National Electricity Market of Singapore

Market Surveillance & Compliance Panel Market Watch

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Market Assessment Unit

Executive Summary

Energy prices in the National Electricity Market of Singapore ("NEMS") rose in Q4 2024 after the decline observed in the previous quarter. The overall elevated energy prices noted in this quarter could be attributed to higher energy offer prices, coupled with lower supply leading to a lower supply cushion, in the market.

On a quarter-on-quarter ("QoQ") comparison, the Uniform Singapore Energy Price ("USEP") and the Wholesale Electricity Price ("WEP") surged 24.19% and 24.36% to $141.67/MWh and $141.62/MWh respectively. The spike in energy prices in Q4 2024 was reflective of the demand and supply conditions. The decline in supply outweighed the reduction in demand and consequently, the quarterly average supply cushion in Q4 2024 fell to 12.45%, a 0.53 percentage point decline from 12.98% in the previous quarter.

The price spikes in Q4 2024 were concentrated in October, specifically with nine periods exceeding the $4,000/MWh mark and totalling the count of periods above $400/MWh to 53 in the month. The high prices recorded in October 2024 were also reflective of the weak monthly average supply cushion at 11.39%, which was the second lowest monthly average level recorded in 2024. The nine periods of significantly high USEPs above $4,000/MWh occurred on 9 October and 28 October 2024 and caused the Temporary Price Cap ("TPC") to be activated on both days. These TPC activations were effected for the minimum trigger period of 48 periods on each occasion, of which seven periods were capped at the TPC energy price cap level. This brings the year-to-date number of TPC activations to 13 instances. Q4 2024 also recorded 24 periods of Demand Response ("DR") activation, all of which occurred in October 2024. This was in comparison to last quarter where prices were relatively muted with no DR activations and TPC applications.

The prices of ancillary services increased in tandem with the QoQ increase in energy prices, which was also reflective of the higher primary reserve and contingency reserve requirement while the regulation requirement remained unchanged. Primary reserve price recorded the largest increase of 300.57% on a QoQ comparison from $1.24/MWh in Q3 2024 to $4.95/MWh this quarter. This was mainly attributed to the 8.39% increase in primary reserve requirement.

Table 1: Energy and Ancillary Services Prices by Quarter

Quarter	Q4 2023	Q3 2024	Q4 2024
Energy ($/MWh)			
USEP	176.78	114.07	141.67
WEP	176.88	113.88	141.62
Ancillary Services ($/MWh)			
Primary Reserve	1.54	1.24	4.95
Contingency Reserve	22.05	7.03	18.25
Regulation	39.69	15.66	21.69

On a year-on-year ("YoY") comparison, the USEP and WEP tumbled 19.86% and 19.93% from $176.78/MWh and $176.88/MWh respectively in Q4 2023. The fall in energy prices coincided with the 2.51% reduction in fuel oil price from US$461.29/MT in Q4 2023 to US$449.70/MT this quarter. This, in turn, contributed to an increase in cheaper energy price offers in the market in Q4 2024 compared to the previous year.

Prices in Q4 2024

The average WEP in Q4 2024 was $141.62/MWh, which was $59.77/MWh below the vesting contract price of $201.38/MWh (Chart 1). Since the introduction of the new Vesting Regime Framework on 1 July 2023, the WEP has been clearing below the vesting contract price for the quarter, with only one exception noted in Q2 2024. This implies that energy prices are gradually stabilising and are in line with the Energy Market Authority's ("EMA") objective for the vesting regime.[1]

On a QoQ comparison, the WEP rose 24.36% QoQ despite a 3.27% drop in fuel oil price (Chart 2), signifying the greater influence of other factors on energy prices, such as market demand and supply conditions, as well as the offer pricing of generators. On the other hand, the WEP dropped 19.93% YoY in tandem with the 2.51% decrease in fuel oil price.

The correlation between the metered energy quantity and the WEP strengthened with a higher r^2 of 0.23 in Q4 2024, compared to 0.14 in Q3 2024 (Chart 3). Correspondingly, there were 37 out of 92 days in Q4 2024 when r was greater than 0.5, compared to 26 out of 92 days in Q3 2024. This implies that the metered energy quantity and the WEP had a stronger positive correlation in Q4 2024 than in Q3 2024.

The distribution pattern of the WEP weighted by hours (Chart 4) was not only similar to its distribution weighted by metered energy quantity (Chart 5), but also trended in a similar manner on both QoQ and YoY basis. In addition, the rightward shift of the distribution pattern of the WEP on a QoQ comparison and the leftward shift of the distribution pattern of the WEP on a YoY comparison were also observed to be mirroring the 24.36% QoQ increase and 19.93% YoY drop in quarterly average WEP respectively.

The peak of the WEP distribution, i.e. the frequency of WEP ranging between $100/MWh and $150/MWh, accounted for 67.89% this quarter, as compared to 52.47% in Q3 2024 and 54.73% in Q4 2023 (Chart 4). Comparing the three quarters, the frequency of WEP above $150/MWh was the highest at 38.90% of the time in Q4 2023, followed by 12.61% in Q4 2024 and 6.05% in Q3 2024. As to the distribution pattern of the WEP weighted by metered energy quantity, the frequency of WEP peaked in the range between $100/MWh and $150/MWh at 68.46% this quarter, a shift from the 53.77% recorded for the same WEP range in Q3 2024 and 53.49% in Q4 2023 (Chart 5).

The average variation between the real-time USEP and the forecast USEP in the short-term schedule ("STS") surged from $2.94/MWh in Q3 2024 to $4.34/MWh this quarter, which was also higher than the $3.98/MWh level in Q4 2023 (Table 2). The trading periods with the maximum price variations are usually observed when the market experiences tight supply cushion. The maximum price variation in Q4 2024 was $4,337.25/MWh, which occurred in period 37 on 2 December 2024 (Monday). In the STS, the supply cushion and USEP were forecasted to be 10.90% and $123.99/MWh respectively. Following the 331 MW capacity withdrawal arising from a forced outage of a Combined-Cycle Gas Turbine ("CCGT") unit in period 36, the supply cushion collapsed to 1.60% in the subsequent period 37, raising the USEP to near the energy price cap at $4,468.86/MWh.

[1] Vesting contracts 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. More information are available on EMA | Vesting Contracts.

Chart 1. Vesting Contract Price Versus WEP by Quarter

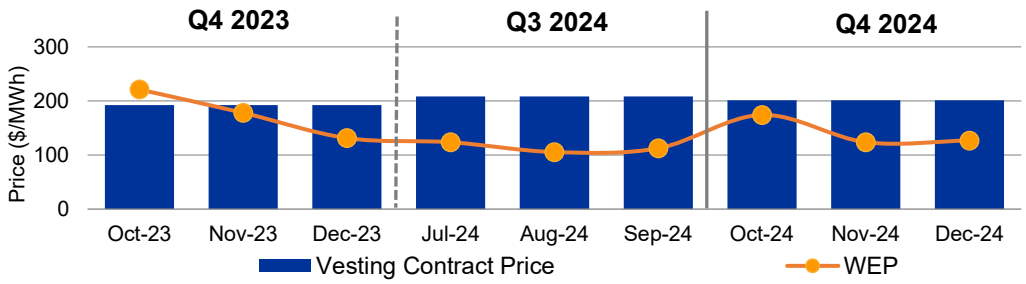


Chart 2. WEP Versus Fuel Oil Price

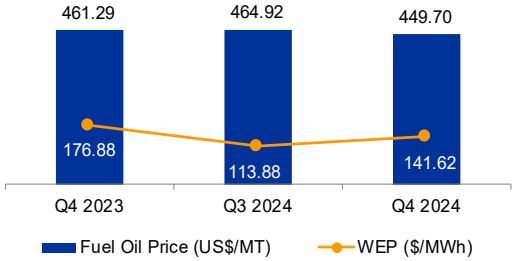


Chart 3. Correlation Between WEP and Metered Energy Quantity

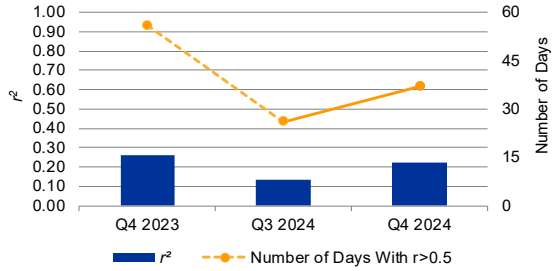


Chart 4: Distribution of WEP over Time

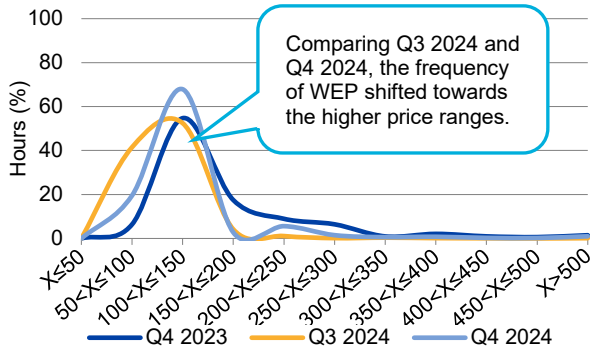


Chart 5: Distribution of WEP over Total Metered Energy Quantity

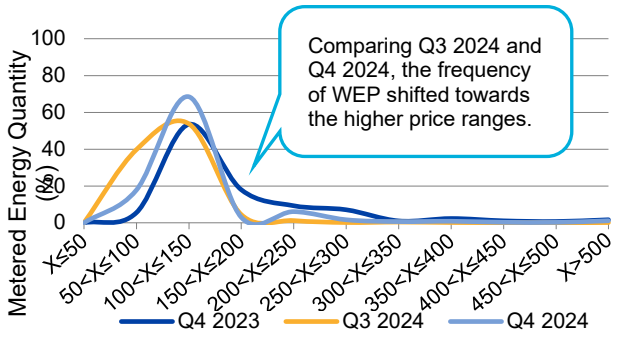


Table 2. Variation Between Real-Time Dispatch Price and Forecast Price[2]

Month/Quarter	Variation Between RTS and STS ($/MWh)	Maximum Periodic Variation ($/MWh)
Oct 23	7.18	2,391.02
Nov 23	4.48	3,847.88
Dec 23	-0.29	235.67
Jul 24	6.01	3,782.03
Aug 24	-0.64	182.08
Sep 24	2.17	271.49
Oct 24	5.58	3,824.31
Nov 24	-0.31	379.19
Dec 24	7.13	4,337.25
Q4 2023	**3.98**	**3,847.88**
Q3 2024	**2.94**	**3,782.03**
Q4 2024	**4.34**	**4,337.25**

[2] A positive variation means the real-time dispatch schedule ("RTS") produced a higher USEP than the STS, while a negative variation means the RTS produced a lower USEP than the STS.

Demand and Supply in Q4 2024

The average forecast demand and actual demand moved in tandem with the average temperature on a QoQ basis over the past three quarters (Chart 6). When the average temperature dropped 0.44°C from Q3 2024, the average forecast demand weakened 2.07% while the average actual demand dropped 2.15%. However, in comparison to a year ago, the average forecast demand and actual demand was 2.79% and 3.44% higher respectively in Q4 2024, despite the 0.22°C lower average temperature.

Consistent with the quarterly average QoQ and YoY trends, the peak forecast demand dropped 0.39% QoQ and rose 2.88% YoY (Chart 7) to 7,582 MW in Q4 2024. The same observation was noted in the 1.14% drop in peak actual demand to 7,695 MW on a QoQ comparison. However, the peak actual demand declined 4.32% YoY, which was in contrast to the increases observed in the average and peak forecast demand.

Comparing the demand profile in Q4 2024 to those in Q3 2024 and Q4 2023 (Chart 8), the peak demand levels generally shifted to the later part of the day amidst an increasing contribution of solar generation during the day. Specifically, it was noted that demand peaked at period 35 in Q4 2023, period 41 in Q3 2024, and period 39 in Q4 2024. All three quarters displayed a dip in demand in the middle of the day when solar generation was at its peak in period 25 in Q4 2023 (at 402.32 MW), period 26 in Q3 2024 (at 538.78 MW) and period 26 in Q4 2024 (at 545.49 MW). The rising peak solar generation profile across the three quarters is also consistent with the growth of solar energy generation in the last few years.

Table 3 shows a 2.67% reduction in supply to 7,372 MW this quarter from 7,574 MW in Q3 2024, in contrast to a 3.93% increase from 7,093 MW in Q4 2023. The lower supply availability on a QoQ comparison could be attributed to the lower demand forecast as a result of the year-end lull period, as well as the 6.27% increase in planned and forced outage levels. With the decrease in supply outpacing the reduction in demand, the corresponding supply cushion weakened 0.53 percentage point from 12.98% in Q3 2024 to 12.45% this quarter. On a YoY comparison, there was a 0.94 percentage point strengthening in the supply cushion as the 3.93% increase in supply overshadowed the 2.79% expansion in demand.

It was observed that the higher USEP was inversely correlated with the lower supply cushion in all three quarters. On a monthly level in Q4 2024, a similar inverse correlation was observed for October and November, where, intuitively, the higher supply cushion correlates with a lower USEP and vice versa (Chart 9). The highest monthly average USEP in Q4 2024 occurred in October at $174.12/MWh, which corresponded to the lowest monthly average supply cushion level out of the three months in Q4 2024 at 11.39%. However, the highest supply cushion in Q4 2024 was recorded in December at 14.05%, despite the monthly average USEP of $127.16/MWh not being the lowest of the three months. Price spikes occurring in the month of December resulted in five periods crossing $1,000/MWh, of which four periods went beyond $4,000/MWh. Also, the higher monthly average USEP in December 2024 was observed in the context of more expensive offers from the generation companies, with the proportion of offers equal to or above $200/MWh increasing to 8.91% in the month, as compared to 7.51% in October 2024 and 7.80% in November 2024 (Chart 10).

On a QoQ comparison, energy offer prices in this quarter were more expensive with a 1.33 percentage points lower proportion of energy offers priced below $200/MWh. (Chart 10). This was despite the cheaper fuel oil price in Q4 2024 as compared to the other quarters (Chart 2). The higher USEP this quarter was also reflected in the number of periods with TPC application rising to 96 in Q4 2024 from zero in the last quarter.

The frequency of DR activations is typically reflective of the frequency of higher USEP, which in turn typically suggests higher average USEP. Consistent with the quarterly average USEP movements, the number of DR activations in Q4 2024 stood at 24, up from zero in Q3 2024, but down from 107 in Q4 2023 (Chart 11). This was also aligned with the number of periods with USEP above $400/MWh amounting to 62 this quarter, as compared to 8 periods in Q3 2024 and 136 periods in Q4 2023.

All DR activations in Q4 2024 occurred in October, where prices rose above $400/MWh in 53 periods (out of 62 periods in the quarter). Of the 24 periods of DR activations, 12 periods occurred during the application of the TPC after it was activated on 9 October and 28 October 2024.

Chart 6. Average Forecast and Actual Demand Versus Average Temperature

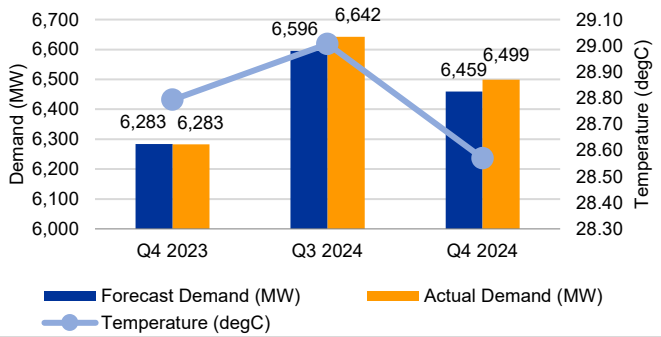


Chart 7. Peak Forecast and Actual Demand

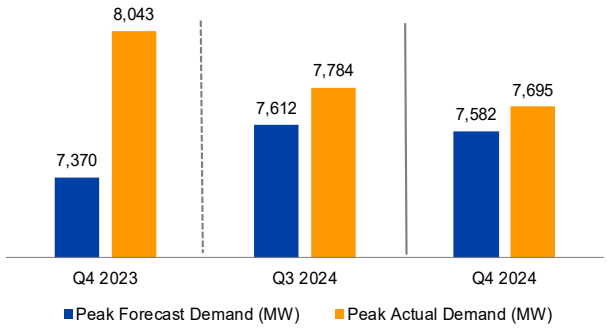


Chart 8. Average Forecast Demand and Average Solar Generation Periodic Profiles

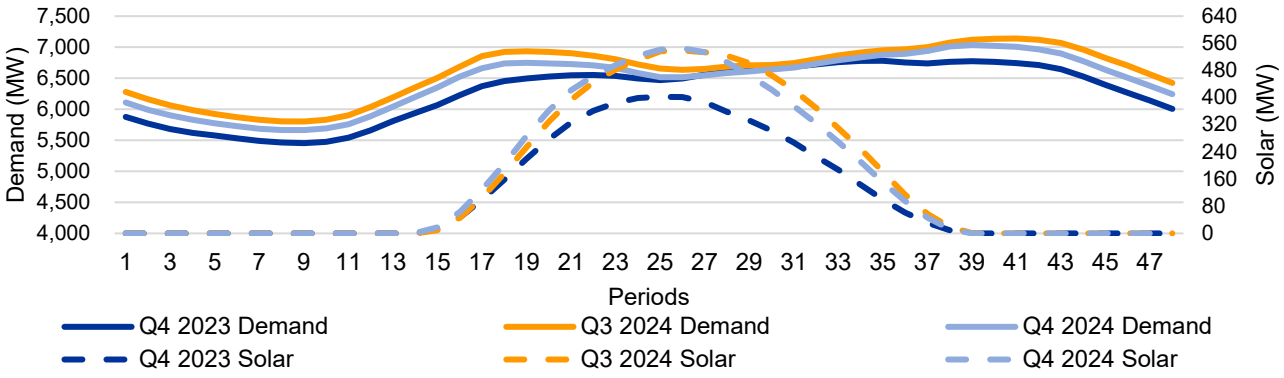


Table 3. Total Outage, Quarterly Average Supply and Supply Cushion

Quarter	Q4 2023	Q3 2024	Q4 2024
	Outage (MW)		
Average Planned Outage	2,381.62	1,107.39	1,204.87
Average Forced Outage	11.14	39.88	14.30
	Supply		
Average Supply (MW)	7,093	7,574	7,372
Supply Cushion (%)	11.51	12.98	12.45

Chart 9. USEP and Supply Cushion

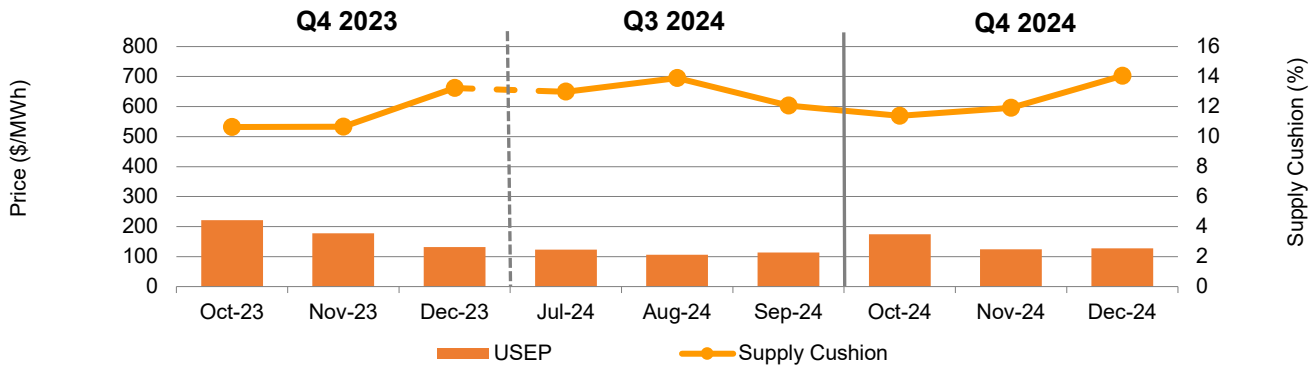
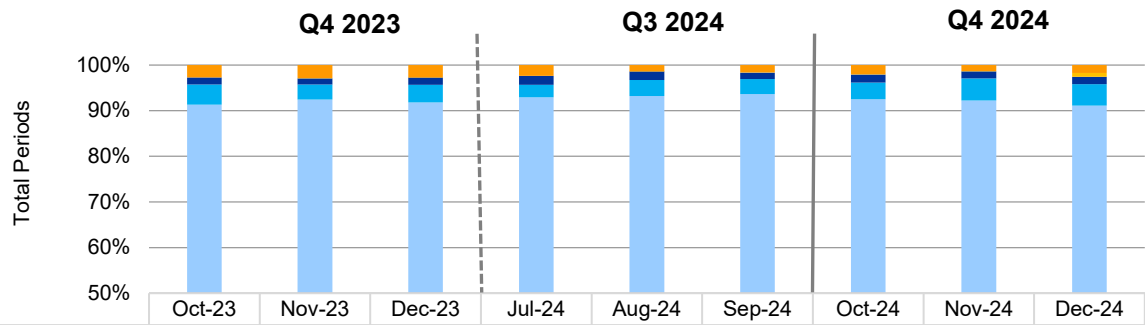
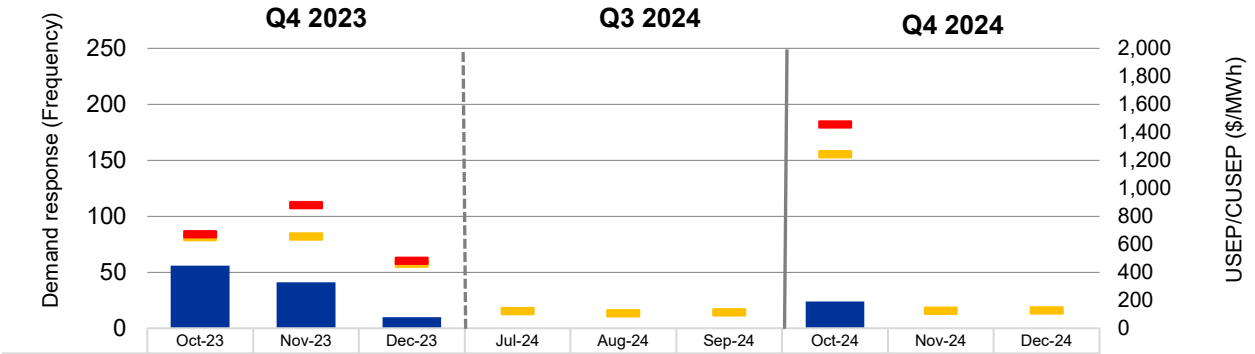


Chart 10. Trend Of Energy Offer Price Proportion



	Oct-23	Nov-23	Dec-23	Jul-24	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24
≥ $3,000/MWh	2.73	2.83	2.71	2.37	1.41	1.58	2.04	1.34	1.76
≥ $1,000/MWh and < $3,000/MWh	0.00	0.08	0.01	0.00	0.00	0.09	0.03	0.06	0.78
≥ $500/MWh and < $1,000/MWh	1.52	1.37	1.61	1.92	1.85	1.41	1.75	1.54	1.63
≥ $200/MWh and < $500/MWh	4.45	3.26	3.83	2.80	3.52	3.26	3.69	4.85	4.74
< $200/MWh	91.30	92.46	91.84	92.91	93.22	93.65	92.49	92.20	91.09

Chart 11. Demand Response Activations[3]



	Oct-23	Nov-23	Dec-23	Jul-24	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24
DR Frequency	56	41	10	0	0	0	24	0	0
USEP ($/MWh)	650.82	655.74	460.69	123.23	105.74	113.23	1,243.42	123.72	127.16
CUSEP ($/MWh)	670.86	880.58	481.67				1,455.44		

[3] The frequency of Demand Response ("DR") activations and the associated average USEP and counterfactual USEP ("CUSEP") during those periods with DR activations, where the CUSEP (in $/MWh) is calculated by the market clearing engine (MCE) with the assumption that there are no dispatchable energy bids.

In Q4 2024, the monthly average load variation between the RTS and the STS remained relatively small at 0.06%, which was a 0.03 percentage point improvement from 0.09% in Q3 2024 and Q4 2023 (Chart 12). The monthly load variation between RTS and PDS averaged at 0.19% in Q4 2024, which was also an improvement in the accuracy from Q3 2024 and Q4 2023 at 0.26% and 0.34% respectively.

Q4 2024 recorded an average variation of 0.14% between the RTS and the metered energy quantity, which was the same level as Q3 2024, and significantly lower than 0.63% in Q4 2023 (Chart 13). On a monthly average level, the variation in Q4 2024 experienced greater fluctuations, ranging between 0.06% and 0.24%, as opposed to a range between 0.11% and 0.16% in Q3 2024 and between 0.35% and 0.88% in Q4 2023. The low load forecast variation this quarter implies the stability in the load forecast accuracy in comparison to Q3 2024 and an improvement when compared to Q4 2023.

Chart 12. Monthly Average Variation Between Real-Time Dispatch Schedule and Forecast Load

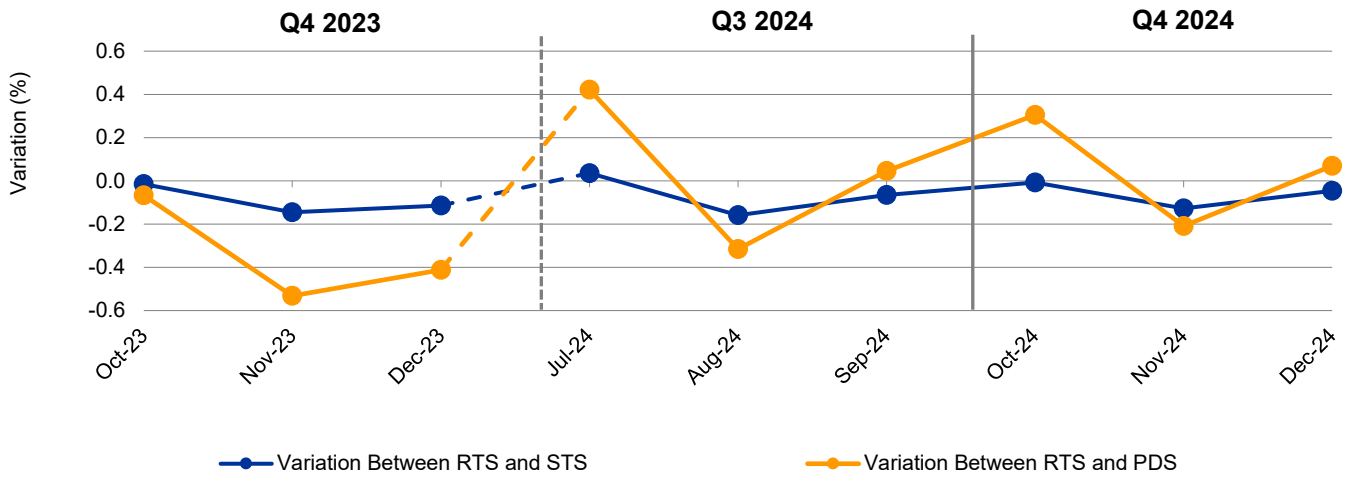
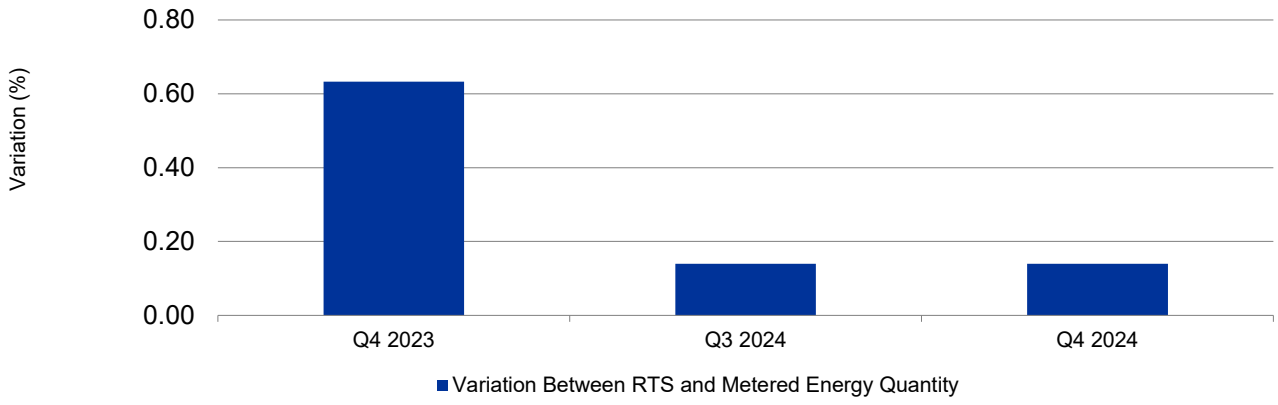


Chart 13. Quarterly Average Variation[4] Between Real-Time Dispatch Schedule and Metered Energy Quantity



[4] The metered energy quantity reflects the actual demand, while the load forecast in the RTS reflects the system demand including the station and auxiliary loads. This difference in methodology creates a variation between the RTS and the metered energy quantity, with the former being higher than the latter for the same trading period.

Market Concentration in Q4 2024

Compared to Q3 2024, the movements of the capacity ratios in this quarter were mixed across the generation types, with a decrease for the CCGT and Steam Turbine ("ST") generation types, and an increase for the Others ("OT"), Open-Cycle Gas Turbine ("OCGT"), imports ("IMPORT") and Energy Storage System ("ESS") generation types (Chart 15). Notably, there remains to be a steady schedule of IMPORT facilities with a 3.19 percentage point increment from 0.05% in Q3 2024 to 3.24% this quarter. The expansion of the capacity ratio for IMPORTS generation type is likely attributed to the registration of new import facilities, bringing the total generation capacity of all import facilities to 350 MW. On a YoY comparison to Q4 2023, the capacity ratios for the generation types increased across the board, with the capacity ratio of ST units growing the most by 44.54 percentage points from 7.03% in Q4 2023 to 51.57% this quarter. This was likely due to the de-registration of the ST facilities which were previously registered but have not been operating in the market.

Based on metered energy quantity, G4, G5 and G2 continued to dominate the first, second and third position respectively (Chart 16). The combined market share of these three leading generation companies slid 3.05 percentage points QoQ and 2.05 percentage points YoY, to 49.04% in Q4 2024. The dilution in market shares from the top three generation companies was largely picked up by G9 and G7, which saw their market shares rising 1.31 and 0.98 percentage points respectively on a QoQ comparison. The increase in the market share of G9 and G7 is consistent with the expansion in maximum generation capacity of their facilities.

There was also no change to the identities of the top three largest generation companies in all three quarters based on maximum generation capacity (Chart 17). However, there was a dilution of the market share of these three largest generation companies (i.e. G4, G5, and G2) as their combined market share fell to 53.07% of the total market share in Q4 2024, down from 53.81% in Q3 2024 and 58.14% in Q4 2023.

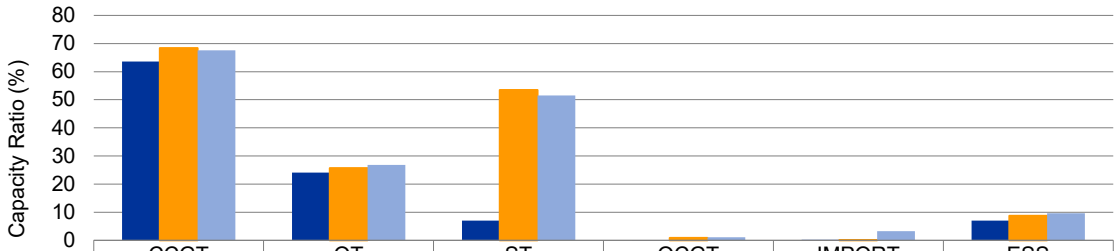
Most of the generation in the NEMS is produced by CCGT units, the most efficient generation technology. This is evident in the CCGT facilities continuing to dominate the market share based on metered energy quantity and maximum generation capacity (Charts 18 and 19). In Chart 18 illustrating the market share based on metered energy quantity, the market share of IMPORT units increased the most by 0.19 percentage point this quarter from zero in Q4 2023 and Q3 2024. On both QoQ and YoY comparison, the market share of CCGT units dropped the most by 0.32 percentage point to 97.84% this quarter, from 98.15% in Q3 2024 and 98.23% in Q4 2023.

Chart 19 shows that the market share based on maximum generation capacity from IMPORTS units rose from 0.82% in Q4 2023 and 1.49% in Q3 2024 to 2.82% this quarter as more import facilities participate in the NEMS. The increase in market share from IMPORTS units led to a 1.20 percentage points drop in the market share for CCGT units from 91.05% in Q3 2024 to 89.85% in this quarter. On a YoY comparison, the market share for ST units dropped 6.17 percentage points from 6.29% in Q4 2023 to 0.12% in this quarter due to the deregistration of ST facilities in 2024.

Chart 20 shows the frequency of pivotal suppliers per trading period for each month. The number of periods with four or more pivotal suppliers totaled 2,598 this quarter, up from 2,390 periods in Q3 2024 but down from 3,380 periods in Q4 2023. In addition, the number of periods with six or more pivotal suppliers soared to 1,677, from 1,098 periods in Q3 2024 and marginally from 1,631 periods in Q4 2023. Given the weaker supply cushion recorded this quarter, more generation companies were identified as pivotal suppliers.

Chart 21 shows the monthly breakdown of price-setting generation companies. In Q4 2024, G5 held the largest share of 41.79%, replacing G3's share of 35.47% in Q3 2024 and 30.23% in Q4 2023 respectively. G3, in turn, held the second spot this quarter at 26.44%, followed by G4 in the third spot at 11.89%. G4 replaced the third spot position previously held by G9 and G2 in Q3 2024 and Q4 2023 respectively.

Chart 15. Capacity Ratio by Generation Type[5]



	CCGT	OT	ST	OCGT	IMPORT	ESS
Q4 2023	63.64	24.08	7.03	0.01	0.13	7.01
Q3 2024	68.34	25.70	53.49	0.84	0.05	8.75
Q4 2024	67.61	26.83	51.57	1.06	3.24	9.64

Chart 16. Market Share of Generation Companies Based on Metered Energy Quantity[6]

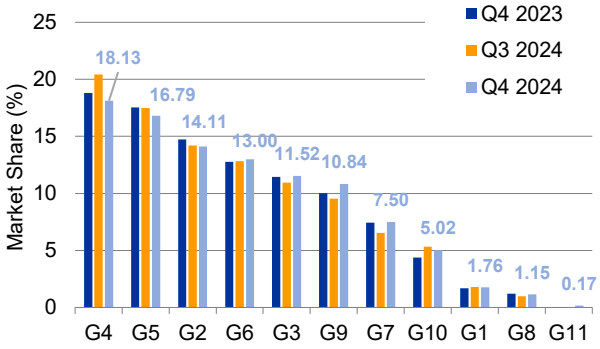


Chart 17. Market Share of Generation Companies Based on Maximum Generation Capacity[7]

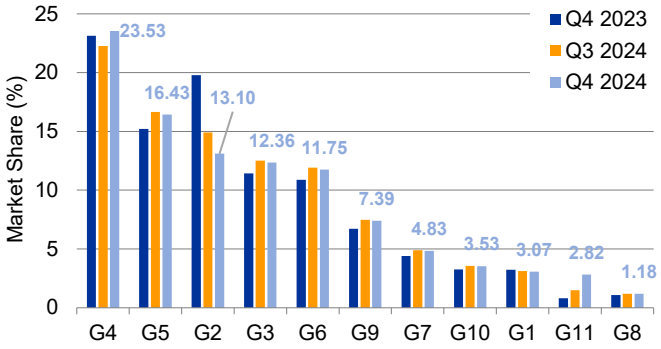
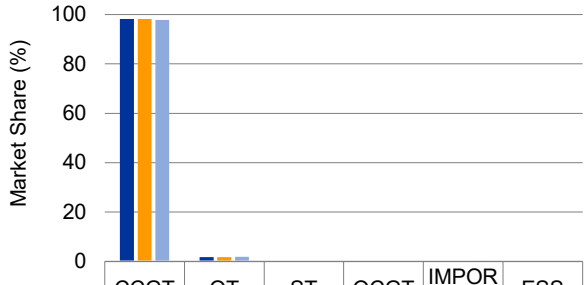
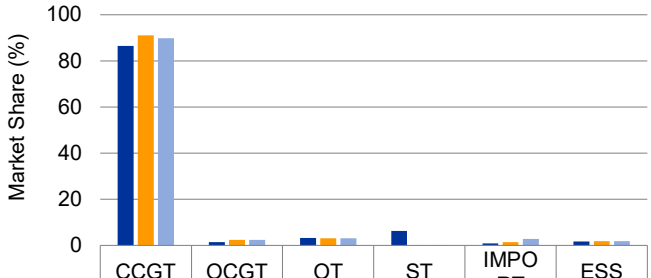


Chart 18. Market Share by Generation Types Based on Metered Energy Quantity[8]



	CCGT	OT	ST	OCGT	IMPORT	ESS
Q4 2023	98.23	1.69	0.07	0.00	0.00	0.00
Q3 2024	98.15	1.79	0.01	0.05	0.00	0.00
Q4 2024	97.84	1.88	0.04	0.06	0.19	0.00

Chart 19. Market Share by Generation Types Based on Maximum Generation Capacity[9]



	CCGT	OCGT	OT	ST	IMPORT	ESS
Q4 2023	86.48	1.48	3.24	6.29	0.82	1.68
Q3 2024	91.05	2.39	3.11	0.13	1.49	1.84
Q4 2024	89.85	2.33	3.07	0.12	2.82	1.81

[5] The capacity ratio of a generation facility measures its scheduled generation output relative to its maximum generation capacity. The generation types are: Combined-Cycle Gas Turbine ("CCGT"), Others ("OT"), Steam Turbine ("ST"), Open-Cycle Gas Turbine ("OCGT"), imports ("IMPORT"), and Energy Storage System ("ESS").
[6] Excludes intermittent generation facilities and Market Participants with net negative quarterly metered energy quantity.
[7] 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.
[8] Excludes intermittent generation facilities and technology type with net negative quarterly metered energy quantity.
[9] 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. Frequency of Generation Companies as Pivotal Suppliers (PS) Per Period

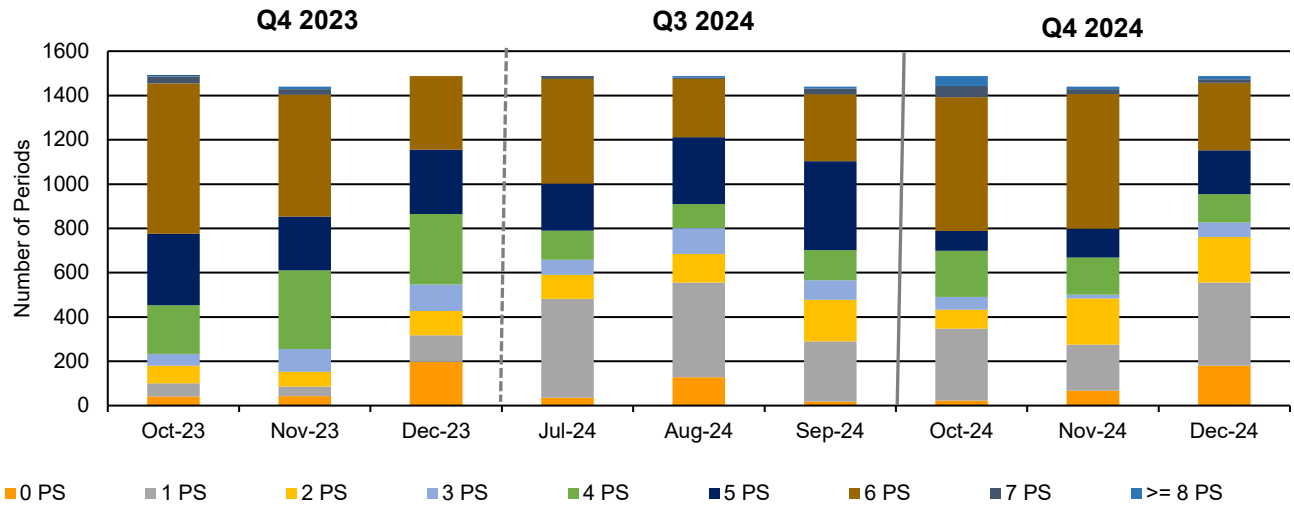
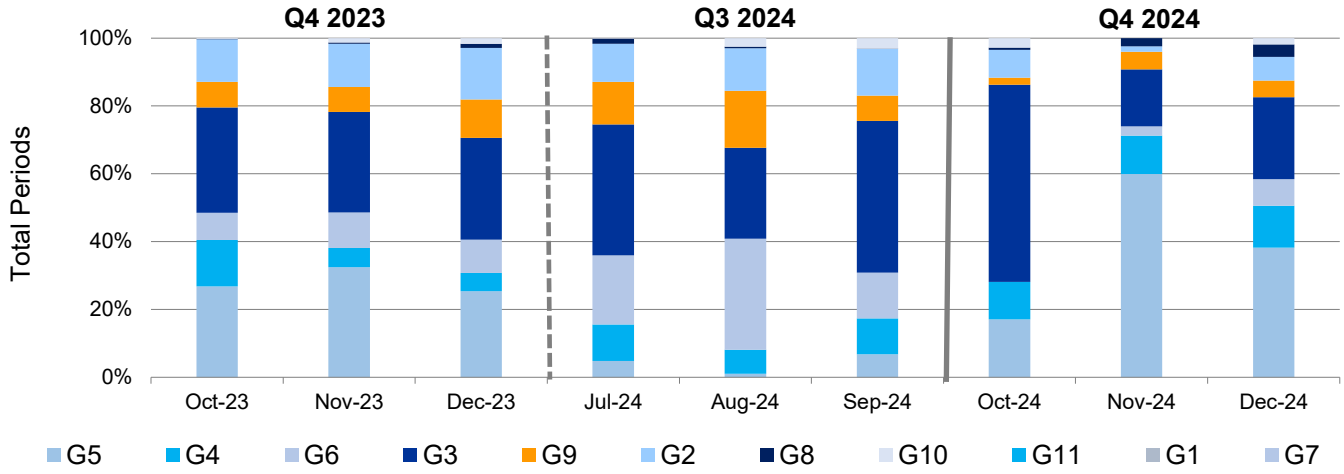


Chart 21. Trend of Price Setting Generation Companies



Compliance Statistics for Q4 2024

Potential Breaches of the Market Rules	Determinations*	Enforcement
118 cases in total	**46 determinations in total**	**1 determination in total**
0 non-gate closure	**3** cases determined to be in breach	**1** financial penalty
118 gate closure	**0** cases determined to take no further action	0 non-compliance letter
	43 cases determined not to be in breach	**0** suspension order
		0 termination order
		0 other MSCP order
		$10,000 of financial penalty imposed
		$2,200 of costs awarded

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

The MSCP issued one rule breach determination this quarter:

i. 3 cases from Tuas Power Generation regarding its failure to comply with gate closure rules on 28 August 2024 (Financial penalty $10,000, $2,200 costs)

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.