

Market Surveillance & Compliance Panel Market Watch

Issue 66

Fourth Quarter (October to December 2022)

Executive Summary

The energy prices in the National Electricity Market of Singapore (“NEMS”) recorded the lowest level in Q4 2022 this year. The fall was primarily led by lower offer prices, demand, and fuel oil price as this quarter also saw the lowest demand and fuel oil price levels this year. Despite the fall in energy prices, the quarterly supply cushion was recorded as the lowest since the commencement of NEMS in 2003. This was attributed to the decline in supply that outpaced the decrease in demand. Nevertheless, the electricity prices have been more stable this quarter given the emergency measures implemented by EMA¹ compared to Q4 2021.

Chart 1. USEP and WEP by Quarter

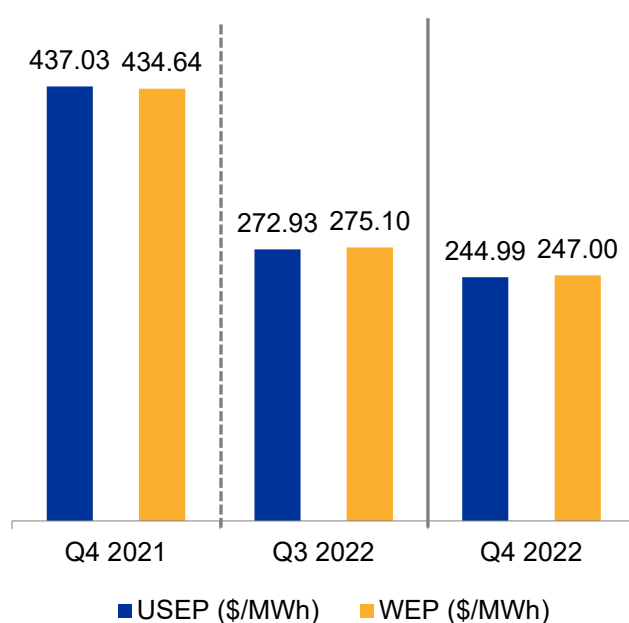


Table 1. Quarterly Outage Volume and Ancillary Service Prices

Quarter	Q4 2021	Q3 2022	Q4 2022
Total Outage Volume (MWh Cumulative)			
Planned Outage	2,214,128	4,594,616	9,898,996
Forced Outage	284,391	168,281	60,716
Ancillary Services (\$/MWh)			
Primary Reserve	1.89	1.97	3.79
Contingency Reserve	21.80	40.43	19.19
Regulation	30.63	51.76	34.00

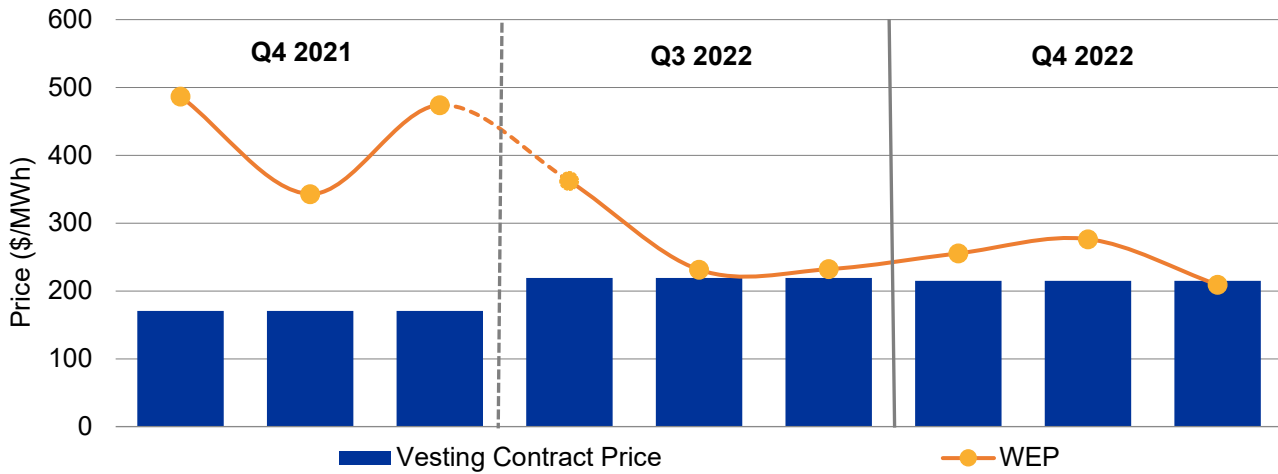
The Uniform Singapore Energy Price (“USEP”) and the Wholesale Electricity Price (“WEP”) decreased by 10.24% to \$244.99/MWh and 10.22% to \$247.00/MWh respectively for a QoQ comparison. This is mainly attributed to the decrease in the fuel oil price, the reduction in demand, and a shift in energy offers to lower price tranches. In particular, the quantity of energy offers made at or below \$100/MWh increased 7.91 percentage points from 72.49% in Q3 2022 to 80.40% in Q4 2022. In line with the contraction of supply, the planned outage volume surged 115.45% to a record high of 9,898,996 MWh.

The prices of ancillary services were mixed across the board. The price of the contingency reserve decreased by 52.53% to \$19.19/MWh, in line with the decrease in requirement by 4.84% to 385 MW. Likewise, the regulation price decreased by 34.30% to \$34.00/MWh in line with the lower USEP observed this quarter. On the other hand, the price of primary reserve increased 92.13% to \$3.79/MWh this quarter, mainly driven by the high prices recorded in December 2022, which observed seven periods with primary reserve shortfalls, consistent with tighter supply conditions and the increased primary reserve requirement.

¹ <https://www.mti.gov.sg/Newsroom/Speeches/2022/10/Opening-Keynote-Address-by-Minister-Gan-Kim-Yong-at-the-Singapore-International-Energy-Week-Summit>

Prices in Q4 2022

Chart 2. Vesting Contract Price Versus WEP by Quarter



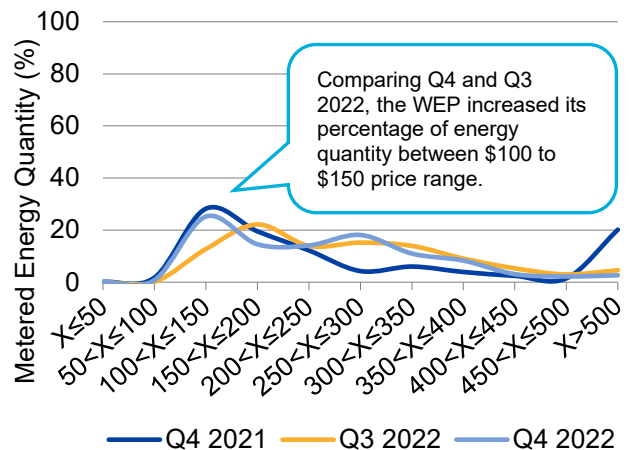
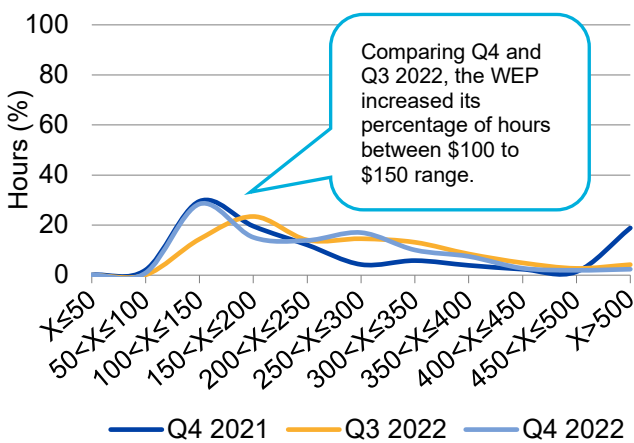
This quarter, the WEP decreased 10.22% from \$275.10/MWh in Q3 2022 to \$247.00/MWh in Q4 2022 and marked the fifth consecutive quarter with average WEP levels above the vesting contract price. Nevertheless, the difference between the vesting contract price and the WEP continued to narrow this quarter with the WEP clearing at \$247.00/MWh, 15.00% higher than the Q4 2022 vesting contract price as compared to 25.49% in Q3 2022. One 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 so the impact of the vesting contract may be less pronounced.

On the monthly level, the average WEP dropped from \$276.43/MWh in November to \$209.09/MWh in December 2022 due to the slightly cooler weather,² and the lower demand given the festive season. December 2022 marked the first month with an average monthly WEP level below the vesting contract price since September 2021.

The vesting contract price decreased 2.03% from \$219.23/MWh in Q3 2022 to \$214.78/MWh in Q4 2022, which marked the first decline in the vesting contract price since Q1 2021. This could be attributed to the decline in the fuel oil price this quarter. Nevertheless, this quarter recorded a 25.97% increment from Q4 2021 vesting contract price. This indicates that the components used in the calculation of the vesting contract price remained relatively high, which could be attributed to the protracted war between Russia and Ukraine.

Chart 3. Distribution of WEP Over Time

Chart 4. Distribution of WEP Over Total Metered Energy Quantity



² <https://www.nea.gov.sg/media/news/advisories/index/wet-and-slightly-cooler-weather-expected-for-rest-of-december-2022>

Charts 3 and 4 show the frequency of the WEP in various price ranges, measured as a percentage of the total number of hours and a percentage of the total metered energy quantity for Q4 2022, compared to the previous quarter and the previous year respectively.

The distribution of the WEP over time moved to the lower price ranges in Q4 2022 when compared to Q3 2022 (Chart 3). The frequencies of WEP in the price range of \$100/MWh to \$150/MWh increased to 28.44 percentage points as compared to 14.40 percentage points in Q3 2022. It is also noteworthy that for 2.81% of the time, the WEP was higher than \$500/MWh in Q4 2022, which is a reduction from 4.21% in Q3 2022, and 18.86% in Q4 2021. This was due to more energy offers moving to lower price tranches observed in October, November and December 2022 compared to Q3 2022 and Q4 2021. This could be attributed to the decrease observed in the fuel oil price, demand and offer prices in Q4 2022.

The distribution of the WEP in terms of percentage metered energy quantity in the market was similar to its distribution based on the percentage number of hours. The peak of the WEP was concentrated in the lower price range for most of the metered energy quantity in Q4 2022 and 2021, compared to Q3 2022 (Chart 4).

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

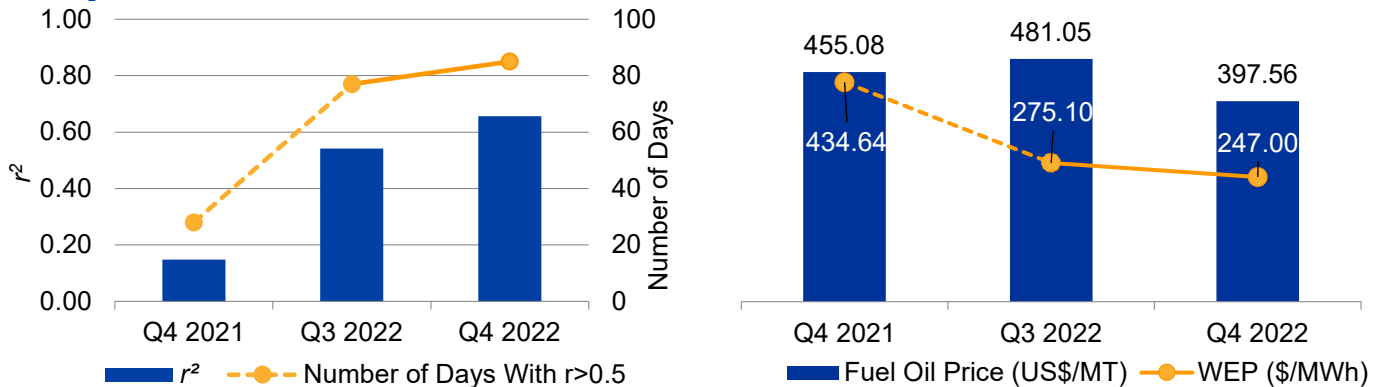


Chart 5 shows the proportion of variance in the WEP which could be explained by changes in the metered energy quantity measured by r^2 . It was observed that the correlation between the metered energy quantity and the WEP strengthened with a higher r^2 at 0.66 obtained in Q4 2022 compared to 0.54 in Q3 2022, indicating that the metered energy quantity had a greater influence on the WEP.

Correspondingly, there were 85 out of 92 days in Q4 2022 where r was greater than 0.5 compared to 77 out of 92 days in Q3 2022. This implies that the metered energy quantity and the WEP had a strong positive correlation over a longer time in Q4 2022 than in Q3 2022.

With the stronger correlation results in Q4 2022, the metered energy quantity remained the main contributing factor to the movements in the WEP. The r value of 0.66 in Q4 2022 meant that changes in the metered energy quantity could account for 66% of the changes in the WEP during the quarter.

As shown in Chart 6, the fuel oil price was reduced by 17.36% from US\$481.05/MT in Q3 2022 to US\$397.56/MT in Q4 2022. Similarly, when compared to the same quarter the previous year, the fuel oil price in Q4 2022 decreased 12.64% from US\$455.08/MT in Q4 2021. This is the lowest quarterly fuel oil price observed this year, forfeiting all the gains since Russia's invasion of Ukraine that exacerbated the global energy crisis. The decline in the fuel oil price is due to the global sentiment that a recession is likely in the coming year.³ Since the fuel oil price is an input to the cost of electricity generation, the decrease in the fuel oil price led to similar changes in the WEP in Q4 2022. The WEP of \$247.00/MWh showed a decrease of 43.17% from \$275.10/MWh in Q3 2022.

³ <https://www.reuters.com/markets/commodities/oil-opens-mixed-economic-fears-pressure-prices-2022-12-07/>

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

Month/Quarter	Variation Between RTS and STS (\$/MWh)	Maximum Periodic Variation (\$/MWh)
Oct-21	122.96	2,666.43
Nov-21	49.25	2,777.26
Dec-21	68.34	2,469.15
Jul-22	1.20	3,638.24
Aug-22	4.79	4,005.47
Sep-22	-2.43	360.89
Oct-22	1.08	2,437.96
Nov-22	11.20	3,346.45
Dec-22	-2.66	2,624.05
Q4 2021	80.18	2,777.26
Q3 2022	2.80	4,005.47
Q4 2022	4.98	3,346.45

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”), together 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 \$4.98/MWh in Q4 2022, which is \$2.18/MWh higher than the price variation observed in Q3 2022 at \$2.80/MWh and \$75.20/MWh lower than that in Q4 2021. The slightly higher average price variation in Q4 2022, as compared to Q3 2022, was mainly due to the higher price variation recorded in November 2022, which could be attributed to the relatively higher and more volatile USEP recorded in November 2022, as compared to October and December 2022. The lower average price variation in Q4 2022 as compared to Q4 2021 was attributed to a reduced number of periods of real-time USEP spikes, 307 periods (\geq \$400/MWh) in Q4 2022 (998 periods in Q4 2021).

Demand and Supply in Q4 2022

Chart 7. Average Forecast and Actual Demand

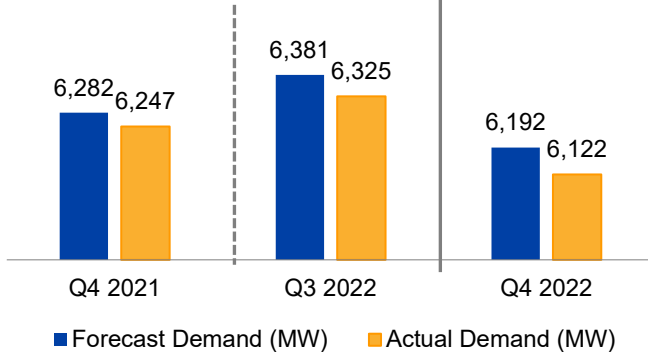
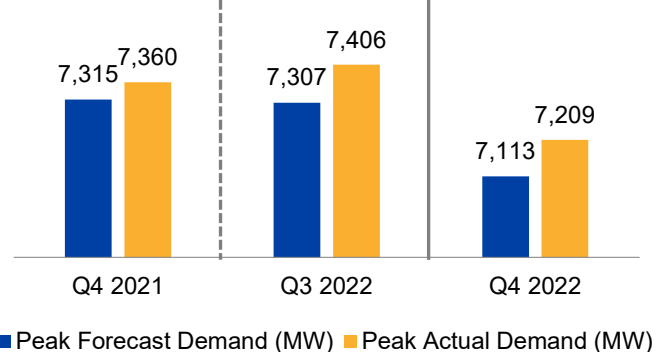


Chart 8. Peak Forecast and Actual Demand



Q4 2022 recorded the lowest average forecast and actual demand levels this year. The average forecast demand decreased by 2.96% from 6,381 MW in Q3 2022 to 6,192 MW in Q4 2022 (Chart 7). Similarly, the average actual demand decreased by 3.20%, from 6,325 MW in Q3 2022 to 6,122 MW in Q4 2022. Both the peak forecast and peak actual demand decreased in Q4 2022 by 2.65% and 2.67% respectively when compared to Q3 2022 (Chart 8).

The weaker demand in Q4 2022 was likely due to:

- More public holidays in Q4 2022 as compared to the previous quarter in Q3 2022.
- Cooler average temperature as Q4 2022 recorded an average monthly temperature of 27.74 °C, while Q3 2022 and Q4 2021 recorded average temperatures of 28.26 °C and 28.35 °C respectively.

Table 3. Quarterly Average Supply and Supply Cushion⁴

Quarter	Q4 2021	Q3 2022	Q4 2022
Average Supply (MW)	7,861	7,217	6,936
Supply Cushion (%)	20.11	11.67	10.85

The quarterly average supply in Q4 2022 decreased by 3.89% to 6,936 MW from 7,217 MW in Q3 2022 (Table 3). The shrink in supply availability could be attributed to the higher outage volume and lower forecast demand. As shown in Table 1, the planned outage volume increased by 115.45% in Q4 2022 compared to the previous quarter.

With a slight decline in demand and a larger reduction in supply, the corresponding supply cushion contracted 0.82 percentage points from 11.67% in Q3 2022 to 10.85% in Q4 2022. This is the lowest quarterly average supply cushion recorded since the market start.

⁴ Supply cushions for Q3 2022 and Q4 2021 have been revised to include new generation types.

Chart 9. Trend Of Energy Offer Price Proportion

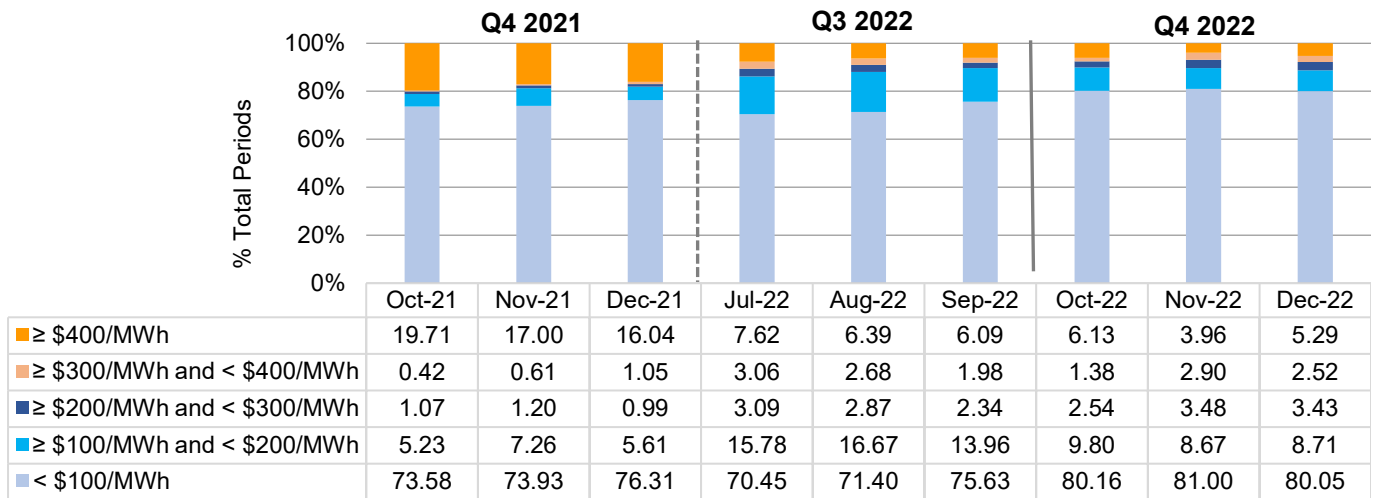


Chart 9 shows the proportion of energy offers below \$100/MWh increased from Q3 to Q4 2022, as more proportion of energy offers priced at or above \$400/MWh shifted to the price tranche below \$100/MWh. The shift in energy offers to lower price ranges has likely outweighed the impact of a tighter supply cushion as the resultant WEP was lower this quarter with the average quarterly WEP decreasing from \$275.10/MWh in Q3 2022 to \$247.00/MWh in Q4 2022.

Chart 10. Monthly Average Variation Between Real-Time Dispatch Schedule and Forecast Load

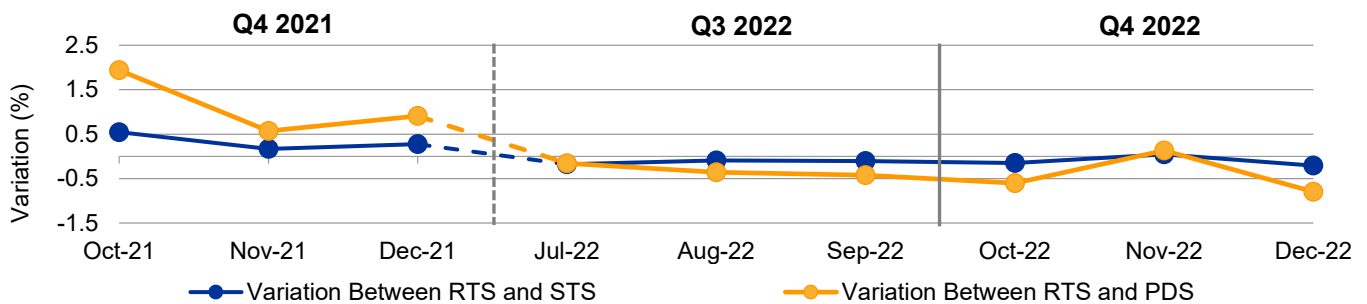
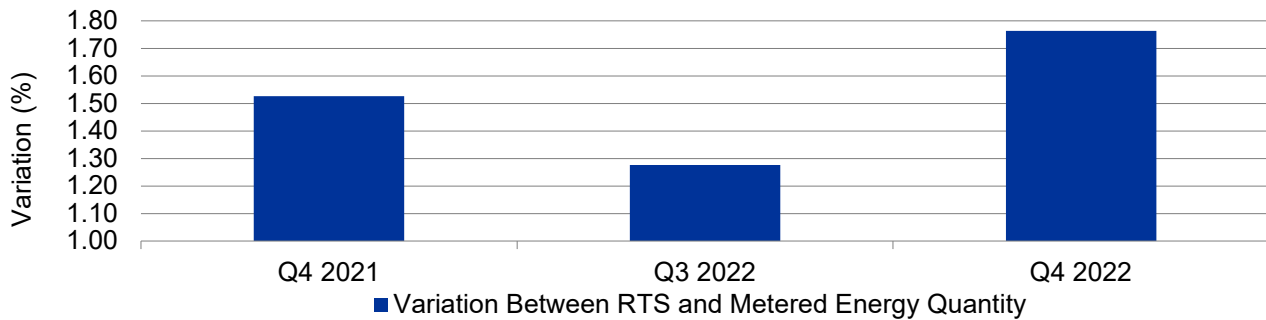


Chart 10 shows the variations in the pre-dispatch schedule (“PDS”) and short-term schedule (“STS”) against the real-time schedule (“RTS”). In Q4 2022, the average monthly variations remained relatively small, and it was observed that both the variations in PDS and STS were largely negatively correlated to RTS. This indicated that the real-time dispatch schedule recorded a lower than forecasted schedule.

The average load variation was maintained at 0.13 percentage points for variation between RTS and STS in Q4 2022, the same as Q3 2022. The percentage points for variation between RTS and PDS was 0.51 for Q4 2022 which was higher than those registered in Q3 2022 at 0.31 percentage points. The variations between RTS and STS reduced in comparison to the variations between RTS and PDS, indicating a more accurate load forecasting nearer to real-time as STS is generated more frequently and closer to the RTS.

As shown in Chart 10, the monthly variations in PDS and STS against the RTS in Q4 2022 reduced when compared to Q4 2021. This may be attributed to the more stable market prices in Q4 2022 as compared to the high price volatility seen in Q4 2021, which could have impacted the load forecast.

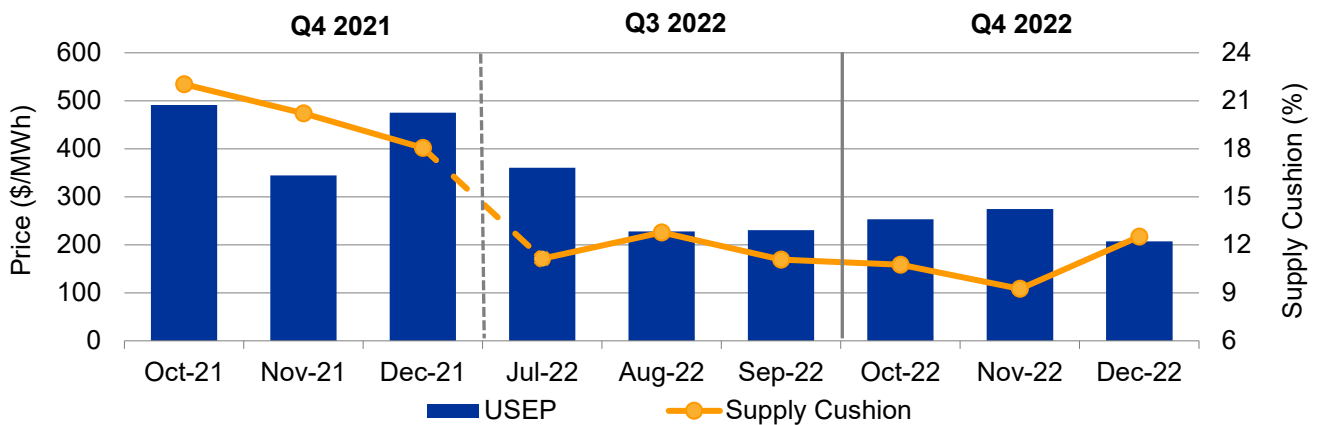
Chart 11. Quarterly Average Variation Between Real-Time Dispatch Schedule and Metered Energy Quantity



Q4 2022 observed the largest difference in the quarterly average load variation between the RTS and the metered energy quantity (the actual generation recorded) this year (Chart 11). The average monthly load variation between the RTS and the metered energy quantity rose from 1.28% in Q3 2022 to 1.76% in Q4 2022.

The RTS includes the station and auxiliary loads, while the metered energy quantity does not. This difference in methodology creates a variation between the RTS and the metered energy quantity, with the RTS being higher than the metered energy quantity.

Chart 12. USEP and Supply Cushion



In Q4 2022, the supply cushion averaged 10.85% as compared to 11.67% in Q3 2022.⁵ It was observed that both the USEP and the supply cushion reduced this quarter, which was counterintuitive.

Nevertheless, on the monthly level, an inverse correlation was observed for October, November, and December 2022, where the higher supply cushion correlates with a lower USEP and vice versa. The highest monthly average USEP for the quarter was recorded in November 2022 at \$274.39/MWh, with a monthly average supply cushion level of 9.25% which marks the lowest supply cushion since the market start. This could be attributed to reduced supply from generation companies due to the relatively higher rate of gas curtailment observed in November 2022.

Despite the tighter supply cushion, the USEP reduced 10.24% to \$244.99/MWh in Q4 2022 as compared to \$272.93/MWh in Q3 2022. This could be due to a decrease in the fuel oil price and a shift of energy offers to the lower price range. Furthermore, the average demand fell from 6,381 MW in Q3 2022 to 6,192 MW in Q4 2022, which could have further driven the reduction in the USEP.

⁵ Supply cushions for Q3 2022 and Q4 2021 have been revised to include new generation types.

Chart 13. Capacity Ratio by Generation Type⁶

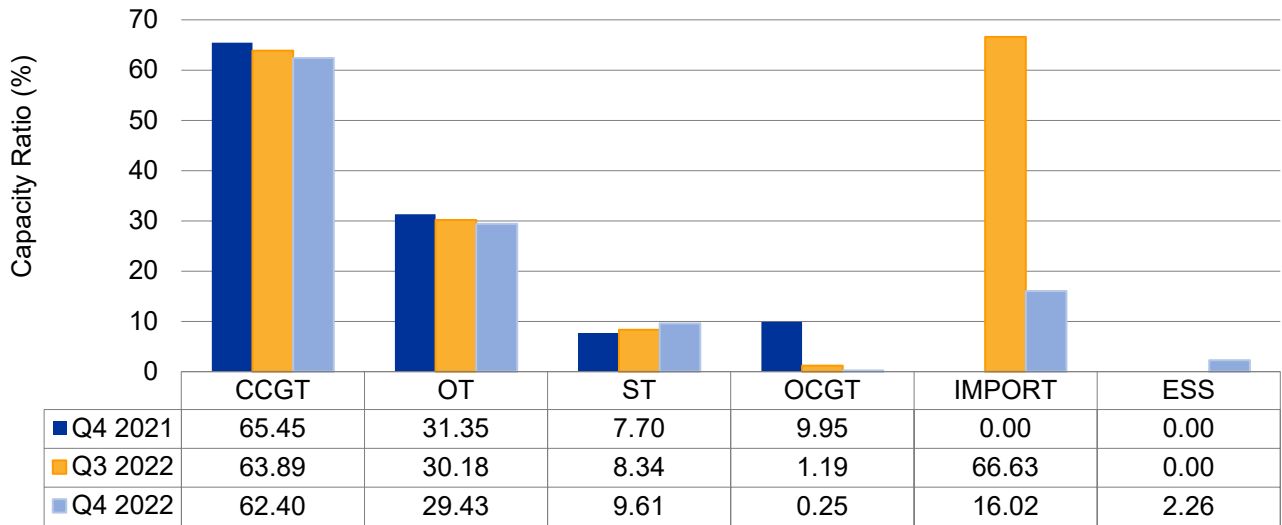
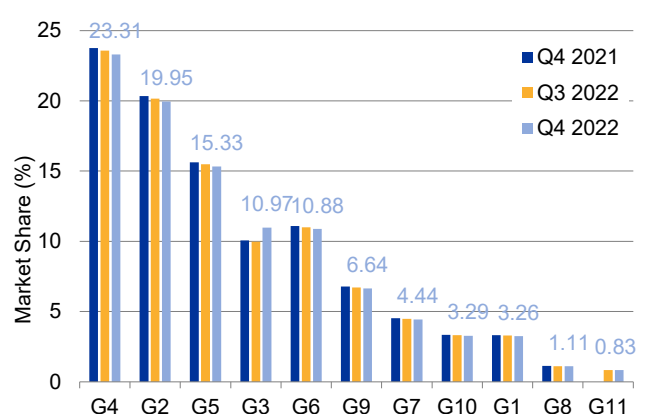
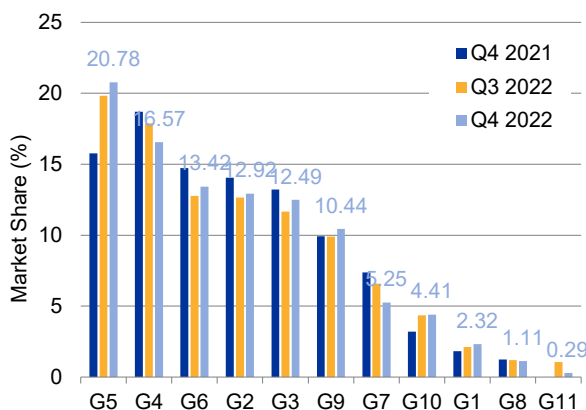


Chart 13 shows the quarterly average capacity ratios of the five generation types in the NEM which includes a new generation type - Energy Storage System (“ESS”), which has been introduced to the system in Q4 2022. In Q4 2022, three new ESS facilities were registered in the system which contributed to the growth in ESS capacity.

The decrease in the capacity ratios of Combined-Cycle Gas Turbine (“CCGT”), Open-Cycle Gas Turbine (“OCGT”), and others (“OT”) was in line with the lower supply (refer to Table 3) due to the higher outage volume observed in Q4 2022. The higher outage volume caused lower utilisation from the main generation types due to the unavailability of the generation facilities. The capacity ratio of imports (“IMPORT”) also decreased 50.60 percentage points from 66.63% in Q3 2022 to 16.02% in Q4 2022, which could be explained by the higher outage volume of the intertie. The capacity ratio of ESS was only 2.26 percentage points in Q4 2022 as the new ESS facilities were introduced to the system in the later part of Q4 2022.

Chart 14. Market Share in Percentage of Generation Companies Based on Metered Energy Quantity⁷

Chart 15. Market Share in Percentage of Generation Companies Based on Maximum Generation Capacity⁸



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.

⁶Chart 13 has been revised based on an addition of a new generation type, ESS. The actual capacities of the ESS facilities were used for the computation of the capacity ratio.

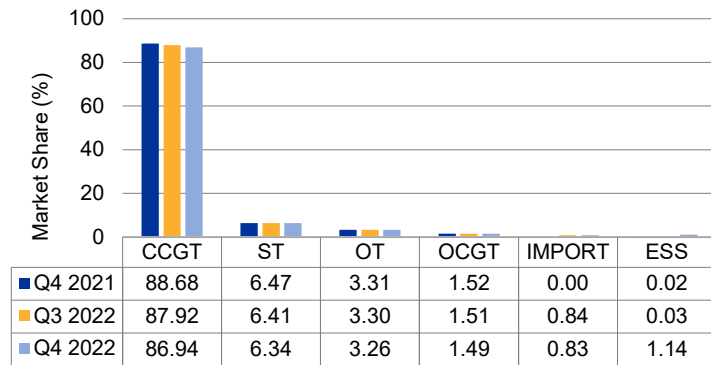
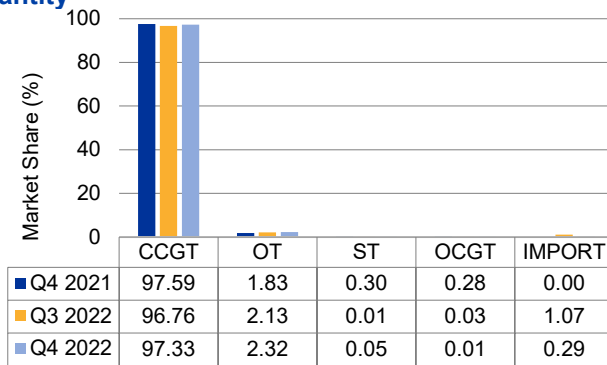
⁷ Exclude intermittent generation facilities and Market Participants with net negative quarterly metered energy quantity.

⁸ Exclude intermittent generation facilities and Market Participants with lesser than 5 MW maximum generation capacity. The actual capacities of the ESS facilities were used for the computation.

Chart 14 shows that G5, G4, and G6 are the three largest generation companies based on the metered energy quantity. The top three generation companies held 50.77% of the total market share in Q4 2022, an increase from 50.47% in Q3 2022 and 49.19% in Q4 2021. The top six generation companies with the largest market shares increased from 84.68% in Q3 2022 to 86.61% in Q4 2022. G5 recorded the greatest increase of 5.02 percentage points, while G4's market share shrunk the most with a reduction of 2.13 percentage points.

As shown in Chart 15, the distribution of market share based on generation capacity was still above 50% – the big three generation companies held 58.58% of the total market share in Q4 2022, a slight reduction from 59.23% in Q3 2022. The market share of G3 had the greatest increase of 0.99 percentage points from 9.98% in Q3 2022 to 10.97% in Q4 2022. The reason for the drop in the market share of the big three-generation companies was the registration of new generation registered facilities including new capacity into the Singapore Wholesale Electricity Market.

Chart 16. Market Share in Percentage of Generation Types Based on Metered Energy Quantity⁹ **Chart 17. Market Share in Percentage of Generation Types Based on Maximum Generation Capacity¹⁰**



Most of the generation in the NEMS is produced by CCGT units (97.33% of the metered energy quantity in Q4 2022 as shown in Chart 16), as the market is dominated by the most efficient generation technology (86.94% of the total maximum generation capacity in Q4 2022 as shown in Chart 17).

As seen in Chart 16, the CCGT market share reduced by 0.57 percentage points from 96.76% in Q3 2022 to 97.33% in Q4 2022, based on the metered energy quantity. This could be attributed to an increase in the proportion of the market share of new generation types like IMPORT and ESS.

The market share based on maximum generation capacity decreased for all generation types except ESS in Q4 2022 (Chart 17) as there were entries of new generation registered facilities in the NEMS in Q4 2022.

⁹ Exclude intermittent generation facilities and technology type with net negative quarterly metered energy quantity.

¹⁰ Chart 17 figures have been revised based on an addition of a new generation type. The actual capacities of the ESS facilities were used for the computation.

Chart 18. Frequency of the Number of Generation Companies as Pivotal Supplier (PS) Per Period¹¹

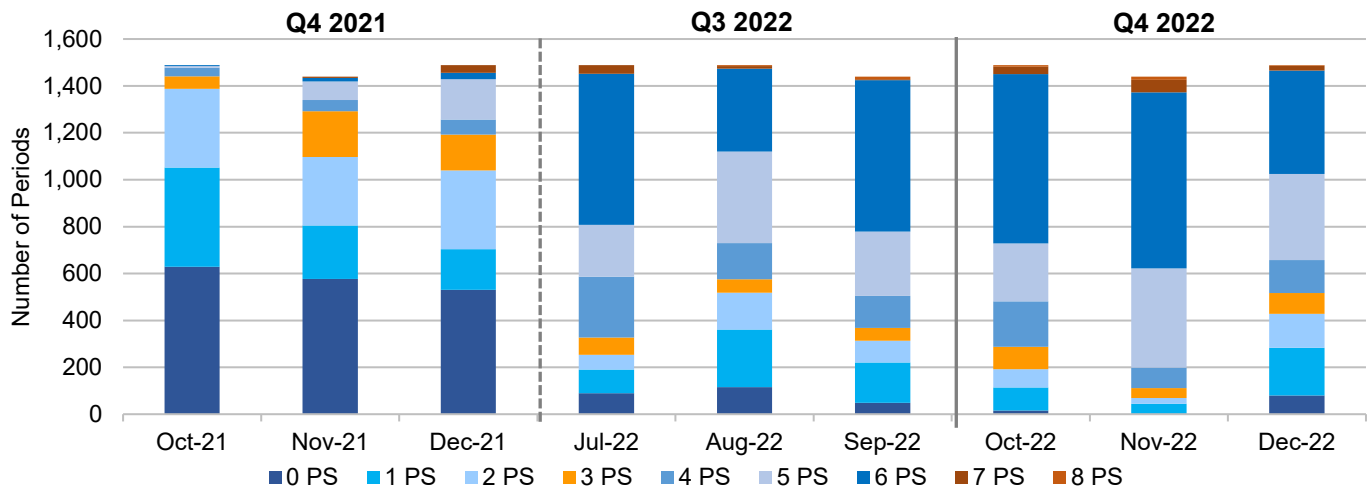


Chart 18 shows the number of trading periods with 0 to 8 pivotal supplier(s) per period for the three quarters under review. The maximum number of pivotal suppliers per period recorded is eight. Q4 2022 observed 3,078 periods with 5 or more pivotal suppliers per period, while Q3 2022 recorded 2,596 periods and Q4 2021 observed only 342 periods. Every quarter has a total of 4,416 dispatch periods.

The reason for the increasing frequency of more than 5 generation companies as pivotal suppliers per period in Q4 2022 could be attributed to the record low supply cushion this quarter. Given the tighter supply cushion recorded this quarter (as shown in Chart 12), more generation companies were identified as pivotal suppliers with the potential ability to exercise unilateral market power. In Q4 2022, 2.90% of the periods have 7 or more pivotal suppliers, an increase from 1.49% in Q3 2022 and 0.86% in Q4 2021.

Chart 19. Trend of Price Setting Generation Companies

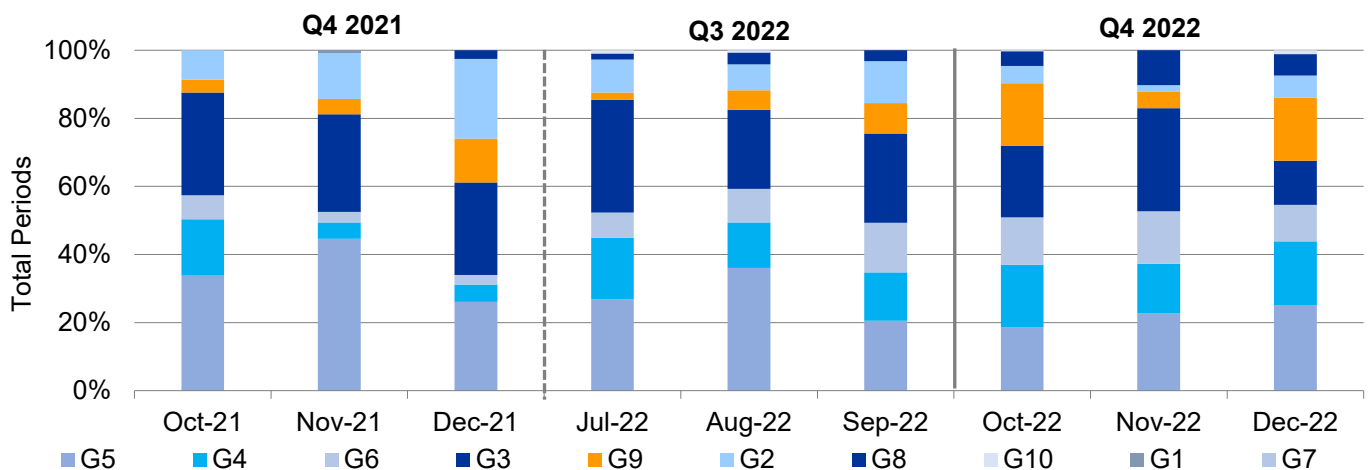


Chart 19 shows the monthly breakdown of price-setting generation companies in Q4 2022, Q3 2022, and Q4 2021. G3, G5, and G4 remained the first, second and third highest frequency price-setting generation companies in the market in Q4 2022, which were the same top three positions in Q3 2022.

¹¹ The assessment approach for 1-Pivotal Supplier Test in Q4 2022 Market Watch differs from the previous Market Watch reports. The previous Market Watch reports focused on the periods with only one pivotal supplier, while the Market Watch this quarter included the assessment of all the pivotal suppliers.

Chart 20. Demand Response Activation

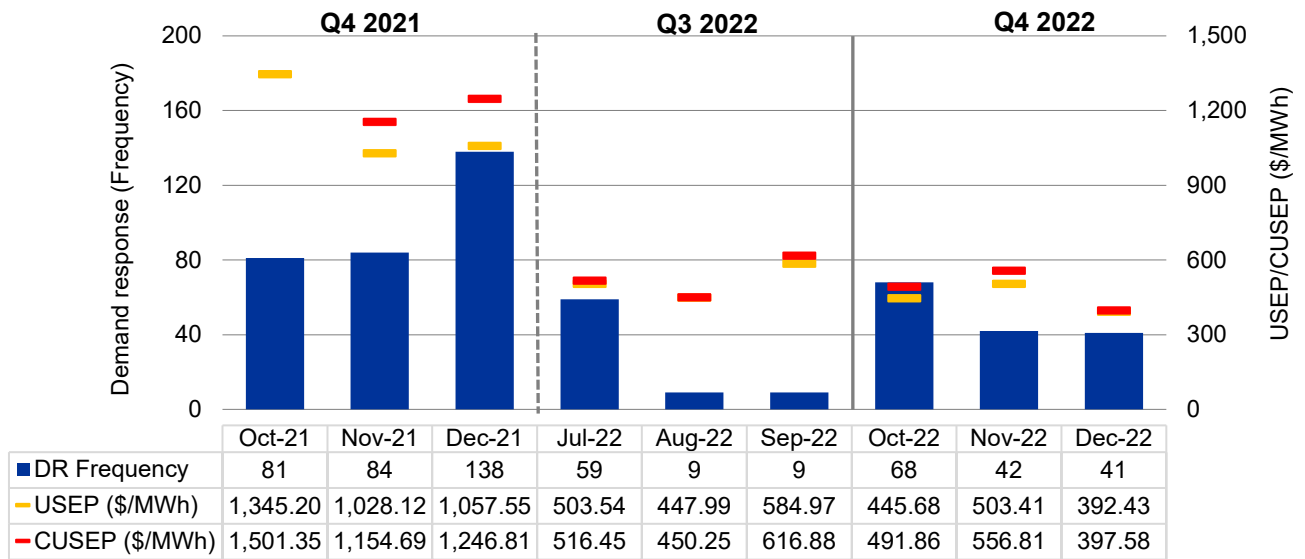


Chart 20 lists the Demand Response (“DR”) activations in the three quarters under review, and the associated USEP and counterfactual USEP (“CUSEP”) during those periods with DR activations.

There were 151 DR activations in Q4 2022, which was higher than the cumulative total of 77 occurrences recorded from the DR activation in Q3 2022. The daily average USEP for periods with DR activation in Q4 2022 was \$447.28/MWh, while the average CUSEP was \$484.33/MWh without DR curtailment.

The number of DR activation is usually reflective of the number of USEP spikes. However, in Q4 2022, the increase in the number of DR activations coincided with the lower WEPs observed. The increase in the number of DR activations could be due to the tighter supply cushion recorded in Q4 2022 compared to Q3 2022, while the lower WEP could be due to the decrease in demand and generators shifting their energy offers to lower price tranches in Q4 2022.

Compliance Statistics for Q4 2022



Potential Breaches of the Market Rules



Determinations*



Enforcement

119 cases in total

1 self-report
118 referrals/complaints
0 MSCP initiative

96 determinations in total

18 cases determined to be in breach
0 cases determined to take no further action
78 cases determined not to be in breach
0 cases determined to be event of default

18 cases in total

2 financial penalty
4 non-compliance letters
0 suspension order
0 termination order
0 other MSCP order
\$764,000 of financial penalty imposed
\$38,000 of costs awarded

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

The MSCP issued 6 rule breach determinations in Q4 2022 to:

- i. 1 case from Energy Market Company Pte Ltd regarding failure to comply with Market Operations Timetable on 12 July 2022 (\$2,000 costs)
- ii. 1 case from YTL PowerSeraya Pte. Limited regarding failure to comply with gate closure rules on 14 July 2022 (Financial penalty \$14,000, \$2,000 costs)
- iii. 6 cases from PacificLight Power Pte. Ltd. regarding failure to comply with gate closure rules on 27 July 2022 (\$2,000 costs)
- iv. 8 cases from Taser Power Pte. Ltd. regarding failure to comply with gate closure rules on 8 August 2022 (\$2,000 costs)
- v. 1 case from YTL PowerSeraya Pte. Limited regarding failure to comply with PSO directions on 7 July 2022 (Financial penalty \$750,000, \$15,000 costs)
- vi. 1 case from YTL PowerSeraya Pte. Limited regarding failure to comply with PSO directions on 7 July 2022 (\$15,000 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
- T P B Menon
- Philip Chua
- Professor Euston Quah
- Dr Stanley Lai
- Yeo Yek Seng

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