

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

Issue 70

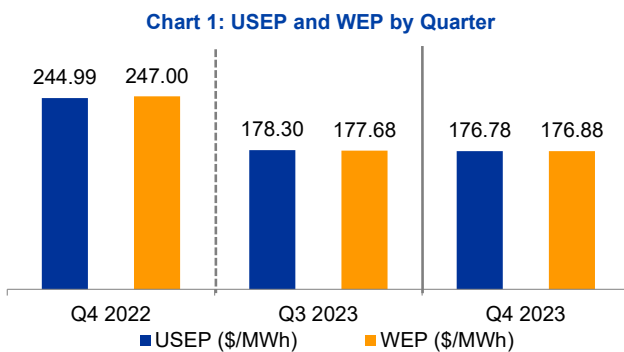
Fourth Quarter (October to December 2023)

## Executive Summary

The energy prices in the National Electricity Market of Singapore (“NEMS”) continued to decline this quarter following the drop in fuel oil price and a stronger supply cushion backed by dampened forecasted demand. Specifically, with the lull period in December, the monthly forecasted demand averaged at 6,112 MW after staying above 6,300 MW for the past nine months. This in turn weakened the overall quarterly forecasted demand for Q4 2023 to average at 6,283 MW. As a result, supply cushion rebounded 0.49 percentage point from 11.02% last quarter to 11.51% in Q4 2023.

The Temporary Price Cap (“TPC”) mechanism was introduced by the Energy Market Authority on 1 July 2023 as a short-term measure to mitigate extreme price volatility and risk aversion in the Singapore Wholesale Electricity Market (“SWEM”) and would be activated only during periods of high and sustained volatility in energy prices. There were no instances of TPC activation this quarter as compared to 3 instances of activation in Q3 2023.

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



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

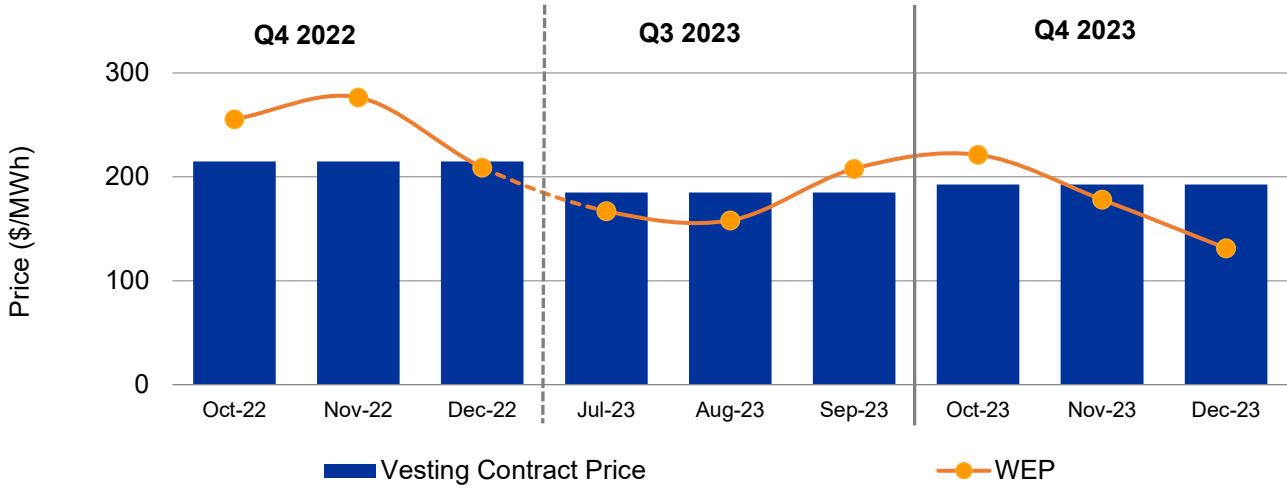
Quarter	Q4 2022	Q3 2023	Q4 2023
<b>Total Outage Volume (MWh Cumulative)</b>			
<b>Planned Outage</b>	4,949,498	5,326,051	5,258,628
<b>Forced Outage</b>	60,716	66,530	24,590
<b>Ancillary Services (\$/MWh)</b>			
<b>Primary Reserve</b>	3.79	1.00	1.54
<b>Contingency Reserve</b>	19.19	15.74	22.05
<b>Regulation</b>	34.00	34.47	39.69

The Uniform Singapore Energy Price (“USEP”) and the Wholesale Electricity Price (“WEP”) decreased 0.85% to \$176.78/MWh and 0.45% to \$176.88/MWh respectively on a quarter-to-quarter comparison in Q4 2023. The reduction in prices is largely attributed to a decrease in the forecasted demand that dropped 1.31% from 6,367 MW in Q3 2023 to 6,283 MW this quarter. Despite the 2.03% decrease in total planned and unplanned outage volume this quarter, supply dropped 0.82% from 7,151 MW in Q3 2023 to 7,093 MW in Q4 2023. As the reduction in forecasted demand outpaced the decrease in supply, the supply cushion expanded 0.49 percentage point to 11.51% this quarter.

The prices of ancillary services increased across the board on a quarter-to-quarter comparison. The prices of primary reserve and contingency reserve rose 54.48% and 40.07% to \$1.54/MWh and \$22.05/MWh respectively this quarter, despite a decrease in the reserve requirement. Regulation price increased 15.14% from \$34.47/MWh in Q3 2023 to \$39.69/MWh this quarter while the requirement remained the same at 117 MW. The increase in ancillary service prices was attributed to more expensive offers in the market.

## Prices in Q4 2023

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

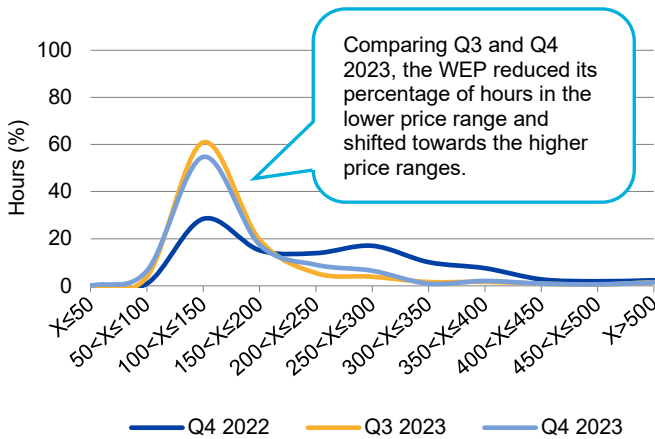


Following the expiry of the existing vesting contracts on 30 June 2023, the new vesting regime framework took effect on 1 July 2023 and hedges the non-contestable consumers load for the next five-year period to 30 June 2028. Under the new framework, the EMA issued vesting contracts under the base vesting scheme, tender vesting scheme, and residual vesting scheme.

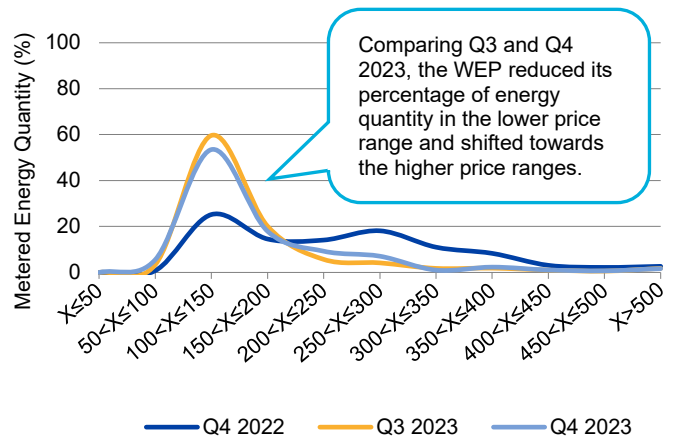
In Q4 2023, the WEP decreased 0.45% from \$177.68/MWh in Q3 2023 to \$176.88/MWh. The vesting contract price rose 4.19% from \$184.90/MWh in Q3 2023 to \$192.64/MWh in Q4 2023 despite the decrease in fuel oil price this quarter, implying that the other non-fuel components of the vesting contract price, for example, capital cost and non-fuel operating cost, had a greater impact on the vesting contract price.

The WEP cleared below the respective vesting contract price in the quarter for both Q3 2023 and Q4 2023. Specifically, the WEP was 3.91% and 8.18% lower than the vesting contract price in Q3 2023 and Q4 2023 respectively. The objective of the vesting contract is to curb the market power of the generation companies and provide a cushion to the consumers in the event of higher prices. The narrowing difference between the vesting contract price and the WEP implies that the energy prices are gradually stabilising and are in line with EMA’s objective.

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



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



Charts 3 and 4 show 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 Q4 2023, compared to the previous quarter and the same quarter in the preceding year.

As shown in Chart 3, the WEP remained below \$200/MWh in majority of the time for Q3 2023 and Q4 2023. Notably, the frequencies of WEP equal to or lower than \$100/MWh rose 1.68 times from 3.78% in Q3 2023 to 6.36% this quarter. Despite the aforementioned, there was a resulting marginal 0.85% decrease in the quarterly average WEP from Q3 2023 to Q4 2023 as the number of periods with WEP exceeding \$1,000/MWh decreased on a quarter-to quarter comparison from 20 periods to 13 periods this quarter, with prices hitting the cap for 3 periods in Q3 2023 as opposed to only 1 period in Q4 2023.

Compared to the same quarter last year, it is noteworthy that the WEP was in the price range of \$100/MWh to \$150/MWh 54.73% of the time in Q4 2023, which was an increase from 28.44% in Q4 2022. There was a higher frequency of WEP in the price range of \$200/MWh to \$350/MWh at 40.94% of the time in Q4 2022 as compared to 16.30% this year. The observations are due to more energy offers moving from the higher price tranches to the lower price tranches this year.

As shown in Chart 4, the distribution of the WEP in terms of percentage metered energy quantity in the market was similar to its distribution on percentage number of hours. The WEP was in the lower price range for most of the metered energy quantity in Q3 2023 and Q4 2023 as compared to last year.

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

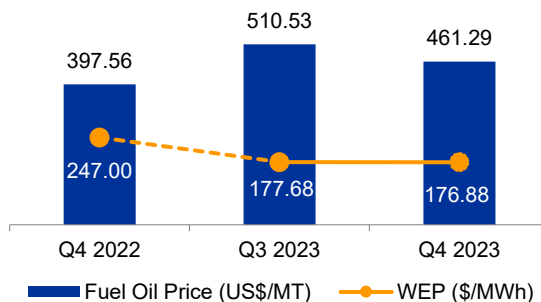
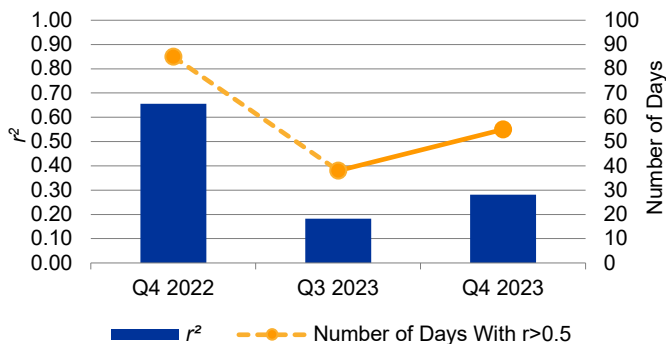


Chart 5 shows the proportion of variance in the WEP which could be explained by changes in the metered energy quantity measured by  $r^2$ . It was observed that the correlation between the metered energy quantity and the WEP strengthened with a higher  $r^2$  at 0.28 obtained in Q4 2023 compared to 0.18 in Q3 2023, indicating that the metered energy quantity had a greater impact on the WEP movements.

Correspondingly, there were 55 out of 92 days in Q4 2023 where  $r$  was greater than 0.5, compared to 38 out of 92 days in Q3 2023. This implies that the metered energy quantity and the WEP had a strong positive correlation over a limited time in Q3 2023 than in Q4 2023.

As shown in Chart 6, fuel oil price dropped 9.65% from US\$510.53/MT in Q3 2023 to US\$461.29/MT in Q4 2023. In contrast, when compared to the previous year, an increase of 16.03% from US\$397.56/MT in Q4 2022 was observed. The lower fuel oil price resulted in a 0.45% decrease in the WEP from \$177.68/MWh in Q3 2023 to \$176.88/MWh this quarter, in addition to the lower forecasted demand as a result of the year-end seasonal effects.

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

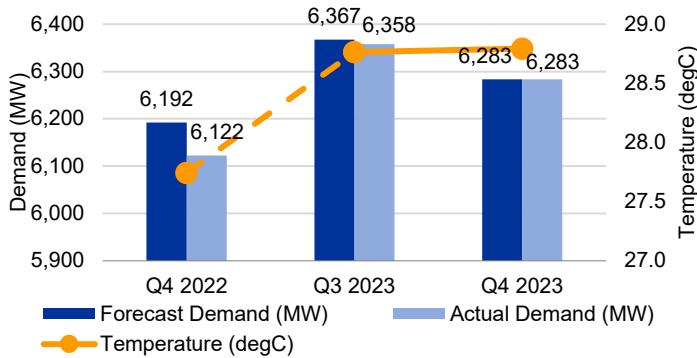
Month/Quarter	Variation Between RTS and STS (\$/MWh)	Maximum Periodic Variation (\$/MWh)
Oct-22	1.08	2,437.96
Nov-22	11.20	3,346.45
Dec-22	-2.55	2,624.05
Jul-23	-0.89	3,269.05
Aug-23	0.56	4,067.58
Sep-23	-9.62	3,915.99
Oct-23	7.18	2,391.02
Nov-23	4.48	3,847.88
Dec-23	-0.36	235.67
<b>Q4 2022</b>	<b>4.94</b>	<b>3,346.45</b>
<b>Q3 2023</b>	<b>3.69</b>	<b>4,067.58</b>
<b>Q4 2023</b>	<b>4.01</b>	<b>3,847.88</b>

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 real-time USEP increased to \$4.01/MWh in Q4 2023, which is \$0.32/MWh higher than the price variation observed in Q3 2023 at \$3.69/MWh, but \$0.94/MWh lower than that in Q4 2022. The periods identified to have the maximum price variations were usually observed when the market experienced tight supply conditions. Specifically, in the quarters identified in Table 2, supply cushion in those periods hovered at only around 2%. Notably, the highest price variation in Q4 2023 happened on 2 November 2023, period 45. In the STS run, demand was clearing close to the inelastic part of the supply curve at \$652.12/MWh. As a result, when demand elevated slightly from STS to RTS, this triggered a sharp increase in the periodic USEP to the energy price cap level of \$4,500/MWh in real-time, alongside a record of energy shortfall.

# Demand and Supply in Q4 2023

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



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

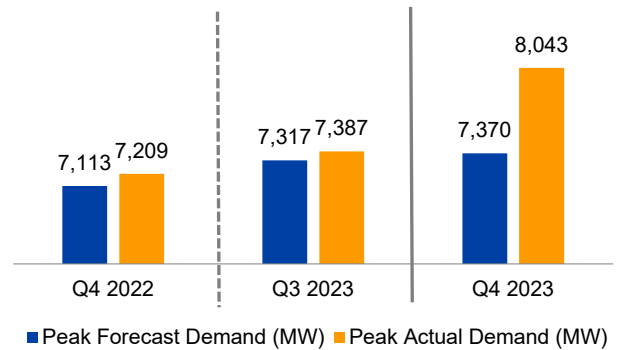
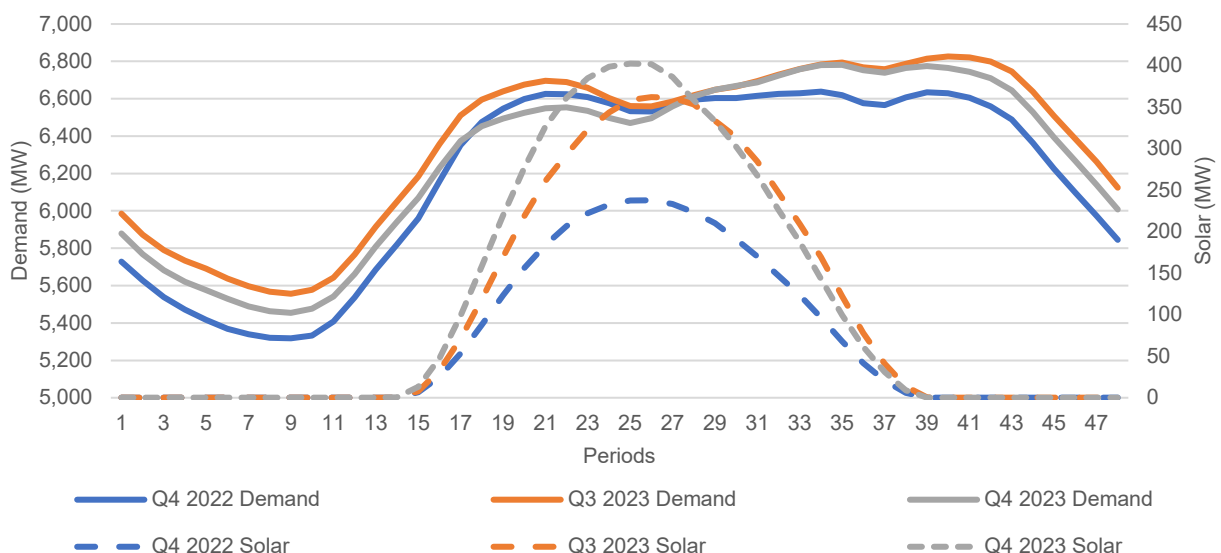


Chart 7 illustrates the relationship between the average actual and forecast demand against the average temperature. The average forecast and actual demand in Q4 2023 decreased 1.31% from 6,367 MW to 6,283 MW and 1.17% from 6,358 MW to 6,283 MW respectively from Q3 2023. However, both the peak forecast and peak actual demand trended in contrast as it rose in Q4 2023 by 0.73% and 8.89% respectively when compared to Q3 2023 (Chart 8). The lower demand in Q4 2023 was likely driven by the year-end seasonal effects coupled with higher solar generation in the quarter.

As shown in Chart 8, the peak forecast and actual demand rose 0.73% and 8.89% from Q3 2023 to 7,370 MW and 8,043 MW respectively. The observations in demand were largely attributed to the relatively warmer weather at 29.45°C in October 2023, which also recorded the fifth-highest monthly level for maximum forecast demand in the past three years.

**Chart 9. Average Demand and Solar Generation Periodic Profiles<sup>1</sup>**



Comparing the demand profile in Q4 2023 to those in Q3 2023 and Q4 2022 (Chart 9), the peak demand levels shifted to the later part of the day. Given that the Singapore demand profile has considered solar generation, it was observed that there was a dip in the demand levels at around period 26 for all three quarters, in line with the peak solar generation profiles.

<sup>1</sup> Solar generation forecasts are expected to be incorporated in the market clearing engine, for EMC to use them, together with existing load forecasts, in the market clearing process to produce market schedules.

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

Quarter	Q4 2022	Q3 2023	Q4 2023
Average Supply (MW)	6,936	7,151	7,093
Supply Cushion (%)	10.85	11.02	11.51

Table 3 shows a 0.82% reduction in the supply in Q4 2023 to 7,093 MW from 7,151 MW in Q3 2023, in contrast to a 2.26% increase from 6,936 MW in Q4 2022. The lower supply availability on a quarter-to-quarter comparison could be attributed to the lower demand forecast as a result of the year-end lull period. With a greater decrease in demand and a smaller reduction in supply, the corresponding supply cushion increased 0.49 percentage point from 11.02% in Q3 2023 to 11.51% in Q4 2023.

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

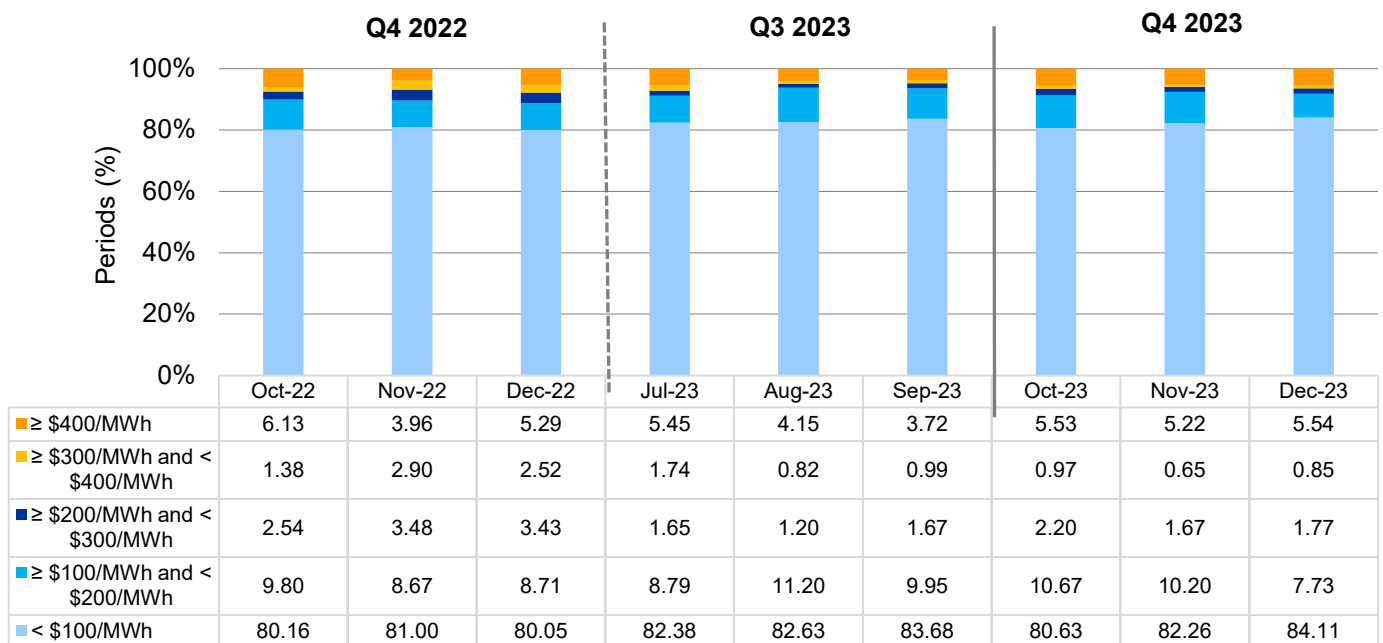


Chart 10 shows a decrease in the proportion of energy offers priced at or below \$200/MWh in Q4 2023 when compared to the previous quarter. Specifically, the energy offers priced at above or equal to \$400/MWh increased from 4.44% in Q3 2023 to 5.43% this quarter. Despite the price increase in energy offers, the quarterly average WEP dropped 0.45% from \$177.68/MWh to \$176.88/MWh as demand conditions were weaker this quarter.

The proportion of energy offers below \$100/MWh increased from 80.52% in Q4 2022 to 82.33% this quarter, which, as a result, lowered the quarterly average WEP from \$247.00/MWh in Q4 2022 to \$176.88/MWh in Q4 2023. The shift in energy offers to lower price ranges, coupled with the expansion of the supply cushion, are likely to have caused the resultant WEP to drop.

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

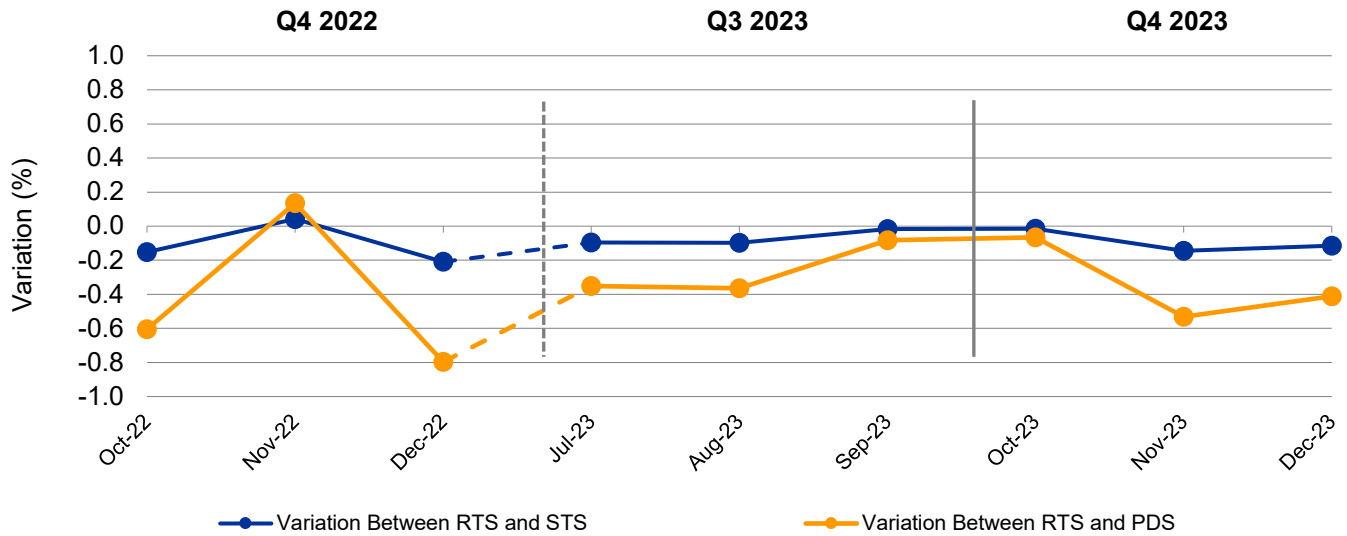


Chart 11 shows the variations in the pre-dispatch schedule (“PDS”) and short-term schedule (“STS”) against the real-time schedule (“RTS”). In Q4 2023, the average monthly variations remained relatively small, and it was observed that both the variations in the PDS and the STS were negatively correlated to the RTS. This indicated that the load in the real-time dispatch schedule recorded a lower value than the forecasted schedule.

The average load variation in Q4 2023 was 0.09 percentage point for variation between the RTS and the STS, as compared to 0.07 percentage point in Q3 2023. The percentage point for variation between the RTS and the PDS was 0.34 percentage point for Q4 2023, which was higher than those registered in Q3 2023 at 0.27 percentage point. The larger load variations in Q4 2023 could be explained by the variations in the temperature from October to December 2023 – with the average temperature in October at 29.45°C, declining to 28.77°C in November and further dropping to 28.16°C in December. Overall, for all quarters, the variations between the RTS and the STS were smaller in comparison to the variations between the RTS and the PDS, indicating a more accurate load forecasting nearer to real-time as the STS is generated more frequently and closer to the RTS.

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

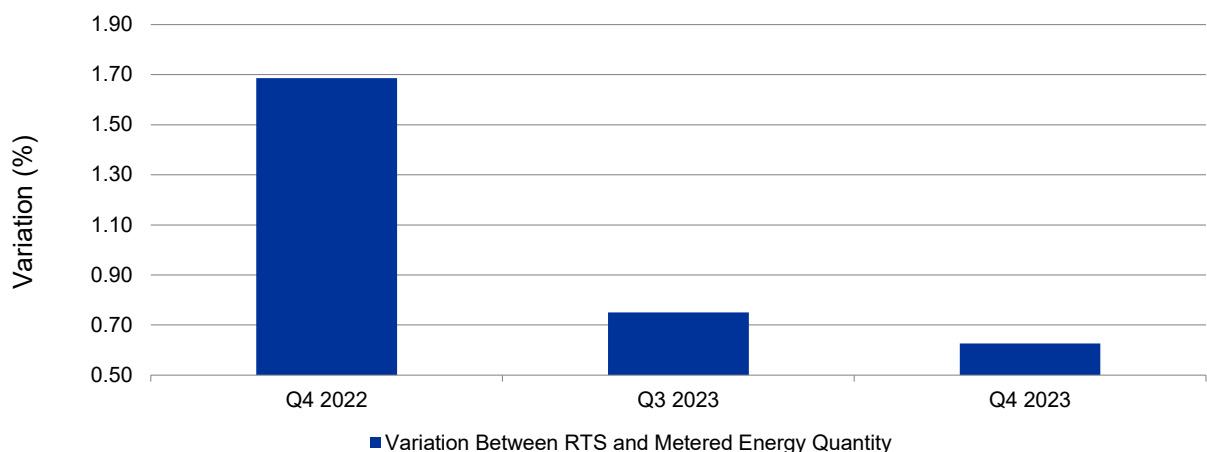
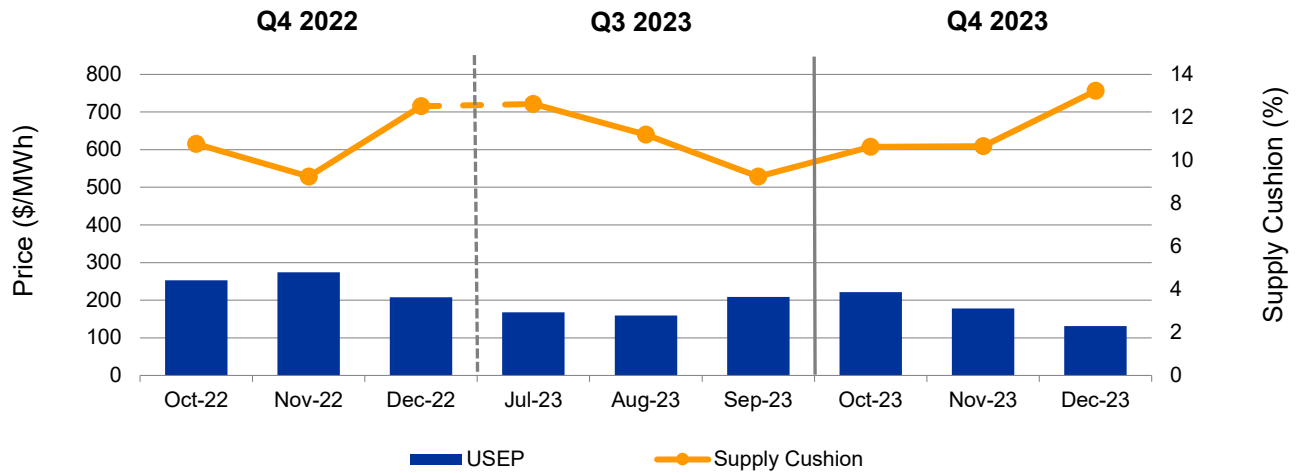


Chart 12 shows that Q4 2023 outperformed Q3 2023 and recorded a smaller variation in the quarterly average load variation between the RTS and the metered energy quantity. The average monthly load variation between the RTS and the metered energy quantity reduced from 0.75% in Q3 2023 to 0.63% in Q4 2023. The reduction implied a continual improvement of load forecast accuracy in comparison to Q4 2022 and Q3 2023.



**Chart 13. USEP and Supply Cushion**



In Q4 2023, the supply cushion averaged 11.51% compared to 11.02% in Q3 2023, aligned with the decrease in USEP and WEP this quarter. This suggested that the changes in demand and supply were largely fuelling the movements in the energy prices during those months.

On the monthly level, a similar positive correlation was observed for October, November and December 2023, where the higher supply cushion correlated with a lower USEP. The highest monthly average USEP for the quarter was recorded in October 2023 at \$221.19/MWh, corresponding to the lowest monthly average supply cushion level of 10.85%. The weakening of the supply cushion in October 2023 could be attributed to the relatively warmer weather experienced in October that month which raised the monthly average demand to 7,370 MW.

**Chart 14. Capacity Ratio by Generation Type**

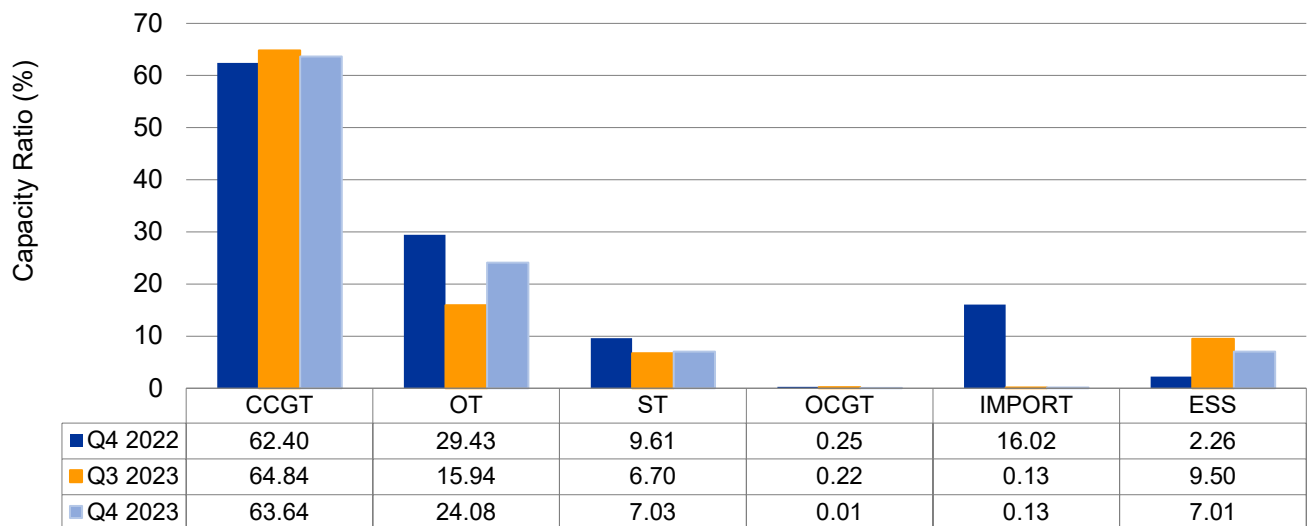
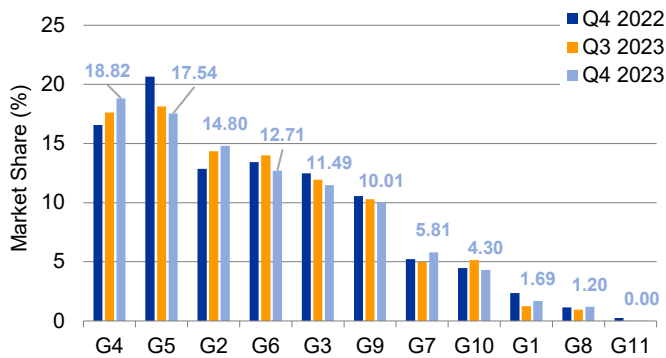


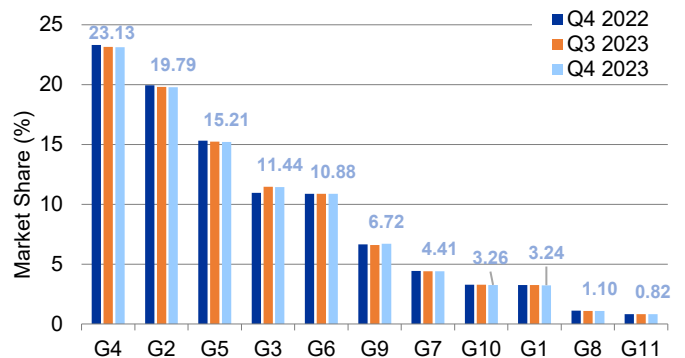
Chart 14 shows the quarterly average capacity ratios of the six generation types in the NEMS which comprise Combined-Cycle Gas Turbine (“CCGT”), Others (“OT”), Steam Turbine (“ST”), Open-Cycle Gas Turbine (“OCGT”), imports (“IMPORT”), and Energy Storage System (“ESS”).

Compared to Q3 2023, the capacity ratios reduced across the CCGT, OCGT, and ESS generation types by 1.20, 0.22 and 2.49 percentage points respectively this quarter. On the other hand, the capacity ratios for the OT and ST generation types rose 8.14 and 0.33 percentage points respectively. The capacity ratio of IMPORT remained constant at 0.13%.

**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>**

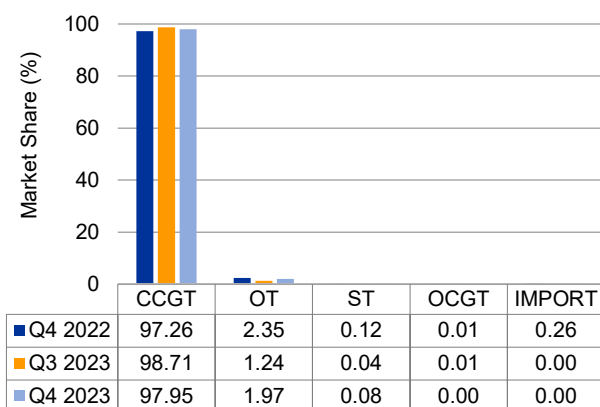


The breakdown of market share in the NEMS based on metered energy quantity and maximum generation capacity by generation company and generation type is shown in Charts 14 and 15 respectively.

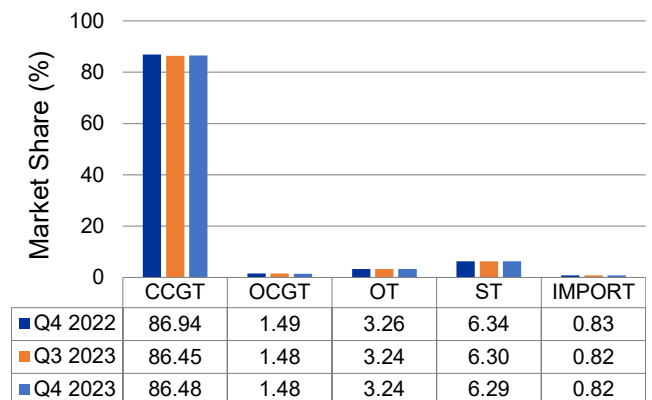
As shown in Chart 15, G4, G5, and G2 are the top three largest generation companies based on the metered energy quantity, with G4 surpassing G5 when compared to the previous quarter. The generation companies that are in the top three positions held 51.16% of the total market share in Q4 2023, an increase from 50.11% in Q3 2023 and a 0.50 percentage point increase from 50.66% in Q4 2022. On a quarter-to-quarter comparison, G4 recorded the greatest increase of 1.19 percentage points, while G6’s market share shrunk the most with a reduction of 1.30 percentage points.

As shown in Chart 16, the distribution of market share based on generation capacity was still above 50% in this quarter – the big three generation companies held 58.14% of the total market share in Q4 2023, a slight reduction from 58.22% in Q3 2023. The market share of G9 recorded an increase of 0.12 percentage point from 6.60% in Q3 2023 to 6.72% in Q4 2023 due to an increase in the registered capacity for an existing facility in the quarter. There were no new generation facilities registered this quarter.

**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**



<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.

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

Most of the generation in the NEMS is produced by CCGT units (97.95% of the metered energy quantity in Q4 2023 as shown in Chart 17), the most efficient generation technology (86.48% of the total maximum generation capacity in Q4 2023 as shown in Chart 18).

As shown in Chart 17, the market share of CCGT for metered energy quantity decreased 0.76 percentage point from 98.71% in Q3 2023 to 97.95% in Q4 2023. This could be attributed to an increase in the proportion of the market share for the OT and ST generation types. The market share of CCGT for total maximum generation capacity in Chart 18 increased in Q4 2023 due to an increase in the registered capacity for an existing CCGT.

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

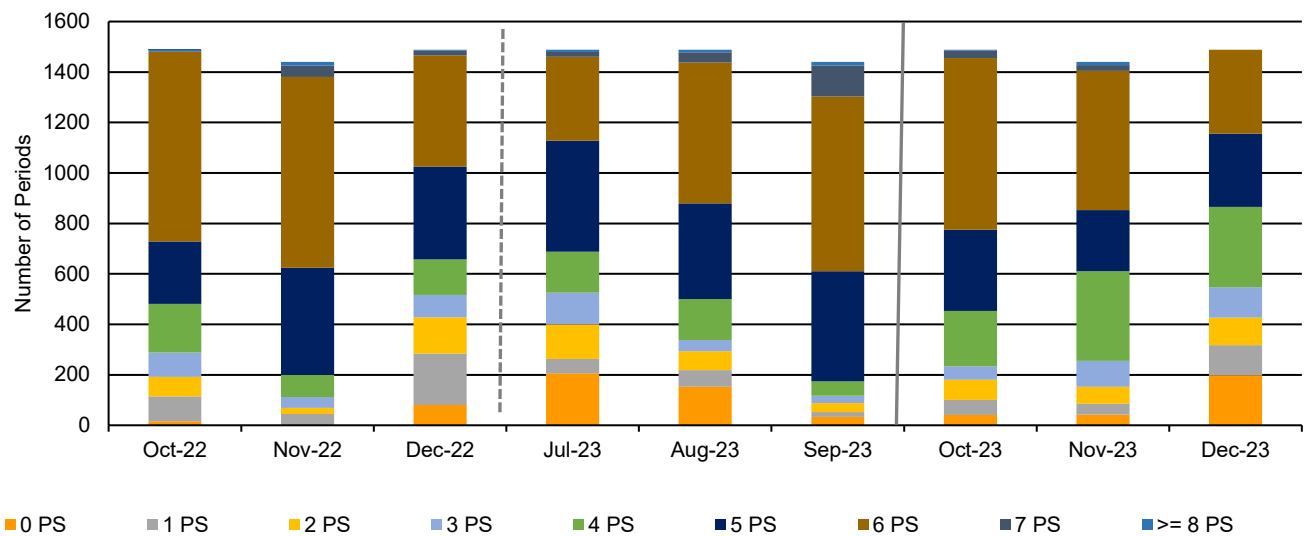


Chart 19 shows the number of pivotal suppliers per trading period for each month in Q4 2022, Q3 2023, and Q4 2023.

In Q4 2023, there were 3,380 periods with 4 or more pivotal suppliers per period, lower than what was observed in Q3 2023 with 3,435 periods. The stronger supply cushion this quarter could likely be the reason for the decreasing frequency of more than 4 generation companies as pivotal suppliers per period as compared to the previous quarter. Given the expanded supply cushion recorded this quarter (Chart 13), lesser generation companies were identified as pivotal suppliers with the potential ability to exercise unilateral market power. Nonetheless, there were still instances of periods where there were most, if not all, generation companies identified as pivotal suppliers as those occurred in the context of very tight supply or energy shortfalls conditions.

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

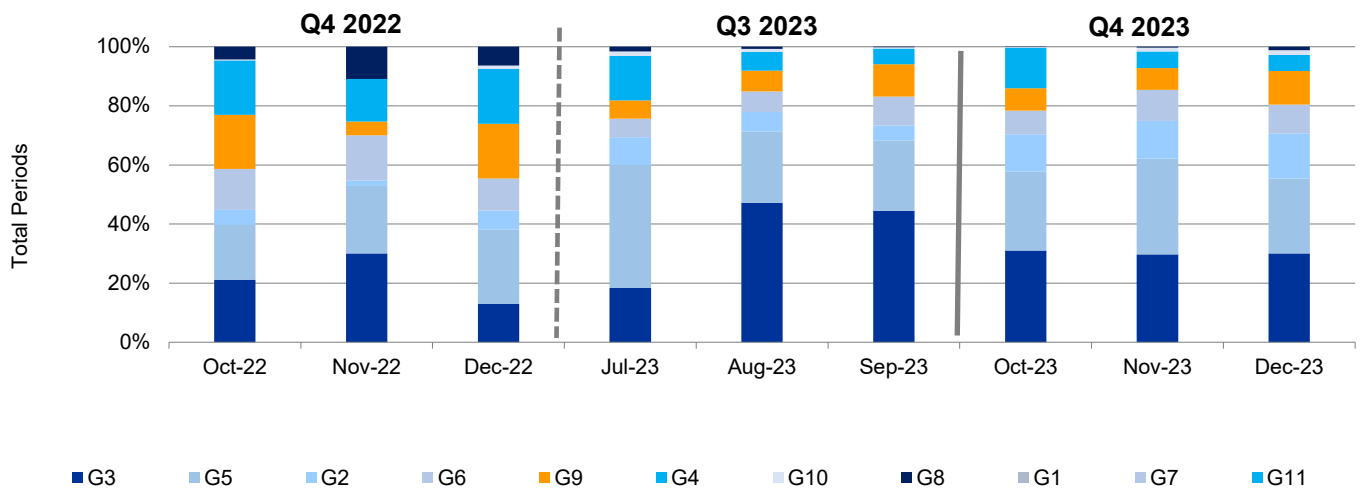


Chart 20 shows the monthly breakdown of price-setting generation companies in Q4 2022, Q3 2023, and Q4 2023. G3 and G5 remained in the top three highest frequency price-setting generation companies in the market in Q4 2023, similar to last quarter and the quarter in the preceding year. This quarter saw G2 replacing G4 as one of the top three price setting generation company. The price setting frequency for G2 grew 6.19 percentage points while G4 reduced 1.49 percentage points in Q4 2023 compared to the previous quarter.

**Chart 21. Demand Response Activations**

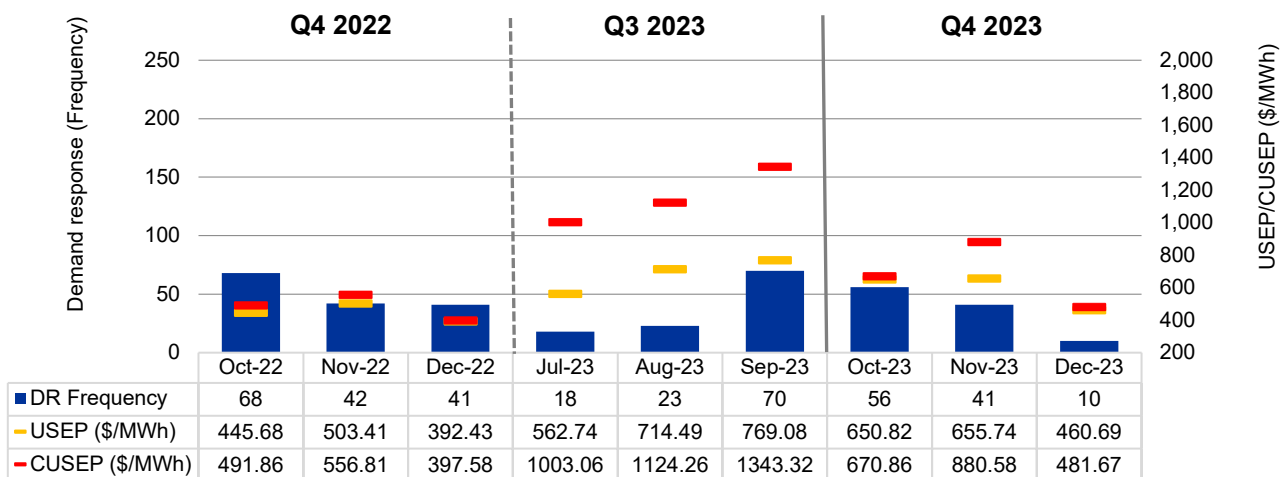


Chart 21 lists the Demand Response (“DR”) activations in Q4 2022, Q3 2023 and Q4 2023, and the associated USEP and counterfactual USEP (“CUSEP”) during those periods with DR activations.

There were 107 DR activations in Q4 2023, which was lower than the cumulative total of 111 occurrences recorded from the DR activation in Q3 2023. The daily average USEP for periods with DR activation in Q4 2023 was \$634.93/MWh, while the average CUSEP was \$733.54/MWh without DR curtailment.

The number of DR activations is usually reflective of the USEP levels and the USEP level in Q4 2023 was relatively lower compared to Q3 2023 (quarterly average USEP \$176.78/MWh in Q4 2023 and \$178.30/MWh in Q3 2023). In Q4 2023, the highest frequency of DR activations was noted in October at 56 instances. This could be due to the increase in forecasted demand in that month as a result of the relatively warm weather.

## Compliance Statistics for Q4 2023



Potential Breaches of the Market Rules<sup>5</sup>



Determinations\*



Enforcement

<p><b><u>82 cases in total</u></b></p> <p>1 non-gate closure 81 gate closure</p>	<p><b><u>72 determinations in total</u></b></p> <p>4 cases determined to be in breach 2 cases determined to take no further action 66 cases determined not to be in breach</p>	<p><b><u>4 cases in total</u></b></p> <p>3 financial penalty 1 non-compliance letter 0 suspension order 0 termination order 0 other MSCP order \$3,000 of financial penalty imposed \$4,000 of costs awarded</p>
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\*This section includes determinations of cases referred to the MSCP in previous quarters.

The MSCP issued 2 rule breach determinations in Q4 2023 to:

- i. [1 case from Senoko Energy regarding failure to comply with gate closure rules on 26 June 2023](#) (Letter of non-compliance, \$2,000 costs)
- ii. [3 cases from Keppel Merlimau Cogen regarding failure to comply with gate closure rules on 1 August 2023](#) (Financial penalty \$3,000, \$2,000 costs)

<sup>5</sup> Revision to the Potential Breaches of the Market Rules to differentiate gate closure and non-gate closure cases.

## MSCP Market Watch

The [MSCP Market Watch](#) 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
- Philip Chua
- Professor Euston Quah
- Dr Stanley Lai
- Yeo Yek Seng

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