National Electricity Market of Singapore

Report by Market Surveillance and Compliance Panel

April 2004 to March 2005

11 July 2005

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

CONTENTS

GLOSSARY

A

AFP - Allocated Regulation Price

C

CCGT - combined cycle gas turbine

E

EMA - Energy Market Authority
EMC - Energy Market Company Pte Ltd
ESRC - Energy System Review Committee

H

HEUC - Hourly Energy Uplift Charge
HHI - Hirfindahl-Hirshman Index

L

LRMC - long run marginal cost

M

market rules - Singapore Electricity Market Rules
MAU - Market Assessment Unit
MEUC - Monthly Energy Uplift Charge
MSCP - Market Surveillance and Compliance Panel
MSSL - Market Support Services Licensee

N

NEA – National Environment Agency
NEMS - National Electricity Market of Singapore

O

OCGT - open cycle gas turbine
OT - other facilities

P

PDS - Pre-dispatch Schedules
PowerSeraya - PowerSeraya Ltd
PSO - Power System Operator

S

Sembcorp Cogen - Sembcorp Cogen Pte Ltd
Senoko Power - Senoko Power Ltd
SRMC - short run marginal cost
ST - steam turbine
STS - Short-term Schedules

T

Tuas Power - Tuas Power Ltd

U

USEP - Uniform Singapore Energy Price

W

WEP - Wholesale Electricity Price

EXECUTIVE SUMMARY

The market rules provide for the MSCP to prepare and submit a report on the conduct of its monitoring and investigation activities to the EMC annually. The report is to be provided by the EMC to the EMA.

This is the third report by the MSCP on the wholesale electricity markets of NEMS. It mainly covers the period 1 April 2004 to 31 March 2005.

The market rules require the report to include:

- A summary of routine reports on the conduct of the MSCP's monitoring and investigation activities;
- A summary of any reports regarding the possibility of anti-competitive agreements or the abuse of a dominant position contrary to sections 50 or 51 of the Electricity Act;
- A summary of all complaints or referrals filed and investigations commenced;
- A summary of any investigations conducted by the MSCP in respect of offer variations after gate closure reported by the EMC;
- The MSCP's general assessment as to the state of competition and compliance within, and the efficiency of, the wholesale electricity markets.

In assessing the state of efficiency of the wholesale electricity markets, the MSCP considered:

- The degree of market competitiveness;
- Whether the markets function properly; and
- Whether prices eventually converge to marginal costs.

Noting that the wholesale electricity markets remain concentrated, the MSCP comments that efficiency in such a market is not automatically assured and some discipline from the outside by a market regulator is necessary. The MSCP observes that the vesting contracts imposed in January 2004 are more market friendly compared to the effective price cap imposed on the whole market in 2003. The question of how much of the wholesale market for energy should be vested however remains controversial and depends on the objectives to be achieved.

In reviewing the state of compliance, the MSCP notes that there have not been any major rule breaches during the period under review.

The MSCP concludes that the wholesale electricity markets of NEMS are functioning in accordance with the relevant legislation, and underlying market rules.

INTRODUCTION

The market rules provide for the MSCP to prepare and submit to the EMC annually a report on the conduct of its monitoring and investigation activities. The report is to be provided by the EMC to the EMA.

This is the third report by the MSCP on the wholesale electricity markets of the NEMS. It mainly covers the period 1 April 2004 to 31 March 2005. The market rules require the report to include a summary of routine reports on the conduct of the MSCP's monitoring and investigation activities, including a summary of any reports regarding the possibility of anti-competitive agreements or the abuse of a dominant position contrary to sections 50 or 51 of the Electricity Act. The report also has to include a summary of all complaints or referrals filed and investigations commenced, and a summary of any investigations conducted by the MSCP in respect of offer variations after gate closure reported by the EMC.

The market rules require the report to contain the MSCP's general assessment as to the state of competition and compliance within, and the efficiency of, the wholesale electricity markets.

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 MSCP comprises the following persons:

(a) Joseph Grimberg SC, Chair;
(b) Lee Keh Sai;
(c) Professor Lim Chin;
(d) TPB Menon; and
(e) David Wong (appointed on 26 May 2005).

The role of the MSCP is to monitor and investigate activities in the wholesale electricity markets and the conduct of market participants, the MSSL, the 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 the conduct of market participants, market support service licensees, the EMC and the PSO and the structure and performance of, and activities in, the wholesale electricity markets of Singapore, including 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 market rules also provide for the MSCP to provide assistance to the regulator, the EMA, in carrying out its functions in relation to prohibiting anti-competitive agreements and abuse of a dominant position under sections 50 and 51 of the Electricity Act.

MARKET ASSESSMENT UNIT

The MSCP is supported in its functions by the MAU. The MAU is established by the EMC and composed of full-time EMC staff.

The market rules provide for the MAU to report to and be under the management and administration of the EMC. The market rules also provide for the MAU to report to and take direction from the Chair of the MSCP on all matters pertaining to market monitoring and investigation.

ACTIVITY LEVEL

MSCP members meet as a panel about once a month to review MAU reports, provide supervision and direction to the MAU and perform the functions more specifically referred to above. Panel members also provide their professional contributions to MSCP matters outside of the regular meetings, as may be necessary.

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.

On 29 August 2003, a catalogue of data was adopted by the MSCP after public consultation. It took effect from 1 October 2003. Data is currently being collected according to this catalogue, with the assistance of market players.

On 29 July 2004, a catalogue of monitoring indices was adopted by the MSCP after public consultation. It took effect from 1 August 2004. The catalogue of monitoring indices is currently used to evaluate the market data collected.

Significant New Initiative During the Year Under Review

Registered Interruptible Load Participant

Interruptible load was implemented with effect from 1 January 2004.

Interruptible load for reserve is a load which can be voluntarily interrupted for a limited duration to enable the power system to return to its normal operating state. Interruptible load can be offered in any or all of the existing primary, secondary and contingency reserve markets. It was introduced to enable load (consumer) side participation. With the introduction of interruptible load, a retailer or a direct market participant may offer to have its supply of electricity interrupted when the system frequency drops below a pre-defined threshold level, thereby contributing to the reserve pool in the system.

On 1 July 2004, the EMC registered the first interruptible load participant. Chart 1 illustrates the total settlement amount for interruptible load and the percentage of the settlement amount to total reserve settlement amount respectively for the period July 2004 to March 2005.

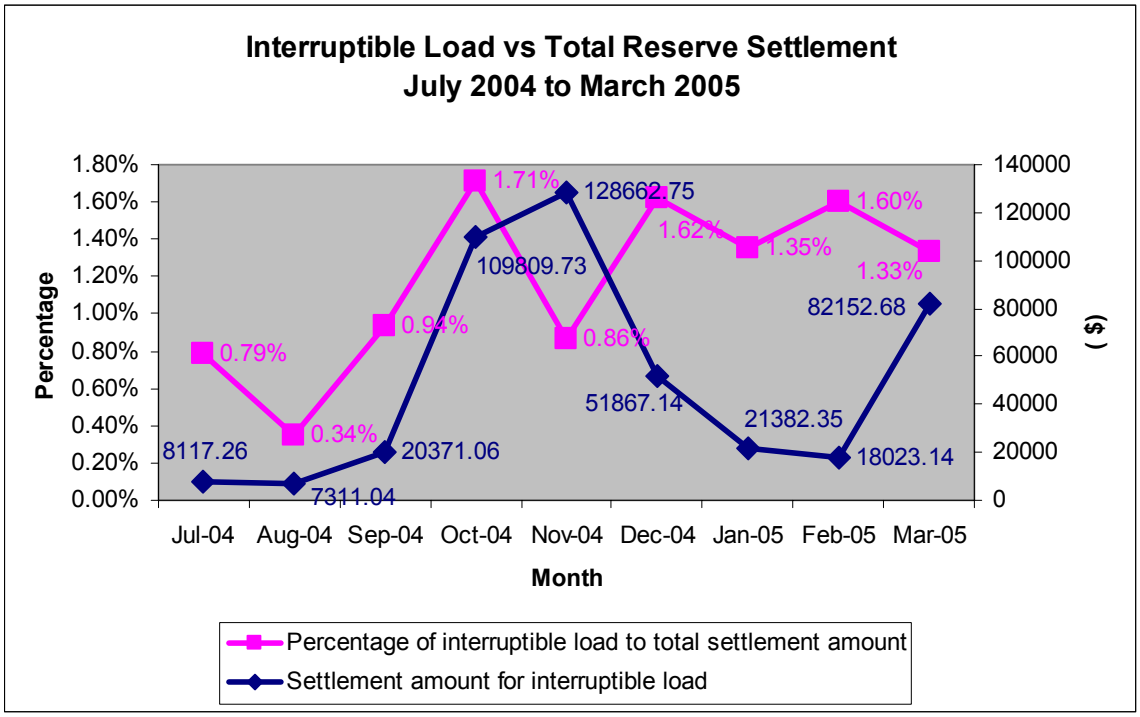


Chart 1

The participation of interruptible load in the wholesale electricity reserve markets is still at a nascent stage. Although there was wide fluctuation in the dollar settlement amount of interruptible load during the period July to March 2005, the percentage of settlement amount for interruptible load to the total reserve settlement amount remained very small during the same period of time.

Major Events During the Year Under Review

1. New Generation Registered Facilities

During the period April 2004 to March 2005, 2 new CCGT units were registered as generation registered facilities. This brings the market share of CCGTs based on maximum generation capacity to 49.7%.

2. Major Blackout on 29 June 2004 due to Gas Interruption

On 29 June 2004, there was an interruption in electricity supply to large parts of Singapore at 22:00hrs. According to news releases from the EMA, it was caused by the disruption of natural gas supply from West Natuna, Indonesia. A valve at the gas receiving station operated by ConocoPhillips had tripped. Natural gas supply from Natuna was disrupted causing 5 units of CCGT units at Tuas Power, PowerSeraya and Sembcorp Cogen to trip. Electricity supply to various locations in Singapore was automatically disconnected to bring demand down to a level which will not overload the system that was still being supported by the remaining generation capacity. About 30% of Singapore was affected by the blackout.

The gas interruption brought about high WEP for 5 periods, i.e., $4597.93/MWh, $4552.59/MWh, $4596.71/MWh, $674.23/MWh and $192.95/MWh respectively for period 46 of 29 June to period 2 of 30 June.

The ESRC was appointed by the Minister for Trade and Industry to study the cause of the power failure on 29 June 2004 and to make recommendations. Its findings have been published.

Indicators of Market Performance

The MAU has been submitting regular monitoring updates to the MSCP. The monitoring updates have included observations of certain indicators of market performance. The indicators can be broadly classified into supply, demand and price indices as detailed below. The commentary and charts are prepared based on market monitoring carried out over the past year. Rerun data which was not available as at 20 April 2005 is not taken into account.

1. Supply Indices

1.1 Capacity ratio of generation registered facilities i.e. ratio of scheduled generation output to maximum generation capacity of generation registered facilities

This index measures the scheduled (by the market clearing engine) output of energy, reserve and regulation as a ratio of a generation registered facility's maximum generation capacity at a given time.

Chart 1.1 illustrates the capacity ratio for each facility type i.e. CCGT, ST, OCGT and OT for the period April 2004 to March 2005. 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.

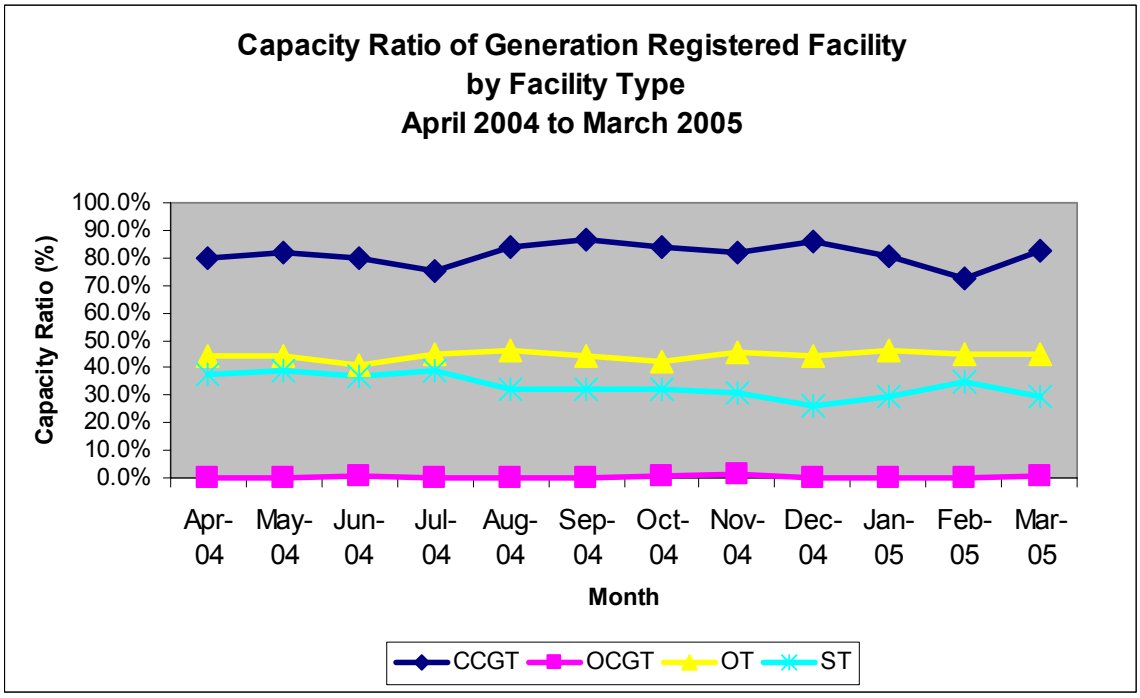


Chart 1.1

For the period April 2004 to March 2005, the monthly capacity ratio of CCGTs remained consistently higher than that of STs, OCGTs and OTs such as incineration plants. The higher capacity ratio of CCGTs indicates that competitive pressures are working in the market to cause energy to be more frequently dispatched by more efficient facilities.

1.2 Supply cushion: Ratio between (a) supply and demand gap (i.e 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 energy offered by all generation registered facilities. System demand refers to the demand forecast by the PSO used to determine the real-time dispatch schedule for energy.

Chart 1.2 is a scatter diagram showing the relationship between the USEP and energy supply cushion for the period April 2004 to March 2005.

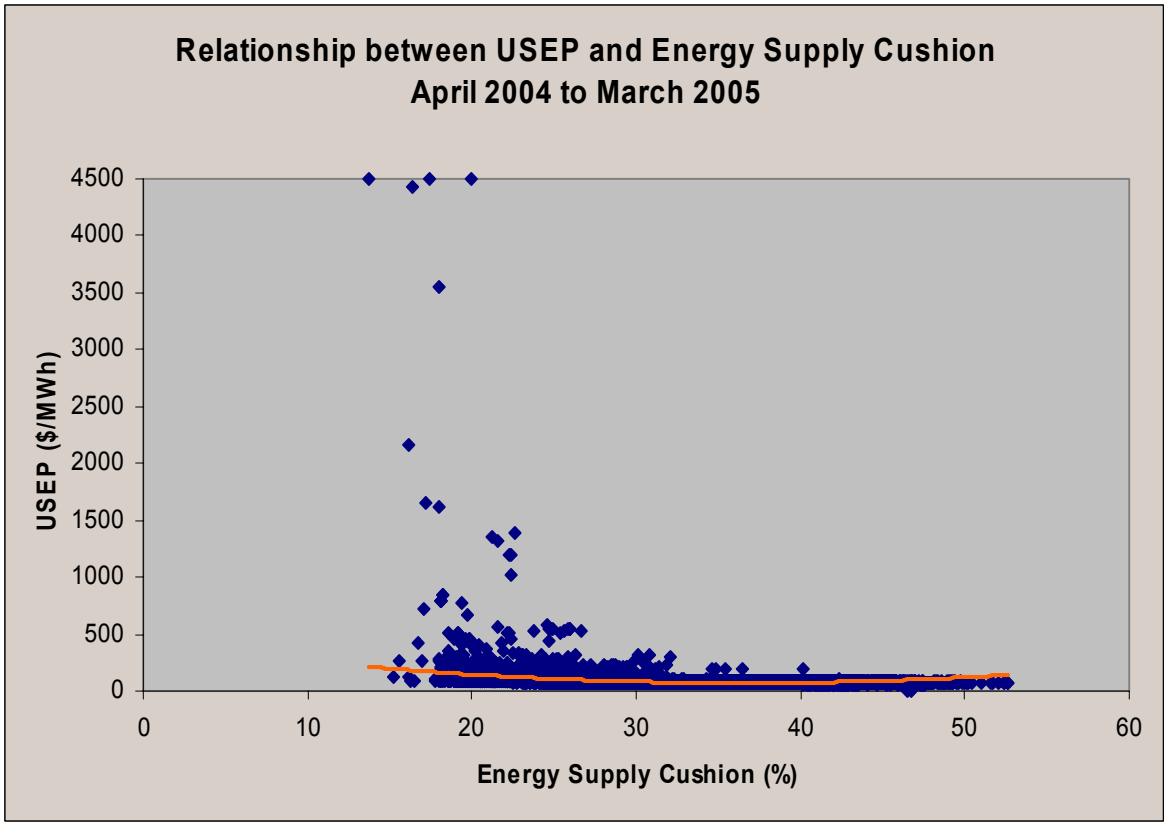


Chart 1.2

The trend line of Chart 1.2 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.

1.3 Market share

As at 31 March 2005, the market share by maximum generation capacity of CCGT units had increased to 49.7%.

For the period April 2004 to March 2005, the MSCP also compared the market share of generation licensees based on their actual generation with their market share based on their maximum generation capacity. For most generation licensees, the results were close. However, it was observed that the generation licensee with the highest CCGT ratio consistently outperformed its market share by maximum generation capacity.

1.4 Outage

Outages of generation registered facilities are divisible into three groups:

(a) planned outage, defined to "include both the Annual Outage plan for overhaul, retrofitting or inspection and Short-term Outage Plan for urgent repair or maintenance" in the System Operation Manual;

(b) unplanned outage, defined as "the case in which the generation licensee has to carry out immediate rectification works and has less than 1 business day to inform the PSO

before intentional de-synchronisation of the generation unit" in the System Operation Manual; and

(c) forced outage, defined as "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" in the market rules.

Planned outage is approved by the PSO to ensure that the outage does not affect system security. Forced outages and, to a certain extent, unplanned outages cannot be anticipated. The frequency of forced outage and unplanned outage indicates the reliability of a generation registered facility. Generation outage can have a significant impact on prices. During periods of high demand, forced outage and unplanned outage may contribute to high energy or ancillary service prices.

Chart 1.4.1 summarises the total capacity on planned outage respectively for each generation licensee during the period April 2004 to March 2005[1].

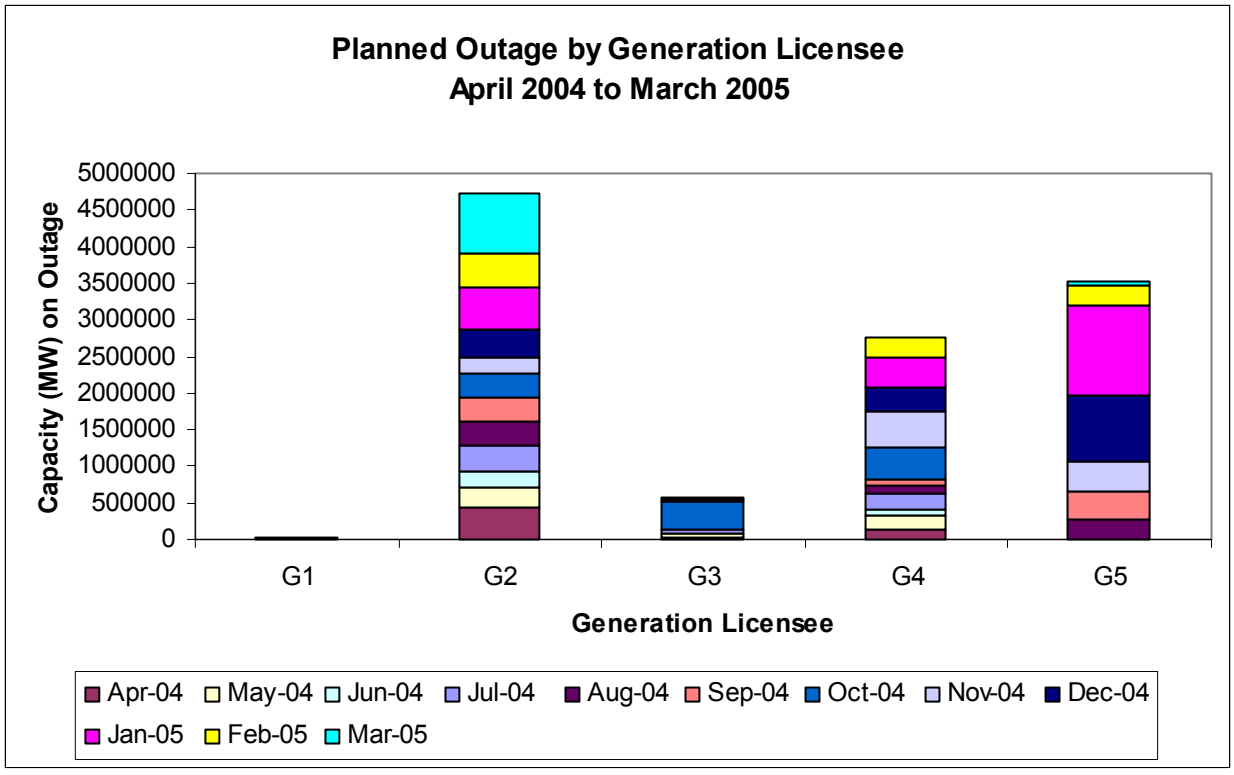


Chart 1.4.1

Charts 1.4.2 and 1.4.3 summarise the total capacity on forced outage and unplanned outage respectively, for each generation licensee during the period April 2004 to March 2005. As there is at present no readily available data as to when a forced outage ends, this chart is based on tracking the duration from commencement of an outage to the point when a generation registered facility under forced outage is next scheduled by the MCE.

[1] This includes the planned maintenance which is carried out in respect of each steam boiler of a generation facility in preparation for the statutory annual inspection by the Chief Inspector of Factories.

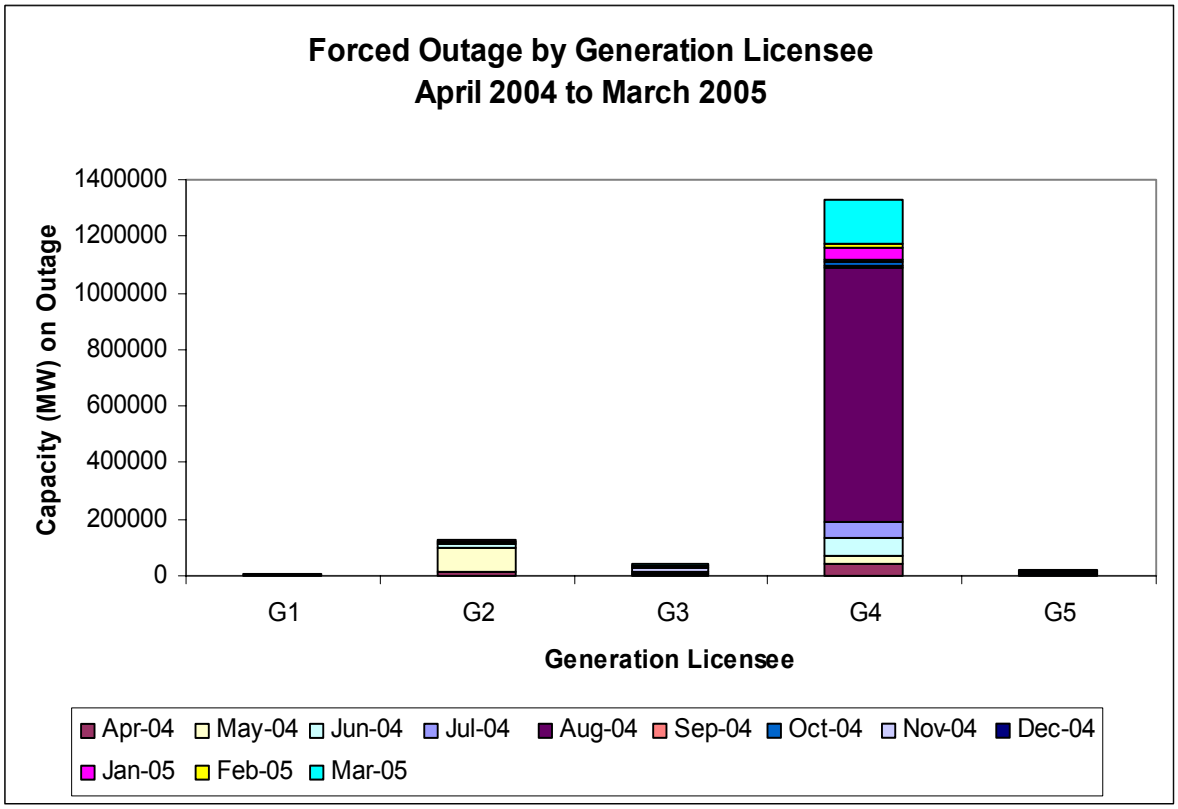


Chart 1.4.2

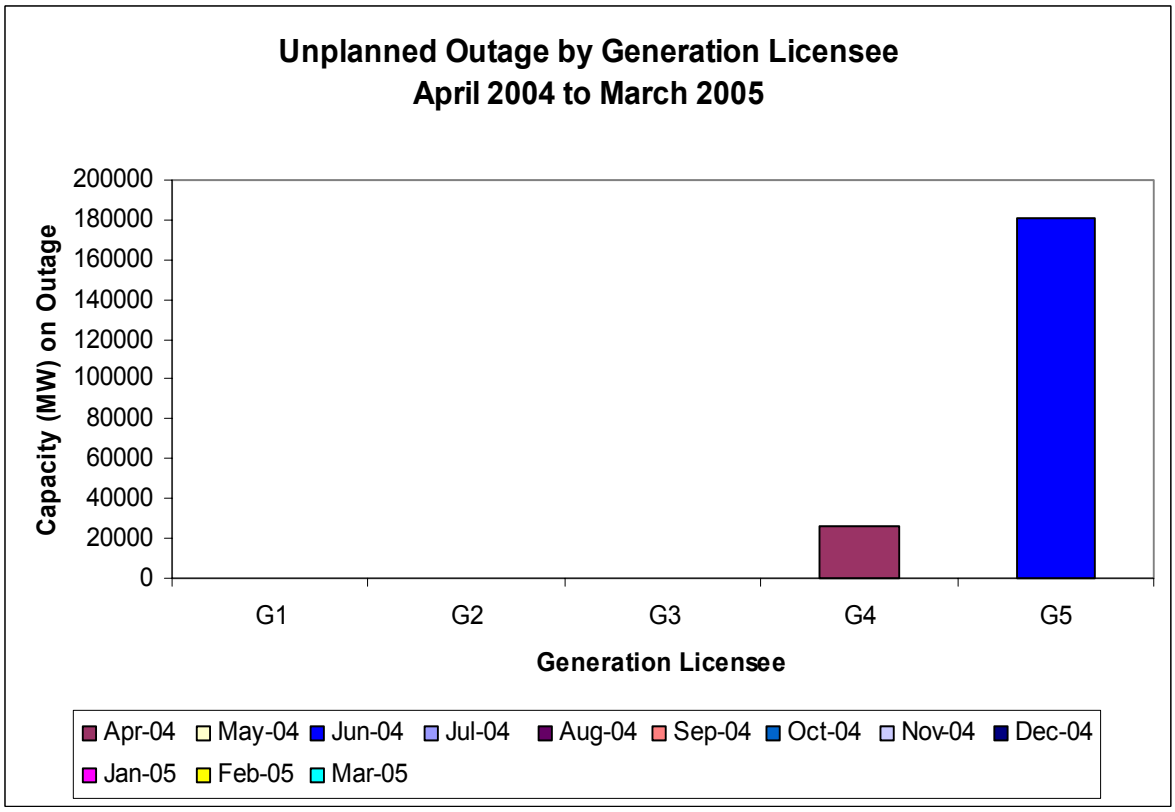


Chart 1.4.3

Forced or unplanned outage leading to high prices is an area of focus for monitoring. During the period April 2004 to March 2005 when the volume-weighted average WEP was $88.27/MW, there were 99 occasions where WEP exceeding $150/MWh were associated with forced or unplanned outages. In particular, the impact on price is significant when forced or unplanned outages occur simultaneously for 2 or more generation registered facilities. The following are the incidents:

Forced Outage at 17:14 (period 35) 8 June and Unplanned Outage from 10:00 (period 21) 8 June to 17:00 (period 35) 12 June

The generation registered facility that was on forced outage had continued offering into the system for periods 36 to 39 while attempting to re-start but was not successful. It offered zero quantity from period 40 onwards. The OCGT units came in to generate during periods 40 to 43. The WEP for periods 40 to 44 reached $182.37/MWh, $182.26/MWh, $180.37/MWh, $171.55/MWh and $106.80/MWh respectively. The volume-weighted average WEP for the day reached $96.08/MWh. The forced outage was caused by loss of the cooling water system and the unplanned outage was due to the repairing of burners.

Forced Outage of 5 generation registered facilities at 22:10 (period 45) 29 June 2004

The WEP for period 46 of 29 June to period 2 of 30 June reached $4597.93/MWh, $4552.59/MWh, $4596.71/MWh, $674.23/MWh and $192.95/MWh respectively. The volume-weighted average WEP for the day reached $325.70/MWh. The forced outages were due to gas interruption which caused blackouts in several parts of the island.

Forced Outage from 9:44 (period 20) to 14:08 (period 29) and Forced Outage from 11:42 (period 24) to 12:34 (period 26) on 29 November

The WEP for period 24 to 26 reached $1641.03/MWh, $2143.34/MWh and $1646.64/MWh respectively. The volume-weighted average WEP for the day reached $268.41/MWh. The forced outage from 9:44 (period 20) to 14:08 (period 29) was caused by the tripping of the generator transformer and the forced outage from 11:42 (period 24) to 12:34 (period 26) was due to the tripping of the gas turbine caused by high gas turbine exhaust temperature while carrying out gas tuning after combustion inspection.

2. Demand Indices

2.1 Comparison of the variation between the latest available pre-dispatch load forecast and real time load forecast and the variation between the latest available very short-term load forecast and real-time load forecast

On 2 March 2004, STS were implemented in NEMS. PDS are updated every 2-hourly covering a time horizon of between 12 to 36 hours after the period in which the relevant pre-dispatch schedule is published. STS are updated every half-hourly covering a time horizon of 6 hours after the period in which the relevant STS is published. The objective of implementing STS is to provide enhanced information to market participants and enable market participants to make more informed and timely decisions.

The accuracy of the load forecast used in generating STS is important in producing an accurate short-term schedule, which enables market participants to respond appropriately in the real-time. The load forecast used to generate STS is known as the very short-term load forecast. Comparison of the very short-term and real-time load forecasts indicates the degree of accuracy of the very short-term load forecast. Less deviation from the very short-

term load forecast to real-time load forecast is expected than that from the pre-dispatch load forecast to real-time load forecast.

Chart 2.1 shows the variation between the latest available pre-dispatch load forecast and the real-time load forecast and the latest available very short-term load forecast for energy for the period April 2004 to March 2005.

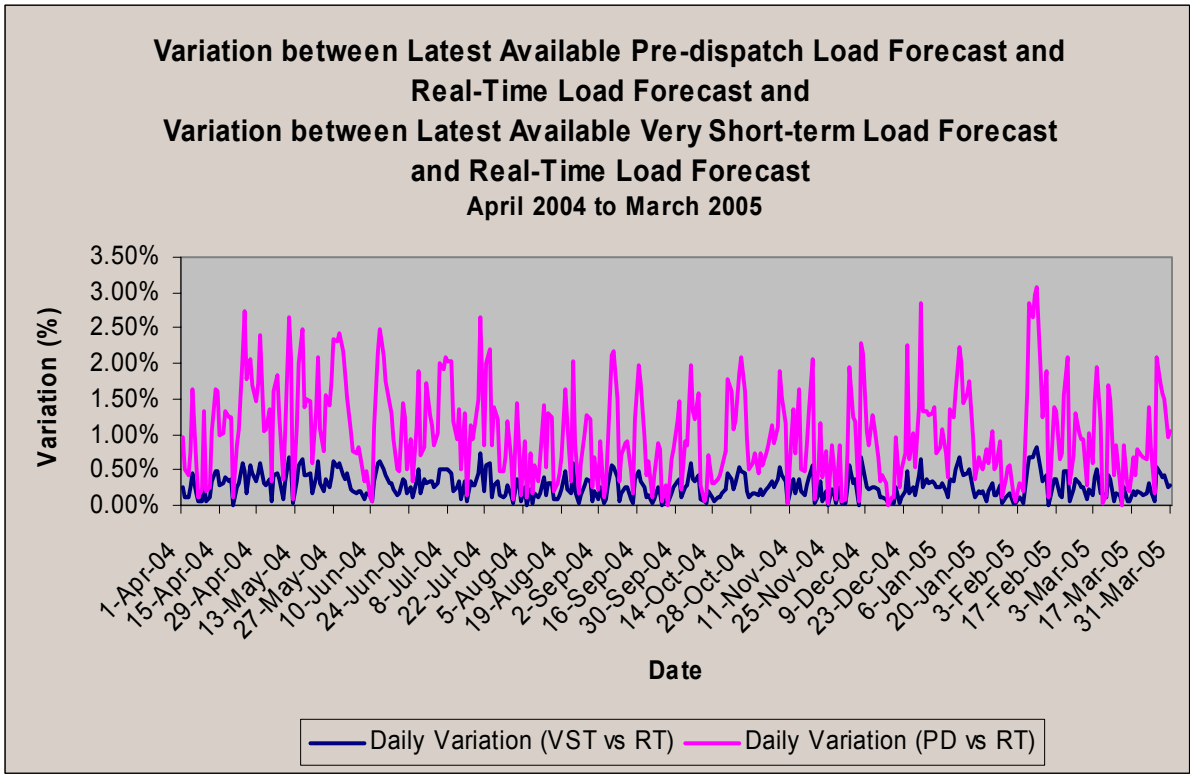


Chart 2.1

The daily variation between the latest available very short-term load forecast and the real-time load forecast for the period April 2004 to March 2005 ranged from 0.01% to 0.82% with an average of 0.27%. The daily variation between the latest available pre-dispatch load forecast and the real-time load forecast for the period April to March 2005 ranged from 0.01% to 3.09% with an average of 1.02%. A significant reduction in variation between the latest available very short-term load forecast and the real-time load forecast compared to that of the latest available pre-dispatch load forecast and the real-time load forecast has been observed. This indicates significant improvement in the accuracy of the information provided to the market with the introduction of STS.

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. Little deviation is expected between the real-time load forecast and the metered energy quantity.

Chart 2.2 shows the variation between the real-time load forecast and the metered energy quantity for the period April 2004 to March 2005.

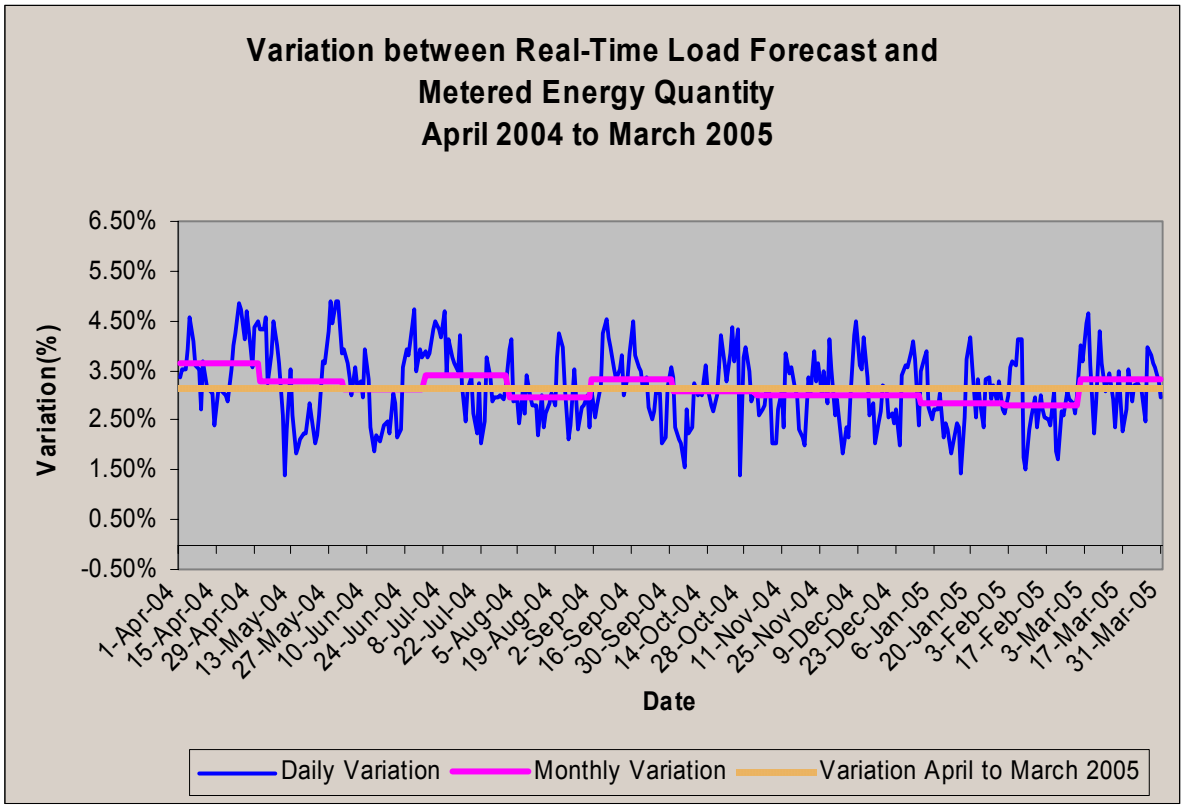


Chart 2.2

Between April 2004 and March 2005, the daily variation[2] between the real-time load forecast of total energy quantity and the metered energy quantity ranged from 1.38% to 4.89%, the monthly variation ranged from 2.79% to 3.66% and the variation for the period April 2004 to March 2005 was 3.15%.

The metered energy quantity based on settlement data furnished by the MSSL excludes the station load and auxiliary load consumption while the real-time load forecast includes these components. This partly explains why the metered energy quantity is systematically lower than the real-time load forecast. Other factors that may contribute to the variation are loss factors and metering errors. Taking into account the station load, the auxiliary load consumption and loss factors, the real-time load forecast reflects quite closely the actual energy demand.

[2] The variation is calculated according to the following formula:
Variation (%) = 100% x (real-time load forecast (MW)*(1/2 h) - metered energy quantity (MWh))/metered energy quantity (MWh)

3. Price Indices

3.1 Vesting contract hedge price

Chart 3.1.1 illustrates the comparison of volume-weighted average USEP+HEUC and vesting contract hedge price for the period January 2003 to March 2005.

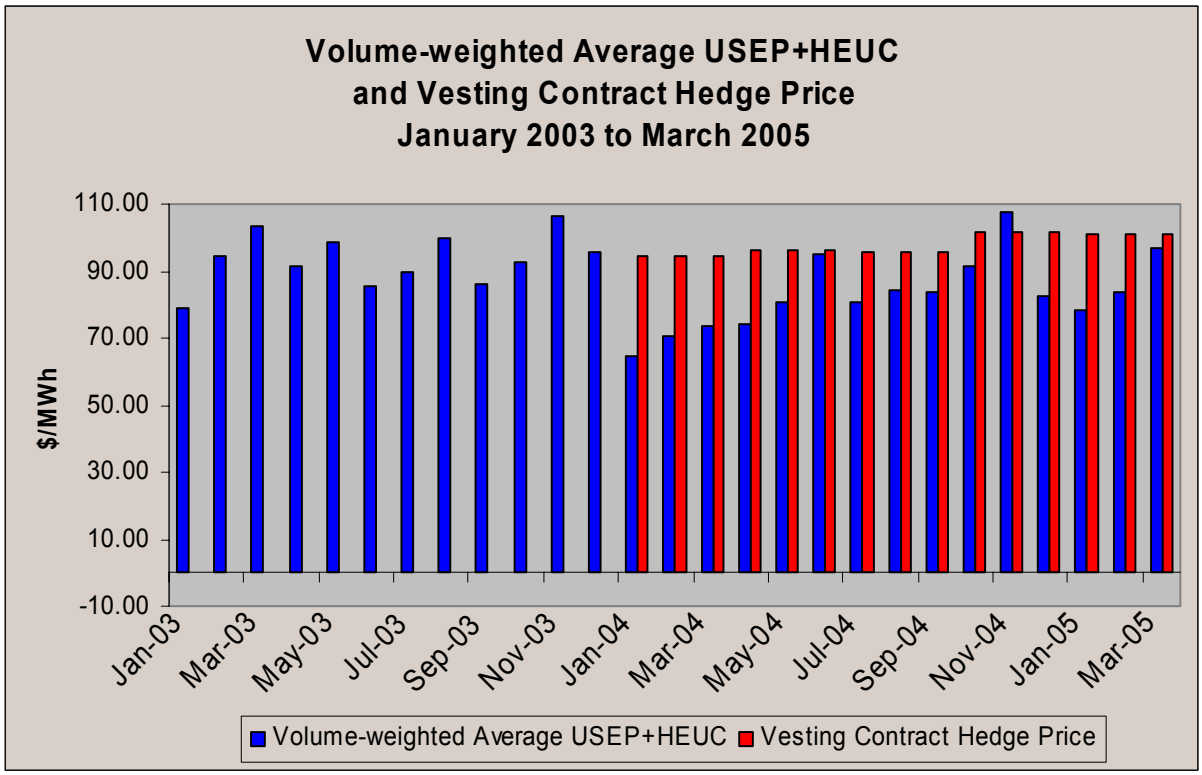


Chart 3.1.1

The vesting contract hedge price is set at the LRMC of the most efficient generation technology currently available. The LRMC includes the cost of assets, running costs and financing costs of the generation licensees computed based on a formula determined by the EMA. The actual vesting contract hedge price and quantities are calculated by the market support services licensee SP Services Pte Ltd on a quarterly basis.

The vesting contract hedge price was \$94.24/MWh for the 1st quarter of 2004, \$96.25/MWh for the 2nd quarter of 2004, \$95.73/MWh for the 3rd quarter of 2004, \$101.56/MWh for the 4th quarter of 2004 and \$101.29/MWh for the 1st quarter of 2005 respectively.

After the initial dip from 2003 to January 2004 when vesting contracts were first introduced, the chart shows a steadily increasing trend of USEP+HEUC from January to November 2004. The volume-weighted average USEP+HEUC in June 2004 at \$95.34MWh was very close to the vesting contract hedge price. Even excluding the 6 periods of high prices during the electricity blackout caused by gas interruption on 29 June 2004, the volume-weighted average USEP+HEUC of \$86.67/MWh for June was still more than 7% higher than that of May 2004.

In July 2004, USEP+HEUC dropped to a level similar to that for May 2004. It increased again slowly but steadily from August to October 2004. In November 2004, it reached \$107.38/MWh, exceeding the vesting contract hedge price for the first time by about 5.7%.

From December 2004 to February 2005, the volume-weighted average USEP+HEUC dropped to $82.35/MWh, $78.61/MWh and $83.51/MWh respectively. In March it rose again to $96.69/MWh, which is about 95.5% of the vesting contract hedge price.

The higher USEP+HEUC for June, October, November 2004 and March 2005 appear to be related to the scheduling of OCGT units. As a result of short supply, OCGT units were scheduled to generate energy at higher cost. The market share of OCGT units by metered energy quantity in the months of June, October, November and March 2005 were 0.07%, 0.04%, 0.09% and 0.02% respectively while in other months over the period January 2004 to March 2005, it was between 0% to 0.01%.

3.2 WEP

The 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 AFP, HEUC, MEUC, EMC administrative costs and PSO administrative costs.

3.2.1 Metered energy quantity

Chart 3.2.1.1 shows the daily average metered energy quantity for each month, with a month on month comparison, over the period January 2003 to March 2005.

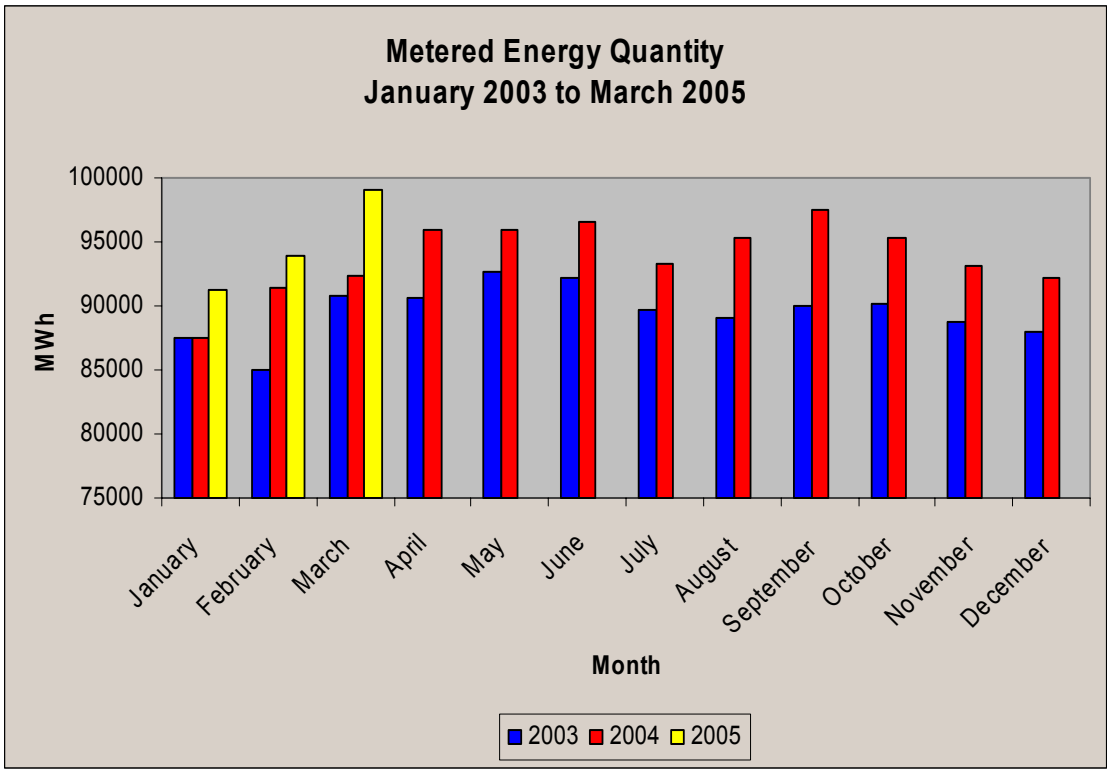


Chart 3.2.1.1

The system demand is higher for the same month in 2004 as compared to 2003. The daily average system demand in 2004 is about 4.8% higher than that in 2003. For the first 3 months of 2005, the system demand is higher than for the same month in 2004. The daily average system demand for the first 3 months in 2005 is about 4.8% higher than that in 2004.

3.2.2 Correlation between WEP and metered energy quantity

Chart 3.2.21 illustrates the movements of the daily volume-weighted average WEP against the total metered energy quantity for the period April 2004 to March 2005.

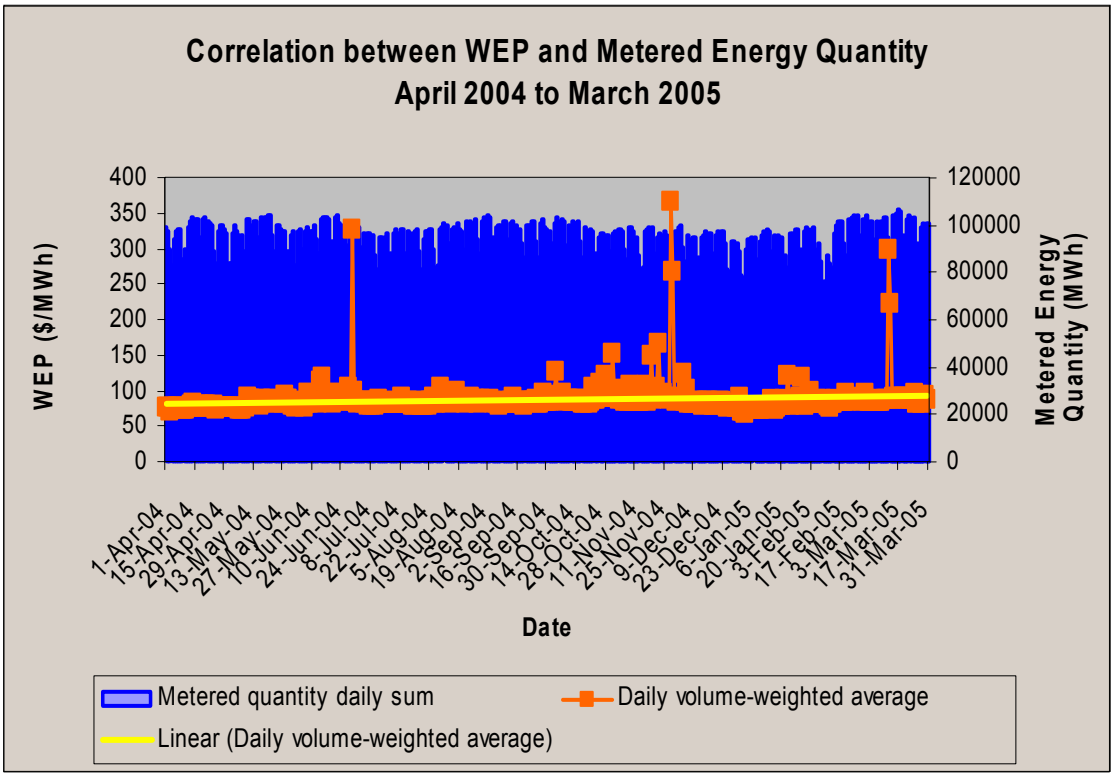


Chart 3.2.2.1

For the period April 2004 to March 2005, the daily volume-weighted average WEP ranged from $68.77/MWh to $365.85/MWh, with a volume-weighted average WEP over the same period of $88.27/MWh. Over the same period, the daily metered energy quantity ranged from 75745 MWh to 106097 MWh with an average of 94952MWh.

Chart 3.2.2.2 shows the daily correlation coefficient[3] of WEP and metered energy quantity for the period April 2004 to March 2005.

[3] The correlation coefficient measures the extent to which two variables move in tandem with each other. It has a value between -1 to 1. When the correlation coefficient is close to 1, it means the two variables are moving closely together in the same direction. When the correlation coefficient is -1, it means the two variables are moving in opposite directions.

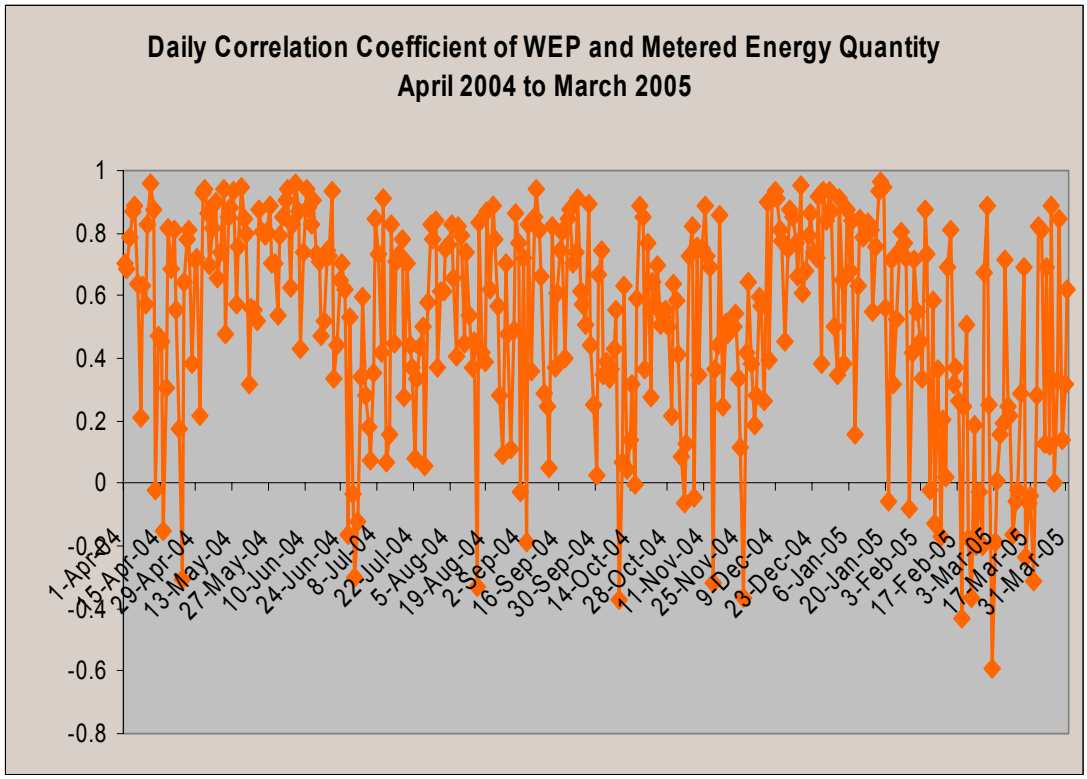


Chart 3.2.2.2

For the period April 2004 to March 2005, the daily correlation coefficients ranged from -0.59 to 0.96 with an average of 0.52. About 60% of the daily correlation coefficients are above 0.5.

For the period April 2003 to March 2004, the daily correlation coefficients ranged from -0.55 to 0.98 with an average of 0.77. More than 88% of the daily correlation coefficients are above 0.5.

There is still a fairly close correlation between WEP and metered energy quantity for the period April 2004 to March 2005. However, compared to the daily correlation coefficients for the period April 2003 to March 2004, both the average and the percentage of correlation coefficients exceeding 0.5 have dropped. It may be indicative that implementation of vesting contracts has to a certain extent influenced the offer patterns of market participants and such behaviour may have weakened the correlation between WEP and metered energy quantity.

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

Tables 3.2.3.1 and 3.2.3.2 illustrate the frequency distribution of WEP according to (a) percentage of hours, and (b) percentage of quantity of energy affected.

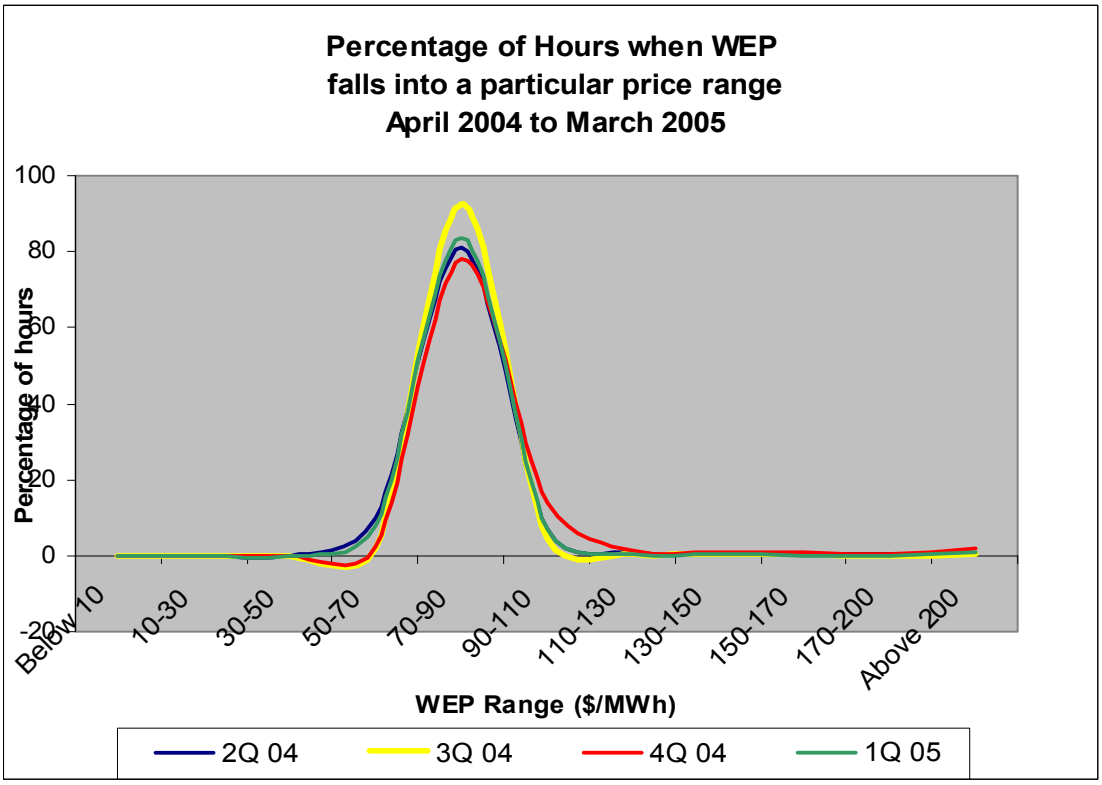


Chart 3.2.3.1

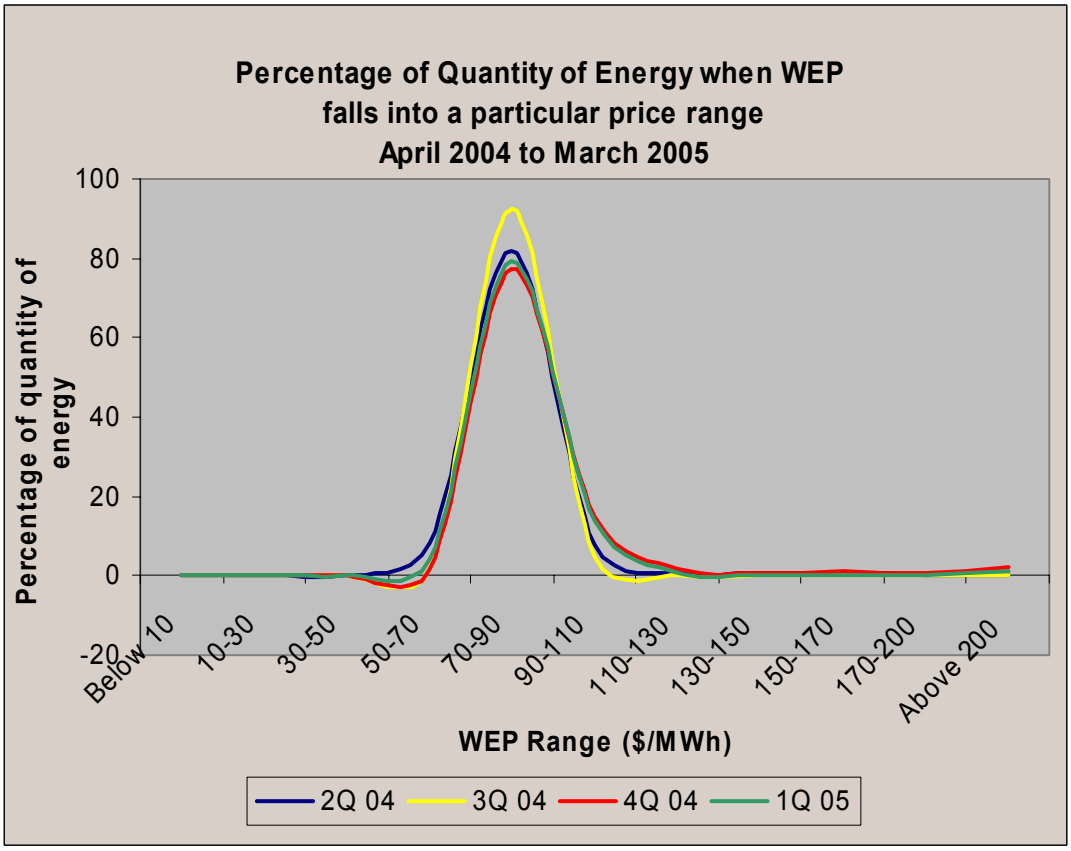


Chart 3.2.3.2

Both charts illustrate a slight rightward shifting of the frequency distribution of WEP from the fourth quarter of 2004 and the first quarter of 2005 to the other quarters of the period under review, indicating an increase in average WEP from the fourth quarter of 2004 and the first quarter of 2005. However, over the period April 2004 to March 2005, the WEP distribution according to percentage of hours, and percentage of quantity of energy affected for each quarter were quite close and stable. This is consistent with the stable trend in daily volume-weighted average WEP observed from Chart 3.2.1.

3.2.4 Correlation between WEP and fuel price

This index measures price responsiveness of WEP 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. The price of natural gas is pegged to the fuel oil price. The published Brent crude spot price, obtained from the US Energy Information Administration is used as a proxy for fuel price in this report.

Chart 3.2.4.1 shows the 21-day moving average of the daily volume-weighted average WEP and 21-day moving average of the one-month futures price of Brent crude oil for the period April 2004 to March 2005.

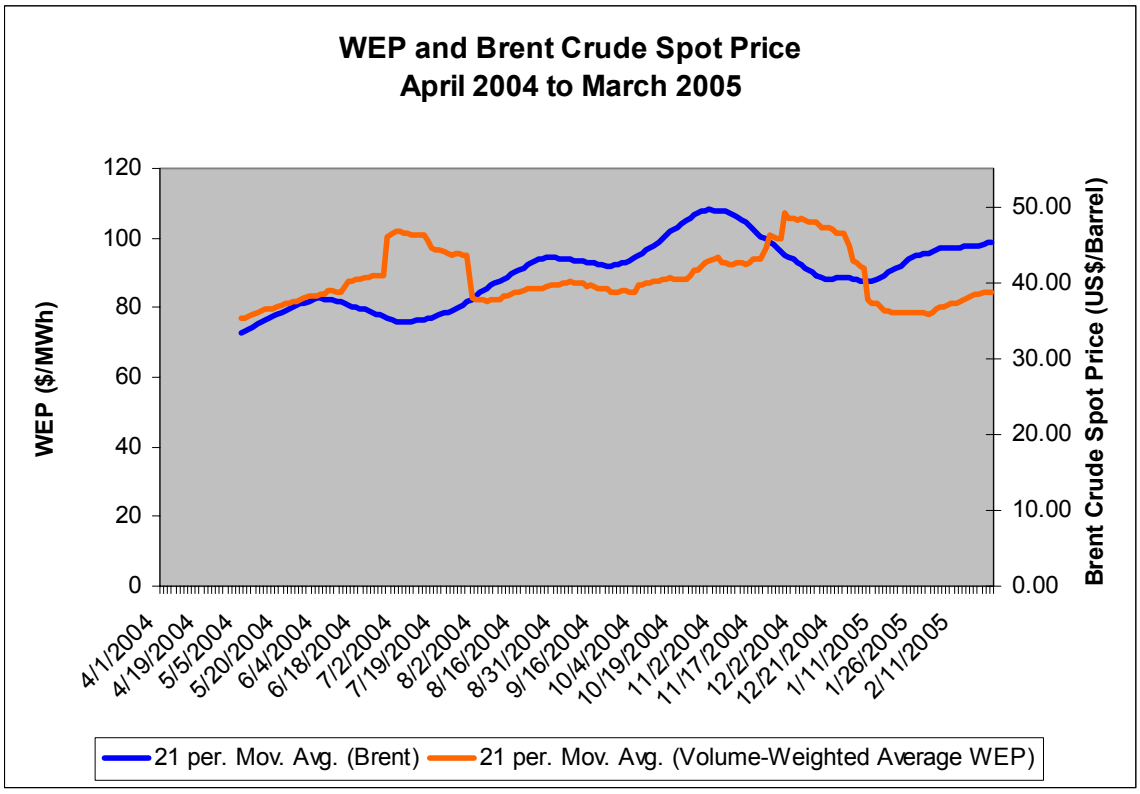


Chart 3.2.4.1

Using the 21-day moving average of the WEP and 21-day moving average of the one-month futures price of Brent crude oil, the correlation coefficient for the period April 2004 to March 2005 is 0.02. Excluding the price spike of 29 June due to the

blackout, the correlation coefficient for the period April 2004 to March 2005 would be 0.27.

3.2.5 Periods with WEP above $150/MWh[4]

From April 2004 to March 2005, there were 296 periods where the WEP exceeded $150/MWh. This constitutes about 1.7% of the total number of periods for the year under review.

The table below compares the situation with that of the previous year:

	WEP > $150/MWh				WEP > $200/MWh			
	All incidents		Excluding gas interruption		All incidents		Excluding gas interruption	
	Peak	Total	Peak	Total	Peak	Total	Peak	Total
Apr 04 to Mar 05	141 47.6%	296	141 48.5%	291	77 43.25%	178	77 44.5%	173
Apr 03 to Mar 04	76.1%	222	77.5%	160	75 71.4%	105	51 69.9%	73

It indicates as follows:

- Excluding situations caused by gas interruption, the number of periods where high prices were observed (using a threshold of WEP > $200/MWh) have increased from 73 periods in 2003/2004 to 173 periods in 2004/2005.
- If a threshold of WEP > $150/MWh were used for 2004/2005, the increase would be even higher to 291 periods in 2004/2005.
- More incidents of high price occurred during non-peak periods in 2004/2005 compared to 2003/2004.

During such occurrences of high WEP, one or more of the following phenomena were observed:

[4] In the last annual report covering the period April 2003 to March 2004, trading periods with WEP above $200/MWh were reported. This reference benchmark is about twice the average WEP for the first three months after market start. As a significant decrease in WEP was observed after the implementation of vesting contracts, the reference benchmark for the period April 2004 to March 2005 has been adjusted to $150/MWh. This is about twice the average WEP for the first 3 months after the implementation of vesting contracts.

(a) Above average system demand

The average system demand referred to is the average peak[5] or non-peak[6] period system demand for the month, depending on whether the period in question falls within a peak or non-peak period. In 220 out of the 296 incidents of high WEP, the system demand for the period was observed to be above the average system demand.

(b) Forced or unplanned outage

Forced or unplanned outage of a generation registered facility has impact on the WEP because of their negative impact on the energy supply cushion in the periods immediately following the period during which the outage commenced. It is observed that 99 out of the 296 incidents of high WEP occurred in relation to the forced or unplanned outage of generation registered facilities.

(c) Offers of 0 quantity when the respective generation registered facilities were not under planned, unplanned or forced outage

Even when generation registered facilities do not have planned, unplanned or forced outages, they may if they wish offer 0 quantity of energy at any given point in time. In all 296 incidents of high WEP, offers of 0 quantity of energy were observed to have been submitted by one or more generation registered facilities in the absence of any outage.

(d) Below average energy supply cushion

The average energy supply cushion referred to is the average peak or non-peak period energy supply cushion for the month, depending on whether the period in question falls within a peak or non-peak period. In 269 out of the 296 incidents of high WEP, the energy supply cushion for the period was observed to be below the average energy supply cushion.

Factors that may contribute to a below average energy supply cushion include an increase in system demand or offers of 0 quantity of energy, or when facilities are under outages. These phenomena have been discussed above. In addition, the supply cushion could be reduced by reduction of actual quantities offered to below the standing offers.

(e) Offers of energy at above $200/MWh (excluding OCGT units[7])

These are cases where energy was offered at above $200/MWh. In 63 out of the 296 incidents of high WEP, it was observed that one or more generation registered facilities had offered energy at prices starting from above $200/MWh.

[5] Peak period refers to periods 19-36 from Mondays to Fridays (excluding public holidays).
[6] Non-peak period refers to periods 1-18 and 37-48 on weekdays and all periods for Saturdays, Sundays and public holidays.
[7] OCGT units operate at higher costs and therefore usually offer higher prices for energy

(f) Offer Variations

148 out of the 296 incidents of high WEP had occurred when offer variations or revisions to standing offers were observed. 116 out of the 148 variations or revisions were made after gate closure.

(g) Running of OCGT units

The OCGT units which were previously contracted ancillary service units had been re-registered as generation registered facilities on 1 January 2004. The cost of OCGT units is higher than that of CCGT and ST units. These units therefore usually offer higher prices for energy and are scheduled to generate only when there is insufficient supply to meet demand. 254 out of the 296 incidents of high WEP had occurred when OCGT units were generating to the system.

Offers of 0 quantity when generation registered facilities are not under planned, unplanned or forced outage can lead to energy shortfalls and associated system security risk and high prices. However, the markets have so far responded effectively to the price signals and shortfall situations have been quickly and satisfactorily addressed.

3.3 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. 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 3.3 summarises the 30-day moving average of daily volume-weighted average USEP and ancillary service prices for the period April 2004 to March 2005.

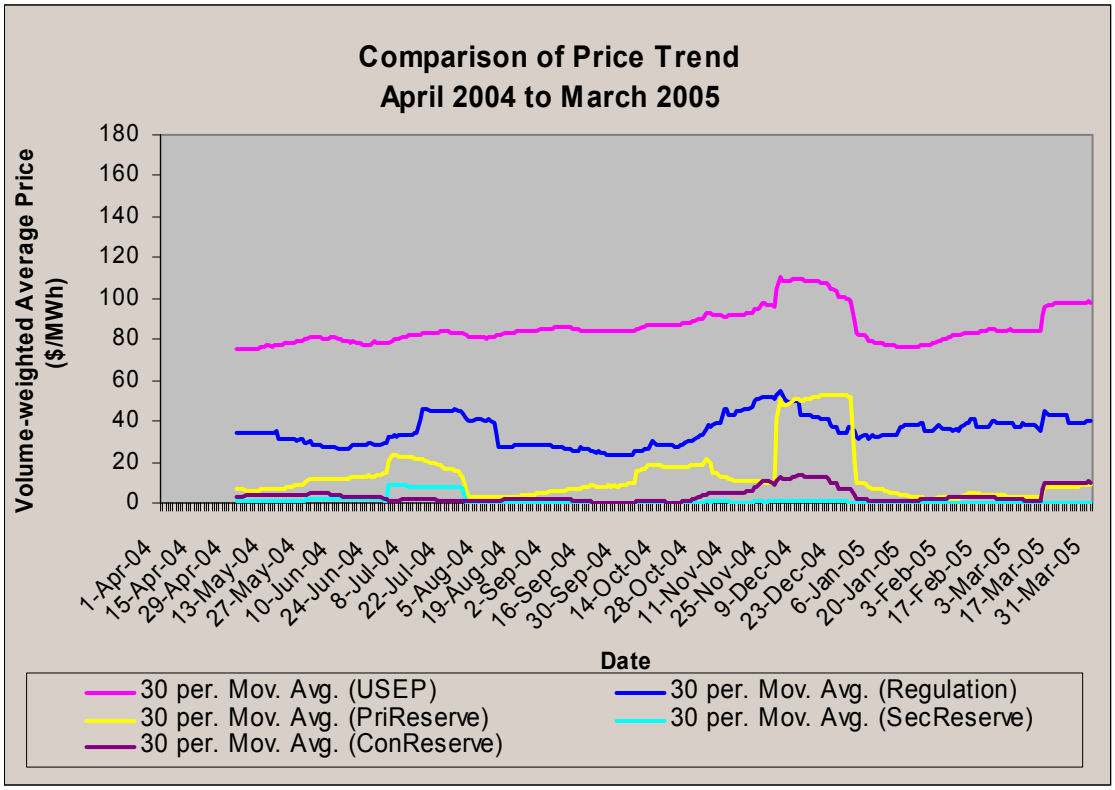


Chart 3.3

High USEP price was observed in November 2004. At that time, significant capacity of generation units was under planned outage. Some generation registered facilities had also offered 0 quantity even though they were not on outage. This resulted in more OCGT units being scheduled to generate energy at higher cost. The market share by metered energy quantity for OCGT in the month of November 2004 was 0.09%, which is the highest since the OCGT facilities registered as generation registered facilities in January 2004.

High reserve prices were observed on the following occasions:

- A slight increase in reserve prices was observed after 19 May 2004 which was due to disconnection in the Singapore-Malaysia intertie.
- High reserve prices were observed towards the end of June when gas interruption caused energy and reserve shortfall. “High risk operating state” notices were issued by the PSO on 6 July, 27 and 28 August and 7 September 2004 when the offshore gas receiving facilities for West Natuna Gas shut down one of the two gas supply streams to perform maintenance on the gas control valve, resulting in no standby gas supply stream. On the four occasions, the PSO had raised the risk adjustment factor for primary reserve from 1 to 1.5. This had resulted in an increasing trend of the moving average primary reserve price.
- High primary reserve prices were also observed in November 2004. There were 6 occasions when primary reserve hit the maximum price of $4250/MWh. They occurred during periods 38 to 40 on 28 November 2004 and periods 24 to 26 on 29 November 2004. The high primary reserve prices for periods 38 to 40 on 28 November 2004 was a result of co-optimization between energy and reserve as demand increased and supply was short during these periods. The high primary

reserve prices for periods 24 to 26 on 29 November 2004 was due to one of the supply gas streams being under maintenance and the risk adjustment factor for the primary reserve being adjusted from 1 to 1.5 during these periods.

- Except for the above occasions, reserve prices remained low for the period under review. This may be attributed to the fact that in the wholesale electricity markets of Singapore, the reserve cost is paid by generation licensees and the reserve cost that each generation licensee pays is affected by the volume of energy it generates, and its reliability.

Besides 29 and 30 June when the gas interruption occurred, the high regulation prices reflected in Chart 3.3 were observed on:

- 17, 27, 30 April;
- 28 June;
- 9, 11, 12 July;
- 2, 17 August;
- 12 September;
- 3, 10, 23, 31 October;
- 1, 2, 3, 4, 7, 12, 19, 29 November;
- 26 December 2004;
- 1, 4, 15, 30 January;
- 8, 12, 20 February; and
- 4, 12, 13 March.

The incidents of high regulation prices were isolated and discontinued. Most of them were caused by the initial load of one or more generation registered facilities failing to meet the minimum energy output at which automatic generator control can operate. The initial load of a generation registered facility is affected by the amount of energy that facility is cleared to generate and this amount is affected by the energy offer and system demand.

INVESTIGATIONS

Summary of Investigation Activities

Under the market rules, the MSCP may initiate an investigation into any activities in the wholesale electricity markets or the conduct of a market participant, the MSSL, the EMC or the PSO that is brought to the attention of the MSCP by way of a referral or complaint from any source, or that the MSCP determines as warranting an investigation.

The MSCP may refuse to commence or may terminate an investigation where the MSCP is of the view that a complaint, referral or investigation is frivolous, vexatious, immaterial or unjustifiable, or not directly related to the operation of the wholesale electricity markets, or is within the jurisdiction of another party.

We have prepared statistics to reflect the position on investigation and enforcement activities as close as possible to the time of preparing this report. These statistics cover the period from market start on 1 January 2003 to 8 July 2005:

Total number of offer variations after gate closure occurring from 1/1/2003 to 8/7/2005		18082
Total number of gate closure cases closed	16959	
Total number of investigation cases (excluding offer variations after gate closure)		82
of which:		
▪ number of self-reports	69	
▪ number of referrals or complaints	8	
▪ number initiated by MSCP	5	
Total number of investigation cases closed		77
▪ number of cases where MSCP determined a breach	52	
▪ number where MSCP determined no breach	6	
▪ number where MSCP decided to take no further action	19	
Number of formal MSCP hearings		0
Enforcement Action		
▪ Highest financial penalty imposed on a party in breach		$50,000
▪ Total financial penalties imposed on parties in breach		$50,000
Costs		
▪ Highest award of costs imposed on a party in breach		$14,000
▪ Total costs imposed on parties in breach		$41,000

Reports of determinations of breach made by the MSCP are published in accordance with the market rules on the EMC website at www.emcsg.com.

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 EMA to fulfill its obligations with respect to prohibiting anti-competitive agreements and abuse of a dominant position under sections 50 and 51 of the Electricity Act.

The first set of information requirements was finalized in consultation with the EMA and published on 27 March 2003. As the market evolved, modifications to the information requirements were published on 18 August 2003 and 28 January 2004.

The MAU regularly provides data to the Authority according to the information requirements.

Reports to the Authority

The market rules also provide for the MSCP to include in its report a summary of reports that have been made to the EMA 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.

The EMA has also clarified that the role of the MSCP is to report possible cases of anti-competitive behaviour to the EMA should any be detected. All investigations into anti-competitive behaviour would be under the purview of the EMA.

In the course of monitoring and investigative activities carried out from April 2004 to March 2005, the MSCP and MAU did not receive any complaint, or uncover any material evidence that indicated the possibility of anti-competitive agreements, or the abuse of a dominant position contrary to sections 50 or 51 of the Electricity Act.

ASSESSMENT OF WHOLESALE ELECTRICITY MARKETS

In our opinion, the wholesale electricity markets of Singapore functioned well generally for the period under review. Our assessment of the state of competition and efficiency, and the state of compliance is set out below.

State of Competition and Efficiency of the Wholesale Electricity Markets

For the purposes of this report, the criteria we have used to gauge market efficiency are:

1. the degree of market competitiveness;
2. whether the markets function properly; and
3. whether prices eventually converge to marginal costs.

Each of these factors is examined below in the context of the wholesale electricity markets of NEMS.

1. Degree of market competitiveness

When considering whether the markets are competitive, the following factors are relevant:

(a) the number of sellers or market concentration;
(b) the entry and renewal of plants; and
(c) the price responsiveness of consumers.

(a) Market concentration

There are at present five generation licensees participating in the wholesale electricity markets. They are:

- PowerSeraya;
- Senoko Power;
- Tuas Power;
- SembCorp Cogen; and
- NEA.

Supply in the wholesale electricity markets remains concentrated because the three big generation licensees together own near to 90% of the total maximum generation capacity in Singapore. In general, when a market is concentrated, supply offers of

the few large sellers could have significant impact on the market prices and there are incentives for strategic behaviour that would lead to departures of market prices from prices that would normally emanate from a more competitive or less concentrated market.

However, the market also has excess capacity which is an important factor in market discipline. As at 31 March 2005, the total maximum generation capacity in Singapore was about 9061MW. The maximum forecasted peak system demand of 5202MW was recorded on 17 March 2005. There is therefore significant excess capacity in the system.

(b) Entry and renewal of plants

In general, ease of entry and plant renewal provide another important source of market discipline even in a concentrated market.

Under the Electricity Act, electricity generation licenses are granted by EMA with the approval of the Ministry of Trade and Industry and may be subject to such conditions as EMA may approve. To participate in the wholesale electricity markets, a generation licensee will have to be registered as a market participant by EMC, the market operator.

Going forward, new generation is expected from the following sources based on licences[8] which EMA has issued:

- Tuas Power is scheduled to commission a generation facility of 367.5 MW in September 2005;
- Keppel Merlimau Cogen is scheduled to commission a 500 MW cogeneration plant by November 2006;
- Island Power is licensed to build two generation facilities of 400 MW each by February 2008.

PowerSeraya has announced that it is repowering three 250 MW steam plants to use orimulsion, a bitumen-water mix fuel. The re-powered plants are expected to be in operation by end 2005 to improve its ability to compete.

(c) Price responsiveness of consumers

As in most electricity markets, demand is highly inelastic. There is currently no demand side bidding. However, a positive step in this direction is that EMC has published real-time USEP and demand and the forecasted USEP and system demand data on its website. Consumers may take advantage of this information to plan and adjust their electricity usage over the long term. However, there is at present no consumer data available to enable monitoring in this regard.

[8] These are not new licences. All were granted before market start and have been renewed annually (with changes where appropriate eg as to timelines).

2. Does the market function properly?

When considering whether the market functions properly, the following factors are relevant:

(a) whether buyers and sellers make informed decisions; and
(b) the ability to allocate risks

(a) Buyers and sellers make informed decisions

In the wholesale electricity markets, the publication of market outlook scenarios, pre-dispatch schedules, market advisories (including information on forced outages) and information on planned outages to market participants assist them in making decisions.

On 2 March 2004, STS were implemented. The objective of implementing STS is to provide enhanced information to market participants and enable market participants to make more informed and timely decisions. Since the implementation of STS, we have observed a significant improvement (see chart 2.1) in their accuracy compared with PDS, in terms of deviation from the real time schedule.

(b) Risk allocation

Market risk is managed through the market rules requiring market participants to provide and maintain credit support on an on-going basis. This is to protect the EMC and other market participants from payment default. The credit support value is 30 times the estimated average daily exposure of the market participant. EMC notifies a market participant when the estimated net exposure of the market participant reaches 60% of the credit support provided by that market participant. A margin call is issued to a market participant when the estimated net exposure of the market participant reaches a value equal to or greater than 70% of the credit support provided by that market participant. If a market participant defaults, EMC is entitled to recover the non-payment by imposing a default levy on non-defaulting market participants. In the year under review, there was no case of default.

Exposure to spot market price volatility is hedged mainly through bilateral contracts and vesting contracts.

3. Does the market converge to marginal cost pricing?

The ultimate gauge of whether a certain degree of efficiency is achieved is in the observed level of wholesale market prices. A reasonably well-functioning market environment that is not tempered by external market regulators should produce prices that predominantly range between the LRMC and SRMC with occasional price hikes under acute shortage of capacity. Over the long term, average price would tend toward the long run marginal costs to preserve the financial sustainability of generating plants.

From January to December 2003, there was a rate of return regulation imposed by EMA on the three big generation licensees. For that period the volume-weighted average USEP[9] was $93.55/MWh. This is very near to the average price cap which effectively results from the rate of return regulation imposed by EMA and also the long run marginal cost of a CCGT.

[9] With HEUC adjustment

EMA implemented vesting contracts on 1 January 2004 in respect of about 65% of the wholesale market for energy. The vesting contract hedge price is the long run marginal cost of a CCGT and is computed quarterly. For the period January to December 2004, the volume-weighted average USEP was $82.58[10]. This is about 14.8% lower than the average vesting contract hedge price of $96.95/MWh over the same period.

With about 65% of the wholesale market for energy settled at the vesting contract hedge price and the remaining settled at USEP, the weighted average settlement price over the same period was $91.92/MWh. This is a 1.74% drop from the volume-weighted average USEP over 2003. This decrease was experienced despite the steep rise in oil prices over 2004.

During the year under review, it was also observed that any price spikes were only temporary, with the market responding by offering more supply, and prices coming down to normal levels very quickly.

In general, if a market is sufficiently competitive, there is no need for any kind of additional market discipline, be it a price cap or a vesting contract. Indeed, price caps or vesting contracts imposed externally on a competitive market would only distort the behaviour of players in the market and may cause economic inefficiency. However, when a market is highly concentrated and has inherent market power, efficiency in such a market is not automatically assured and some discipline from the outside by a market regulator is necessary. The vesting contracts imposed in January 2004 are more market friendly compared to the effective price cap imposed on the whole market. They have the effect of mitigating the exercise of market power and also allow for some degree of competition. There is debate over the question of how much of the wholesale market for energy should be vested. This issue remains a controversial one and there is no clear answer to this as it depends on a variety of factors including the objectives for which a vesting contract is designed.

State of Compliance within the Wholesale Electricity Markets

There have not been any major rule breaches in the wholesale electricity markets during this period. Our assessment as to the state of compliance within the wholesale electricity markets is set out below.

1. Offer Variations After Gate Closure

On 1 July 2004, the market rules were amended to reduce the gate closure period from 4 hours to 2 hours. With this change, there has been a corresponding reduction in the number of offer variations made after gate closure:

No of offer variations made after gate closure over 9 months from 1 October 2003 to 30 June 2004 (4-hour gate closure period)	6555
No of offer variations made after gate closure over 9 months from 1 July 2004 to 31 March 2005 (2-hour gate closure period)	3848
% reduction of offer variations made after gate closure	41.3%

[10] Volume based on actual metered energy quantity

During the period of assessment, the MSCP had also observed cases where offer variations after gate closure were sometimes not made on grounds permitted under the market rules or involved price change which is not permitted under the market rules. The MSCP had been taking a lenient view on the basis that market participants may still not fully understand the scope of the rules on offer variations after gate closure. On 25 November 2004 and 6 April 2005, the MSCP issued statements indicating that such offer variations would be treated as potential breaches of the market rules. In the 6 April 2005 statement, the MSCP also clarified the scope of the rule prohibiting price change and indicated that with effect from 15 April 2005, enforcement action would be taken in appropriate cases where there was found to be a breach of the market rules in relation to offer variations after gate closure.

2. Non-compliance With Dispatch Instructions

It was reported in the last MSCP Annual Report that there were 3 cases where energy was offered at $4500/MWh and when cleared by the MCE, the generation facility could not actually dispatch the quantities cleared. The MSCP was concerned that such behaviour may have a potential impact on system security or undermine the fair and efficient operation of the wholesale electricity markets. On 13 August 2004, the MSCP issued a statement to market participants emphasizing that a market participant was expected to be able to comply with dispatch instructions if, based on the offers it had made, it was scheduled in the real-time dispatch schedule. This applied even if the market participant was not scheduled in a pre-dispatch schedule. Since the issuance of the MSCP statement, the MAU has not observed any further cases involving high energy price offers followed by failure to comply with dispatch instructions.

3. Rule Breaches

For the period 1 April 2004 to 31 March 2005, most of the cases where the MSCP had determined a rule breach concerned failure by the market operator EMC to determine, release and publish information relating to dispatch schedules on time. It is noteworthy that these breaches were all self-reported. They had occurred due to IT problems. However, they have not been found to have had any significant impact on the wholesale electricity markets.

EMC has also been carrying out disaster recovery exercises. Advance notice has been given to the MSCP where there may be potential breaches of the market rules due to missed schedules. The MSCP recognizes these exercises as being part of an important risk management process for the wholesale electricity markets.

4. Issues Regarding Financial Penalties and Costs

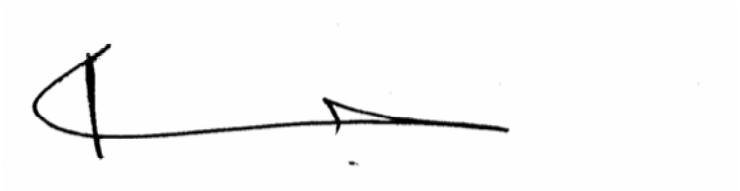
In the last MSCP Annual Report, the MSCP had also stated that it had on 27 April 2004 written to the EMA expressing its concern that the imposition of penal sanctions was generally void unless it had a statutory basis. Any financial penalties imposed by the MSCP pursuant to the market rules might therefore not be legally enforceable in the absence of legislative authority. In this regard, there does not appear to be any statutory basis for the imposition of financial penalties against the EMC or the MSSL.

The EMA was also asked for its views as to whether investigation costs were recoverable from the PSO, given that the PSO was not subject to financial penalties under the market rules.

The EMA has since confirmed that they have no objections that the MSCP may award investigation costs against the PSO. At the time of preparing this report, the MSCP understands that the issue regarding the statutory basis for the imposition of financial penalties against the EMC or the MSSL is under review by the EMA.

CONCLUSION

In our view, the wholesale electricity markets of NEMS continue to function in accordance with the relevant legislation, and underlying market rules.



Joseph Grimberg
Chair, Market Surveillance and Compliance Panel
11 July 2005