National Electricity Market of Singapore

Market Surveillance & Compliance Panel Market Watch

Issue 71
First Quarter (January to March 2024)

Market Assessment Unit

Executive Summary

Energy prices in the National Electricity Market of Singapore ("NEMS") continued to decline for the third consecutive quarter following a reduction in fuel cost and a higher supply cushion. The expanded supply cushion was attributed to a rise in supply that outpaced the increase in demand. The higher supply was mainly due to a reduction in the planned and unplanned outage volumes observed in Q1 2024, while the strengthened forecasted demand was consistent with the warmer weather in Singapore compared to the previous quarter. Combined with an increase in energy offers in the lower price tranches, energy prices dipped this quarter.

Despite the lower energy prices in Q1 2024 overall, several periods of higher price volatility led to the activation of the Temporary Price Cap ("TPC"), recording two instances of TPC activation compared to none in the previous quarter. The TPC capped the Uniform Singapore Energy Price ("USEP") for a total of 15 periods this quarter, with the difference between the USEP and Reference USEP ("RUSEP")[1] ranging between $0.42/MWh and $2,765.88/MWh. The longest duration of TPC activation for this quarter was recorded at 52 periods, exceeding the minimum trigger period of 48 periods.

Chart 1. USEP and WEP by Quarter

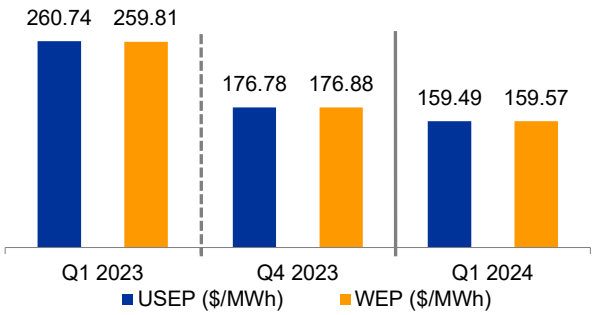


Table 1. Quarterly Outage Volume and Ancillary Service Prices

Quarter	Q1 2023	Q4 2023	Q1 2024
Total Outage Volume (MWh Cumulative)			
Planned Outage	5,082,780	5,258,628	2,919,095
Forced Outage	223,155	24,590	45,871
Ancillary Services ($/MWh)			
Primary Reserve	0.19	1.54	1.08
Contingency Reserve	8.32	22.05	19.76
Regulation	45.32	39.69	26.71

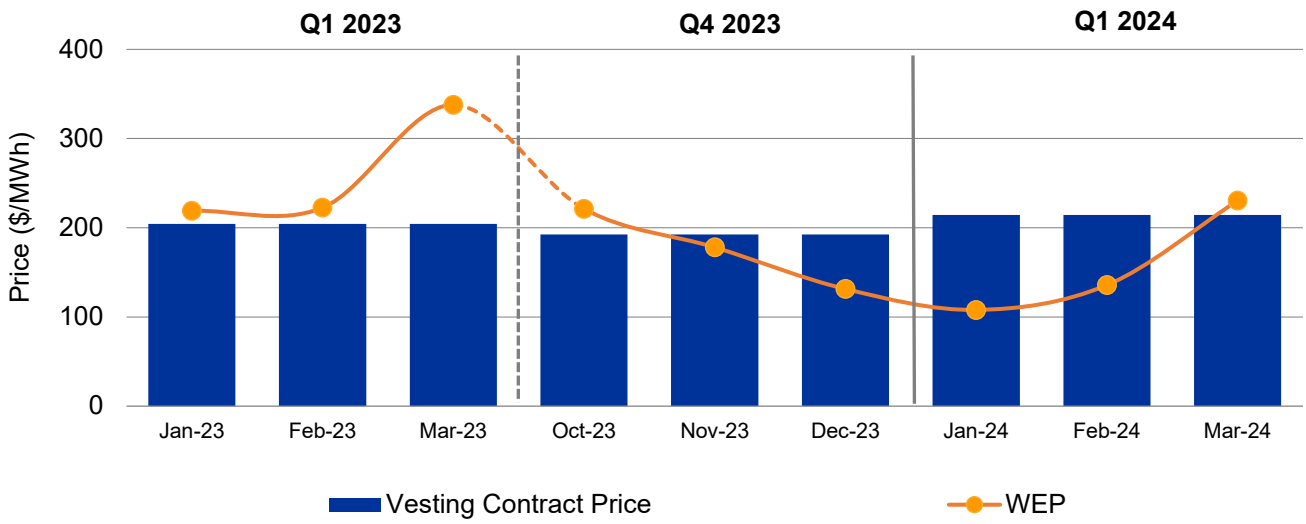
The USEP and the Wholesale Electricity Price ("WEP") decreased by 9.78% to $159.49/MWh and 9.79% to $159.57/MWh respectively in a quarter-on-quarter comparison. The reduction in prices was largely attributed to a higher supply cushion that rose 1.90 percentage points from 11.51% in Q4 2023 to 13.41% this quarter, and a reduction in the fuel oil price. In line with the lower planned and unplanned maintenance which fell 43.88%, the supply increased by 2.29% from 7,093 MW last quarter to 7,256 MW this quarter.

The prices of ancillary services decreased across the board in a quarter-on-quarter comparison. The prices of primary reserve and contingency reserve dropped 29.71% and 10.40% to $1.08/MWh and $19.76/MWh respectively this quarter, despite an increase in the reserve requirement. The regulation requirement recorded a decline of 2.35% from the previous quarter, resulting in the easing of the regulation price from $39.69/MWh in Q4 2023 to $26.71/MWh in Q1 2024. A shift to cheaper offer price bands was the main driver of the lower ancillary service prices this quarter.

[1] RUSEP is the uncapped counterfactual USEP during a TPC activation.

Prices in Q1 2024

Chart 2. Vesting Contract Price Versus WEP by Quarter



Vesting contracts[2] were introduced by the Energy Market Authority ("EMA") with the objective of curbing the market power of generation companies, and providing a cushion to consumers in the event of higher prices.

The WEP decreased 9.79% from $176.88/MWh in Q4 2023 to $159.57/MWh in Q1 2024. Conversely, the vesting contract price rose 11.32% from $192.64/MWh in Q4 2023 to $214.44/MWh in Q1 2024. The increase in the vesting contract price occurred despite a decrease in the fuel oil price this quarter, implying that other non-fuel components of the vesting contract price, such as capital cost and non-fuel operating cost, had a greater impact on the vesting contract price.

Q1 2024 marked the third consecutive quarter with average WEP levels below the vesting contract price, with the quarterly WEP recording 25.59% lower than the vesting contract price. The narrowing difference between the vesting contract price and the WEP implies that energy prices are gradually stabilising and are in line with the EMA's objective for the vesting regime.

Chart 3. Distribution of WEP Over Time

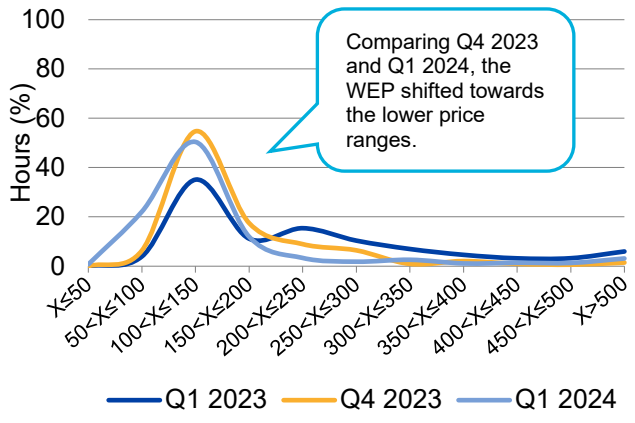
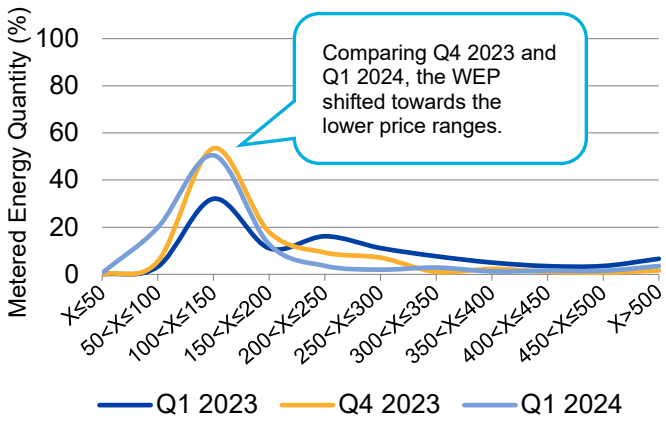


Chart 4. Distribution of WEP Over Total Metered Energy Quantity



[2] EMA | Vesting Contracts

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 Q1 2024, compared to the previous quarter and the same quarter in the preceding year.

As shown in Chart 3, the distribution of the WEP over time moved to the lower price ranges in Q1 2024 when compared to Q4 2023. The frequencies of WEP in the price range of equal to or lower than $50/MWh increased by 0.76 percentage points compared to zero in Q4 2023. The frequencies of WEP between $50/MWh and $100/MWh rose to 22.14% this quarter from 6.36% the previous quarter. This could be due to the lower fuel cost recorded in Q1 2024, which resulted in more energy offers shifting to lower price tranches.

As shown in Chart 4, the WEP over metered energy quantity shifted to the lower price ranges for most of the time in Q1 2024, compared to Q4 2023 and Q1 2024. The similar distribution pattern of the WEP weighted by metered energy quantity and the distribution of WEP weighted by hours indicate that the demand may have maintained a fairly consistent level throughout the day with little variability, with the exception of a few peak hours of higher demand.

Chart 5. Corelation Between WEP and Metered Energy Quantity

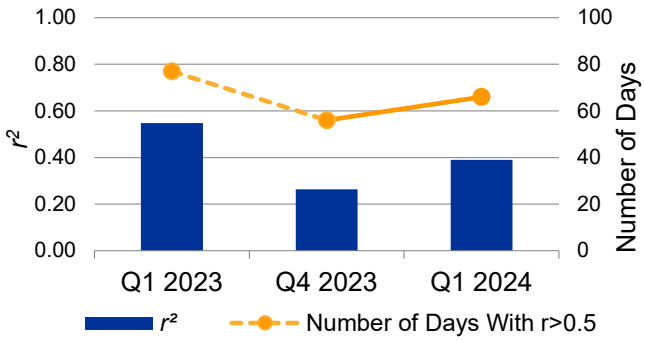


Chart 6. WEP Versus Fuel Oil Price

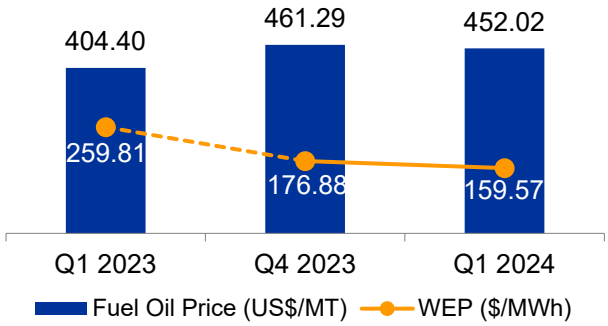


Chart 5 shows the proportion of variance in the WEP which could be explained by changes in the metered energy quantity, as measured by r^2. The correlation between the metered energy quantity and the WEP strengthened with a higher r^2 of 0.39 in Q1 2024 compared to 0.26 in Q4 2023. This indicates that the metered energy quantity had a greater influence on the WEP movements this quarter.

Correspondingly, there were 66 out of 91 days in Q1 2024 where r was greater than 0.5, compared to 56 out of 92 days in Q4 2023. This implies that the metered energy quantity and the WEP had a strong positive correlation over a longer period in Q1 2024 than in Q4 2023.

As shown in Chart 6, the fuel oil price dropped 2.01% from US$461.29/MT in Q4 2023 to US$452.02/MT in Q1 2024. The lower fuel oil price, as well as the higher supply cushion, corresponded to a 9.79% decrease in the WEP to $159.57/MWh this quarter in comparison to the previous quarter. In contrast to the same quarter of the previous year, an increase of 11.78% from US$404.40/MT in Q1 2023 was observed.

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

Month/Quarter	Variation Between RTS and STS ($/MWh)	Maximum Periodic Variation ($/MWh)
Jan-23	8.36	3,732.04
Feb-23	-16.95	3,980.44
Mar-23	-3.07	2,336.81
Oct-23	6.93	2,391.02
Nov-23	4.43	3,847.88
Dec-23	-0.29	235.67
Jan-24	0.34	100.12
Feb-24	3.88	248.13
Mar-24	0.83	4,042.31
Q1 2023	**9.46**	**3,980.44**
Q4 2023	**3.88**	**3,847.88**
Q1 2024	**1.68**	**4,042.31**

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 decreased to $1.68/MWh in Q1 2024. This was a $2.20/MWh and $7.78/MWh drop from the average price variation observed in Q4 2023 and Q1 2023 respectively.

The trading periods with the maximum price variations were usually observed when the market experienced tight supply conditions. The highest price variation in Q1 2024 was observed for 27 March 2024, period 35. In the STS, the supply cushion for period 35 was recorded at 4.00% and the USEP cleared at $457.69/MWh. Following the forced outage of a facility at 418 MW, the supply cushion collapsed to lower than 0%, resulting in an energy shortfall in the RTS for period 35. Consequently, the USEP cleared at the energy price cap of $4,500/MWh.

Demand and Supply in Q1 2024

Chart 7. Average Forecast and Actual Demand Versus Average Temperature

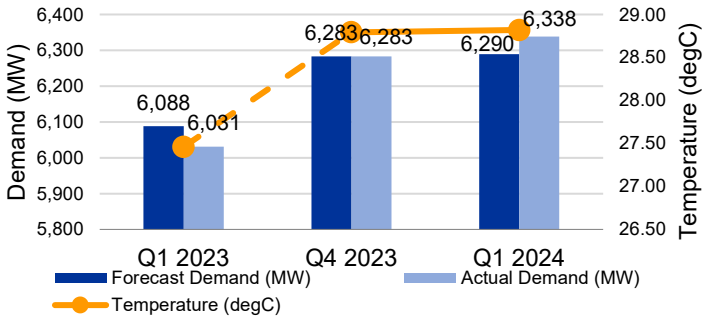


Chart 8. Peak Forecast and Actual Demand

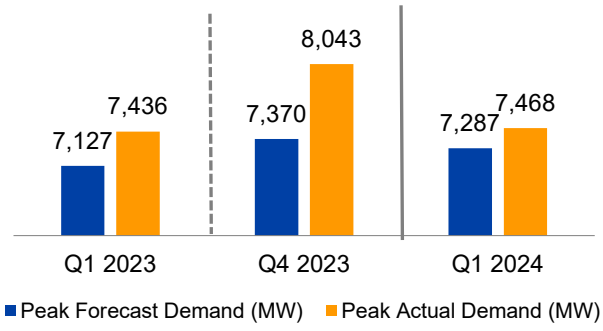
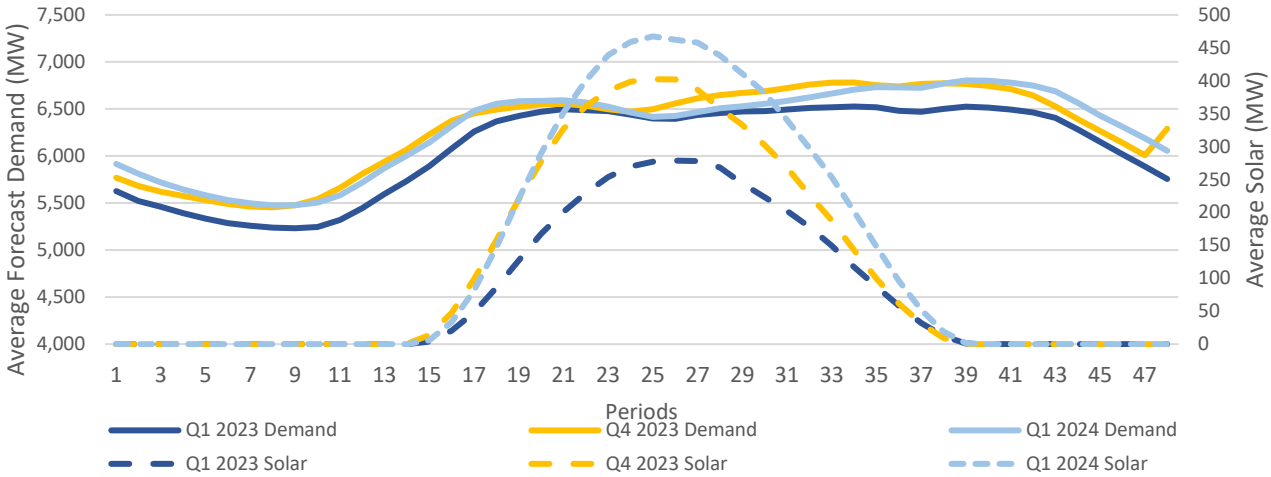


Chart 7 illustrates the relationship between the average actual and forecast demand against the average temperature. The average forecast and actual demand in Q1 2024 increased by 0.10% from 6,283 MW to 6,290 MW and 0.87% from 6,283 MW to 6,338 MW respectively from Q4 2023. The slightly higher demand in Q1 2024 was likely driven by the relatively warmer weather of 28.82°C this quarter as compared to 28.79°C in the previous quarter. Moreover, there was a greater number of public holidays in Q1 2024 (5 days) compared to Q4 2023 (3 days).

In contrast to the climb in the quarterly average demand seen in Chart 7, Chart 8 shows the peak forecast and peak actual demand dipped from the previous quarter, by 1.12% and 7.15% to 7,287 MW and 7,468 MW respectively. The periods of peak forecast and peak actual demand were typically recorded between periods 29 to 34, when the solar generation was gradually tapering off.

Chart 9. Average Forecast Demand and Average Solar Generation Periodic Profiles



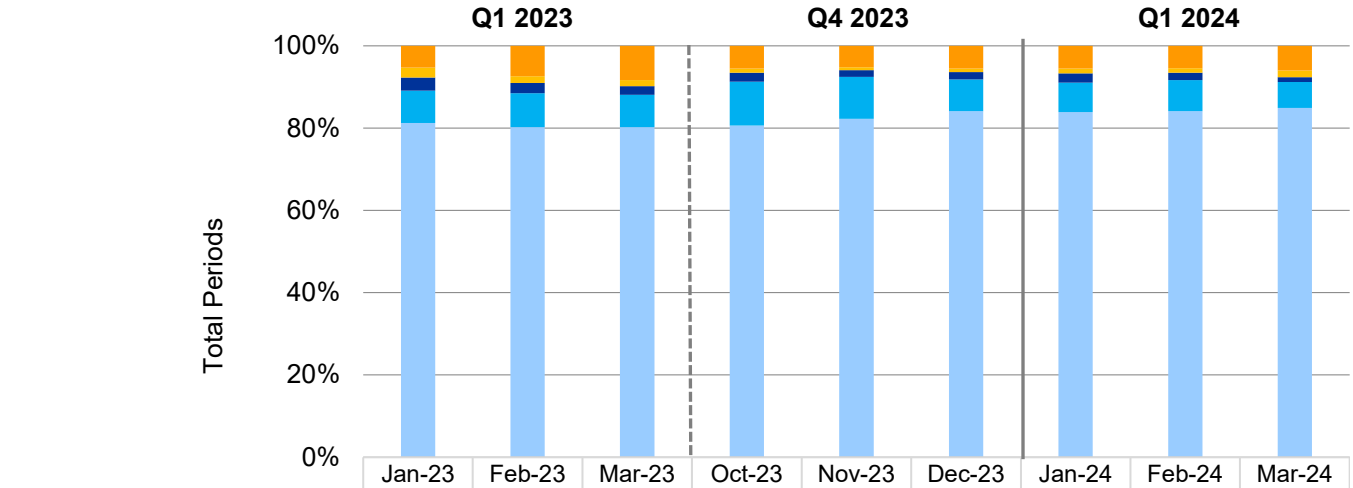
Comparing the average forecast demand profile in Q1 2024 to Q4 2023 and Q1 2023 (Chart 9), the peak demand levels moved slightly from period 34 (Q1 2023) to period 35 (Q4 2023), followed by a greater shift to period 39 (Q1 2024) . Given that the Singapore demand profile has incorporated the contribution of solar generation, the dip in the demand, particularly between periods 24 and 26, was in line with the peak in the solar generation profiles.

Table 3. Quarterly Average Supply and Supply Cushion

Quarter	Q1 2023	Q4 2023	Q1 2024
Average Supply (MW)	6,921	7,093	7,256
Supply Cushion (%)	12.15	11.51	13.41

Table 3 shows a 2.29% growth in the supply in Q1 2024 to 7,256 MW from 7,093 MW in Q4 2023, and a 4.84% increase from 6,921 MW in Q1 2023. The higher supply availability in a quarter-on-quarter comparison could be attributed to the lower planned and unplanned maintenance compared to Q4 2023 and Q1 2023. With a slight increase in demand and a larger growth in supply, the corresponding supply cushion increased 1.90 percentage points from 11.51% in Q4 2023 to 13.41% in Q1 2024.

Chart 10. Trend Of Energy Offer Price Proportion



	Jan-23	Feb-23	Mar-23	Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	Mar-24
≥ $400/MWh	5.31	7.40	8.29	5.53	5.22	5.54	5.51	5.43	5.98
≥ $300/MWh and < $400/MWh	2.38	1.62	1.53	0.97	0.65	0.85	1.21	1.13	1.61
≥ $200/MWh and < $300/MWh	3.22	2.50	2.05	2.20	1.67	1.77	2.25	1.76	1.19
≥ $100/MWh and < $200/MWh	7.83	8.22	7.88	10.67	10.20	7.73	7.12	7.58	6.33
< $100/MWh	81.27	80.26	80.25	80.63	82.26	84.11	83.91	84.10	84.89

Chart 10 shows an increase in the proportion of energy offers priced below $100/MWh in Q1 2024 compared to Q4 2023, and a dip in the proportion of energy offers priced between $100/MWh and $300/MWh. The shift in energy offers to lower price ranges this quarter was in line with the lower fuel cost. Consequently, the quarterly average WEP decreased from $176.88/MWh in Q4 2023 to $159.57/MWh in Q1 2024. There was also a slight increase in the proportion of energy offers priced above $400/MWh, which could be attributed to the expanded supply this quarter.

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

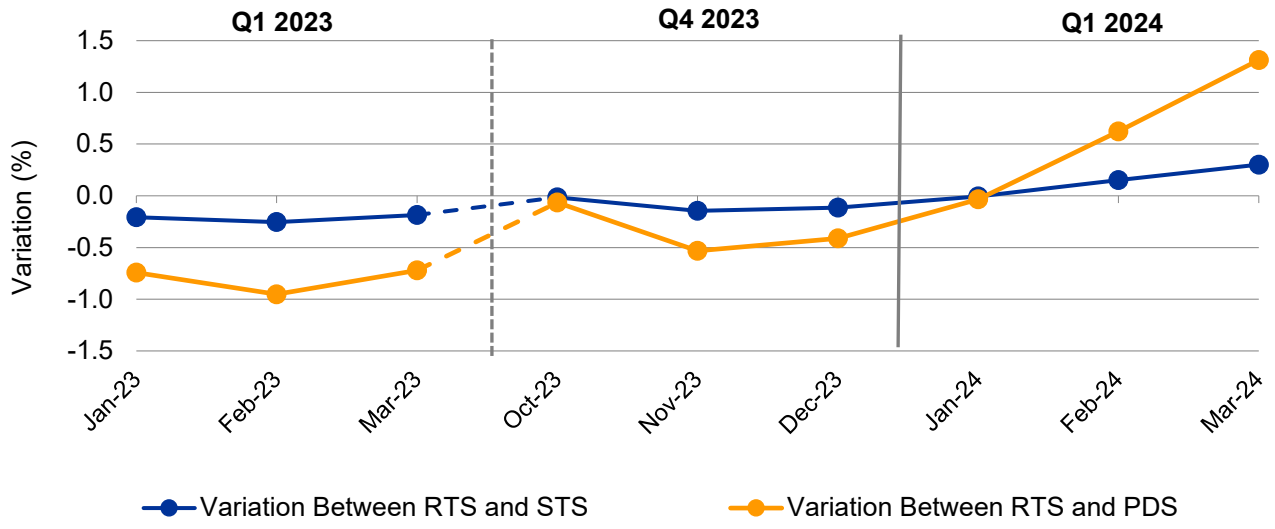


Chart 11 shows the variations in the pre-dispatch schedule ("PDS") and short-term schedule ("STS") against the real-time schedule ("RTS"). In Q1 2024, the monthly average variations remained relatively small, and it was observed that the forecasted schedule mostly recorded a lower value than the load in the real-time dispatch schedule .

The average load variation between the RTS and the STS in Q1 2024 was 0.15%, compared to 0.09% in Q4 2023. The average load variation between the RTS and the PDS was 0.66% for Q1 2024, compared to 0.34% in Q4 2023.

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. This indicates 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

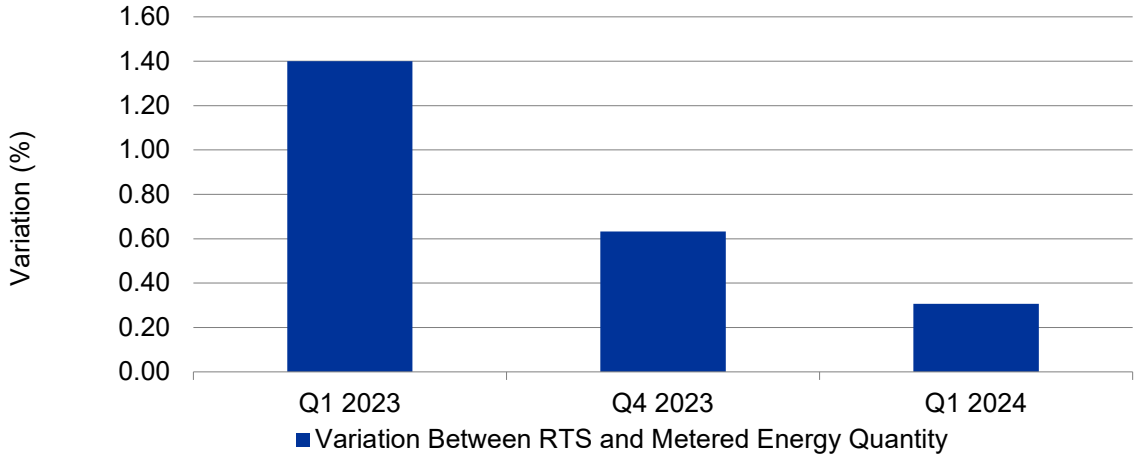
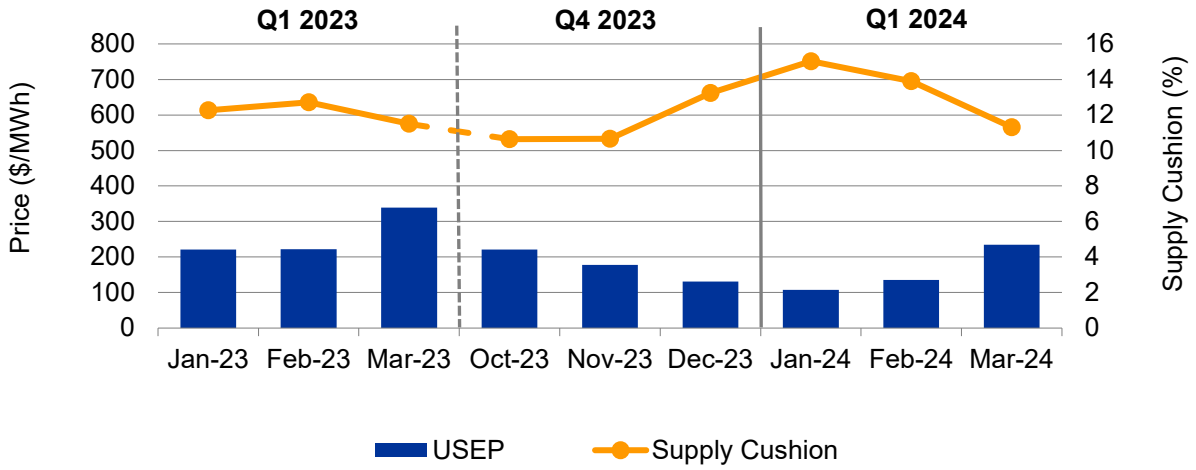


Chart 12 shows that Q1 2024 recorded a smaller variation in the quarterly average load variation between the RTS and the metered energy quantity compared to Q1 2023 and Q4 2023. The monthly average load variation between the RTS and the metered energy quantity reduced to 0.31% in Q1 2024 from 1.40% in Q1 2023 and 0.63% in Q4 2023. The reduction implies a continual improvement of load forecast accuracy in comparison to Q1 2023 and Q4 2023.

Chart 13. USEP and Supply Cushion

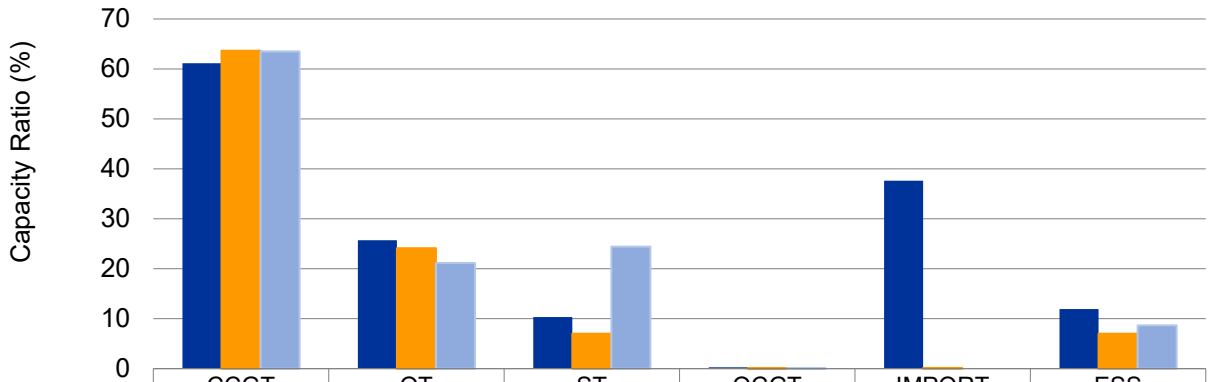


As observed in Chart 13, the average supply cushion increased to 13.41% in Q1 2024 from 11.51% last quarter, leading to a drop in the quarterly Uniform Singapore Energy Price ("USEP") and Wholesale Electricity Price ("WEP"). Notably, the highest monthly average USEP for Q1 2024 was recorded in March at $235.06/MWh. During the month of March, several periods of tight supply conditions led to price volatility, eventually triggering the activation of the Temporary Price Cap ("TPC").

Prior to the TPC activation in period 36 on 1 March 2024, the periodic USEP rose above $1,000/MWh for 5 periods as the supply cushion dipped below 5%. During the activation, the USEP was capped for 2 periods, with the difference between the USEP and Reference USEP ("RUSEP") registering at $261.93/MWh and $272.64/MWh. The TPC was later deactivated after the minimum trigger period, largely due to the weaker demand profile on Saturday 2 March.

On 27 March 2024, the forced outage of a facility at 418 MW in period 33 resulted in the periodic USEP rising above $3,000/MWh for 4 periods, as well as contingency and regulation shortfalls. The TPC was subsequently activated at period 39. During the activation, the USEP was capped for a total of 13 periods, with the difference between the USEP and RUSEP ranging between $0.42/MWh and $2,765.88/MWh. The highest periodic USEP recorded on that day was $4,500.00/MWh, corresponding to the supply cushion plunging below 0% and the system experiencing an energy shortfall. The TPC was later deactivated after 52 periods (exceeding the minimum trigger period), as a result of an increase in the supply.

Chart 14. Capacity Ratio by Generation Type



	CCGT	OT	ST	OCGT	IMPORT	ESS
Q1 2023	61.14	25.71	10.34	0.29	37.63	11.96
Q4 2023	63.64	24.08	7.03	0.01	0.13	7.01
Q1 2024	63.53	21.18	24.45	0.05	0.00	8.68

Chart 14 shows the quarterly average capacity ratios of the six generation types in the National Electricity Market of Singapore ("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 Q4 2023, the capacity ratios reduced across the CCGT, OT, and IMPORT generation types by 0.11, 2.90, and 0.13 percentage points respectively this quarter. On the other hand, the capacity ratios for the ST, OCGT and ESS generation types rose 17.42, 0.04 and 1.67 percentage points respectively. The capacity ratio of ST recorded the largest increase following the deregistration of three partially retired STs that had previously diluted the capacity ratio.

Chart 15. Market Share of Generation Companies Based on Metered Energy Quantity[3]

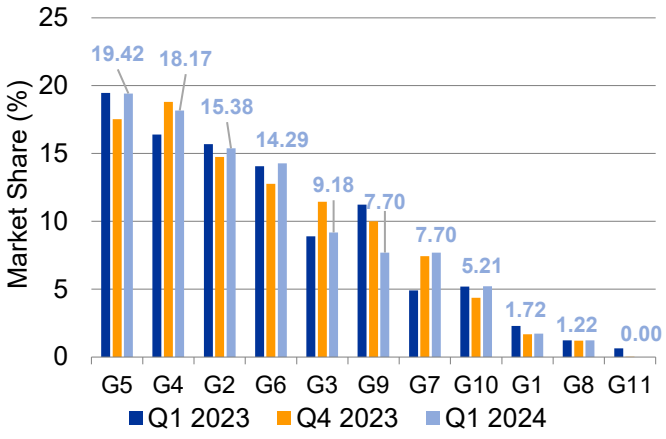
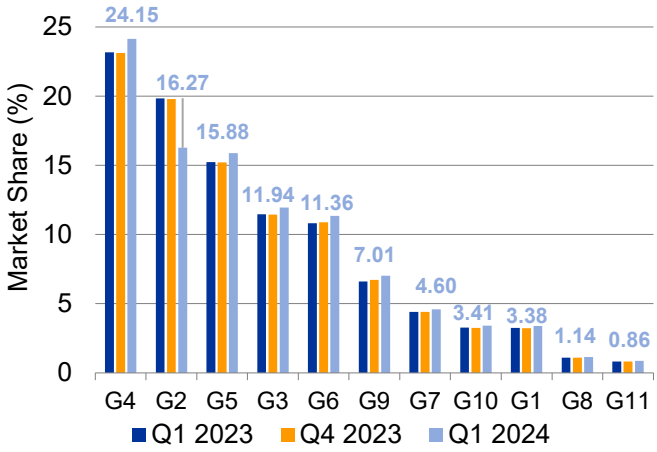


Chart 16. Market Share of Generation Companies Based on Maximum Generation Capacity[4]



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 15 and 16 respectively.

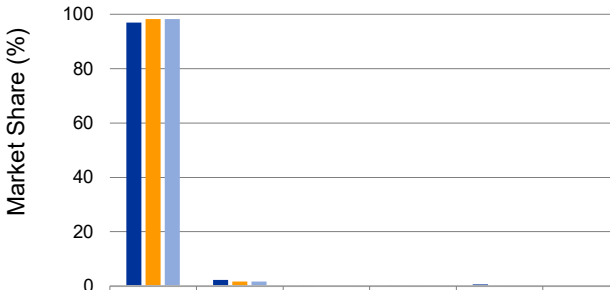
As shown in Chart 15, G5, G4, and G2 are the top three largest generation companies based on metered energy quantity, with G5 surpassing G4 compared to the previous quarter. The generation companies in the top three positions held 52.98% of the total market share in Q1 2024, an increase from 51.09% in Q4 2023 and 51.54% in Q1 2023. In a quarter-on-quarter comparison, G5 recorded the greatest increase of 1.88 percentage points, while G9's market share experienced the largest decline of 2.30 percentage points.

As shown in Chart 16, the three largest generation companies based on maximum generation capacity held a combined 56.30% of the total market share in Q1 2024, a slight reduction from 58.14% in Q4 2023. The market share of G2 recorded a decrease of 3.52 percentage points from 19.79% in Q4 2023 to 16.27% in Q1 2024. This was due to the deregistration of three facilities under G2 this quarter.

[3] Excludes intermittent generation facilities and Market Participants with net negative quarterly metered energy quantity.

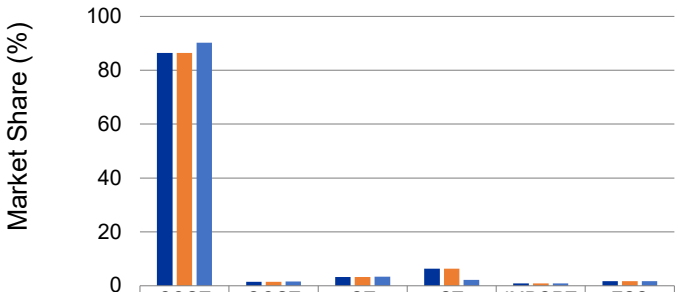
[4] Excludes intermittent generation facilities and Market Participants with less than 10 MW maximum generation capacity. The actual capacities of the ESS facilities are used for the computation.

Chart 17. Market Share by Generation Types Based on Metered Energy Quantity[5]



	CCGT	OT	ST	OCGT	IMPORT	ESS
Q1 2023	96.95	2.30	0.10	0.01	0.63	0.00
Q4 2023	98.23	1.69	0.07	0.00	0.00	0.00
Q1 2024	98.20	1.74	0.06	0.00	0.00	0.00

Chart 18. Market Share by Generation Types Based on Maximum Generation Capacity[6]



	CCGT	OCGT	OT	ST	IMPORT	ESS
Q1 2023	86.45	1.49	3.24	6.31	0.83	1.69
Q4 2023	86.48	1.48	3.24	6.29	0.82	1.68
Q1 2024	90.28	1.55	3.38	2.18	0.86	1.75

Most of the generation in the NEMS is produced by CCGT units, the most efficient generation technology.

As shown in Chart 17, the market share of CCGT by metered energy quantity reduced by 0.03 percentage point from 98.23% in Q4 2023 to 98.20% in Q1 2024. As shown in Chart 18, the market share of CCGT by maximum generation capacity increased to 90.28% in Q1 2024 from 86.48% in Q4 2023. The gains observed in the CCGT category largely resulted from the reduction in the ST market share from 6.29% in Q4 2023 to 2.18% in Q1 2024, in line with the deregistration of the 3 largest ST units in the NEMS this quarter.

Chart 19. Frequency of Generation Companies as Pivotal Suppliers (PS) Per Period

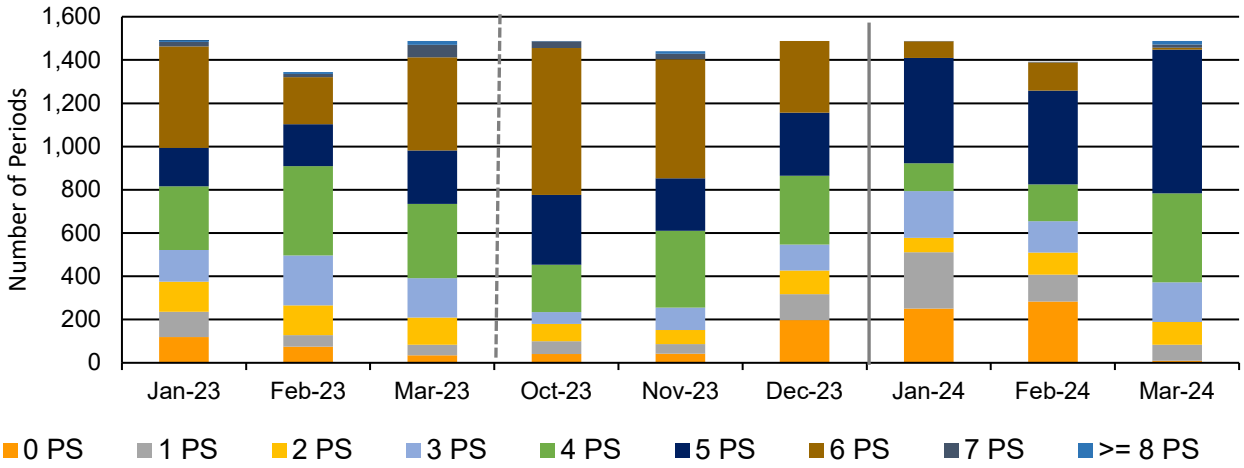


Chart 19 shows the number of pivotal suppliers per trading period for each month in Q1 2023, Q4 2023, and Q1 2024.

The number of periods with 4 or more pivotal suppliers dropped from 3,380 periods in Q4 2023 to 2,547 this quarter, indicating there were fewer generation companies with the potential ability to exercise unilateral market power. The declining frequency of greater numbers of pivotal suppliers was consistent with the expanded supply cushion this quarter. Nonetheless, there were still instances where there were most, if not all, generation companies identified as pivotal suppliers, occurring in times of very tight supply or energy shortfall conditions.

[5] Excludes intermittent generation facilities and technology type with net negative quarterly metered energy quantity.

[6] Excludes intermittent generation facilities and Market Participants with less than 10 MW maximum generation capacity. The actual capacities of the ESS facilities are used for the computation.

Chart 20. Trend of Price Setting Generation Companies

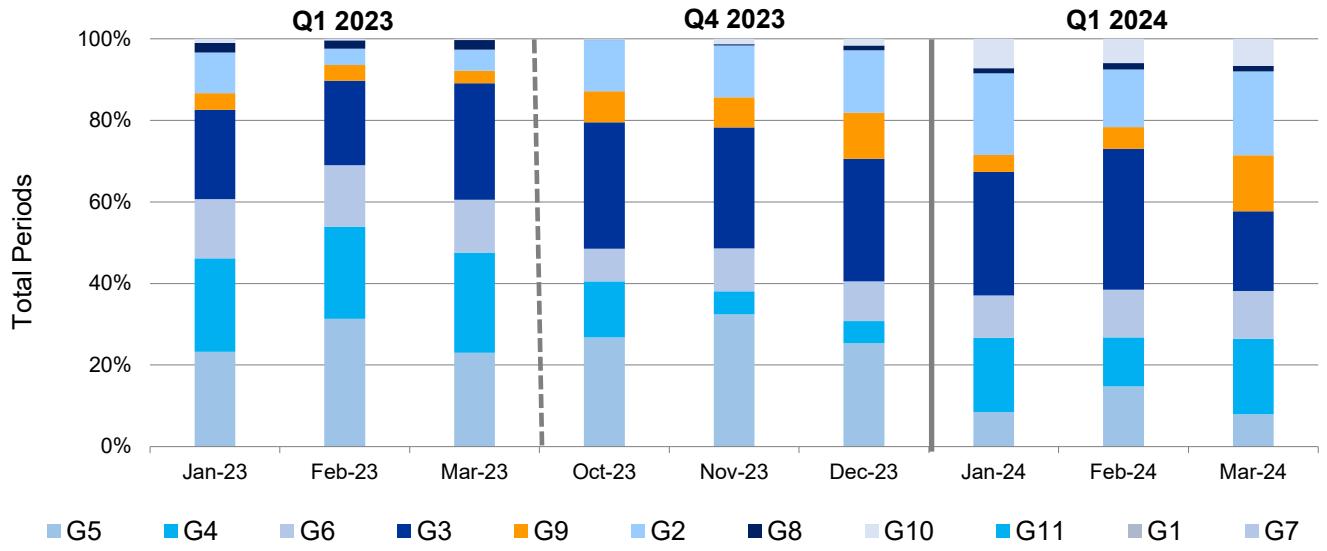
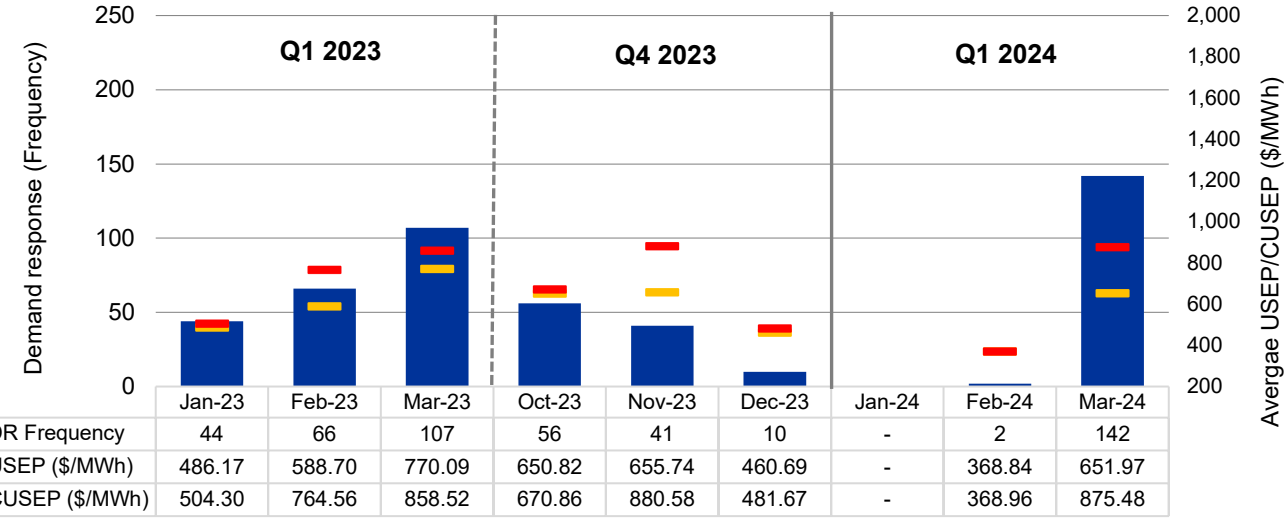


Chart 20 shows the monthly breakdown of price-setting generation companies in Q1 2023, Q4 2023, and Q1 2024. Of the top three price-setting generation companies in Q1 2024, G2 and G3 remained in similar positions as the previous quarter, while G4 replaced G5 compared to last quarter. The price setting frequency of G4 grew 8.10 percentage points while G5 declined by 17.85 percentage points in Q1 2024 compared to the previous quarter.

Chart 21. Demand Response Activations



	Jan-23	Feb-23	Mar-23	Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	Mar-24
DR Frequency	44	66	107	56	41	10	-	2	142
USEP ($/MWh)	486.17	588.70	770.09	650.82	655.74	460.69	-	368.84	651.97
CUSEP ($/MWh)	504.30	764.56	858.52	670.86	880.58	481.67	-	368.96	875.48

Chart 21 shows the frequency of Demand Response ("DR") activations in Q1 2023, Q4 2023, and Q1 2024, and the associated average USEP and counterfactual USEP ("CUSEP")[7] included the during those periods with DR activations.

The number of DR activations increased from 107 occurrences in Q4 2023 to 144 occurrences in Q1 2024. The DR effectively lowered the USEP by $220.40/MWh as the average USEP for periods with DR activation in Q1 2024 was $648.04/MWh, while the average CUSEP was $868.44/MWh.

DR is typically activated in view of higher USEP levels. However, in Q1 2024, the number of DR activations increased significantly, despite a lower USEP; the average USEP was $159.49/MWh in Q1 2024, compared to $176.78/MWh in Q4 2023. The higher number of DR activations in March of 142 instances occurred during the periods of tight supply conditions and price volatility that led to the activation of the TPC (as explained in Chart 13).

7 The CUSEP (in $/MWh) is calculated by the market clearing engine (MCE) with the assumption that there are no dispatchable energy bids.

Compliance Statistics for Q1 2024

Potential Breaches of the Market Rules

78 cases in total

0 non-gate closure
78 gate closure

Determinations*

92 determinations in total

0 case determined to be in breach
2 cases determined to take no further action
90 cases determined not to be in breach

Enforcement

0 case in total

0 financial penalty
0 non-compliance letter
0 suspension order
0 termination order
0 other MSCP order
$0 of financial penalty imposed
$0 of costs awarded

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

The MSCP did not issue any determinations this quarter.

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

Disclaimer

If you have any specific query or feedback for the improvement of this publication, you may write to mau@emcsg.com.