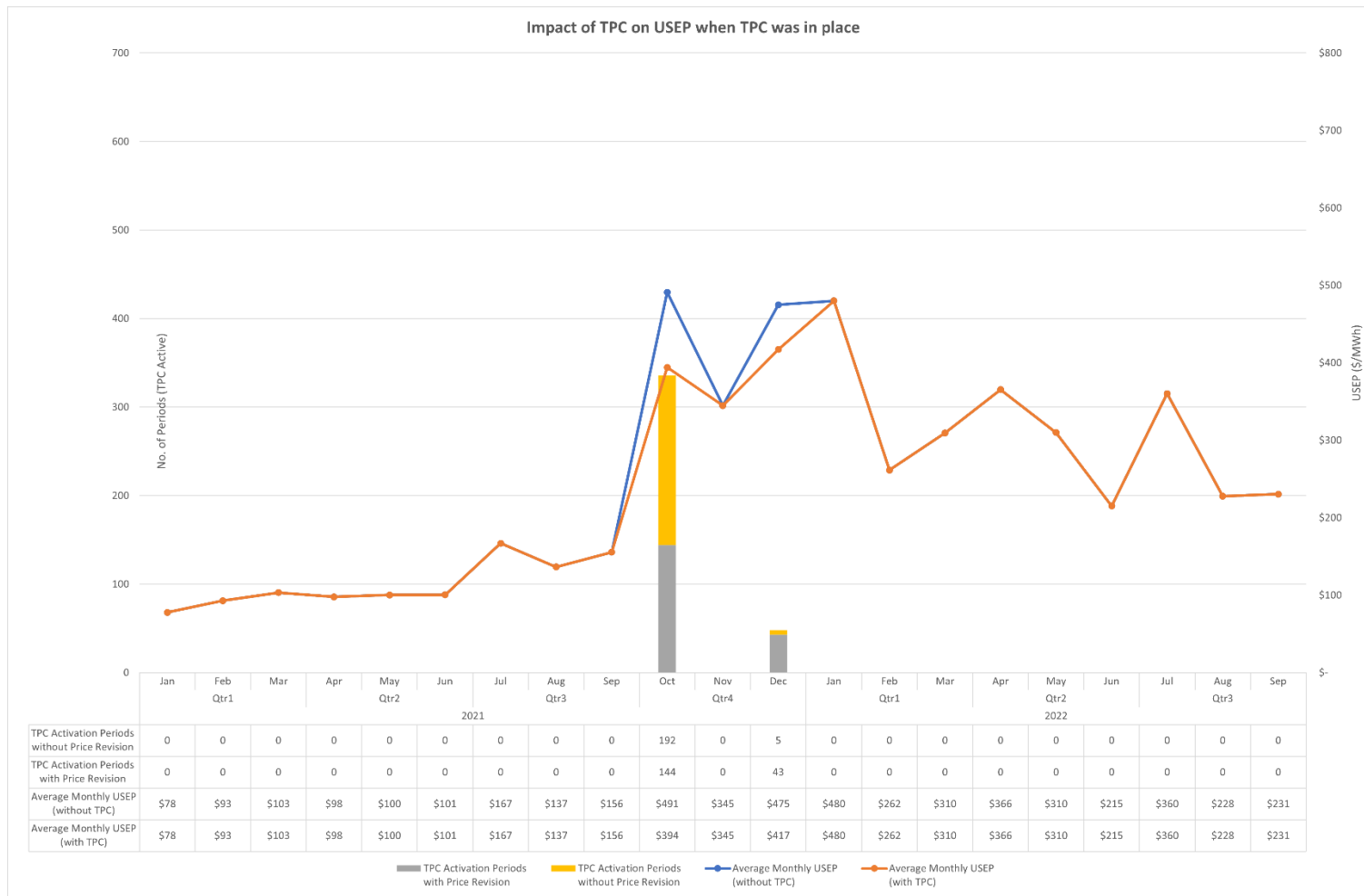


Table 2-1: SD of USEP for each Activation under Scenarios 1 – 3

Activation No.	Scenario 1			Scenario 2			Scenario 3		
	Time Period#	SD (no TPC) (\$/MWh)	SD (with TPC) (\$/MWh)	Time Period#	SD (no TPC) (\$/MWh)	SD (with TPC) (\$/MWh)	Time Period#	SD (no TPC) (\$/MWh)	SD (with TPC) (\$/MWh)
1	10 - 12 May 21	177	177	25 - 28 Jul 21	422	227	6 - 20 Oct 21	840	646
2	25 - 28 Jul 21	415	154	22 - 24 Sep 21	565	461	24 Nov - 2 Dec 21	1,195	1,011
3	27 - 29 Jul 21	201	57	9 - 11 Oct 21	822	748			
4	1 - 3 Aug 21	384	373	11 - 17 Oct 21	914	335			
5	22 - 24 Sep 21	554	390	25 - 27 Nov 21	1,261	805			
6	8 - 11 Oct 21	813	607	28 Nov - 3 Dec 21	1,278	531			
7	10 - 17 Oct 21	920	289	7 - 10 Dec 21	933	466			
8	7 - 9 Nov 21	544	516	16 - 18 Jan 22	528	467			
9	25 - 27 Nov 21	1,235	651	17 - 19 Jan 22	657	577			
10	28 Nov - 3 Dec 21	1,269	440	22 - 24 Jan 22	493	487			
11	6 - 8 Dec 21	594	474	29 - 31 Jan 22	791	791			
12	7 - 10 Dec 21	886	130	4 - 6 Feb 22	554	514			
13	16 - 18 Dec 21	343	301	24 - 26 Apr 22	875	807			
14	9 - 11 Jan 22	611	549	16 - 18 Jul 22	1,131	1,061			
15	15 - 18 Jan 22	434	315						
16	17 - 19 Jan 22	651	480						
17	21 - 23 Jan 22	493	430						
18	29 - 31 Jan 22	772	407						
19	3 - 5 Feb 22	555	354						
20	13 - 15 Mar 22	416	235						
21	4 - 6 Apr 22	761	678						
22	17 - 19 Apr 22	656	578						
23	24 - 26 Apr 22	870	542						
24	25 - 27 Apr 22	444	119						
25	9 - 11 May 22	211	173						
26	14 - 16 May 22	228	205						
27	16 - 18 Jul 22	1,188	816						

Refers to the time period from the start of the MAP till the end of the TPC activation.

Appendix 3 – Format for Submission of Comments

CONSULTATION PAPER – TEMPORARY PRICE CAP MECHANISM

Comments submitted by:

Name :
Designation :
Company :
Email :
Contact No. :

S/No.	Please indicate in each cell in this column, the section/paragraph to which your comment refers	Comments
1		
2		
3		
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Any other comments		