

# **User Guide to Market Surveillance & Compliance Panel Market Watch**

Market Assessment Unit

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## 1. Introduction

The Market Surveillance and Compliance Panel Market Watch (“[MSCP Market Watch](#)”) is a quarterly report prepared by the Market Assessment Unit (“MAU”) of Energy Market Company Pte Ltd (“EMC”) and submitted to the MSCP, pursuant to section 4.4.5 of Chapter 3 of the Singapore Electricity Market Rules (“Market Rules”). The report summarises the MAU’s day-to-day monitoring, cataloguing and evaluation activities and analyses of the National Electricity Market of Singapore (“NEMS”). The MSCP Market Watch also includes compliance statistics which provides details on the MSCP’s investigation activities throughout each quarter.

The indices in the MSCP Market Watch mainly take reference from the [Catalogue of Monitoring Indices](#), which is re-evaluated and modified in accordance with section 4.3.6 of Chapter 3 of the Market Rules, by the MAU under the supervision and direction of the MSCP, as the MSCP deems appropriate. The MSCP has adopted the latest modifications to the Catalogue of Monitoring Indices from 1 July 2020. Therefore, as the Catalogue of Monitoring Indices continue to be updated to align with the developments in the NEMS, the MSCP Market Watch will evolve accordingly as well.

The MSCP Market Watch has been published since the second quarter of 2006. Each publication is available approximately one month after each calendar quarter.

This user guide serves as a supplementary document to the MSCP Market Watch. It is designed to introduce readers to the report layout and help readers understand the data and underlying concepts in the report.

## 2. Review Period

The MSCP Market Watch provides information on the wholesale market activities in the NEMS for every quarter of the calendar year, where:

- Q1 refers to 1 January to 31 March;
- Q2 refers to 1 April to 30 June;
- Q3 refers to 1 July to 30 September; and
- Q4 refers to 1 October to 31 December.

The MSCP Market Watch also includes data from the preceding quarter and the same quarter of the previous year to allow readers to observe the changes in the NEMS on a quarterly and annual basis. Unless otherwise stated, comparisons of indicators in the report are comparisons between the current quarter and the preceding quarter.

## 3. General Notes

All prices and percentages are rounded off to two decimal places. The percentages may not add up to 100% due to rounding.

Apart from vesting contract prices and fuel oil price, all prices mentioned in the MSCP Market Watch are provided by the EMC.

Any reference to combined cycle gas turbine (“CCGT”) units in this report includes all generation facilities under the generation type CCGT/COGEN/TRIGEN.

A dotted line between markers or bars in a chart denotes a non-consecutive month or quarter. Likewise, a solid line between markers or bars in a chart indicates a continuous series of months or quarters.

Details of the charts and tables are discussed in the following sections, categorised by the subheadings in the MSCP Market Watch.

## 4. Executive Summary

### USEP and WEP by Quarter

The MSCP Market Watch presents the change in the quarterly averages of the Uniform Singapore Energy Price (“USEP”) and the Wholesale Electricity Price (“WEP”).

The USEP is the energy price paid by retailers and calculated as the weighted average of the nodal prices at all off-take nodes every half hour. The WEP is the net purchase price paid by retailers and calculated as a sum of the USEP, administrative costs and uplift charges incurred in the wholesale market.

Due to the additional components in the WEP, it is usually slightly greater than the USEP. However, depending on the relative changes in the administrative costs and uplift charges (which is often a return to retailers instead of a charge), the WEP could be the same or less than the USEP. The overall impact of the changes in these additional components is shown as the difference observed when comparing the USEP and the WEP.

### Quarterly Outage Volume and Ancillary Service Prices

The MSCP Market Watch shows the total outage volumes and the average price of each ancillary service in each quarter. As a larger outage volume causes a contraction in energy supply and increase in demand for ancillary services, a larger outage volume is usually accompanied by higher prices of ancillary services and vice versa.

There are two types of outages: planned and forced. Both planned and forced outage volumes are compiled from reports prepared by the Power System Operator (“PSO”), namely the Annual Overhaul Program of Generating Units (“AGOP”)<sup>1</sup> and the quarterly report on forced outages<sup>2</sup>.

A planned outage is subject to approval by the PSO, provided that the outage does not impact system reliability. A forced outage is unexpected and causes sudden changes in the supply of energy and the demand for ancillary services, which could lead to immediate increases in energy or ancillary service prices.

When a forced outage occurs, there is an abrupt loss of energy or reserves from the system and the system frequency falls. Primary reserve (with a shorter response time of 9 seconds) will be activated first to cover the fall in system frequency, contingency reserve (with a longer response time of 10 minutes) will then be activated to replace the lost energy or reserve. Regulation provides frequency adjustment to correct any system frequency variation or imbalance between supply and demand in the system.

## 5. Prices

The MSCP Market Watch provides information on the trends in the NEMS by monitoring prices in each quarter, which are often the combined result of various changes in the market. Taking reference from the MAU’s catalogues of data and monitoring indices, this report includes price indicators such as ancillary service prices, fuel oil price and distribution of the WEP over time and demand, on top of the USEP and the WEP.

### Vesting Contract Price Versus WEP by Quarter

The report shows the changes in the quarterly vesting contract price and the monthly average WEP. As the vesting contract price reflects the long run marginal cost of a generation facility, the WEP should follow the vesting contract price closely in an efficient market. A persistent gap between the WEP and the vesting contract price may suggest a need for a [review of the vesting contract regime](#).

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<sup>1</sup> The AGOP is an outage plan of all generation registered facilities for a calendar year. It is based on the outage plans submitted by market participants and published by the PSO. The AGOP is also updated throughout the year by the PSO to reflect subsequent submissions from market participants. The AGOP is further detailed under section 7.2 of Chapter 5 of the Market Rules.

<sup>2</sup> Pursuant to section 7.1.3 of Chapter 5 of the Market Rules, the PSO submits a report on forced outages to the MSCP every quarter.

The vesting contract prices present in the NEMS are the Allocated Vesting Price (“AVP”) and the LNG Vesting Price (“LVP”). The Allocated Vesting Price (“AVP”) is the weighted average of the Balance Vesting Price (“BVP”) and LVP which are differentiated based on the primary fuel source (piped natural gas or liquefied natural gas (“LNG”). However, since the Balance Vesting Quantity was reduced to zero and the BVP was removed accordingly on 1 July 2019, the AVP has solely depended on the LVP.

Vesting contract prices are provided by SP Services Limited (“SP Services”) as the market support services licensee (“MSSL”) on the [Open Electricity Market’s website](#) every quarter, based on a list of long run marginal cost parameters of a CCGT unit from the Energy Market Authority (“EMA”), including capital cost, non-fuel operating cost, carbon price and fuel oil price. Fuel oil price is the main component of the vesting contract price, so a change in the fuel oil price is likely to have an impact on the vesting contract price in the same direction.

The Brent Index Price<sup>3</sup> and the Previous Net Shortfall (“PNS”) tend to influence the vesting price as well. The Brent Index Price is one of the long run marginal cost parameters considered by the EMA when determining the vesting contract price. The Brent Index Price in a quarter is the average price of Platts Dated Brent for every business day from the first business day to the 15<sup>th</sup> calendar day of the third month in the preceding quarter. For example, to calculate the Brent Index Price for Q1, the Platts Dated Brent price on each business day from 1 October to 15 December would be included. A rise in the Brent Index Price is likely to result in a rise in the vesting contract price and vice versa. Even so, as the periods used in calculating the Brent Index Price and the fuel oil price in a quarter are not the same, the movements in these two prices may be different.

The PNS is a settlement adjustment brought about by the difference between the amount paid by the vesting contract consumers and the amount paid to the vesting contract generators in the previous quarter. The PNS in the current quarter is calculated based on amounts in the previous quarter and recovered in the next quarter<sup>4</sup>. A positive PNS in the current quarter implies that the amount paid by the vesting contract consumers exceeded the amount paid to the vesting contract generators in the previous quarter and such adjustment would then have a downward effect on the vesting contract price in the next quarter. Conversely, if the PNS in the current quarter is negative, it implies that the amount paid by the vesting contract consumers was less than the amount paid to the vesting contract generators in the previous quarter and such adjustment would then have an upward effect on the vesting contract price in the next quarter.

Vesting contracts were bilateral contracts between a generation company and the MSSL introduced in 1 January 2004 by the EMA as a regulatory instrument to mitigate the exercise of market power by generation companies. It mandates generation companies to sell a specified amount of electricity (vesting contract level) at a specified price (vesting contract price), thus removing the incentive for generation companies to withhold their generation capacity to sustain inefficient spot prices in the wholesale electricity market.

To encourage the acceptance of regasified LNG, the EMA also implemented the LNG Vesting Scheme upon the completion of the LNG terminal in May 2013, which would be in force until 2023. There will be no LNG vesting quantity when the LNG vesting contracts expire on 30 June 2023. From 1 July 2023, all vesting contracts will cease and the vesting contract regime will be completely phased out.

### **Distribution of WEP Over Time**

The MSCP Market Watch shows the frequency of the WEP in various price ranges, measured as a percentage of the total number of hours in each quarter. Designed for long-term observation, this chart provides insights on price trends by showing the changes in price distribution.

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<sup>3</sup> Further details on the Brent Index Price and PNS are available in the [EMA’s Procedures for Calculating the Components of the Vesting Contracts](#).

<sup>4</sup> The current quarter will end the day before the new quarter begins and settlement for the last day of the current quarter will not be finalised until about a week after the new quarter begins. Consequently, it is necessary to stagger the period in which the surplus or shortfall is measured, relative to the actual three-month period. The EMA intends that the settlement adjustment period be staggered by three months. For example, for vesting contracts which apply for from January to March this year, the settlement adjustment would be based on the cumulative surplus or shortfall from July, August and September in the previous year.

A positively skewed distribution (leftward shift of the distribution) indicates that the WEP falls in the lower price ranges over longer hours and there are very few instances of high WEP, which would be associated with a lower average WEP in the quarter. Conversely, a negatively skewed distribution (rightward shift of the distribution) indicates that the WEP is observed to be in higher price ranges over longer hours and there are very few instances of low WEP, which would then be associated with a higher average WEP in the quarter. The peak of the distribution shows the price range where the WEP occurs most of the time – if the peak moves up, it means the frequency of the WEP in the corresponding price range has increased and vice versa.

### **Distribution of WEP Over Total Metered Energy Quantity**

The analysis shows the frequency of the WEP in various price ranges, measured as a percentage of the total metered energy quantity in each quarter. Similar to “Distribution of WEP Over Time”, this chart is designed for long-term observation and provides insights on price trends by showing the changes in price distribution.

A positively skewed distribution (leftward shift of the distribution) indicates that the WEP falls in the lower price ranges over a higher metered energy quantity and there are very few instances of high WEP, which would be associated with a lower average WEP in the quarter. Conversely, a negatively skewed distribution (rightward shift of the distribution) indicates that the WEP is observed to be in higher price ranges over a higher metered energy quantity and there are very few instances of low WEP, which would then be associated with a higher average WEP in the quarter. The peak of the distribution shows the price range where the WEP mostly occurs in terms of metered energy quantity – if the peak moves up, it means the WEP in the corresponding price range is recorded over a higher metered energy quantity and vice versa.

“Distribution of WEP Over Time” and “Distribution of WEP Over Total Metered Energy Quantity” may not necessarily show similar changes in price distribution. The WEP may be observed in the lower price ranges over long hours, but it may only cover a low percentage of the total metered energy quantity, for example, if the WEP and demand remain low throughout the day except for a few peak hours where demand is very high. If “Distribution of WEP Over Total Metered Energy Quantity” shows a similar change in price distribution as “Distribution of WEP Over Time”, it would provide additional support to explain the changes in the WEP.

### **Correlation Between WEP and Metered Energy Quantity**

The correlation coefficient,  $r$ , measures the strength of the relationship between the WEP and the metered energy quantity (actual demand) and has a value between -1 and 1. A high positive  $r$  indicates that as demand rises, the WEP also rises; a high negative  $r$  indicates that as demand decreases, the WEP decreases as well. A low  $r$  in either direction indicates a weak correlation between the WEP and demand.

The square of the correlation coefficient,  $r^2$ , is the proportion of variance in the WEP which could be explained by variations in demand.

### **WEP Versus Fuel Oil Price**

The report presents the changes in the quarterly averages of the WEP and fuel oil price which is an input to electricity generation. The WEP is expected to be positively related to fuel oil price.

Although the generation facilities in Singapore are mostly powered by gas, fuel oil price remains to have a significant impact on the WEP as gas imports are typically pegged to fuel oil prices.

The fuel oil price mentioned in past issues of the MSCP Market Watch was based on the Intermediate Fuel Oil (“IFO”) 180 price, a component used in the calculation of vesting contract prices. Due to the unavailability of the IFO 180 price, after 19 February 2020, the fuel oil price recorded from Q2 2020 (MSCP Market Watch Issue 56) was changed from the IFO 180 price to the [SGX Platts Singapore Fuel Oil 180cst Index Futures](#), which is published by the Singapore Exchange Limited, chosen as a suitable proxy to allow for continuous monitoring of IFO 180 price movements.



### **Variation Between Real-Time Dispatch Price and Forecast Price**

The MSCP Market Watch presents the monthly and quarterly average variations 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.

Similar to the load variations in “Monthly Average Variation Between Real-time Dispatch Schedule and Forecast Schedules”, the variations in the USEP show if there has been an improvement in the accuracy of the forecast USEP in the STS through the months and quarters – the smaller the variation, the more accurate the forecast USEP is and vice versa. The accuracy of the forecast USEP is important as it signals any upcoming situation in the real-time market so that the market participants could plan and avoid any system shortfall in the real time.

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 largest variation observed in a single dispatch period during each month and quarter is based on the absolute magnitude of the variation. For example, a variation of -\$100.00/MWh is larger than a variation of \$10.00/MWh.

## **6. Demand and Supply**

The MSCP Market Watch monitors demand and supply to identify the impact of changes in the behaviours of consumers and generation companies on electricity prices. Apart from demand and supply, this report is aligned with the MAU’s catalogues of data and indices and analyses demand and supply by looking at supply cushion, generators’ offers, forecast and real-time schedules, capacity ratio and market share.

### **Average Forecast and Actual Demand**

The analysis illustrates how the quarterly averages of forecast demand and actual demand have changed through the quarters. For a comparison of the forecast demand and actual demand, the report looks at the variation between these two demand levels in “Monthly Average Variation Between Real-time Dispatch Schedule and Forecast Schedules”.

Forecast demand refers to the forecasted electricity consumption in Singapore and excludes transmission losses, intertie flows and generation from exempted embedded generators. Forecast demand is calculated by the market clearing engine (“MCE”) based on data provided by the PSO and is used to determine forecast schedules and real-time schedules. Forecast demand is important in ensuring the reliability of electricity supply, as generation companies can anticipate the need for additional generation and adjust their generation accordingly.

Actual demand is computed from the metered energy quantity. Data on metered energy quantity is provided by SP Services.

Forecast demand is expected to be higher than actual demand given that the former excludes transmission losses. The difference between the forecast demand and actual demand reflects the forecast accuracy which is further elaborated in “Average Monthly Variation Between Real-time Dispatch Schedule and Forecast Schedules”.

### **Peak Forecast and Actual Demand**

The report shows the changes in peak forecast demand and peak actual demand in each quarter. The peak demand is the highest electricity demand observed in the quarter. The peak demand could be used in energy management to ensure that there is enough capacity in the system to meet high levels of demand.

## **Average Demand and Solar Generation Periodic Profiles**

The analysis shows the changes in the average quarterly demand periodic profiles (which takes solar generation into consideration) with the changes in the average quarterly solar generation.<sup>5</sup>

The chart illustrates how the gradual increase in Singapore's installed solar capacity impacts the average quarterly demand periodic profiles. For example, slight dips in demand are observed in the middle of the part that coincides the peaks of the solar generation profile the peak demand shifts to a later period when the sun sets or when there is less generation from solar sources.

## **Quarterly Average Supply and Supply Cushion**

The report shows the changes in the quarterly averages of supply and supply cushion.

The supply is the sum of offers submitted by generation companies. Supply cushion is the ratio between (a) the difference between supply and demand and (b) supply. Supply cushion measures supply adequacy, the level of capacity which was offered but not scheduled and could be called up if necessary.

## **Trend of Energy Offer Price Proportion**

The MSCP Market Watch displays the changes in the quarterly average percentage of energy offers from generation companies submitted at or below \$100/MWh, between \$100/MWh to \$200/MWh, between \$200/MWh to \$300/MWh, between \$300/MWh to \$400/MWh and at or above \$400/MWh. Given that the USEP is the weighted average of nodal prices which are dependent on generation companies' energy offer prices, a higher percentage of offers submitted at lower prices is likely to result in lower USEP and WEP and vice versa.

## **Monthly Average Variation Between Real-Time Dispatch Schedule and Forecast Schedules**

The analysis examines the monthly average load variations in the pre-dispatch schedule ("PDS") and the STS, when compared to the RTS. These variations indicate if there has been an improvement in the accuracy of the forecast schedules through the quarters – the smaller the variation, the more accurate the forecast schedule is and vice versa. The accuracy of the forecast schedules is important in avoiding potential fluctuations in the real-time market as generation companies could take reference from the forecast schedules to plan and adjust their generation in the real-time market.

The PDS is updated every two hours and cover a time horizon of 12 to 36 hours after the period in which the relevant PDS is published.

The STS is updated every half hour and covers a time horizon of six hours after the period in which the relevant STS is published. As the STS is generated more frequently and closer to the real-time dispatch period than the PDS, the load variation in the STS tends to be smaller than that in the PDS (i.e., STS is more reflective of real-time market conditions). The STS provides more updated information to market participants and helps them in decisions relating to their generation and consumption for an upcoming dispatch period.

## **Quarterly Average Variation Between Real-Time Dispatch Schedule and Metered Energy Quantity**

The MSCP Market Watch monitors the changes in the quarterly variation between the real-time load forecast and metered energy quantity, which could be interpreted as the changes in the accuracy of the RTS in each quarter. A decrease in the variation between the real-time load forecast and metered energy quantity in a quarter means that the RTS is more accurate and reflective of actual demand in that quarter and vice versa.

The RTS is issued to the PSO and market participants 30 seconds before each dispatch period.

The real-time load forecast includes the station and auxiliary loads, while the metered energy quantity does not. This difference in methodology creates a variation between the real-time load forecast and the metered energy quantity, with the real-time load forecast being higher than the metered energy quantity. Other possible

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<sup>5</sup> The solar generation figure published in Market Watch refers to the metered solar generation in the National Electricity Market Singapore (NEMS).



reasons for the variation between the real-time load forecast and the metered energy quantity are metering errors and transmission losses.

### **USEP and Supply Cushion**

This assessment shows the relationship between the supply cushion and the USEP. Supply cushion is one of the factors affecting the USEP.

The typical relationship between the supply cushion and the USEP is that when the supply cushion weakens, the USEP rises to reflect the tight supply in the system. Similarly, when the supply cushion increases, the USEP falls to correspond to the excess supply in the system.

### **Capacity Ratio by Generation Type**

The report analyses the changes in the quarterly average capacity ratios of the four generation types in the NEMS. Capacity ratio is calculated as the ratio of a generation facility's scheduled output of energy, reserve and regulation to its maximum generation capacity.

The capacity ratio of a generation facility indicates its utilisation. If the capacity ratio decreases, it could be due to lower demand, lower generation scheduled from that generation type or higher generation capacity from new generation facilities entering the market. If the capacity ratio increases, it could be brought about by higher demand, higher generation scheduled from that generation type or lower generation capacity from generation facilities deregistering from the market. In a competitive market, more efficient facilities like CCGT units are expected to have a higher capacity ratio than less efficient ones like steam turbines ("ST").

### **Market Share in Percentage of Generation Companies Based on Metered Energy Quantity**

The report presents the changes in the market share of generation companies based on metered energy quantity. The distribution of market share could indicate the degree of market concentration and may assist in assessing whether the market design facilitates the efficient and fair operation of a competitive market. A market where most of the market share is held by a small number of generation companies is more concentrated than a market where the market share is spread across many generation companies. The more concentrated a market is, the less competitive it is and vice versa.

The generation companies are arranged in descending order according to their market share based on metered energy quantity in the current review period.

The data callouts are the market shares in the current review period.

### **Market Share in Percentage of Generation Companies Based on Maximum Generation Capacity**

As a supplement to "Market Share in Percentage of Generation Companies Based on Metered Energy Quantity", the report provides analysis on the changes in the market share of the generation companies based on maximum generation capacity.

The generation companies are arranged in descending order according to their market share based on maximum generation capacity in the current review period. The data callouts are the market shares in the current review period.

The generation companies may not necessarily be lined up in the same order in "Market Share in Percentage of Generation Companies Based on Metered Energy Quantity" and "Market Share in Percentage of Generation Companies Based on Maximum Generation Capacity". A generation company may hold a large market share in terms of generation capacity but only a small market share in terms of metered energy quantity. For instance, a generation company which only owns ST units could have a large generation capacity but may not be scheduled to generate any electricity that quarter.

### **Market Share in Percentage of Generation Type Based on Metered Energy Quantity**

This section shows the changes in the market share of the generation types based on metered energy quantity. The market share indicates the extent to which the different generation types are serving the system demand.

The generation types are arranged in descending order according to their market share based on metered energy quantity in the current review period.

Most of the generation in the NEMS is produced by CCGT units as the market moves towards more efficient technology. ST units take longer to start up, so they are increasingly scheduled less often to generate electricity to meet system demand. Open cycle gas turbines ("OCGT") units could start up quickly but are also more costly to operate, so they are generally scheduled only when supply cushion is weak. OT units include incineration plants which convert incineration refuse to electricity, accounting for a small but consistent market share over time.

### **Market Share in Percentage of Generation Types Based on Maximum Generation Capacity**

As a supplement to “Market Share in Percentage of Generation Type Based on Metered Energy Quantity” the report shows the changes in the market share of the generation types based on maximum generation capacity.

The generation types are arranged in descending order according to their market share based on maximum generation capacity in the current review period.

Ideally, the generation type with a large market share in terms of metered energy quantity should hold a large market share in terms of generation capacity as well. This shows that the market is moving towards adopting a generation type which is the most efficient and suitable for the market. If a generation type takes up a small market share in terms of metered energy quantity but a large market share in terms of generation capacity, it implies that the generation type is becoming less suitable for the market.

### **Frequency of Number of Generation Companies as Pivotal Supplier**

The MSCP Market Watch presents the number of dispatch periods with the number of pivotal suppliers for each month. The single pivotal supplier test is an assessment of structural market power in a market. A generation company is considered a pivotal supplier for a particular dispatch period if the total electricity demand in the NEMS during that dispatch period cannot be fulfilled without including the electricity supply from this generation company.

There could be periods with multiple pivotal suppliers, which means that the total electricity demand in the NEMS cannot be met by the combined electricity supply from these generation companies.

The presence of structural market power depends on the characteristics of the market, as such the number of market participants, barriers to entry and product differentiation, but does not depend on the market participants' behaviour. This means that structural market power could exist even if the market participants do not take any action to influence the market price. The changes in the number of dispatch periods held by each generation company as the pivotal supplier illustrate the changes in the distribution of such structural market power in the NEMS.

### **Trend of Price Setting Generation Companies**

The report monitors the monthly distribution of price setting generation companies, expressed as a percentage of the total number of dispatch periods in each month where there is only a single price setter. There could be periods where there is no price setter or where there are multiple price setters, such periods are excluded from this report.

The generation companies are arranged in descending order based on their share of the total number of dispatch periods where there was a price setting generation company in the current review period.

In the NEMS, generation facilities are dispatched by merit order – the generation facilities are ranked according to their offers, those with the lowest offer prices will be dispatched first to meet the electricity demand and those with higher offer prices will be dispatched only when the electricity demand is high enough. A generation company is deemed a price setting generation company if its generation facility provides the marginal unit of electricity to meet the electricity demand in the NEMS.

Although considered the price setter, a generation company is only deemed so because its generation facility provides the marginal unit of electricity to meet the electricity demand and the corresponding price of this marginal unit of electricity is taken as the market clearing price. Apart from the generation companies' offer prices, the marginal unit of electricity cleared depends on other market factors like electricity demand and supply.

### **Demand Response Activations**

The EMA introduced the demand response programme<sup>6</sup> in 2016 to enable electricity demand to be met effectively, promote better investment in the NEMS and improve system reliability when electricity supply is low.

The demand response programme allows load providers<sup>7</sup> to curtail their load (electricity consumption) in exchange for payment. The load providers must fulfil at least 100% of their scheduled load curtailment to be paid. The load providers who only comply with less than 100% of their scheduled load curtailment will not receive any payment and will incur a penalty if they comply with less than 95% of their scheduled load curtailment in accordance with the Market Rules.

The MSCP quarterly report presents the demand response activations in each quarter, including the associated USEP and counterfactual USEP ("CUSEP") during the activations. The CUSEP is the USEP calculated by MCE assuming that there is no dispatchable energy bid from the load providers. Demand response has a dampening effect on the USEP as it reduces the likelihood of scheduling more expensive generation to satisfy electricity demand. Therefore, the CUSEP (USEP without demand response activation) is usually higher than the USEP when demand response is activated.

## **7. Compliance Statistics**

### **Potential Breaches of the Market Rules**

This section of the MSCP Market Watch displays the number of cases received or initiated by the MSCP during the review period. A case could be submitted to the MSCP by the alleged market participant as a self-report or by a third party as a referral or complaint. The MSCP could also initiate a case if it determines that an activity in the wholesale electricity markets or the conduct of a market participant, the MSSL, the EMC or the PSO warrants an investigation.

### **Determinations**

The number of cases considered and concluded by the MSCP during the review period are presented in the MSCP Market Watch. This could be different from the case count under potential breaches of the Market Rules as the MSCP may decide on a case which was received in a past quarter. The [MSCP determinations](#) are published on the EMC's website.

### **Enforcement**

The MSCP Market Watch includes the number of cases where the MSCP determined that a market participant, the EMC or the PSO has breached the Market Rules and took enforcement actions towards the party in breach.

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<sup>6</sup> Further details on the demand response programme are available in the [EMA's final determination paper](#).

<sup>7</sup> A load provider participating in the demand response programme is required to hold a Wholesaler (Demand Side Participation) Licence issued by the EMA. A retail electricity licensee, however, is eligible to participate in the demand response programme as a load provider with its Retail Electricity Licence, without applying for a Wholesaler (Demand Side Participation) Licence.

## 8. Glossary

Term	Description
AVP: Allocated vesting price	<p>The allocated vesting price approximates the long run marginal cost of a theoretical new entrant which uses the most efficient generation technology which accounts for at least 25% of the system demand in Singapore. Presently, the most efficient technology is the combined cycle gas turbine.</p> <p>The allocated vesting price was the weighted average of the balance vesting price and the LNG vesting price. As the balance vesting price is no longer in use, the allocated vesting price now solely depends on the LNG vesting price.</p>
BVP: Balance vesting price	<p>The price calculated for balance vesting quantity. As part of the EMA’s decision to phase out the vesting contract regime, the balance vesting price was removed since 1 July 2019, when the corresponding balance vesting quantity was reduced to zero.</p>
BVQ: Balance vesting quantity	<p>The amount of vesting contract quantity provided by piped natural gas, calculated as the vesting contract quantity above the LNG vesting quantity.</p>
Capacity ratio	<p>Capacity ratio indicates the utilisation of a generation facility as a ratio of its scheduled output and maximum generation capacity.</p>
CCGT: Combined cycle gas turbine	<p>A combined cycle gas turbine uses a gas turbine and a steam turbine to produce electricity and heat. The heat is channelled to the steam turbine to produce more electricity. A combined cycle gas turbine can generate electricity via its gas turbine even when its steam turbine is down.</p>
Contingency reserve	<p>A facility offering contingency reserve shall be capable of achieving its scheduled MW response within 10 minutes of being instructed to do so and shall be able to maintain its scheduled MW response for not less than 30 minutes.</p>
CUSEP: Counterfactual Uniform Singapore Energy Price	<p>The USEP calculated by the market clearing engine assuming that there is no dispatchable energy bid from the load providers. The CUSEP could be interpreted as “the USEP if demand response was not activated.”</p>
EG: Embedded generator	<p>A company which principally generates and supplies electricity to serve its load facilities.</p>
Forced outage	<p>An unanticipated intentional or automatic removal from service of equipment or the temporary de-rating of, restriction of use or reduction in performance of equipment.</p>

Term	Description
Forecast demand	<p>Demand compiled from reports prepared by the PSO. The forecast demand excludes transmission losses, intertie flows and generation from exempted embedded generators.</p> <p>Forecast demand is important in ensuring the reliability of electricity supply, as market participants can anticipate the need for additional generation and adjust their generation accordingly.</p>
IGS: Intermittent generation source	<p>An electricity output which depends on environmental factors and weather conditions, e.g., solar and wind energy.</p> <p>While there are intermittent generation sources connected to the grid in Singapore, intermittent generation sources are not scheduled for dispatch by the PSO because such electricity output cannot be controlled or varied at will.</p>
LNG: Liquefied natural gas	<p>Primarily natural gas cooled and condensed into a liquid form. The cooling process shrinks the volume of the gas so that it is easier and safer to store and ship. When liquefied natural gas reaches its destination, it is converted back into gas at regasification plants, then piped to homes, businesses and industries where it is burnt for heat or to generate electricity.</p>
LVP: LNG vesting price	<p>The price calculated for LNG vesting quantity. The LNG vesting price depends on the LNG terminal tariff, the average gas pipeline transportation tariff applicable to regasified LNG users, the LNG aggregator's margin, the cost of lost and unaccounted for gas, the Brent Index Price, the spot exchange rate and any fee or charge imposed on the imported gas.</p>
LVQ: LNG vesting quantity	<p>The amount of vesting contract quantity provided by LNG. There will be no LNG vesting quantity once the LNG vesting contracts expire on 1 July 2023. The vesting contract regime will be completely phased out by then.</p>
MSSL: Market support services licensee	<p>A company which provides services such as bill settlement, meter reading, data management and customer transfer services for consumers who switch from one electricity retailer to another. SP Services Limited is the only MSSL in Singapore.</p>
MCE: Market clearing engine	<p>A linear programme maintained by the EMC, which considers various constraints in the system when producing forecasts. The constraints include offers submitted by generation companies, ramping rates of generation facilities, forecast demand at each node, reserve and regulation requirements, transmission system availability, losses, and constraints in relation to system security.</p>
MW: Megawatt	<p>A unit of electrical power which is equal to one million watts. Megawatt hour ("MWh") represents the number of MW produced or consumed in an hour.</p>



Term	Description
OCGT: Open cycle gas turbine	An open cycle gas turbine converts natural gas or other liquid fuels to mechanical energy which drives a generator to produce electricity.
PDS: Pre-dispatch schedule	The pre-dispatch schedule is issued every two hours and covers a time horizon of 12 to 36 hours after the period in which it is published.
Planned outage	The annual outage plan for overhaul, retrofitting or inspection and the short-term outage plan for urgent repair or maintenance of a generation facility.
PNS: Previous net shortfall	The settlement adjustment to account for a shortfall or surplus between the amount paid by the vesting contract consumers and the amount paid to the vesting contract generators in the previous quarter.
Primary reserve	<p>A facility offering primary reserve shall be capable of achieving its scheduled MW response automatically without further instruction from the PSO within 9 seconds of being triggered by any contingency event and shall be able to maintain that scheduled MW response until 10 minutes from the time it was triggered.</p> <p>With effect from 1 October 2017, the primary reserve and secondary reserve classes were combined into a new single primary reserve class.</p>
$r$	$r$ shows the degree of relationship between the WEP and the metered energy quantity.
$r^2$	$r^2$ represents the proportion of a change in the WEP which could be attributed to changes in the metered energy quantity.
Regulation	Regulation is the frequent adjustment to a generation facility's output to correct any power system frequency variation or imbalance between supply and demand in the system.
Reserve	Reserve is generation capacity or load reduction capacity which can be called upon to replace unavailable scheduled energy supply due to a forced outage or to supplement scheduled energy as a result of unexpected demand or other contingencies.
RTS: Real-time dispatch schedule	A schedule determined by the market clearing engine that contains the quantities of energy, reserve and regulation scheduled in respect of a registered facility.
ST: Steam turbine	A steam turbine converts steam energy to rotational energy which spins the turbine blades and stimulates an attached generator to produce electricity.

Term	Description
STS: Short-term schedule	A forecast schedule issued every half an hour (every dispatch period), covering the following six hours.
Supply cushion	Supply cushion indicates the level of capacity which was offered but not scheduled and could be called up if necessary.
USEP: Uniform Singapore Energy Price	The energy price paid by retailers and calculated as the weighted average of the nodal prices at all off-take nodes. Generation companies are paid for their generation based on nodal prices.
WEP: Wholesale electricity price	The net purchase price paid by retailers. The wholesale electricity price includes the USEP, all administrative costs and uplift charges incurred in the wholesale market – USEP, allocated regulation price, hourly energy uplift charge, monthly energy uplift charge, EMC fee and PSO fee.

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