

Market
Surveillance
and
Compliance
Panel
Singapore Wholesale
Electricity Market

**Report by
Market Surveillance and Compliance Panel**

January to March 2003

12 May 2003

This is an edited version of a report prepared for the Energy Market Company Pte Ltd and Energy Market Authority in accordance with the Singapore Electricity Market Rules. The report has been edited to protect confidential information.

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INTRODUCTION

The Singapore Electricity Market Rules (the “market rules”) provide for the Market Surveillance and Compliance Panel (“MSCP”) to prepare and submit to the Energy Market Company Pte Ltd (“EMC”) a report on the conduct of its monitoring and investigation activities. The report is to be provided by the EMC to the Energy Market Authority.

This is the first report by the MSCP on the Singapore wholesale electricity markets. It covers the first three months of market operation ie 1 January 2003 to 31 March 2003.

MARKET SURVEILLANCE AND COMPLIANCE PANEL

The MSCP is an independent body established under the market rules. Its members are appointed by the EMC Board.

The market rules provide for the MSCP to consist of persons each having sufficient relevant experience in one or more of the following areas:

- (a) the operation of competitive wholesale electricity markets;
- (b) Singapore laws and/or electricity regulations;
- (c) competition laws and policies;
- (d) power system operations; and/or
- (e) economics.

In making appointments to the MSCP, the EMC Board is to endeavour to appoint persons with the expertise necessary to ensure that the combined expertise of the members of the MSCP covers the areas specified above.

The role of the MSCP is to monitor and investigate activities in the wholesale electricity markets and the conduct of market participants, market support services licensees, the Power System Operator (“PSO”) and the EMC to:

- (a) identify breaches of the market rules, any market manual or system operation manual;
- (b) assess whether the underlying structure of the wholesale electricity markets is consistent with the efficient and fair operation of a competitive market; and
- (c) recommend remedial actions to mitigate the conduct and inefficiencies referred to above.

More specifically, the market rules provide that the MSCP is to monitor and investigate conduct or activities that provide indications of the following phenomena:

- (a) breaches of the market rules, a market manual or system operation manual;
- (b) actual or potential design or other flaws and inefficiencies in the market rules, market manuals, the system operation manual and other rules and procedures of the EMC or the PSO; and
- (c) actual or potential design or other flaws in the overall structure of the wholesale electricity markets.

The current members of the MSCP were identified just before the commencement of the Singapore wholesale electricity markets. Our term of office formally commenced upon market start on 1 January 2003.

The MSCP comprises the following persons:

- (a) Joseph Grimberg, Chair;
- (b) Lee Keh Sai;
- (c) Professor Lim Chin; and
- (d) TPB Menon.

Members of the MSCP are professionals with full-time responsibilities outside of the Singapore wholesale electricity markets. Since market start, we have been meeting on a monthly basis (and more frequently where necessary) to discharge our role in relation to the Singapore wholesale electricity markets.

MARKET ASSESSMENT UNIT

The MSCP is supported in its functions by the Market Assessment Unit ("MAU").

The market rules provide for the MAU to be established by the EMC and composed of full-time EMC staff. The MAU team was established a few months before market start. The MAU reports to and is under the management and administration of the EMC. The MAU also reports to and takes direction from the Chair of the MSCP on all matters pertaining to market monitoring and investigation.

ASSESSMENT

The market rules provide that once annually, the report of the MSCP is to contain the MSCP's general assessment as to the state of competition and compliance within, and the efficiency of, the wholesale electricity markets. As we have covered only a period of three months, it would not be meaningful to draw conclusions at this early stage. We therefore propose in this report to set out the areas that the MSCP and MAU have covered during this period in terms of monitoring activities and also provide statistics in relation to investigative activities.

MARKET MONITORING

Catalogue of Data and Catalogue of Monitoring Indices

To effectively carry out monitoring, the market rules provide for the MAU, under the supervision and direction of the MSCP, to develop a catalogue of the data it will acquire and a catalogue of the monitoring indices that it will use to evaluate the data so acquired.

The catalogue of data was considered at the first MSCP meeting on 30 January 2003. At its second meeting on 27 February 2003, the MSCP approved a proposed catalogue of data for public consultation. The proposed catalogue of data was introduced to market participants and service providers at a Data Catalogue Consultation Forum conducted by the MAU on 7 March

2003. A consultation paper was published on the EMC website on 10 March 2003 to seek public comments on the proposed catalogue.

We have received comments from a number of market participants and service providers. These comments were considered at the third MSCP meeting on 27 March 2003 with decisions to take follow up action on several areas. Each comment is receiving careful attention. Where relevant, these comments are also evaluated against our monitoring objectives. We propose to report to the market on the outcome of our evaluation at an appropriate time.

At the first MSCP meeting on 30 January 2003, the MSCP also considered a draft of the catalogue of monitoring indices. The monitoring indices will require a longer period of testing with market data to understand the correlation between the different data and to determine the appropriateness of the indices proposed. The MSCP and MAU are also undergoing a learning curve upon market start, with regards to how much data can reasonably and usefully be extracted, managed and analysed. Adjustments may need to be made to the draft catalogue of monitoring indices after a period of observation. We will be liaising with the market on the catalogue of monitoring indices in due course.

Summary of MAU Routine Monitoring Reports

Since market start, the MAU has been submitting regular monitoring updates to the MSCP. The monitoring updates have been prepared based on the monitoring of certain indicators of market performance. We are evaluating these indicators to assess their usefulness for inclusion in the catalogue of indices. The indicators can at present be broadly classified into supply, demand and price indices. The commentary and charts below do not take into account rerun data which was not available as at 16 April 2003.

1. Supply Indices

1.1 Capacity ratio of generation registered facilities ie ratio of scheduled generation output to maximum generation capacity of generation registered facilities

This index measures the level to which a generation registered facility is scheduled to provide energy, reserve and regulation as compared to its maximum generation capacity. The scheduled generation output is the total amount of energy, reserve and regulation which the market clearing engine ("MCE") schedules a generation registered facility to provide. The maximum generation capacity is the maximum amount of generation output that a generation registered facility can provide at any time, as registered with the EMC.

The capacity ratio assesses the extent to which a generation registered facility is successful in being selected by the MCE.

Chart 1.1 illustrates the capacity ratio for each facility type ie combined cycle facilities (“CCP”), steam turbine facilities (“ST”) and other facilities (“OT”) for the period January to March 2003. The ratios were computed taking into account the total scheduled generation output and total maximum generation capacity of each type of facility for each month.

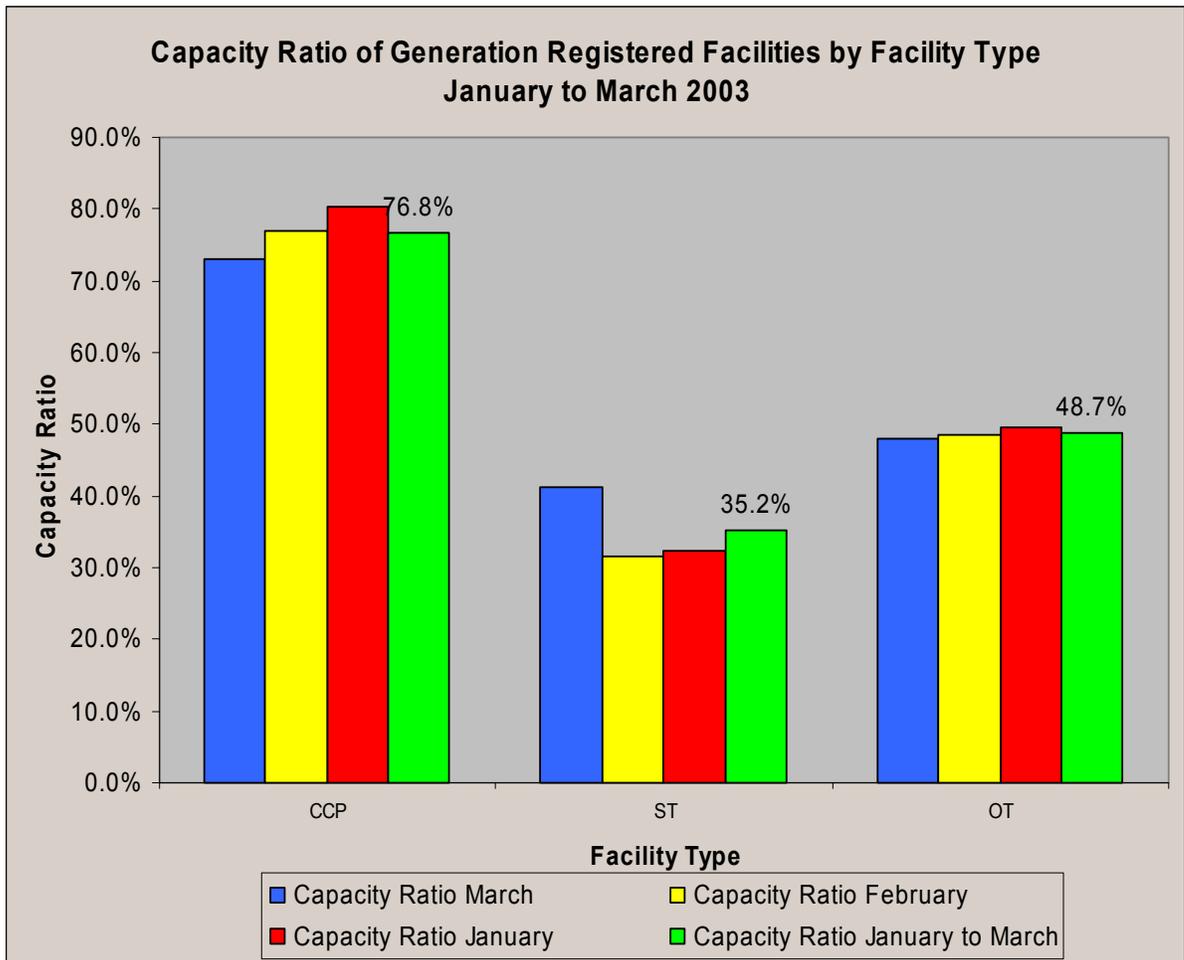


Chart 1.1

For the period January to March 2003, the capacity ratios of combined cycle, steam turbine, and other facilities (mostly incineration plants), were 76.8%, 35.2% and 48.7% respectively. Combined cycle facilities have higher capacity ratios because they are more efficient and are able to generate electricity at lower production costs. It is a positive sign that the market dispatches more energy from the more efficient facilities.

1.2 Supply cushion: Ratio between (a) supply and demand gap (difference between total offered volume and system demand) and (b) supply

This index measures supply adequacy. It indicates the level of unused capacity that was offered but not scheduled and could be called up if required. The total offered volume refers to the total amount of a type of product (ie energy, reserve or regulation) offered by all generation registered facilities. System demand refers to the demand forecast by the PSO for each type of product.

As energy is the main product in the wholesale electricity markets, we elaborate further on the energy supply cushion.

Chart 1.2.1 is a scatter diagram showing the relationship between the Uniform Singapore Energy Price ("USEP") and energy supply cushion for the period January to March 2003.

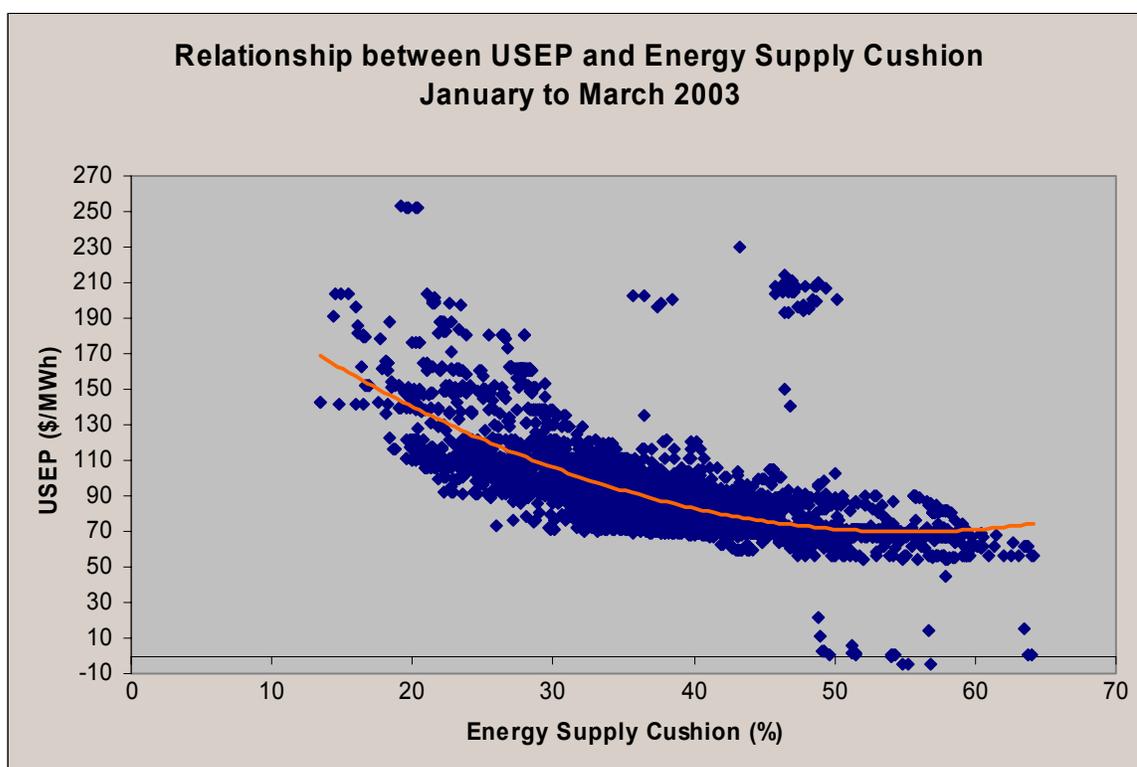


Chart 1.2.1

The trend line of Chart 1.2.1 shows an inverse relationship between the USEP and the energy supply cushion. As the energy supply cushion increases, the USEP decreases. This is consistent with competitive market predictions.

Chart 1.2.2 is a scatter diagram showing the relationship between the energy supply cushion and system demand for the period January to March 2003.

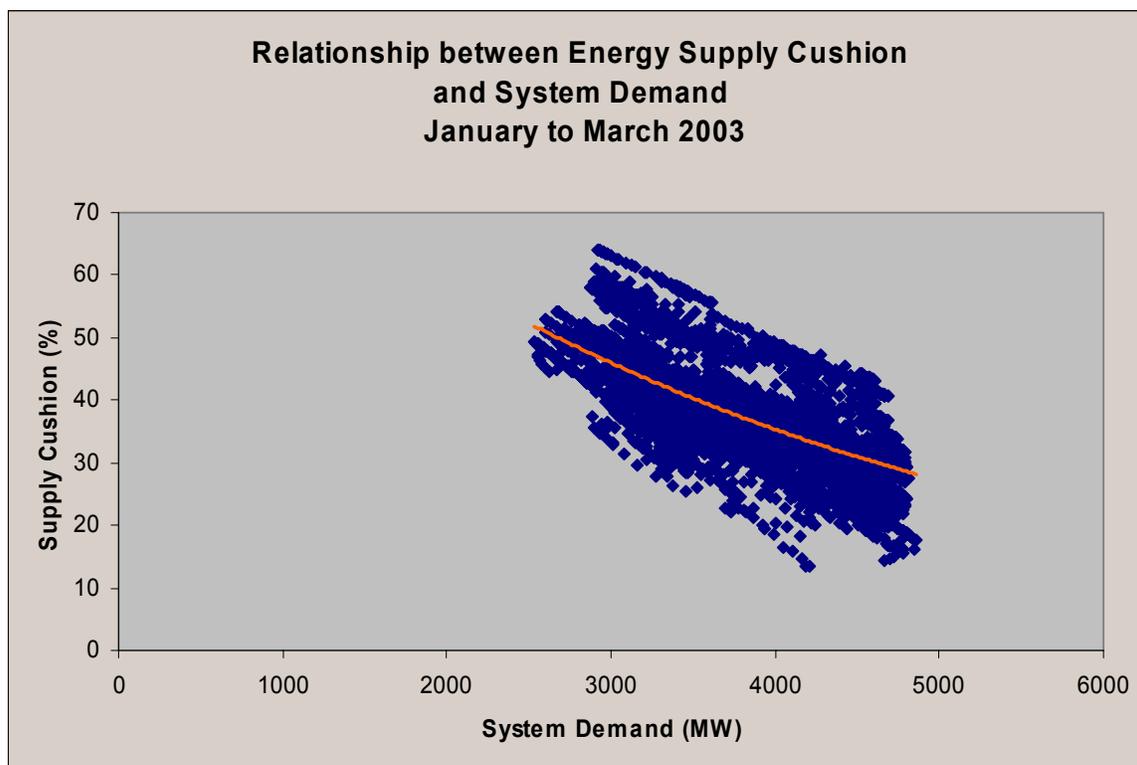


Chart 1.2.2

The inverse relationship between supply cushion and system demand is self-evident from the formula for the energy supply cushion.

1.3 Market share

Over the period January to March 2003, we have compared the market share by actual metered energy quantity with the market share by maximum generation capacity,
(a) by generation licensee; and
(b) by generation registered facility.

We have observed that the market share of actual metered energy quantity is close to the market share of the generating capacity of each generation licensee but not that of each generation registered facility. This is not surprising since a generation licensee that owns more than one generation registered facility should be more concerned about its overall market share and less concerned about how its overall output is distributed among its generation registered facilities.

1.4 Outage

Outages can be divided into two groups, planned outage (annual overhaul and short term planned outage) and forced outage. Planned outage is approved by the PSO to ensure that the outage does not impact on system security. Forced outages cannot be anticipated. The frequency of forced outage indicates the reliability of a generation registered facility. Generation outage can have significant impact on prices. During periods of high demand, forced outage may contribute to high energy or ancillary service prices.

Chart 1.4.1 summarises the total capacity on planned outage by generation licensee for the period January to March 2003.

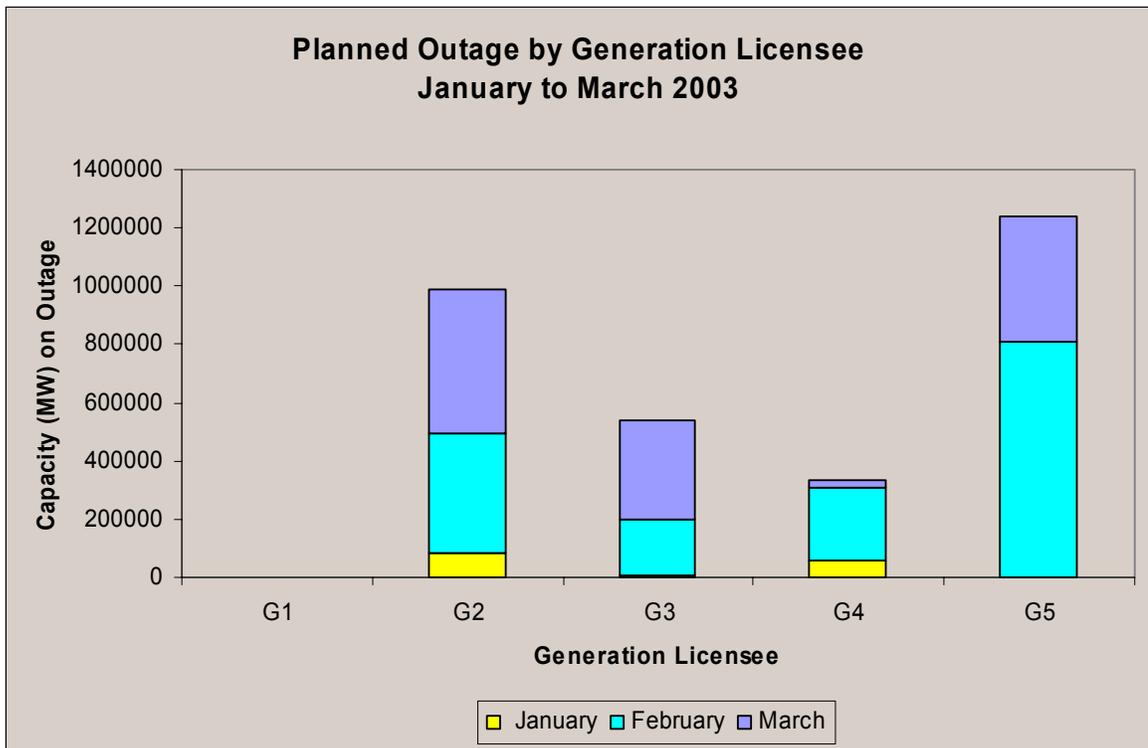


Chart 1.4.1

Chart 1.4.2 summarises the total capacity on forced outage by generation licensee for the period January to March 2003. Partial trips were not counted for this chart. As there is at present no readily available data as to when a forced outage ends, we have prepared this chart by tracking the duration from commencement of a forced outage to when a generation registered facility under forced outage is next scheduled by the MCE.

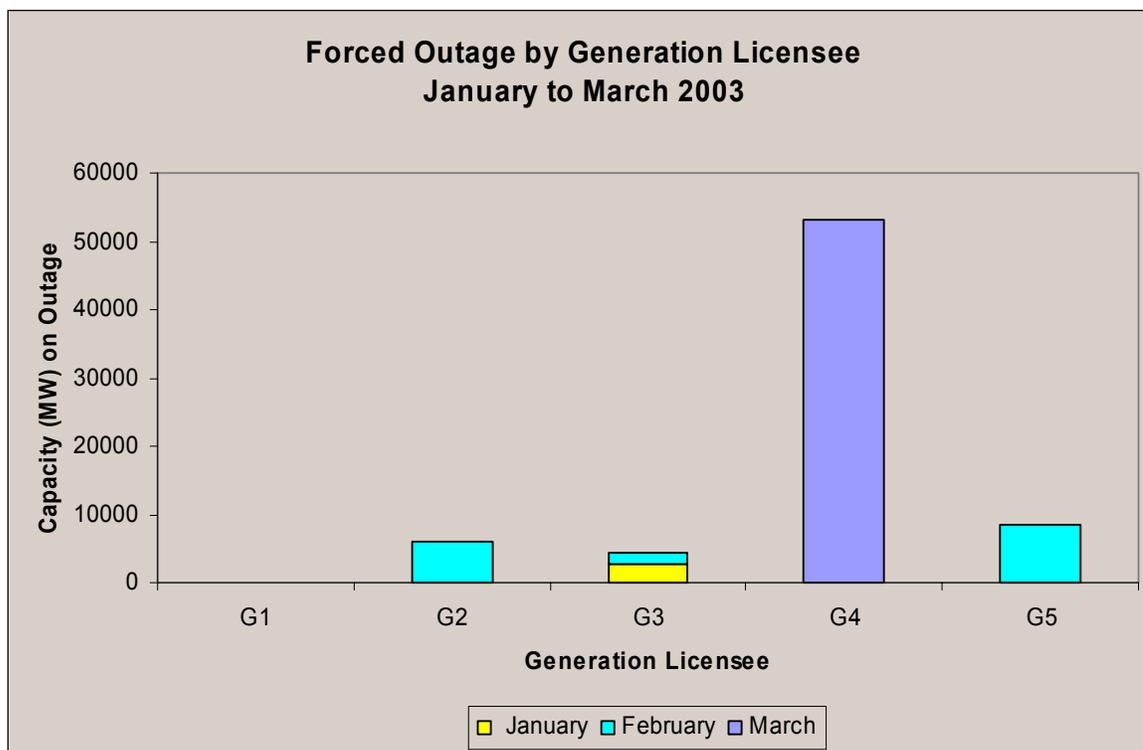


Chart 1.4.2

The capacity on planned outage in February and March increased significantly compared to January 2003. The capacity on forced outage also progressively increased from January to March 2003.

3 forced outages occurred during peak periods (i.e. weekday periods 19 to 36) at the following times:

- 25 February 2003 at 10:52 hrs (period 22)
- 28 February 2003 at 15:23 hrs (period 31)
- 27 March 2003 at 13:10 hrs (period 27)

The impact of the above forced outages on the USEP was as follows:

25 February 2003 at 10:52 (period 22)

The USEP for periods 21 to 24 reached \$148.70, \$148.69/MWh, \$148.70/MWh and \$253.63/MWh respectively, while the average peak period USEP for the day was \$126.74/MWh. The USEP dropped to \$116.37/MWh in period 25 and no subsequent volatility was observed thereafter.

28 February 2003 at 15:23 (period 31)

The USEP for periods 31 to 33 reached \$147.83/MWh, \$147.84/MWh and \$146.61/MWh respectively, while the average peak period USEP for the day was \$125.84/MWh. The USEP dropped to \$116.4/MWh in period 34 and no subsequent volatility was observed thereafter.

27 March 2003 at 13:10 (period 27)

The USEP for periods 27 to 32 reached \$110.06/MWh, \$138.69/MWh, \$138.69/MWh, \$150.51/MWh, \$138.71/MWh and \$129.4/MWh respectively, while the average peak period USEP price for the day was \$115/MWh. The USEP dropped to \$119.39/MWh in period 33 and no subsequent volatility was observed thereafter.

Forced outage leading to high prices will continue to be an area of focus for monitoring.

2. Demand Indices

2.1 Comparison of latest available pre-dispatch load forecast with real-time load forecast

The accuracy of the load forecast used in generating the pre-dispatch schedule is important in producing an accurate pre-dispatch schedule which enables market participants to respond appropriately in the real-time. Comparison of the pre-dispatch and real-time load forecasts indicates the degree of accuracy of the pre-dispatch load forecast.

Chart 2.1 shows a comparison of the latest available pre-dispatch load forecast (medium scenario) and real-time load forecast for energy and reserve (primary, secondary and reserve classes) for the period January to March 2003.

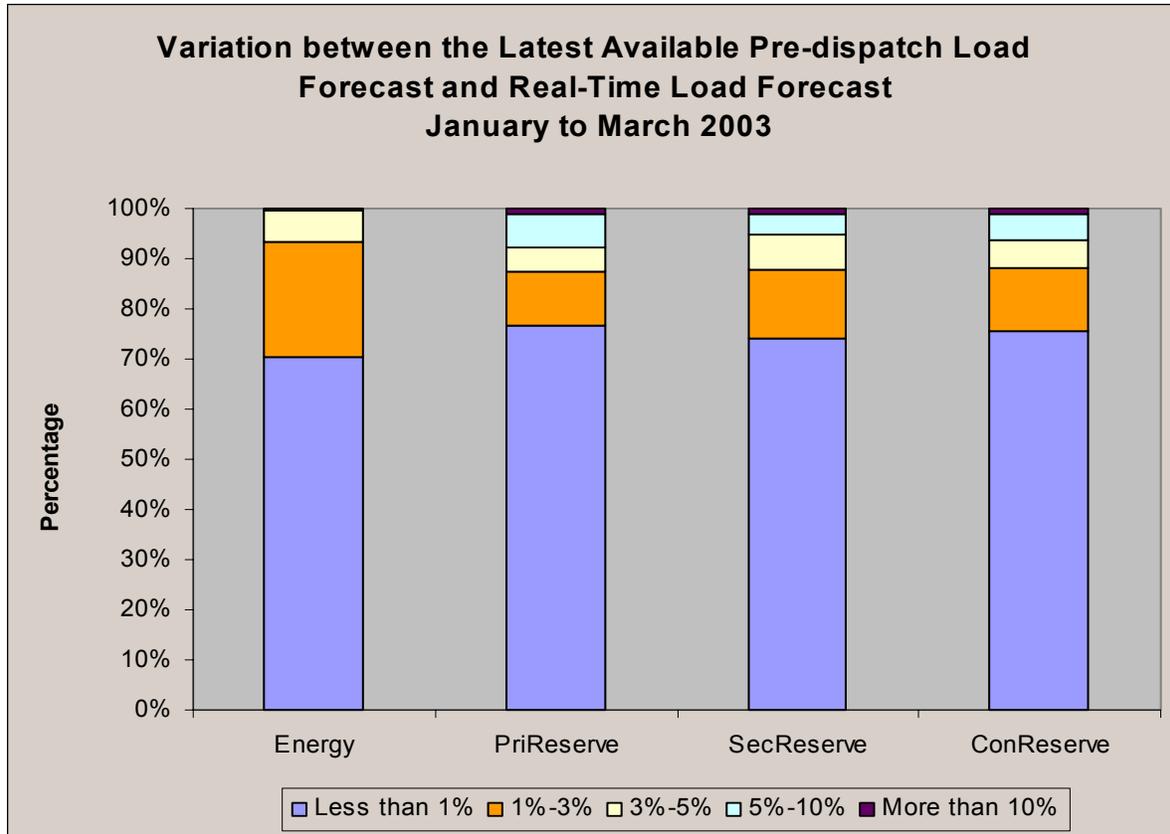


Chart 2.1

Chart 2.1 shows that 99.5% of the time, there is less than 5% variance between the latest available pre-dispatch load forecast and the real-time load forecast for energy. It also shows that about 99% of the time, there is less than 10% variance between the latest available pre-dispatch load forecast and the real-time load forecast for reserve. This indicates that the pre-dispatch load forecast is generally a very accurate prediction of the real-time load forecast.

2.2 Comparison of real-time load forecast with metered energy quantity

The accuracy of the load forecast used in generating real-time dispatch and pricing schedules is important as it affects pricing outcomes and system security in the real-time. Comparison of the real-time load forecast and metered energy quantity indicates how closely the load forecast used by the MCE in generating the real-time dispatch schedule matches the actual metered energy quantity.

Chart 2.2 shows the daily variation between the real-time load forecast and the metered energy quantity for the period January to March 2003.

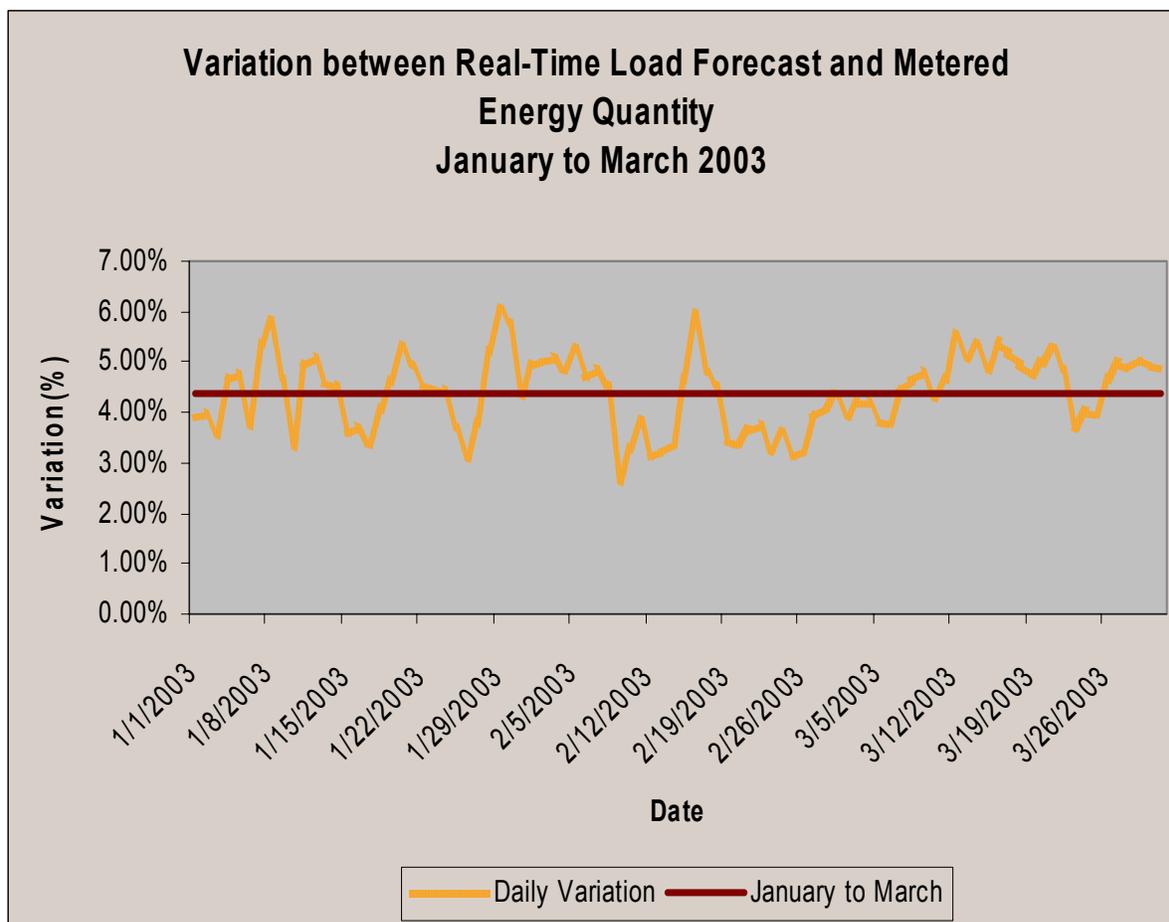


Chart 2.2

The daily variation for the period January to March 2003 ranged from 2.6%-6%. The variation between the total energy quantity derived from the real-time load forecast and the total metered energy quantity over January to March 2003 was 4.4%. Therefore the real-time load forecast quite closely reflects actual energy demand.

3. Price Indices

3.1 Wholesale Electricity Price

The Wholesale Electricity Price (“WEP”) is the price that retailers pay for energy in \$/MWh. The USEP makes up the bulk of the figure. The rest of the components are the Allocated Regulation Price (“AFP”), Hourly Energy Uplift Charge (“HEUC”), Monthly Energy Uplift Charge (“MEUC”), EMC administrative fees and PSO administrative fees.

Table 3.1.1 shows the daily volume-weighted average WEP which ranges from \$69.40/MWh to \$133.80/MWh. The price movement shows an increasing trend from market start to 19 March 2003 and a decreasing trend thereafter till the end of March 2003.

3.1.1 Correlation between WEP and metered system demand

Chart 3.1.1 also illustrates the movements of the daily volume-weighted average WEP and the total metered withdrawal quantity of energy for the period January to March 2003.

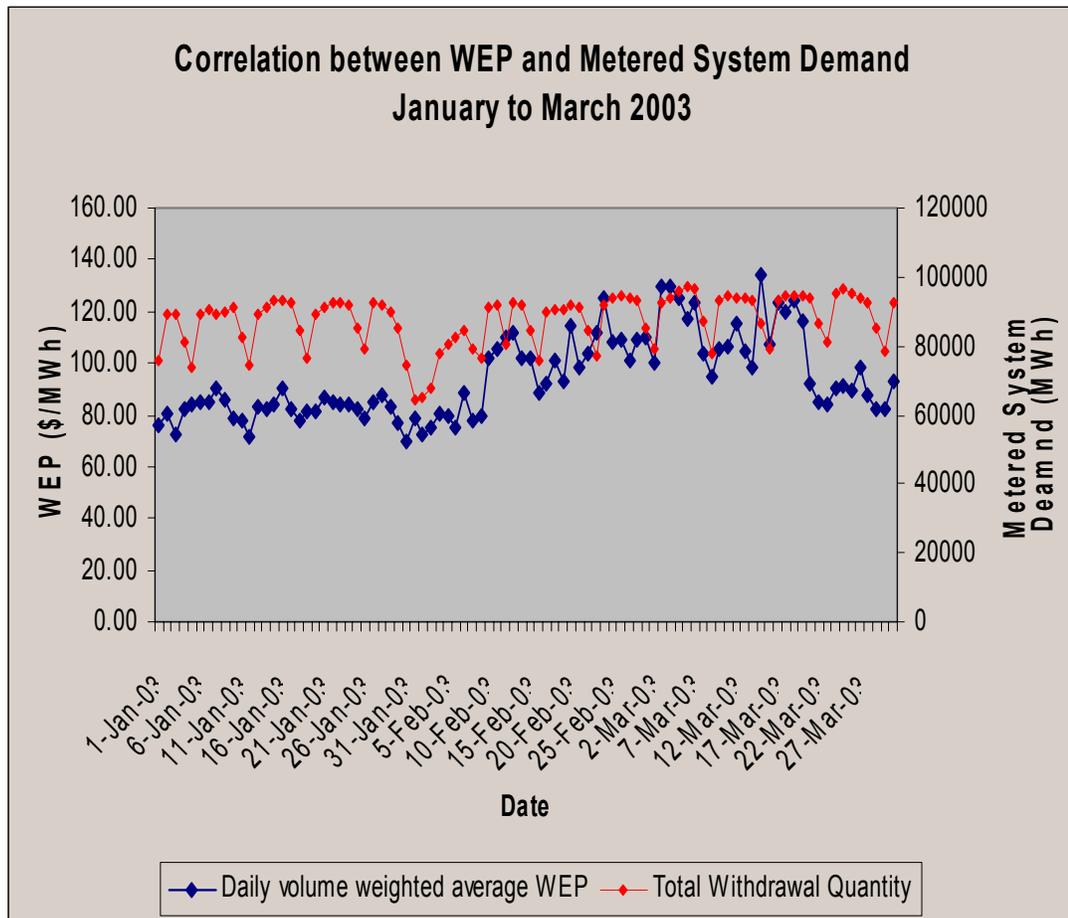


Chart 3.1.1

There is suggestion of correlation between WEP and system demand, indicating a responsiveness of prices to changes in system demand.

Chart 3.1.1 also shows that the demand for energy in Singapore stays quite stable from week to week. Differences between demand on a “week-day” (peak period) and “week-end” (off-peak period) are clearly shown. Furthermore, off-peak demand during “public holidays” such as Chinese New Year in early February is also evident.

3.1.2 Frequency distribution of WEP according to (a) number of hours of occurrence and (b) quantity of energy affected

Charts 3.1.2.1 and 3.1.2.2 illustrate the frequency distribution of WEP according to (a) percentage of hours, and (b) percentage of quantity of energy affected.

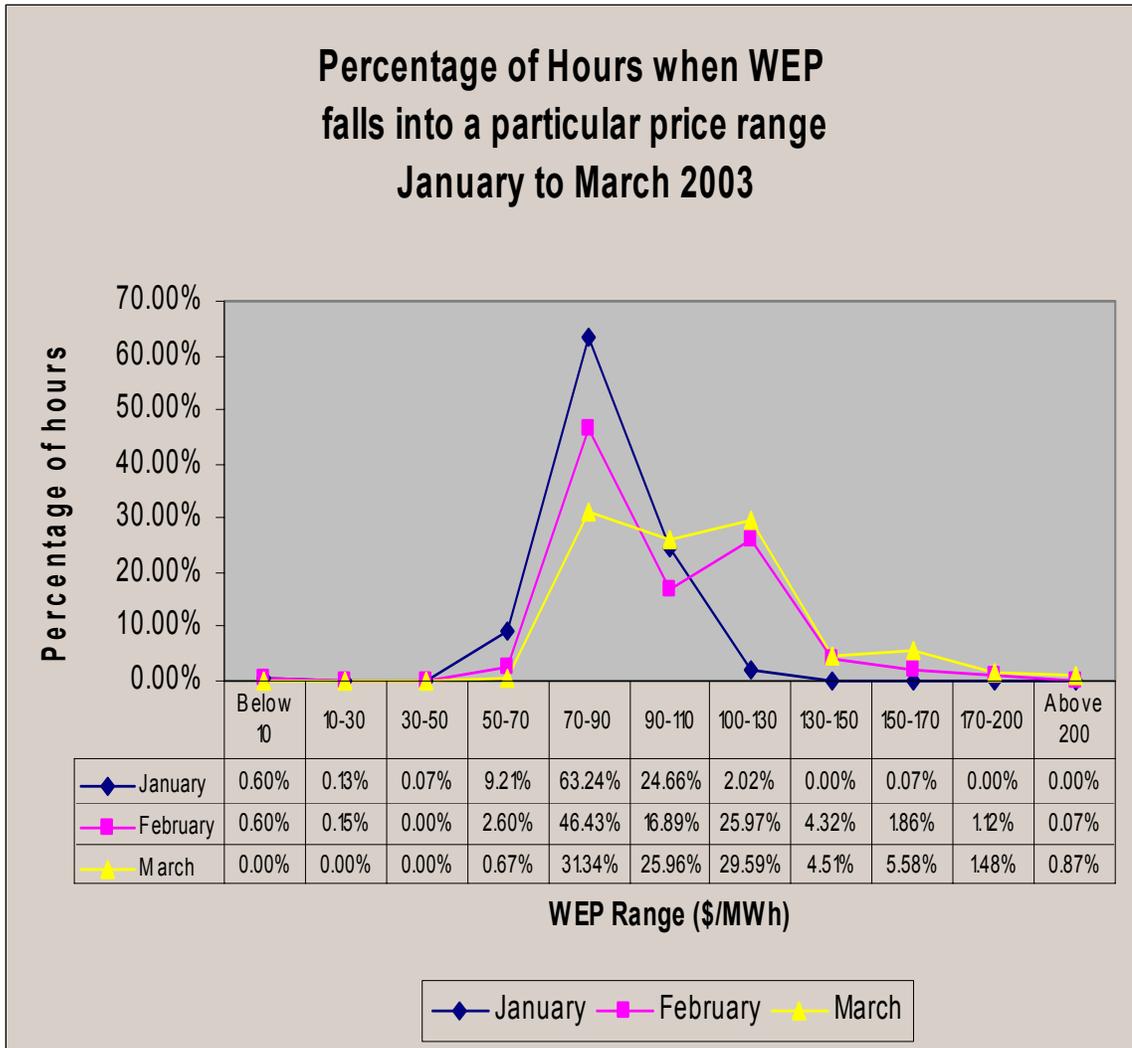


Chart 3.1.2.1

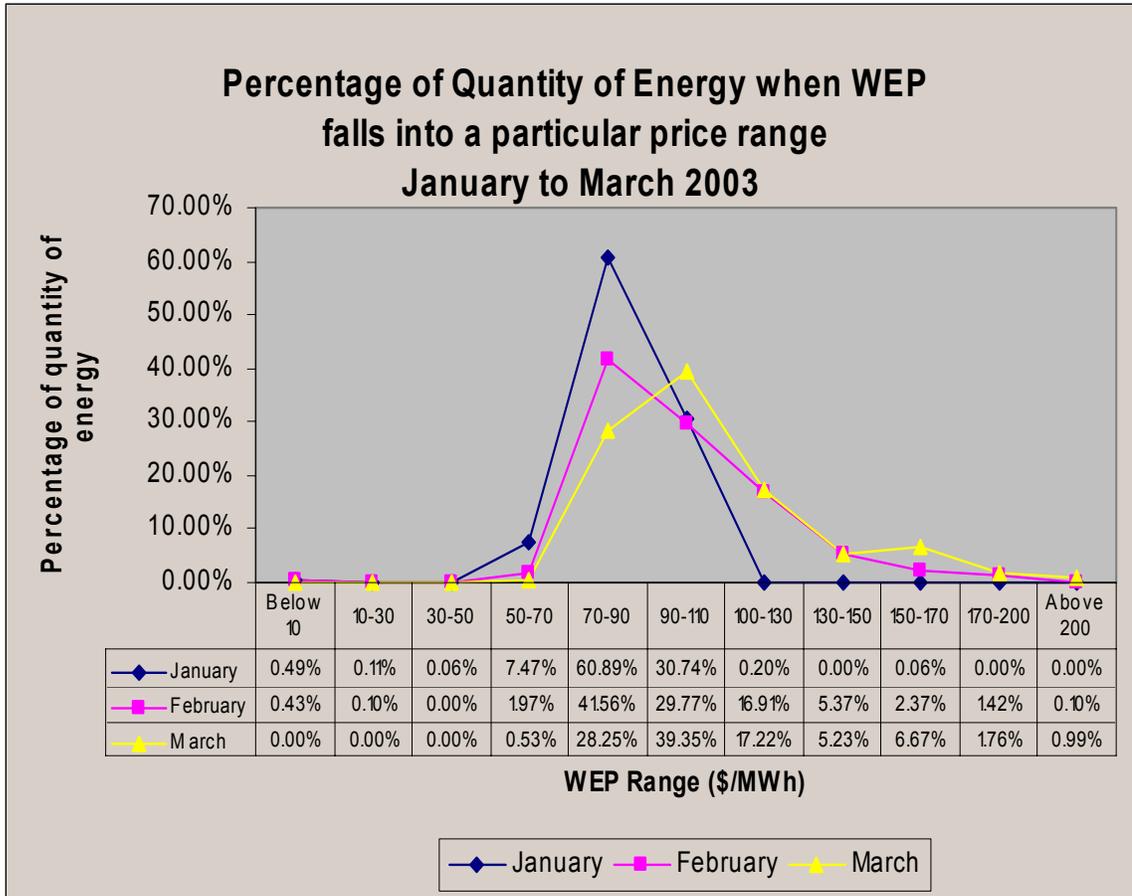


Chart 3.1.2.2

Both charts illustrate a slight rightward shifting of the frequency distribution of WEP, indicating a slight increase of average WEP from January to March. This could be due to the increasing amount of capacity on outage from January to March that is discussed in section 1.4.

3.1.3 Periods with WEP above \$200/MWh

Over the period of January to March 2003, there were 14 periods where the WEP exceeded \$200/MWh. It occurred on 25 February 2003 for period 24, 3 March for periods 23, 24, 28, 29 & 33, and 15 March 2003 for periods 19 to 26 respectively.

On 25 February 2003 in period 24 (starting from 11:30 hrs), the WEP reached \$255.53/MWh, which is the third highest WEP since market start. A forced outage of a generation registered facility had occurred at 10:52 hrs. On this day, 3 other generation registered facilities were on annual overhaul and another 3 others were on short-term planned outage. The forced outage combined with the planned outages resulted in a low energy supply cushion of 19.2% during period 24. The WEP dropped in the subsequent period to \$118.1/MWh as other generation registered facilities offered more supply. The energy supply cushion in the next period increased to 23.6%.

On 3 March 2003, the WEP for periods 23, 24, 28, 29 and 33 reached \$205.68/MWh, \$202.62/MWh, \$205.08/MWh, \$205.27/MWh and \$204.97/MWh respectively. The system demand for those periods was 4664 MW, 4633 MW, 4704 MW, 4720 MW and 4784 MW respectively, which exceeded the weekday average peak period system demand for the period January to March 2003 of 4484 MW. During these periods, 3 generation registered facilities were on planned outage. The corresponding energy supply cushion for these periods was 21%, 21.5%, 14.6%, 14.9% and 15.5% respectively, which are much lower than the weekday average peak period energy supply cushion of 31.6% for the period January to March 2003. In the meantime, another 4 generation registered facilities with total maximum generation capacity of 976 MW were not scheduled to generate as 3 of them had offered 0 quantities for all the relevant periods, and one of them had offered all its capacity at the high price of \$4500/MWh for periods 23 and 24 and 0 quantities for periods 28, 29 and 33.

On 15 March 2003, the WEP for periods 19 to 26 reached \$200.37/MWh, \$201.82/MWh, \$254.42/MWh, \$255.57/MWh, \$255.81/MWh, \$254.49/MWh, \$201.52/MWh and \$200.86/MWh respectively, which include the highest WEP of \$255.81/MWh for the period January to March 2003. Although system demand for the corresponding periods ranged between 4236 MW to 4438 MW, which was slightly lower than the weekday average peak period system demand for the period January to March 2003 of 4484MW, the energy supply cushion ranged from 19.6% to 23.4%, which was much lower than the weekday average peak period energy supply cushion for the period January to March of 31.6%. On this day, 2 generation registered facilities were on planned outage during the relevant periods. Another 8 generation registered facilities with total maximum generation capacity of 2310 MW were not scheduled to generate as 6 of them had offered 0 quantities and 2 of them had offered all their capacity at \$4500/MWh for the relevant periods.

3.1.4 Correlation between WEP and fuel price

This index measures price responsiveness to fuel cost, which makes up the major part of the variable cost of energy. In Singapore, the main sources of fuel for electricity generation are fuel oil and natural gas. As the crude oil price is readily available, the published Brent crude oil price has been used as a proxy for the purpose of studying the correlation between the WEP and the price of fuel oil. The correlation between the WEP and the price of natural gas is also studied. The fuel prices are obtained from the International Petroleum Exchange ("IPE").

Chart 3.1.4.1 shows the trend lines indicating the relationship between the daily volume-weighted average WEP and daily Brent crude oil price for the period January to March 2003.

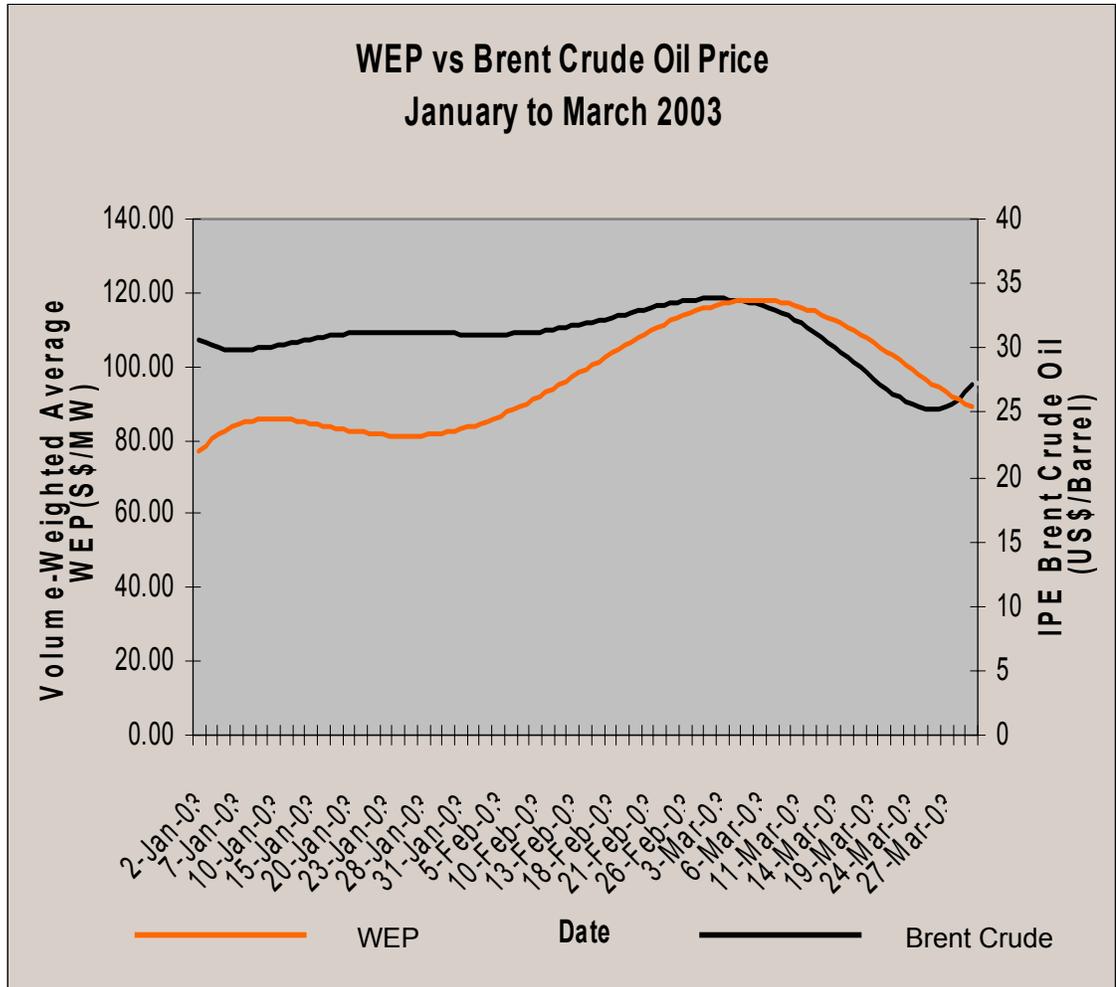


Chart 3.1.4.1

Chart 3.1.4.1 shows the WEP price trend closely follows the Brent Crude Oil price trend.

Chart 3.1.4.2 shows the trend lines indicating the relationship between the daily volume-weighted average WEP and daily natural gas price for the period January to March 2003.

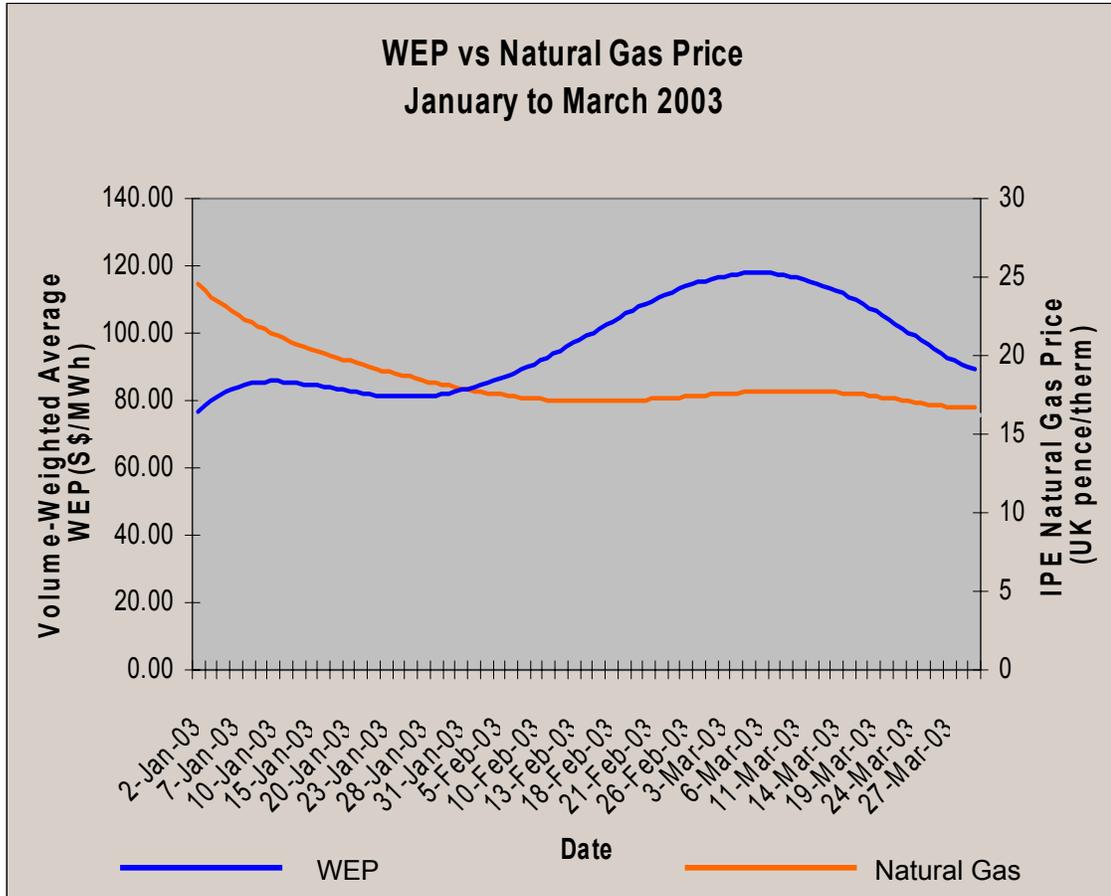


Chart 3.1.4.2

Chart 3.1.4.2 does not show a close correlation between the WEP and the price of natural gas, especially during the month of January 2003. We will continue to monitor this area.

3.2 USEP and ancillary prices

The wholesale electricity markets also include real-time markets for ancillary services (ie reserve and regulation). Reserve means generation capacity that can be called upon to replace scheduled energy supply that is unavailable as a result of a forced outage or to augment scheduled energy as a result of unexpected demand or outages. It is divided into three classes: primary reserve, secondary reserve and contingency reserve. Regulation enables the output for a generating unit to be frequently adjusted so that any power system frequency variations or imbalance between load and output from the generating facilities can be corrected.

Chart 3.2 summarises the volume-weighted average USEP and ancillary service prices for the period January to March 2003.

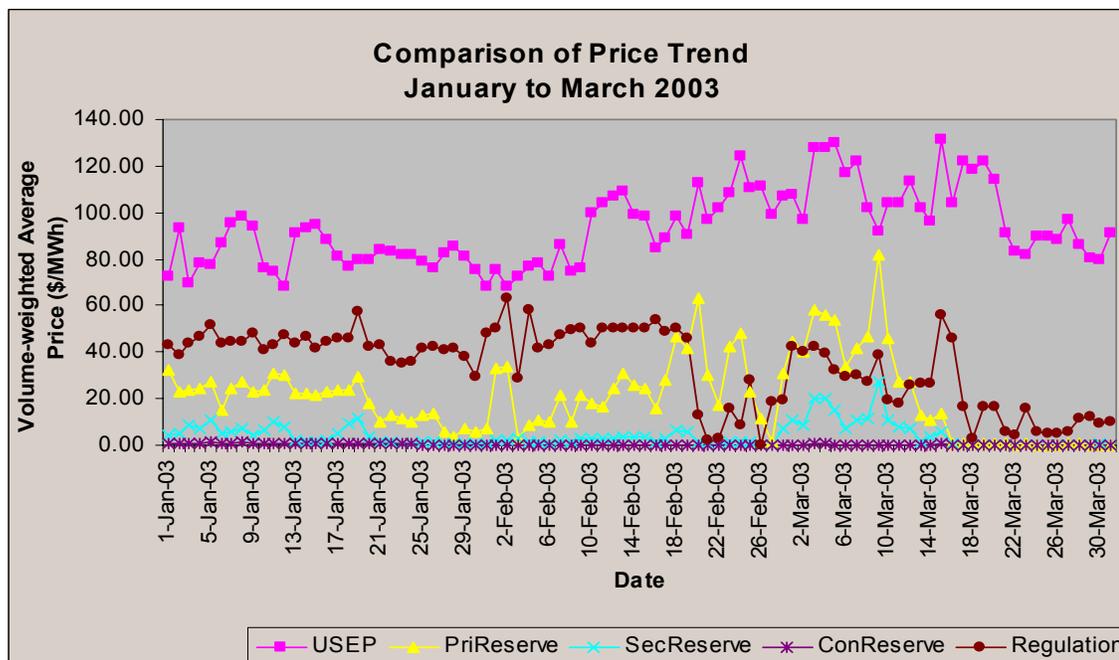


Chart 3.2

The USEP movement for the period January to March 2003 shows an increasing trend from market start to 19 March 2003 and a decreasing trend thereafter till the end of March 2003. The movement of the regulation price has generally been in the opposite direction compared to that of the USEP.

The primary and secondary reserve prices for the period January to March 2003 were quite volatile from market start to 15 March 2003. From mid to end March, the prices of all 3 classes of reserve were reduced to close to \$0/MWh.

A longer period of observation will be necessary to ascertain if any meaningful conclusions can be drawn.

Monitoring Issues

Some issues which were observed in the early days of the market are as follows:

1. High MNN prices for multi-unit combined cycle plant

In January and early February 2003, there were a number of incidents where constraint violation penalties gave rise to high MNN prices (\$4500/MWh) for multi-unit combined cycle plant (“CCP”) generation registered facilities when they offered 0 MW. The Market Network Node (“MNN”) prices for other generation registered facilities were significantly lower. The problem arose from the way multi-unit CCPs were represented in the market clearing engine (MCE) according to the market rules. However, no payment had been made in respect of the relevant multi-unit CCPs as they had offered 0 MW and were thus not scheduled to generate. The EMC had moved an urgent rule modification to correct this flaw in the market rules. The modified market rule came into effect on 5 February 2003 and the MCE was modified. Such incidents were not observed after 5 February 2003.

2. High USEP due to network status file error

A few occurrences of high USEP were observed on 31 January 2003 for period 23, on 25 February 2003 for periods 47 and 48, on 26 February 2003 for periods 1 and 2, on 5 March 2003 for period 24 and on 6 March 2003 for period 21 due to the MCE capturing incorrect network status data transmitted by the PSO. The EMC has since modified the network status file to reflect the correct value of the network status data and rerun the MCE to revise the USEPs for settlement purposes. The re-runs produced corrected USEPs which were lower. The EMC is currently putting in place a validation process to check the accuracy of network status data to ensure that correct data is used in each run.

3. Settlement of reserve and regulation for generation registered facilities under forced outage

Under the current market rules, reserve and regulation payments are determined based on scheduled quantities. In the event of an outage, generation licensees are still paid as if the relevant facility is a normal operating facility. This matter was brought up by some market participants following occurrences of forced outage during the period of January to March 2003. We understand that the EMC is currently reviewing this situation.

INVESTIGATIONS

Delegation to the MAU

Before market start, in our capacity as MSCP designates, we issued a statement on 30 December 2002 to inform the market that the MAU is the contact point for communications between market players and the MSCP. The MSCP will delegate to the MAU the authority to carry out on a day-to-day basis some specific functions prescribed by the market rules to be carried out by the MSCP. Most of these functions relate to investigations. The MSCP will have oversight of the activities of the MAU. All delegation of authority to the MAU will be accompanied by a level of accountability on the part of the MAU to the MSCP.

MSCP Enforcement Policy

On 30 December 2002, we also issued a statement regarding the enforcement policy the MSCP would adopt during the three months immediately after market start.

Recognising that all parties affected by the market rules would be operating under the new rules for the first time and that the exercise of tolerance by the MSCP with regards to the imposition of sanctions would encourage greater involvement in the market and better communication with the MAU and MSCP, we decided that when considering a potential rule breach during the first three months, we would:

- (a) treat each case on its merits;
- (b) factor into consideration that all parties would be going through a learning curve; and
- (c) take whatever action the rules permit if breaches of the market rules have occurred in circumstances where the party under consideration has acted unreasonably or has not made a reasonable attempt to comply with the rules.

Investigation Activities

The MAU has been submitting monthly investigation updates to the MSCP. From January to March 2003, the MSCP received complaints or referrals (including self-reports) in respect of 20 incidents. Of these 20 complaints or referrals, the MSCP has commenced investigations into 18. The MSCP has on its own initiative also commenced investigations into 2 other incidents. Of the 22 cases, there are:

- 3 cases which were closed on the basis that further investigations were not necessary;
- 1 case where a determination of breach was made;
- 10 cases where investigations have been completed and are awaiting final written representations, if any, prior to making determinations;
- 7 cases where investigations are in progress; and
- 1 case which is being assessed as to whether an investigation should be commenced.

The EMC also reported to the MSCP 2,578 incidents of offer variations or revisions to standing offers made 4 hours prior to relevant dispatch periods which had occurred during the period January to March 2003. The MAU has been working closely with the EMC to amplify the reports so as to provide necessary data that would facilitate investigations. Reports with the necessary data were received by end April 2003. Some market participants have been furnishing self-reports regarding such incidents to the MAU. The MAU has also been in contact with relevant market participants where high incidents of such offer variations have been observed. Investigations into such offer variations are underway.

SECTIONS 50 AND 51 OF THE ELECTRICITY ACT

Information Requirements to Assist the Authority

The market rules provide for the MAU, under the supervision and direction of the MSCP, to develop a set of information requirements to assist the Energy Market Authority to fulfill its obligations with respect to competition and abuse of a dominant position under sections 50 and 51 of the Electricity Act. The information requirements are to be made available for publication within 3 calendar months of market start.

At the first MSCP meeting on 30 January 2003, the MSCP considered a draft of the information requirements. The information requirements were subsequently finalized in consultation with the Energy Market Authority and made available to the EMC for publication on 27 March 2003. The information requirements were published on 31 March 2003.

Reports to the Authority

The market rules also provide for the MSCP to include in our report a summary of reports that have been made to the Energy Market Authority regarding any complaint that may have been received or any information that may have been uncovered that may indicate the possibility of anti-competitive agreements or the abuse of a dominant position contrary to sections 50 or 51 of the Electricity Act.

In the course of monitoring and investigative activities carried out from January to March 2003, the MSCP and MAU did not receive any such complaint or uncover any such information.

CONCLUSION

The first three months of market operation have been a learning experience for the MSCP and the MAU, and it is considered that, in all the circumstances, both have functioned creditably and in accordance with the relevant legislation, and underlying market rules. At any rate, we have received no indications to the contrary.



**Lim Chin
Panel Member
on behalf of
Chair, Market Surveillance and Compliance Panel**