

# **Market Surveillance & Compliance Panel Market Watch**

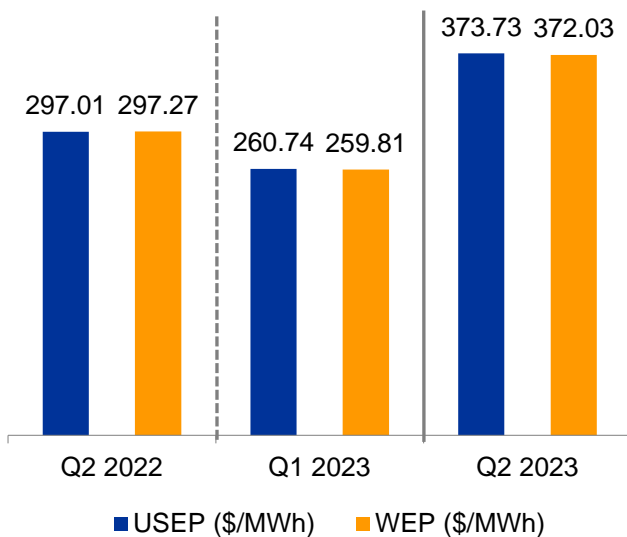
Issue 68

Second Quarter (April to June 2023)

## Executive Summary

The energy prices in the National Electricity Market of Singapore (“NEMS”) rose for the second consecutive quarter in 2023 after four quarters of consecutive decline in 2022. The growth was primarily attributed to the historical high demand levels which have marked the highest average quarterly demand recorded since market start (at 6,449 MW). The stronger demand this quarter was likely due to higher temperature when compared to the previous quarter. The second highest demand level registered at 6,325 MW, was recorded in Q3 2022, due to the expansion in Singapore’s economic activities. An increase in supply was also observed this quarter, however, it was outpaced by the strong quarterly growth demand; as a result, the quarter registered a lower supply cushion and an increase in energy prices compared to Q1 2023.

**Chart 1. USEP and WEP by Quarter**



**Table 1. Quarterly Outage Volume and Ancillary Service Prices**

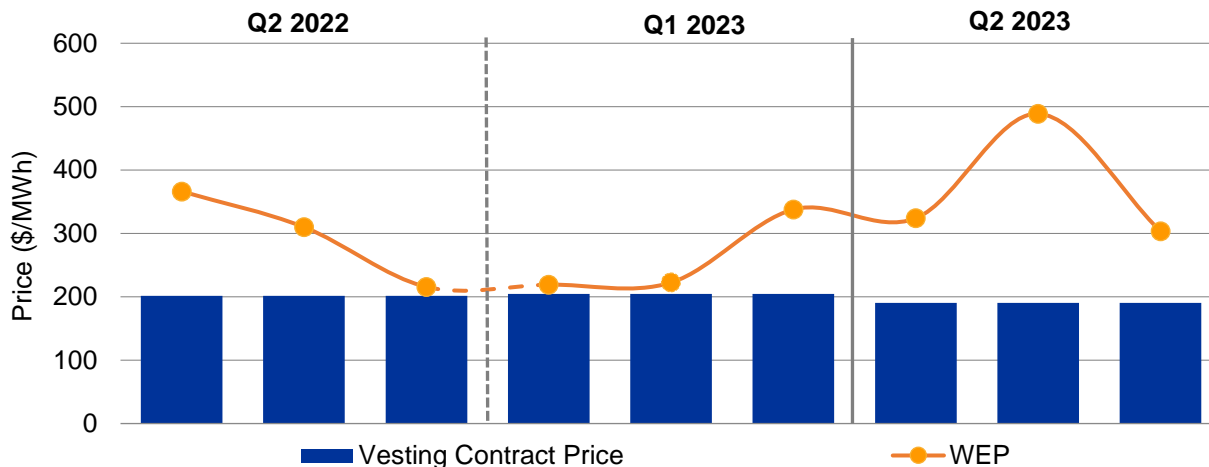
Quarter	Q2 2022	Q1 2023	Q2 2023
<b>Total Outage Volume (MWh Cumulative)</b>			
<b>Planned Outage</b>	4,883,446	5,082,780	4,490,522
<b>Forced Outage</b>	72,465	223,155	130,396
<b>Ancillary Services (\$/MWh)</b>			
<b>Primary Reserve</b>	0.24	0.19	0.38
<b>Contingency Reserve</b>	41.17	8.82	19.18
<b>Regulation</b>	49.99	45.23	51.57

The Uniform Singapore Energy Price (“USEP”) and the Wholesale Electricity Price (“WEP”) increased by 43.34% to \$373.73/MWh and 43.19% to \$372.03/MWh respectively on a quarter-to-quarter comparison. This rise is largely attributed to an increase in the average demand level that went up by 6.93% to 6,449 MW, despite the increase in the average quarterly supply level. As a result, the supply cushion fell 0.39 percentage points to 11.76% this quarter. Given the historical high demand levels seen in this quarter, the supply was unable to meet the demand for several periods with 12 periods of energy shortfalls observed during the quarter.

In line with the increase in USEP, the prices of ancillary services increased across the board. The price of the contingency reserve increased by 117.54% to \$19.18/MWh, the primary reserve increased by 96.22% to \$0.38/MWh and the regulation increased by 14.02% to \$51.57/MWh. The higher ancillary prices were attributed to more expensive offers submitted by generation companies.

## Prices in Q2 2023

**Chart 2. Vesting Contract Price Versus WEP by Quarter**

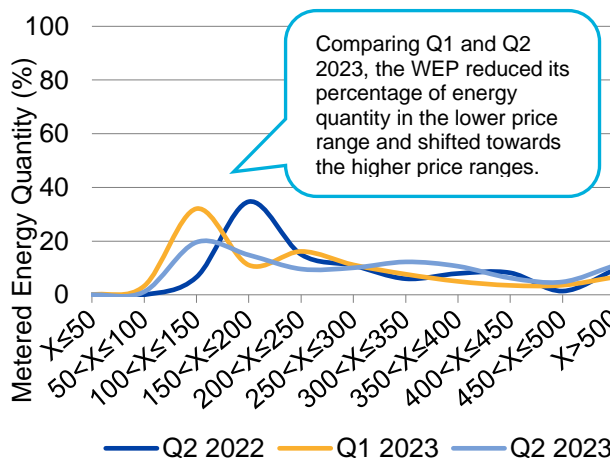
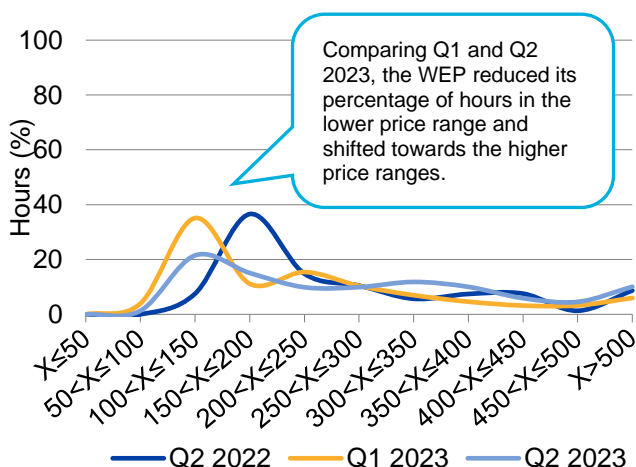


In Q2 2023, the WEP increased by 43.19% from \$259.81/MWh in Q1 2023 to \$372.03/MWh. The difference between the vesting contract price and the WEP widened this quarter and marked the seventh consecutive quarter with average WEP levels above the vesting contract price. The vesting contract regime was meant to discourage generation companies to withhold their generation capacity and exert upward pressure on the WEP, via vesting contracts which mandate a certain electricity volume (vesting contract level) to be hedged at a certain price (vesting contract price). The observation of the WEP exceeding the vesting contract price highlighted the importance of the vesting contract regime in stabilising the electricity prices.

The WEP cleared 95.26% higher than the Q2 2023 vesting contract price as compared to the 27.09% increase recorded in Q1 2023. In contrast, the vesting contract price decreased by 6.80% from \$204.44/MWh in Q1 2023 to \$190.53/MWh in Q2 2023 despite the increase in fuel oil price this quarter. This indicates that the other components used in the calculation of the vesting contract price may have declined.

**Chart 3. Distribution of WEP Over Time**

**Chart 4. Distribution of WEP Over Total Metered Energy Quantity**



Charts 3 and 4 illustrate the frequency of the WEP across different price ranges, measured as a percentage of the total number of hours and a percentage of the total metered energy quantity for Q2 2023, compared to the previous quarter and the same quarter for the previous year.

As shown in Chart 3, compared to the previous quarter (Q1 2023), the peak of the distribution in Q2 2023 is lower, which means that the frequency of the WEP in the price range of \$100/MWh to \$150/MWh decreased 13.62 percentage points

as the WEP falls in price ranges higher than \$150/MWh more often. This may be attributed to the higher demand levels observed in Q2 2023 compared to Q1 2023.

Compared to last year (Q2 2022), the peak of distribution shifted right which indicates that the WEP falls in the lower price ranges over longer hours and there are lesser instances of high WEP occurring in this quarter. The high WEP recorded in the same quarter in the previous year could be attributed to the significantly higher fuel oil price that resulted from the Russia-Ukraine geopolitical tension and the curtailment of piped natural gas into Singapore from Indonesia. Since then, the fuel oil price has gradually declined from the 2022 levels and EMA has introduced measures to secure the supply of natural gas into Singapore. Hence, the WEP in Q2 2023 has declined as compared to last year, despite the record-high demand levels.

As shown in Chart 4, the distribution of the WEP in terms of percentage metered energy quantity in the market showed a similar change to its distribution based on the percentage number of hours. This suggests that the demand in Q2 2023 has maintained a consistent level throughout the day with low fluctuations on exceptional days.

**Chart 5. Correlation Between WEP and Metered Energy Quantity**      **Chart 6. WEP Versus Fuel Oil Price**

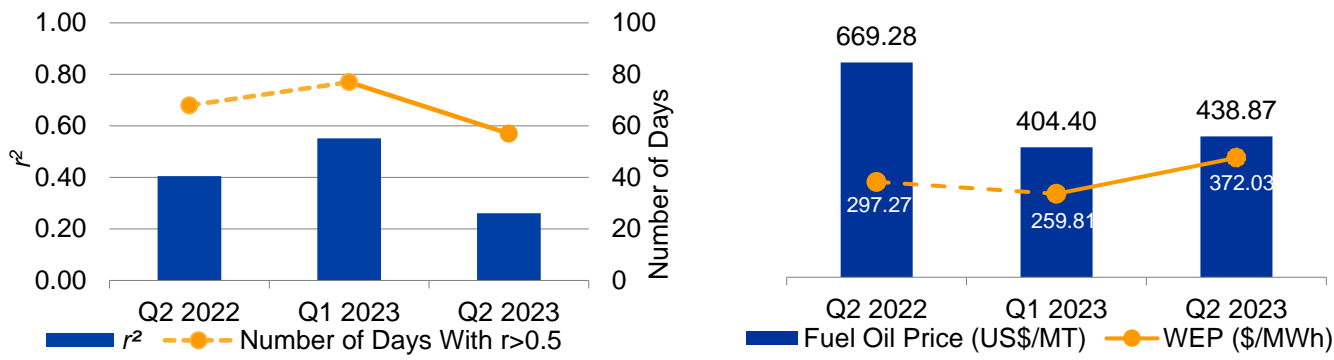


Chart 5 shows the proportion of variance in the WEP which could be explained by changes in the metered energy quantity measured by  $r^2$ . It was observed that changes in the metered energy quantity for Q2 2023 had a relatively lesser impact on the WEP movements as the correlation between the two variables slightly weakened. The  $r^2$  value decreased to 0.26 in Q2 2023 from 0.55 in Q1 2023, implying that the changes in the metered energy quantity could only account for 26% of the changes in the WEP during the quarter.

Correspondingly, there were 20 fewer days in Q2 2023 where  $r$  was greater than 0.5 compared to Q1 2023. This indicated that the metered energy quantity and the WEP had a strong positive correlation over a more limited time in Q2 2023 (57 out of 92 days) than in Q1 2023 (77 out of 92 days). Nevertheless, the metered energy quantity remained the main contributing factor to the movements in the WEP attributed to the stronger correlation value of 0.51 in Q2 2023.

As shown in Chart 6, the fuel oil price rose by 8.52% from US\$404.40/MT in Q1 2023 to US\$438.87/MT in Q2 2023, while a decrease of 34.43% from US\$669.28/MT was observed from Q2 2022. As fuel cost is one of the key cost components of electricity generation, the WEP moved in tandem with the quarterly increase in the fuel oil price.

**Table 2. Variation Between Real-Time Dispatch Price and Forecast Price**

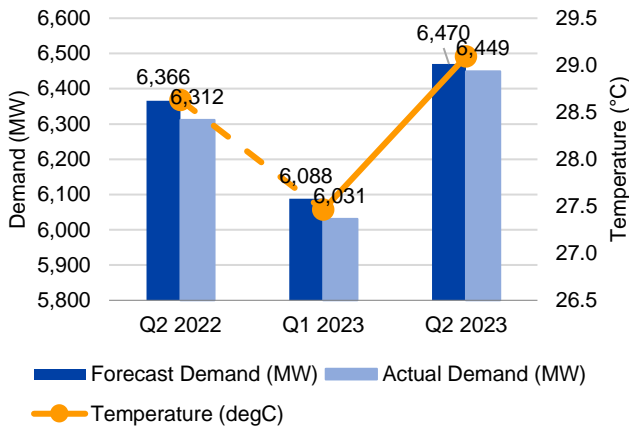
Month/Quarter	Variation Between RTS and STS (\$/MWh)	Maximum Periodic Variation (\$/MWh)
Apr-22	28.47	2,965.39
May-22	2.26	347.12
Jun-22	-3.25	969.79
Jan-23	8.36	3,732.04
Feb-23	-16.95	3,980.44
Mar-23	-3.07	2,336.81
Apr-23	5.19	3,187.11
May-23	14.65	1,899.24
Jun-23	9.28	4,107.30
<b>Q2 2022</b>	11.33	2,965.39
<b>Q1 2023</b>	9.46	3,980.44
<b>Q2 2023</b>	9.71	4,107.30

Table 2 shows the monthly and quarterly average variation in the USEP produced in the real-time dispatch schedule (“RTS”) and the short-term schedule (“STS”), along with the largest variation observed in a single dispatch period during each month and quarter. A positive variation means the RTS produced a higher USEP than the STS, while a negative variation means the RTS produced a lower USEP than the STS.

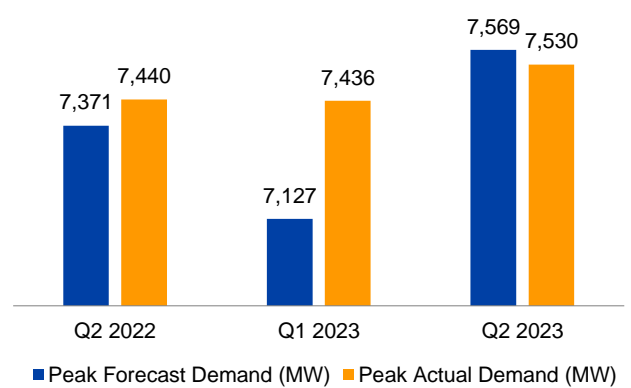
The average variation between the forecast USEP in the STS and the RTS increased to \$9.71/MWh in Q2 2023, \$0.25/MWh higher than the price variation observed in Q1 2023 at \$9.46MWh and \$1.62/MWh lower than that in Q2 2023. It is noteworthy to mention that the largest price variation was as high as \$4,107.30/MWh in Q2 2023, versus \$3,980.44/MWh in Q1 2023. The slightly higher average price variation this quarter could be attributed to the higher temperature experienced, when compared to previous quarter.

## Demand and Supply in Q2 2023

**Chart 7. Average Forecast and Actual Demand Versus Average Temperature**

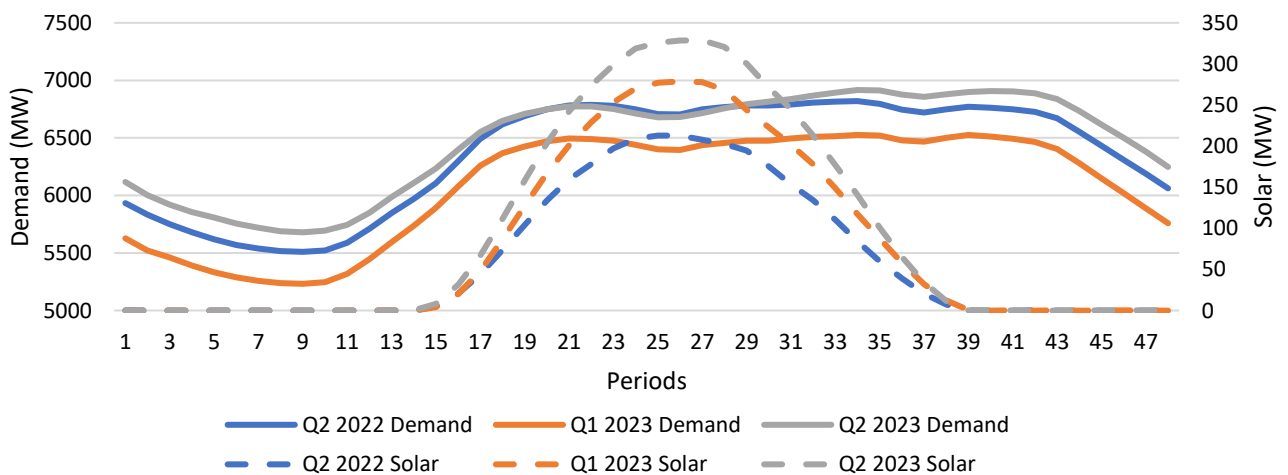


**Chart 8. Peak Forecast and Actual Demand**



According to Chart 7, there is a notable relationship between the average actual and forecast demand against the average temperature. Both, the average forecast and actual demand hit historical level this quarter as they increased by 6.28% from 6,088 MW to 6,470 MW and by 6.93% from 6,031 MW to 6,449 MW in Q2 2023 respectively. Similarly, both the peak forecast and peak actual demand increased in Q2 2023 by 6.20% and 1.27% respectively when compared to Q1 2023 (Chart 8). The record high demand in Q2 2023 was likely driven by the higher average temperature as Q2 2023 recorded an average quarterly temperature of 29.1°C, while Q1 2023 and Q2 2022 recorded average temperatures of 27.5°C and 28.6°C respectively.

**Chart 9. Average Demand and Solar Generation periodic profiles**



Comparing the demand profile in Q2 2023 to those in Q1 2023 and Q2 2022 (Chart 9), the peak demand levels shifted to the later part of the day. The demand trend across the quarters was against a backdrop of warmer weather and higher solar energy production. Given that the Singapore demand profile has taken solar generation into consideration, slight dips in demand levels were observed in around period 25 across all three quarters as it corresponded to the peaks of the respective solar generation profiles. In particular, the upward shift in demand profile for Q2 2023 between periods 15 to 34 may have been counterbalanced by the higher solar generation during those periods.

**Table 3. Quarterly Average Supply and Supply Cushion**

Quarter	Q2 2022	Q1 2023	Q2 2023
Average Supply (MW)	7,677	6,921	7,326
Supply Cushion (%)	17.10	12.15	11.77

Table 3 shows an increase in the quarterly average supply in Q2 2023 by 5.85% to 7,326 MW from 6,921 MW in Q1 2023. The increase in supply availability could be attributed to the higher demand forecast and lower planned and forced outage volume. As observed in Table 1, the planned outage and forced outage volume decreased by 11.65% and 41.57% respectively in Q2 2023 compared to the previous quarter. Despite the increase in supply given the decrease in outage volumes, the increase in demand was of greater magnitude, causing the corresponding supply cushion to decline by 0.39 percentage points from 12.15% in Q1 2023 to 11.77% in Q2 2023.

**Chart 10. Trend Of Energy Offer Price Proportion**

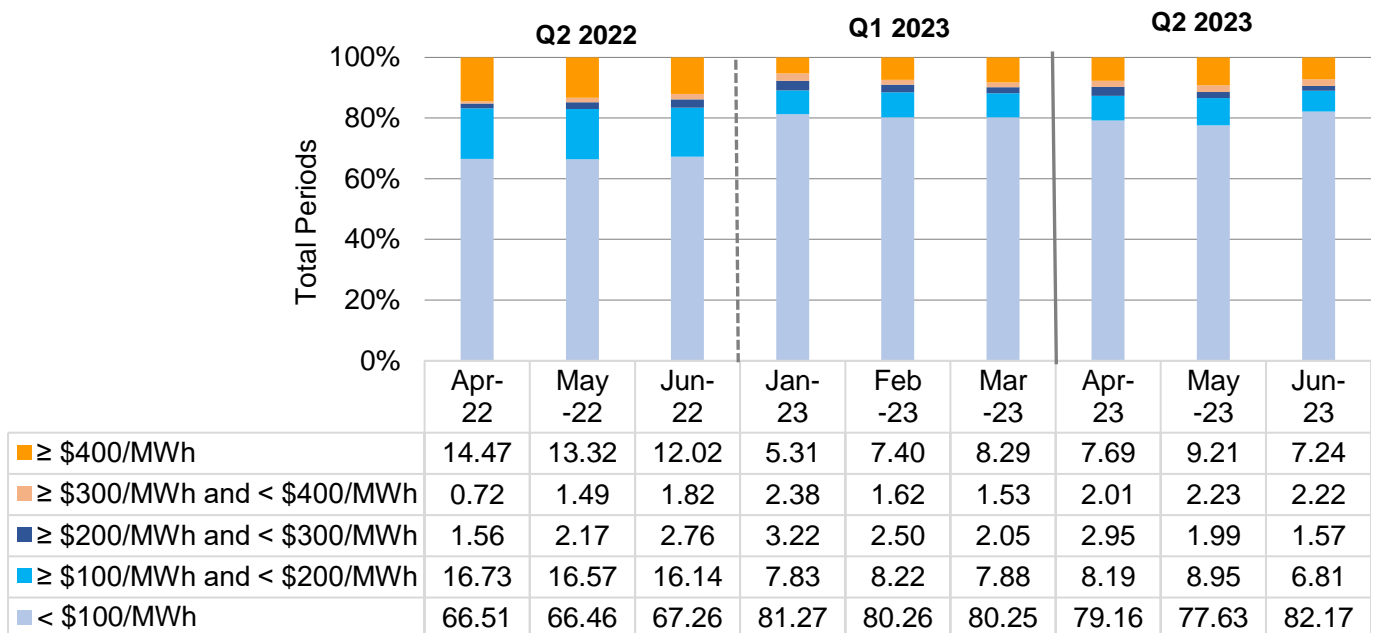


Chart 10 shows an increase in the proportion of energy offers above \$400/MWh in Q2 2023 compared to Q1 2023, with a lesser proportion of energy offers priced below \$400/MWh. The shift in energy offers to higher price ranges is in line with the tighter supply cushion as the average quarterly WEP increased from \$259.81/MWh in Q1 2023 to \$372.03/MWh in Q2 2023.

**Chart 11. Monthly Average Variation Between Real-Time Dispatch Schedule and Forecast Load**

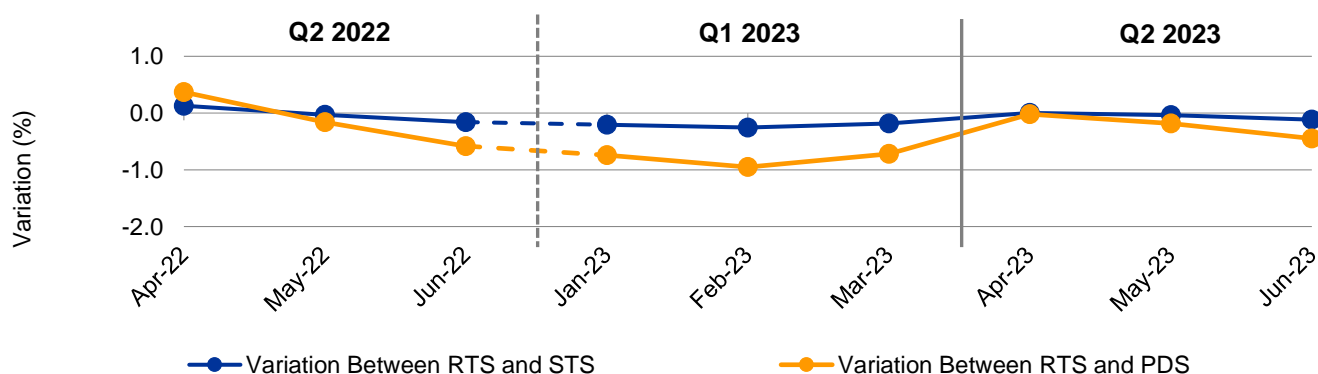




Chart 11 displays the variations in the pre-dispatch schedule (“PDS”) and short-term schedule (“STS”) against the real-time schedule (“RTS”). The average monthly variations remained relatively small in Q2 2023 (0.05 for variation between RTS and STS and 0.22 for variation between RTS and PDS, in percentage points), which is a decrease from Q1 2023 (0.22 for variation between RTS and STS and 0.81 for variation between RTS and PDS, in percentage points).

The forecasted schedule was slightly over-forecasted as both the variations in PDS and STS were largely negatively correlated to RTS. This could be attributed to the variations in the temperature from April to June 2023 – with the average temperature in April at 29.03°C, rising to 29.58°C in May before declining to 28.67°C in June.

**Chart 12. Quarterly Average Variation Between Real-Time Dispatch Schedule and Metered Energy Quantity**

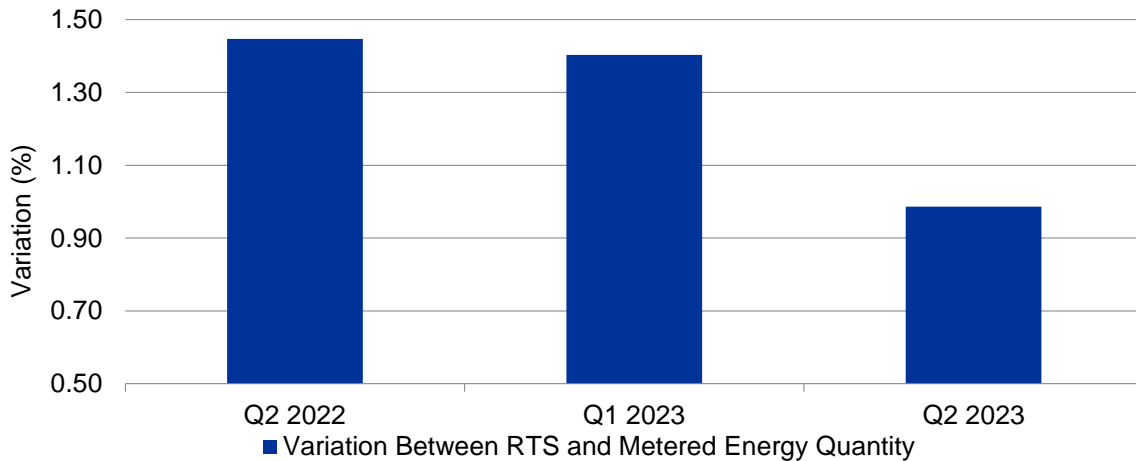
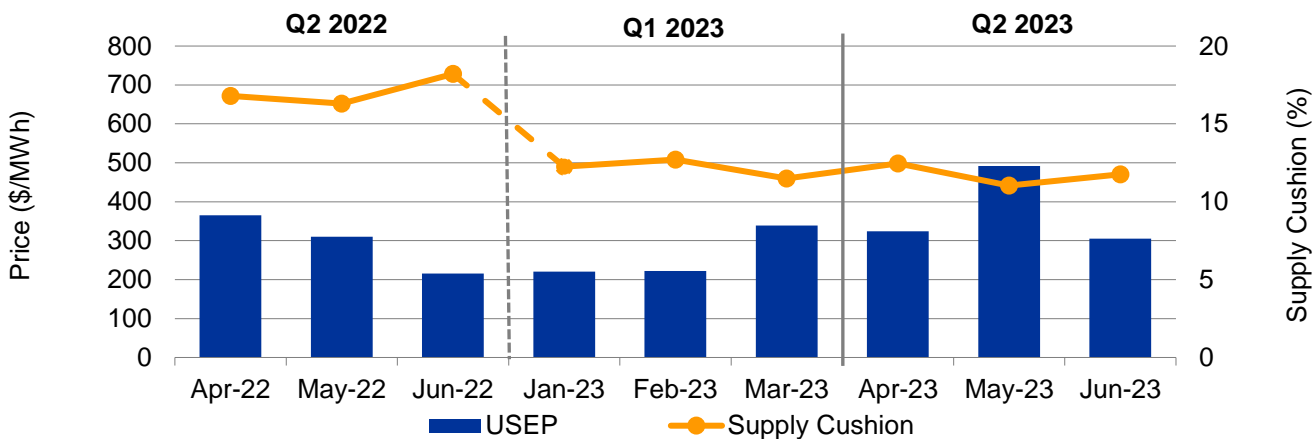


Chart 12 shows that Q2 2023 outperformed Q1 2023 and recorded a smaller variation in the quarterly average load variation between the RTS and the metered energy quantity. The average monthly load variation between the RTS and the metered energy quantity reduced from 1.40% in Q1 2023 to 0.99% in Q2 2023. The reduction implied a continual improvement of load forecast accuracy in comparison to Q1 2023 and Q2 2022.

**Chart 13. USEP and Supply Cushion**



In Q2 2023, the supply cushion averaged 11.77% compared to 12.15% in Q1 2023. It was observed that the higher USEP was inversely correlated with the lower supply cushion. On the monthly level, a similar inverse correlation was observed for April, May, and June 2023, where intuitively the higher supply cushion correlates with a lower USEP and vice versa. The highest monthly average USEP for the quarter was recorded in May 2023 at \$492.09/MWh, corresponding to the lowest monthly average supply cushion level of 11.05%. The tight supply cushion in May 2023 could be attributed to the stronger demand resultant from the relatively higher monthly average temperature.



**Chart 14. Capacity Ratio by Generation Type<sup>1</sup>**

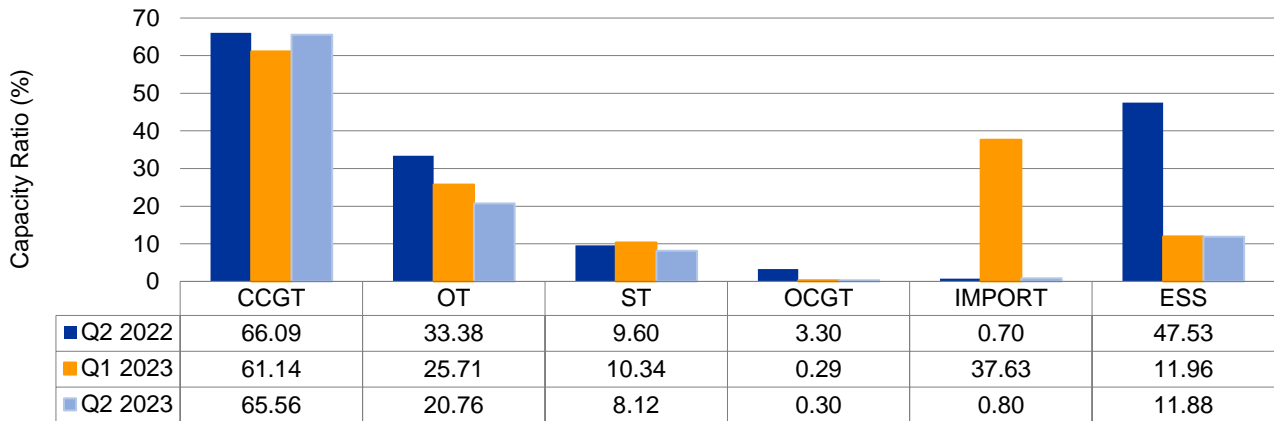
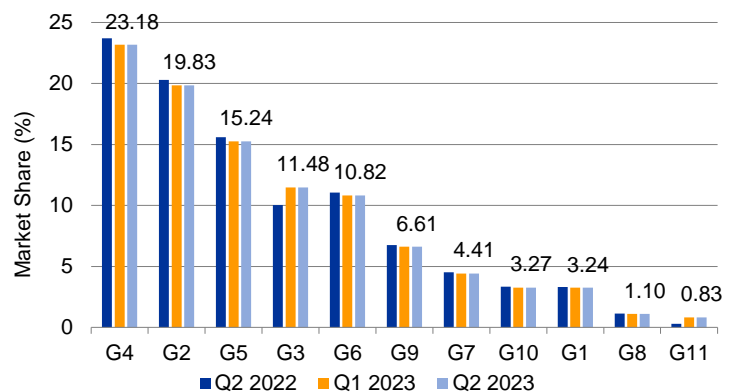
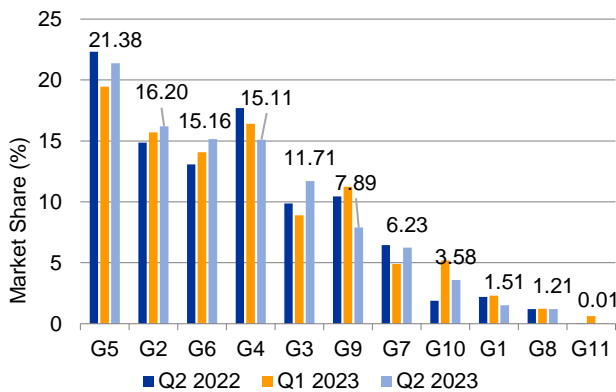


Chart 14 depicts the quarterly average capacity ratios of the six generation types in the NEMS which comprise Combined-Cycle Gas Turbine (“CCGT”), Others (“OT”), Steam Turbine (“ST”), Open-Cycle Gas Turbine (“OCGT”), imports (“IMPORT”), and Energy Storage System (“ESS”). IMPORT and ESS were newly introduced to the system in Q3 2022 and Q4 2022 respectively.

Compared to Q1 2023, the capacity ratios of CCGT and OCGT in Q2 2023 increased by 4.42 and 0.02 percentage points respectively. The increase in capacity ratio of CCGT is consistent with the higher plant availability given the lower planned and forced outage volume as indicated in Table 1. In contrast, the capacity ratios of OT, ST, IMPORT, and ESS declined by 4.96, 2.22, 36.83, and 0.07 percentage points respectively. In particular, the significant decline in IMPORT this quarter is due to the prolonged dry season in Lao PDR which disrupted the hydropower generation.

**Chart 15. Market Share in Percentage of Generation Companies Based on Metered Energy Quantity<sup>2</sup>**      **Chart 16. Market Share in Percentage of Generation Companies Based on Maximum Generation Capacity<sup>3</sup>**



Charts 15 and 16 provide a comparison of the market share comparison in the NEMS based on metered energy quantity and maximum generation capacity by generation companies.

As shown in Chart 15, G5, G2 and G6 are the top three largest generation companies based on the metered energy quantity with G2 and G6 surpassing G4 this quarter. The generation companies that are in the top three positions held 52.74% of the total market share in Q2 2023, an increase from 51.55% in Q1 2023. In comparison to the previous year, there was a reduction of 2.12 percentage points from 54.86% in Q2 2022, mainly due to the introduction of new facilities under other generation companies in the system.

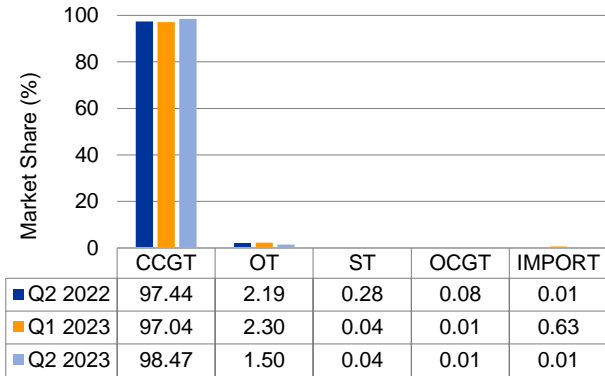
<sup>1</sup> ESS figure for Q1 2023 has been updated due to revised ESS maximum capacity in March 2023.

<sup>2</sup> Exclude intermittent generation facilities and Market Participants with net negative quarterly metered energy quantity.

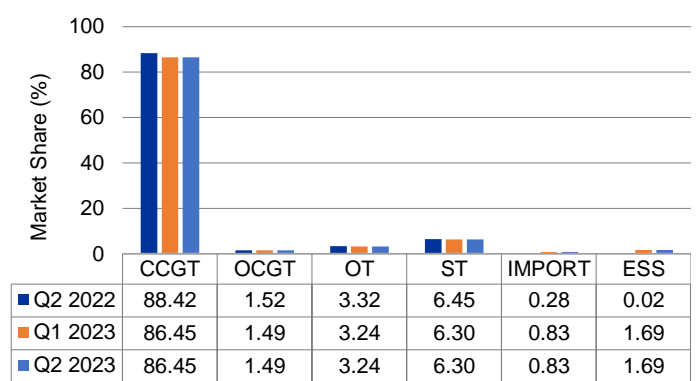
<sup>3</sup> Exclude intermittent generation facilities and Market Participants with lesser than 10 MW maximum generation capacity. The actual capacities of the ESS facilities were used for the computation.

As shown in Chart 16, the total market share of the big three generation companies in terms of the maximum generation capacity remained at 58.25% in Q2 2023, no change from Q1 2023. There were no new generation facilities registered under the big three generation companies in Q2 2023.

**Chart 17. Market Share in Percentage of Generation Types Based on Metered Energy Quantity<sup>4</sup>**



**Chart 18. Market Share in Percentage of Generation Types Based on Maximum Generation Capacity**



Most of the generation in the NEMS is produced by the most efficient generation technology, this is evidenced by the majority of the generation in the NEMS being produced by CCGT facilities. Charts 17 and 18 show that the CCGTs accounted for 98.47% of the metered energy quantity and 86.45% of the total maximum generation capacity in Q2 2023.

As shown in Chart 17, the market share of CCGT for metered energy quantity increased 1.43 percentage points from 97.04% in Q1 2023 to 98.47% in Q2 2023. With the record high demand levels recorded this quarter, lower forced and planned outage volumes, and the lower contribution from IMPORT due to the seasonality of hydropower, an increase in the market share of CCGT facilities was observed. The market share of all generation technology for total maximum generation capacity remained the same in Q2 2023 as there was no entry of new facilities with significant generation capacity.

**Chart 19. Frequency of the Number of Generation Companies as Pivotal Supplier (PS) Per Period**

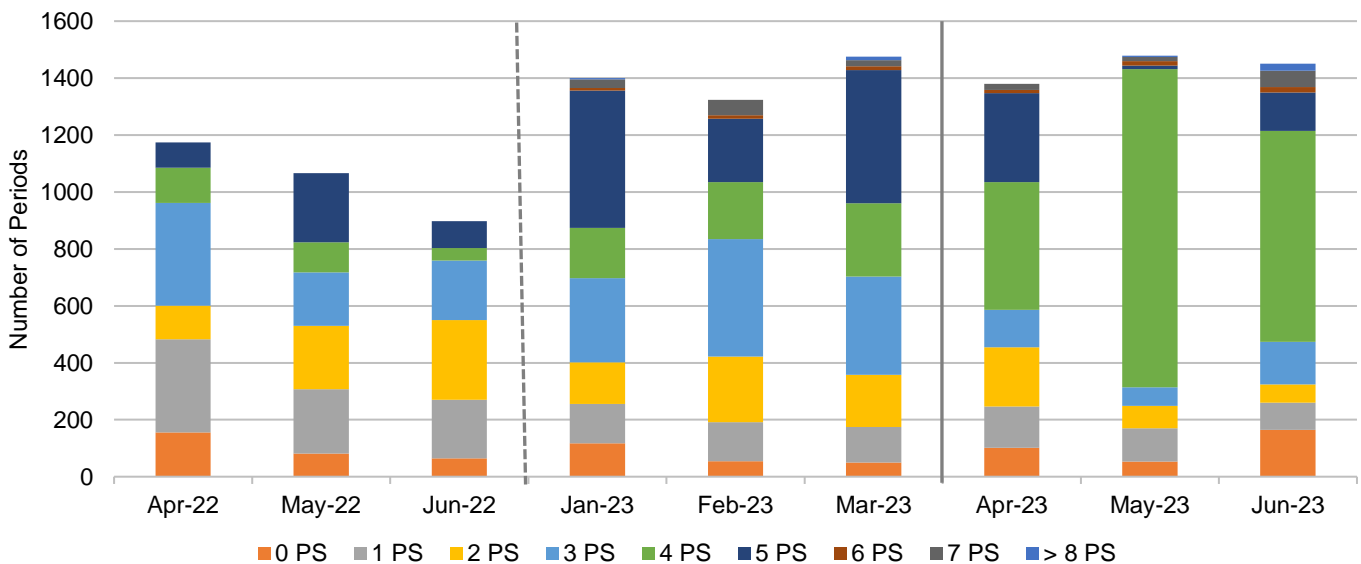


Chart 19 shows the number of trading periods with the number of pivotal suppliers per period for each month in Q2 2022, Q1 2023, and Q2 2023.

Q2 2023 recorded 3,680 periods with 4 or more pivotal suppliers per period, higher than what was observed in Q1 2023 with 2,869 periods. The reason for the increasing frequency of more than 4 generation companies as pivotal suppliers

<sup>4</sup> Exclude intermittent generation facilities and technology type with net negative quarterly metered energy quantity.

per period in Q2 2023 could be attributed to the lower supply cushion observed this quarter compared to the previous quarter. Given the tighter supply cushion recorded this quarter (Chart 13), more generation companies were identified as pivotal suppliers with the potential ability to exercise unilateral market power.

**Chart 20. Trend of Price Setting Generation Companies**

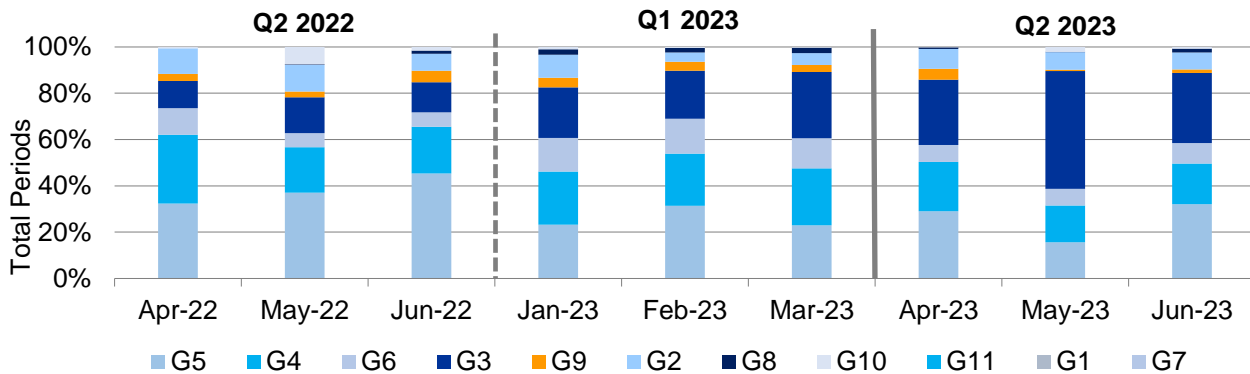


Chart 20 shows the monthly breakdown of price-setting generation companies in Q2 2023, Q1 2023, and Q2 2022. G3, G5, and G4 remained the top three highest frequency price-setting generation companies in the market in Q2 2023, which were at the same top three positions in Q1 2023. The price setting frequency for G3 and G5 grew 12.12 and 0.20 percentage points respectively, but G4 reduced 4.77 percentage points in Q2 2023 compared to Q1 2023.

**Chart 21. Demand Response Activations**

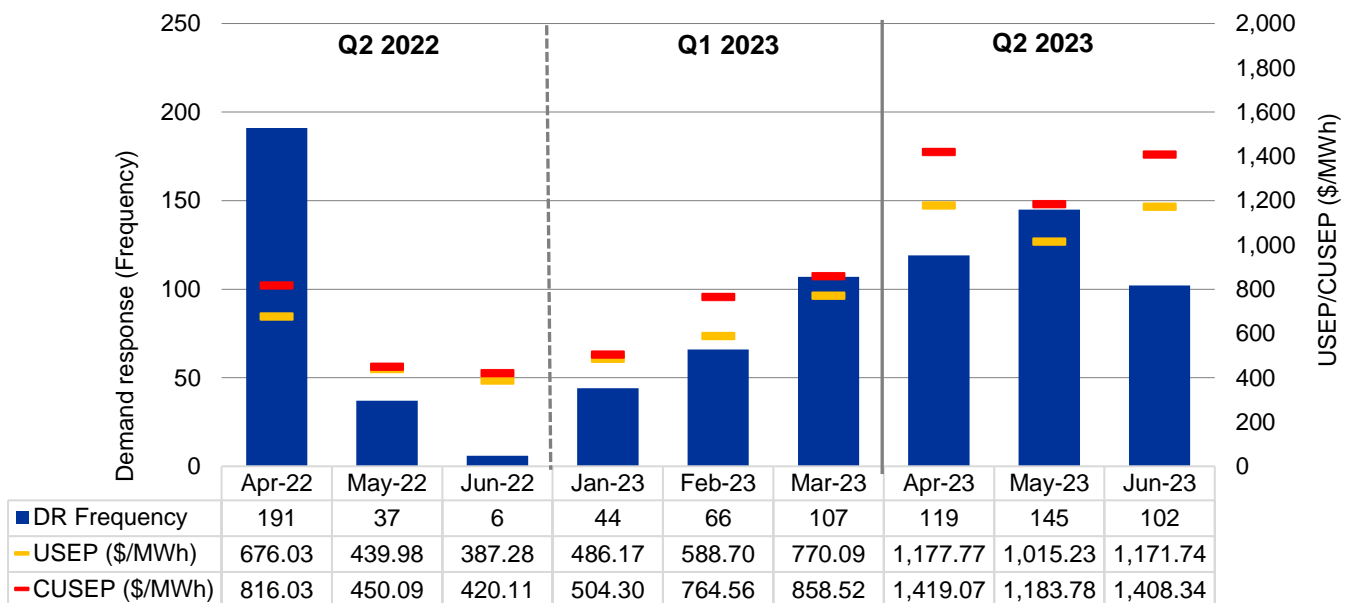


Chart 21 lists the Demand Response (“DR”) activations in Q2 2023, Q1 2023 and Q2 2022, and the associated USEP and counterfactual USEP (“CUSEP”) during those periods with DR activations.

There were 366 DR activations in Q2 2023, which was higher than the cumulative total of 271 occurrences recorded from the DR activation in Q1 2023. The daily average USEP for periods with DR activation in Q2 2023 was \$1,111.69/MWh, while the average CUSEP was \$1,322.86/MWh without DR curtailment.

The number of DR activation is usually reflective of the USEP levels and the USEP level in Q2 2023 was relatively higher compared to Q1 2023 (average USEP \$1,111.69/MWh in Q2 2023 and \$657.35/MWh in Q1 2023). Furthermore, the Energy Market Authority launched a Demand Side Management Sandbox from 1 January 2023 to 31 December 2024 to enhance the DR and Interruptible Load programs.<sup>5</sup>

<sup>5</sup> [https://www.ema.gov.sg/media\\_release.aspx?news\\_sid=20221024BUJD4YDq1igs](https://www.ema.gov.sg/media_release.aspx?news_sid=20221024BUJD4YDq1igs)

## Compliance Statistics for Q2 2023



**Potential Breaches of the Market Rules**



**Determinations\***



**Enforcement**

**136 cases in total**

0 self-reports  
**136** referrals/complaints  
 0 MSCP initiative

**89 cases in total**

7 cases determined to be in breach  
 1 case determined to take no further action  
**81** cases determined not to be in breach

**7 cases in total**

0 financial penalty  
**1** non-compliance letter  
 0 suspension order  
 0 termination order  
 0 other MSCP order  
**\$160,000** of financial penalty imposed  
**\$2,000** of costs awarded

\*This section includes determinations of cases referred to the MSCP in previous quarters.

The MSCP issued one rule breach determination in Q2 2023 to:

- i. 7 cases from Senoko Energy Pte. Ltd. regarding failure to comply with gate closure rules on 10 December 2022 (\$2,000 costs)

## MSCP Market Watch

This is a quarterly report prepared by the Market Assessment Unit (“MAU”) of EMC and submitted to the MSCP. The report summarises the MAU’s day-to-day monitoring, evaluation activities and analyses, and compares the market performance for the current quarter with the quarter a year ago and the previous quarter.

All prices and percentages in this report are rounded off to two decimal places.

The [User Guide to MSCP Market Watch](#) provides a glossary of the terms used in the MSCP Market Watch among other information to facilitate readers’ understanding.

## Market Surveillance and Compliance Panel

The MSCP is established by the EMC Board in accordance with section 2.6 of Chapter 3 of the Singapore Electricity Market Rules.

The MSCP, with the assistance of the MAU, monitors and investigates the conduct of market participants, the market support services licensee, EMC and the Power System Operator and the structure and performance of the wholesale electricity markets.

The MSCP comprises the following members:

- Professor Walter Woon, Chairman
- T P B Menon
- Philip Chua
- Professor Euston Quah
- Dr Stanley Lai
- Yeo Yek Seng

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