



National
Electricity
Market of
Singapore

Report by Market Surveillance and Compliance Panel

**For the period from
April 2005 to March 2006**

18 July 2006

**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.**

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EXECUTIVE SUMMARY

In the year under review, the average USEP price increased by 34.5 percent and the average household tariff¹ rose by 14.5 percent. The year also saw rising reserve² and regulation costs, as the total reserve payment and average regulation price rose nearly 85 percent and 104 percent respectively, with the average regulation price reaching a historical high of \$72.43/MWh. The rising USEP prices were mainly due to rising fuel oil prices that increased by more than 50 percent compared to the previous year. Other contributing factors were a tighter supply cushion arising due to higher demand and more withdrawals of ST generators, coupled with a declining of offers lower than \$100/MWh.

Besides higher average prices, the frequency of high price periods that exceeded a benchmark price also rose from 1.7 to 3.2 percent. This was despite an upward revision of the benchmark price from \$150/MWh to \$180/MWh. Most of the high prices occurred in the month of September and October.

A few periods of sharp price spikes in September and October prompted a request for investigation into market abnormalities by a market participant who alleged that such high prices, were unjustified given the large amount of installed capacity in the market. Concern was expressed that market outcomes may not have been fair and efficient because of certain behaviour on the part of the bigger players. The MSCP issued a report of its findings on 31 March 2006, which concluded that there was no evidence of inefficient or unfair market behaviour during the relevant period.

In reviewing the state of competition and efficiency of the wholesale electricity markets, the MSCP arrived at the following conclusions:

- The supply indicators signalled the continued proper functioning of NEMS, and there was evidence of competitive pressures and price responsiveness of supply conditions;
- The NEMS remained highly concentrated, but vesting contracts helped to mitigate market power risk;
- There was a continued lack of a mechanism for demand to respond to prices in NEMS;
- Price spikes were observed despite the fact that installed capacity was around 10,000MW, against, an average demand of 4253MW and the maximum peak demand of 5359MW. This was due largely to the inelastic demand in the electricity market;
- The availability of financial hedging instruments such as vesting contracts and bilateral contracts as well as credit support were important in the management of market risk, and to ensure market stability, especially during high price periods; and
- The market went through a healthy process of continual structural shift, in which the inefficient STs were increasingly replaced by more efficient CCGT units.

The MSCP also conducted its first hearing at the request of a market participant. In imposing a financial penalty of \$66,000 on the market participant for market rule breaches in relation to offer variations after gate closure, the MSCP considered that:

- The market participant had committed many breaches within a short period of time;
- Its initial responses to requests for information were unsatisfactory; and
- There was a lack of due diligence in setting up procedures which could have prevented the breaches from occurring.

¹ Based on average tariff for domestic low tension supplies.

² Reserve cost is not bound by end consumer. The cost is shared among generation companies.

The MSCP also ordered the market participant to pay the investigation and hearing costs, in the sum of \$23,000. The report of determination was issued by the MSCP on 24 February 2006.

In sum, the MSCP is generally satisfied with the market outcomes of the NEMS in the year under review.

GLOSSARY

A

AGC – automatic generator control
AFP - allocated regulation price

C

CCGT - combined cycle gas turbine

E

EMA - Energy Market Authority
EMC - Energy Market Company Pte Ltd

H

HEUC - hourly energy uplift charge
HSFO 180 cst – High Sulphur Fuel Oil

L

LRMC - long run marginal cost

M

market rules - Singapore electricity market rules
MAU - Market Assessment Unit
MCE – market clearing engine
MEUC - monthly energy uplift charge
MSCP - Market Surveillance and Compliance Panel
MSSL - market support services licensee
MOS – market outlook scenarios

N

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

O

OCGT - open cycle gas turbine
OT - other facilities (i.e. incineration plants)

P

PDS - pre-dispatch schedules
PowerSeraya - PowerSeraya Ltd
PSO - Power System Operator

S

SembCorp Cogen - SembCorp Cogen Pte Ltd
Senoko Power - Senoko Power Ltd
SP Services – SP Services 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

V

VCHP – vesting contract hedge price
VCSC - vesting contract settlement credit
VHP – vesting hedge proportion

W

WEP - wholesale electricity price

A USERS' GUIDE TO THE REPORT

General

Data

All real-time and forecast prices, and settlement data have been provided by EMC.

Vesting contract hedge prices were computed by SP Services based on a formula set by EMA.

Fuel oil data is based on the monthly "Oil Market Report" published by the International Energy Agency. A copy of the report is available from www.oilmarketreport.org.

Data for forecast demand and outages were compiled from reports prepared by the PSO, including advisory notices.

Metered energy quantities were supplied by SP Services as the MSSL. All metered data used in this report is final data, derived after any settlement reruns as may have been necessary.

Throughout this document, the demand figures are based on the forecast demand supplied by the PSO, except for the metered energy demand in section 3, which was compiled based on metered energy quantities.

Peak period refers to periods 19-36 from Mondays to Fridays (excluding public holidays).

Non-peak period refers to periods 1-18 and 37-48 on weekdays and all periods for Saturdays, Sundays and public holidays.

Period of Review

This report reviews activities mainly over the period of a year from 1 April 2005 to 31 March 2006. Each quarter of the year is denoted as follows:

1Q 05/06: 1 April 2005 to 30 June 2005

2Q 05/06: 1 July 2005 to 30 September 2005

3Q 05/06: 1 October 2005 to 31 December 2005

4Q 05/06: 1 January 2006 to 31 March 2006

Supply Indices

Capacity Ratio measures the scheduled (by the MCE) output of energy, reserve and regulation as a ratio of a generation registered facility's maximum generation capacity at a given time.

Supply cushion is the ratio between (a) the 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.

Market share was computed based on the generation output of each company against the total generation output as scheduled by the MCE. The *maximum capacity* for each generation company is the registered maximum capacity in the standing data.

Outages

Outages of generation registered facilities are divisible into three groups:

- (a) planned outage, defined in the System Operation Manual to “include both the Annual Outage plan for overhaul, retrofitting or inspection and Short-term Outage Plan for urgent repair or maintenance”;
- (b) unplanned outage, defined in the System Operation Manual 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”; and
- (c) forced outage, defined in the market rules 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”.

Demand Indices

STS are updated every half-hour 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 more updated information to market participants and enable market participants to make more informed and timely decisions.

PDS are updated every 2-hours covering a time horizon of between 12 to 36 hours after the period in which the relevant *PDS* is published.

MOS are released daily covering a six-day horizon.

Vesting Contracts

VCHP is calculated by the MSSL every three months. The EMC’s settlement system uses the *VCHP* to settle vesting quantity between MSSL and the generation companies. It is determined using the long run marginal cost of the most efficient technology in the Singapore power system, i.e. the CCGT (combined cycle gas turbine).

VHP is the vesting contract hedge quantity to contestable consumers.

INTRODUCTION

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

This is the fourth report by the MSCP on the wholesale electricity markets of the NEMS. It mainly covers the period 1 April 2005 to 31 March 2006. 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 includes 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 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 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, MSSLs, the PSO and 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, MSSLs, 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 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 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 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 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 acquires and a catalogue of the monitoring indices that it uses to evaluate 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 used to evaluate the market data collected.

Indicators of Market Performance

The MAU has submitted 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 were prepared based on market monitoring carried out over the year under review.

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**

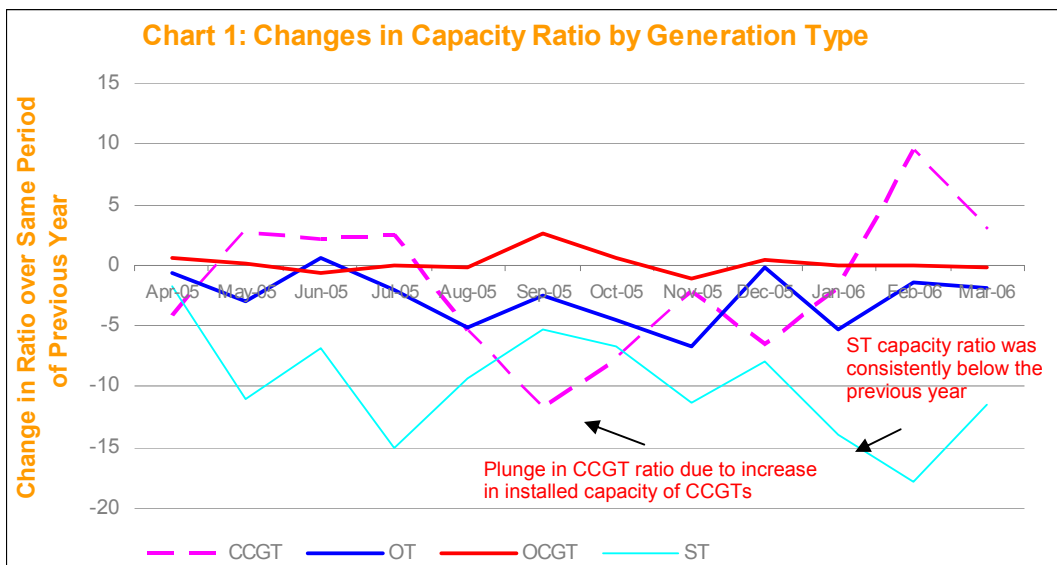
Although CCGT market share has risen from 71.7 to 78.9 percent in the year under review, the average CCGT capacity ratio actually dropped from 81.2 to 79.5 percent (see table 1) due to an increase in the total installed capacity of CCGT. By comparison, the capacity ratio of STs, which were the dominant suppliers of electricity in Singapore prior to the establishment of the NEMS, fell from 33.3 to 23.4 percent during the same period.

The re-commissioning of ST capacity and rising fuel oil prices during this period may have contributed to the lower ST capacity ratio. The re-commissioning of three ST units that are capable of running on Orimulsion added close to 750MW of installed capacity to the market. The cost of running ST plants also rose, since the benchmark HSFO 180 cst gained by more than 50 percent. Rising average offer prices by the ST units were the strongest evidence of the rising cost of running an ST.

Since market start in 2003, there has been a continuing structural shift in the type of generation unit being run to supply electricity in Singapore. This year saw the addition of another 720MW of the more efficient CCGTs in July 2005. As shown in chart 1, this has resulted in a sharp fall in the CCGT capacity ratio after July 2005, compared with the previous year. The fall in CCGT capacity ratio is also due to units undergoing commissioning, thereby limiting their generation output. Rising fuel costs had a lesser impact on CCGTs which are more fuel efficient.

The relatively high CCGT ratio compared to ST continued to signal the existence of competitive pressure in the NEMS, as the more efficient and cost effective CCGT plants were selected ahead of the less efficient ST plants.

	Year 04/05				Year 05/06				Change over Same Period of Previous Year			
	CCGT	OT	OCGT	ST	CCGT	OT	OCGT	ST	CCGT	OT	OCGT	ST
Apr-05	80.1	44.4	0.1	37.3	76.0	43.8	0.7	35.5	-4.1	-0.6	0.6	-1.7
May-05	81.6	44.4	0.2	38.8	84.4	41.4	0.3	27.7	2.8	-3.0	0.1	-11.0
Jun-05	79.8	40.7	0.7	37.2	81.8	41.2	0.1	30.3	2.1	0.5	-0.6	-6.9
Jul-05	75.2	45.0	0.0	38.7	77.6	42.9	0.0	23.7	2.4	-2.1	0.0	-15.0
Aug-05	83.6	46.5	0.2	31.9	78.2	41.4	0.0	22.6	-5.4	-5.1	-0.2	-9.4
Sep-05	86.6	44.4	0.0	32.4	74.8	41.8	2.7	27.2	-11.8	-2.5	2.6	-5.2
Oct-05	83.7	42.3	0.6	32.5	75.9	37.8	1.2	25.8	-7.7	-4.6	0.6	-6.7
Nov-05	82.1	45.6	1.2	30.7	80.0	38.9	0.1	19.4	-2.2	-6.7	-1.2	-11.3
Dec-05	86.2	44.1	0.1	26.2	79.7	44.0	0.6	18.3	-6.5	-0.1	0.5	-7.9
Jan-06	80.2	46.5	0.2	29.5	78.3	41.2	0.2	15.5	-1.9	-5.3	0.0	-14.0
Feb-06	72.5	45.0	0.0	35.1	81.9	43.6	0.0	17.2	9.4	-1.4	0.0	-17.9
Mar-06	82.5	44.9	0.4	29.6	85.5	43.1	0.2	18.1	3.0	-1.8	-0.2	-11.5
Average:	81.2	44.5	0.3	33.3	79.5	41.8	0.5	23.4				



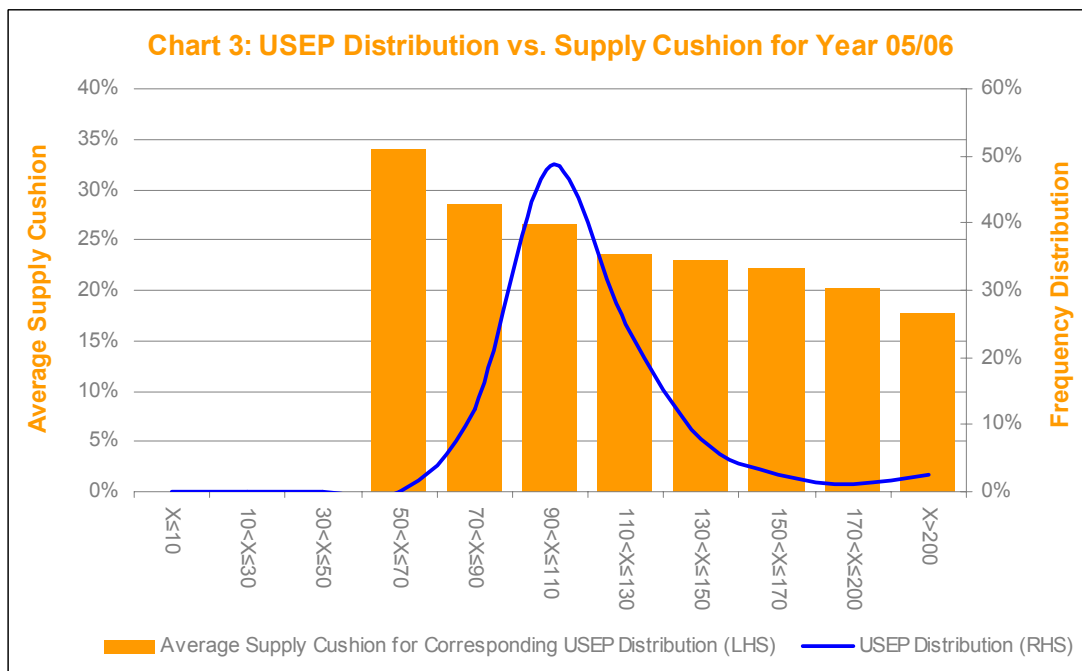
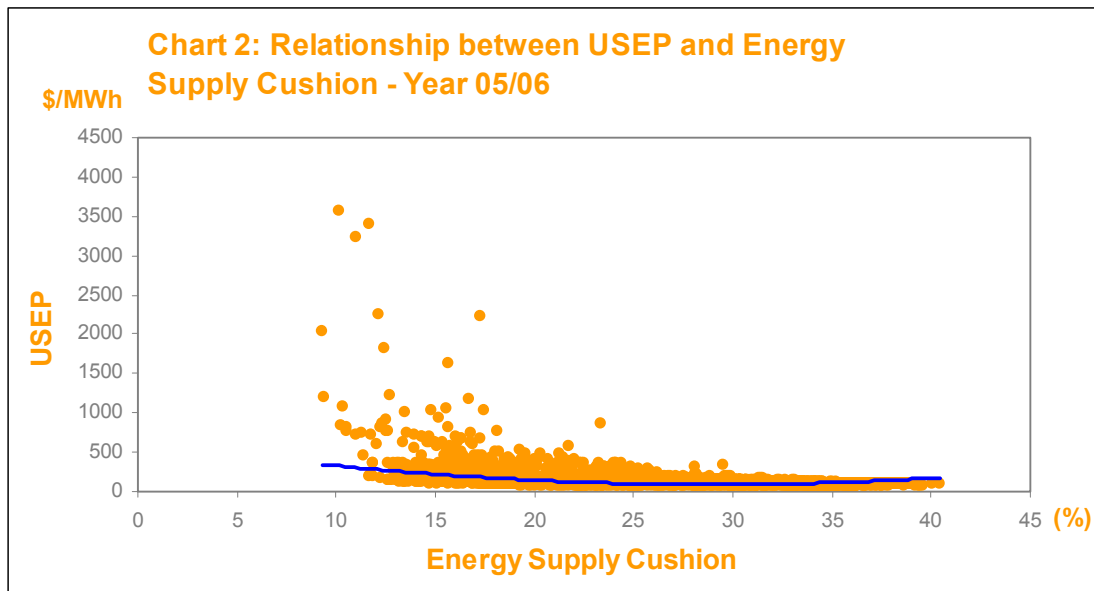
1.2 Supply cushion: ratio between (a) supply and demand gap (i.e. difference between total offered volume and system demand) and (b) supply

The supply cushion, which measures the spare capacity available after dispatch, was a little tighter compared to the previous year, dropping nearly 1 percentage point to 25.1 percent. This was despite an increase in installed capacity of 720MW CCGTs and the repowering of three STs, which added another 750MW.

The main reasons for the tighter supply cushion were weaker plant availability arising from a 28.5 percent fall in availability of less efficient ST plants, and the higher electricity demand which grew by 4.2 percent. Peak demand also hit a new high of 5359MW on 11 October 2005.

Chart 2 shows the inverse relationship between energy prices (USEP) and the supply cushion. High prices occurred more frequently when the supply cushion approached the 10 percent mark. Chart 3 confirms this relationship, with the average supply cushion becoming tighter at the higher average price range.

The lowest supply cushion was below 10 percent. This occurred in September 2005, the month in which peaks in energy prices were observed.



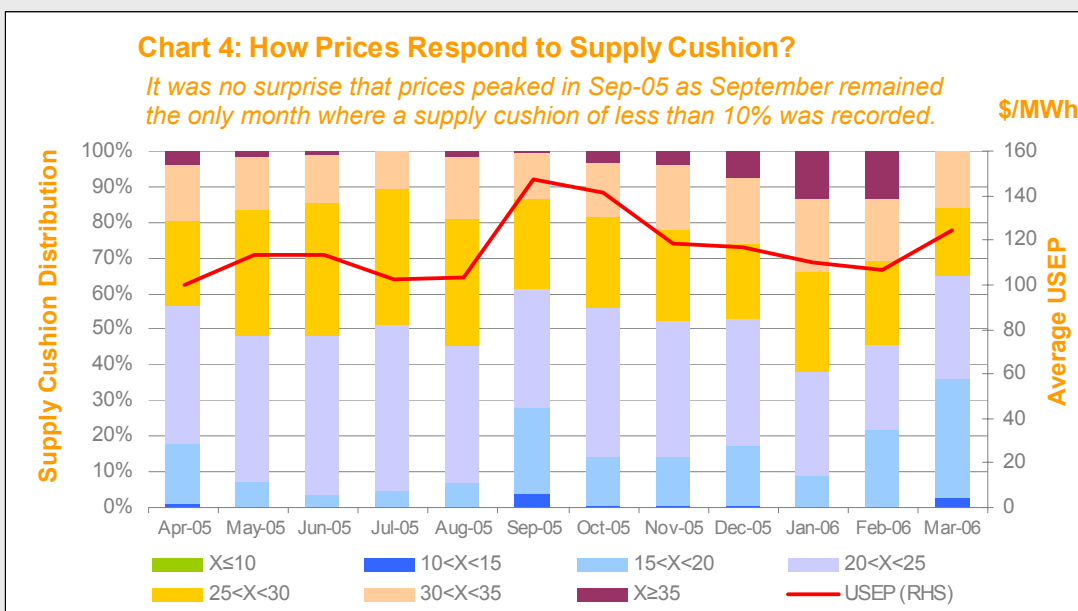
Note: X represents USEP in \$/MWh

Impact of Tight Supply Cushion in September 2005

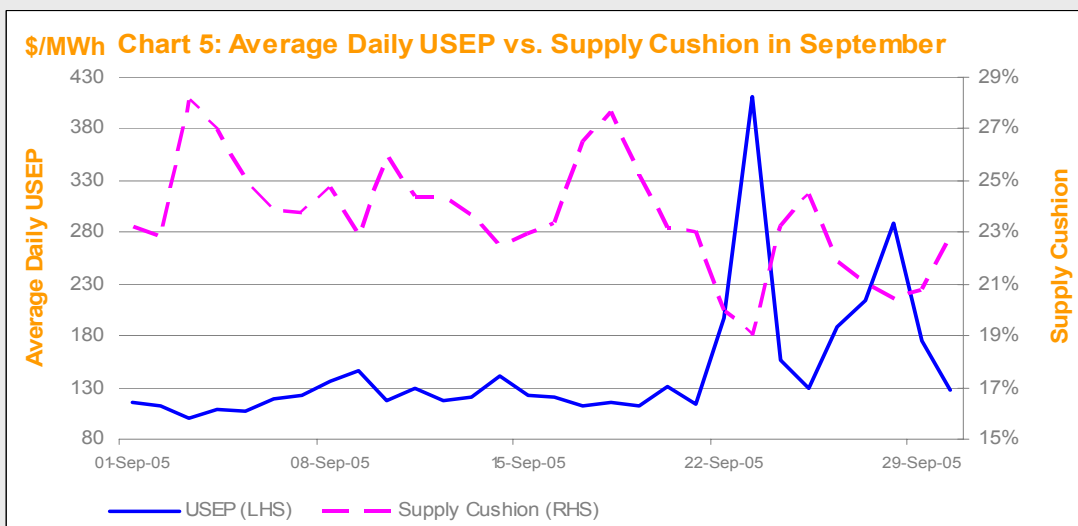
The average USEP in September peaked at \$147.25/MWh with contingency reserve and regulation prices also hitting the price caps of \$3250/MWh and \$2750/MWh respectively.

The average supply cushion for September dropped to 23.3 percent, below the average of 25.1 percent for the year (see chart 4). The drop in supply cushion to below 10 percent on two occasions also saw the USEP hitting a high of \$1187.24/MWh and \$2023.39/MWh on 23 September 2005 (see chart 5 on relationship between the daily average USEP and supply cushion in September). The previous year, the USEP reached the \$4500/MWh mark for one period when the supply cushion for the corresponding period dropped below 10 percent on 19 June 2004.

The main reason for the tighter supply cushion in September was the increase in planned maintenance from base load CCGTs to more than 50 percent. The worsening CCGT supply also coincided with a strengthening demand, as the average demand in September was the second highest of the year.



Note: X represents supply cushion in percent



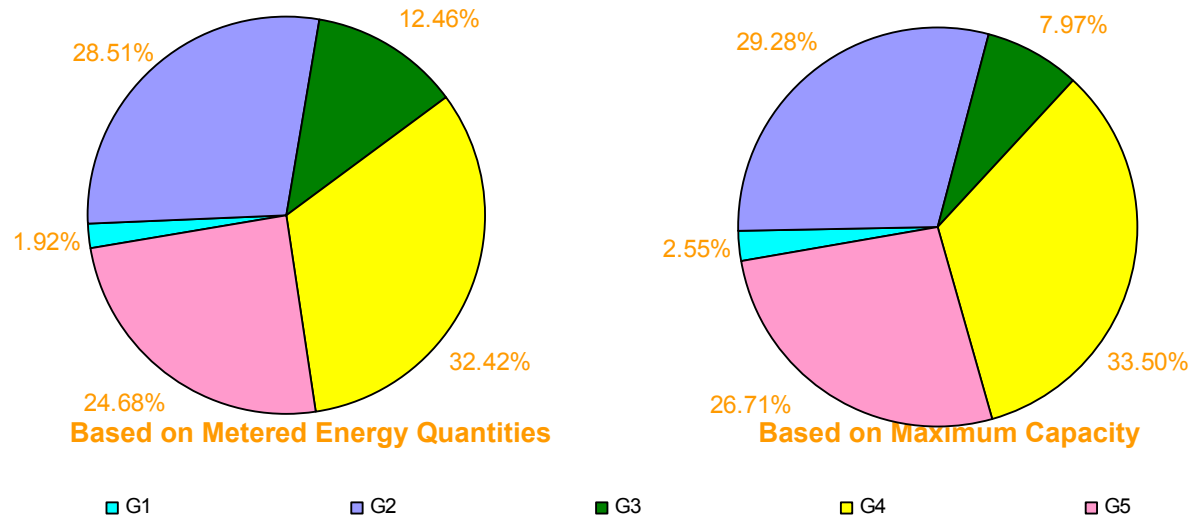
1.3 Market share

As shown in chart 6, with the exception of one generation company, the average market share of most generation companies, based on metered energy quantities, continued to reflect their market share based on maximum capacity. The market also favoured the running of the more efficient CCGTs, as their market share rose to a record high of 78.9 percent, despite the fact that CCGTs, the dominant type of generation, accounted for less than half of the maximum generation capacity in NEMS (see chart 7).

In particular, two generation companies gained in market share based on metered energy quantities and maximum capacity (see chart 8). A generation company added two new CCGTs to its portfolio, while another generation company repowered three ST plants running on Orimulsion. The addition of two CCGTs by the generation company saw the maximum capacity for CCGTs in the market rise from 47.2 to 49.5 percent, and CCGT market share based on metered energy quantities rise from 71.7 to 78.9 percent over the year (see Chart 9).

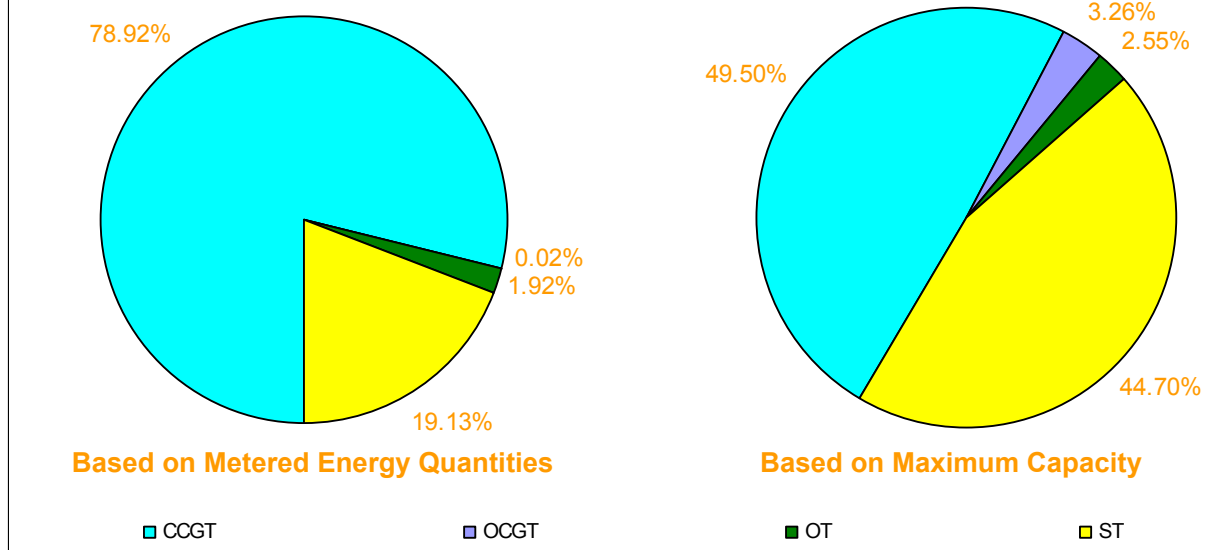
Competition and rising fuel oil prices continued to exert pressure on generation companies to offer more efficient CCGT plants in preference to ST plants.

Chart 6: Comparison of Average Market Shares by Generation Company, Year 05/06

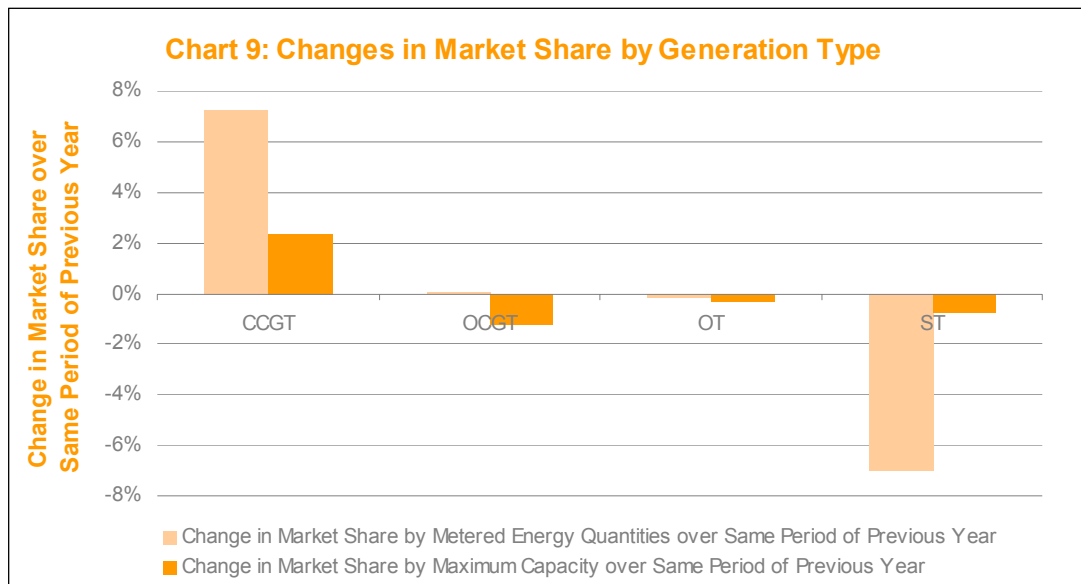
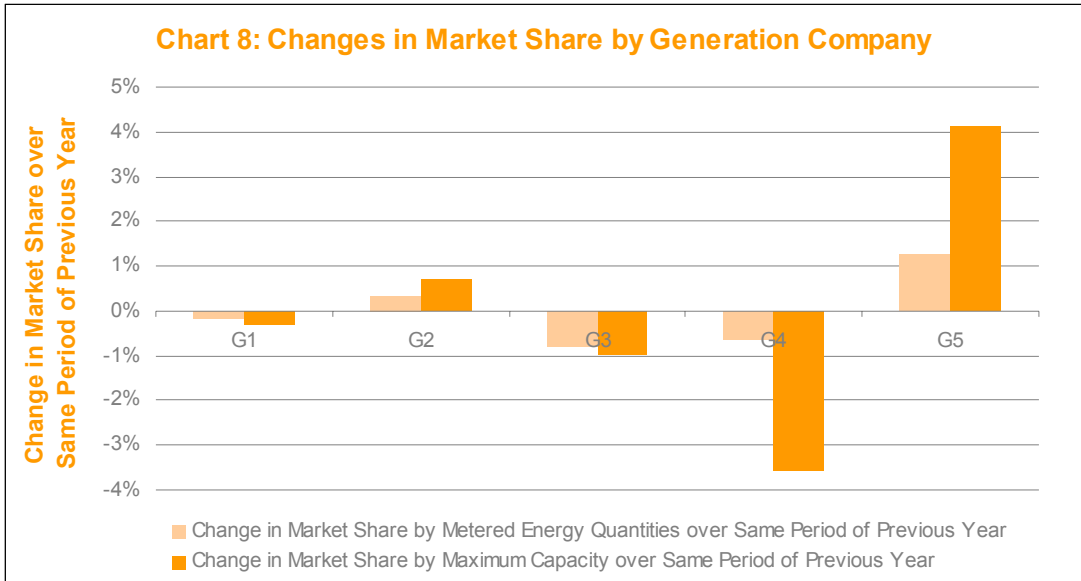


Note: The average metered energy quantity for this year is 4115MW
 The total installed capacity is 10,076MW

Chart 7: Comparison of Average Market Shares by Generation Type, Year 05/06



Note: The average metered energy quantity for this year is 4115MW
 The total installed capacity is 10,076MW



1.4 Outages

There are three types of outages in NEMS, namely planned outages, unplanned outages and forced outages. During the year under review, 19,752,358MW of outage capacity was recorded, with nearly 97 percent resulting from planned outages (see table 2a). The outage figure has not changed significantly since market start. The total outage capacity translates into an average outage per period of 1127MW, which is equivalent to the capacity of about 4 ST plants of about 250MW each or 3 CCGT plants, out of about 33 generation plants in the market.

In general, the correlation between generation planned outages and USEP was weak. As shown in table 2b, the correlation coefficient between generation planned outages and USEP was close to zero but between CCGT planned outages and USEP was relatively much stronger. This was mainly due to a significant contribution from the base load CCGT units in terms of market share. As a result, prices tended to be higher in their absence, as the efficient CCGT plants were displaced by more expensive ST plants.

Table 2a: Summary of Outages for 2005/06

	<u>Total Outage Capacity (MW)</u>		
	<u>Planned</u>	<u>Unplanned</u>	<u>Forced</u>
Apr-05	2,562,930	0	47,773
May-05	1,819,836	133,200	25,517
Jun-05	2,057,984	0	45,654
Jul-05	1,532,053	19,440	20,602
Aug-05	1,026,554	0	24,647
Sep-05	1,113,080	0	22,768
Oct-05	1,999,791	0	24,769
Nov-05	1,388,295	0	84,656
Dec-05	1,311,392	0	78,098
Jan-06	1,742,270	0	24,974
Feb-06	1,626,749	0	4,230
Mar-06	937,811	14,176	63,109
Sum:	<u>19,118,745</u>	<u>166,816</u>	<u>466,797</u>
% of Total Outage:	<u>96.8%</u>	<u>0.8%</u>	<u>2.4%</u>

Table 2b: Correlation between Planned Outages and Prices

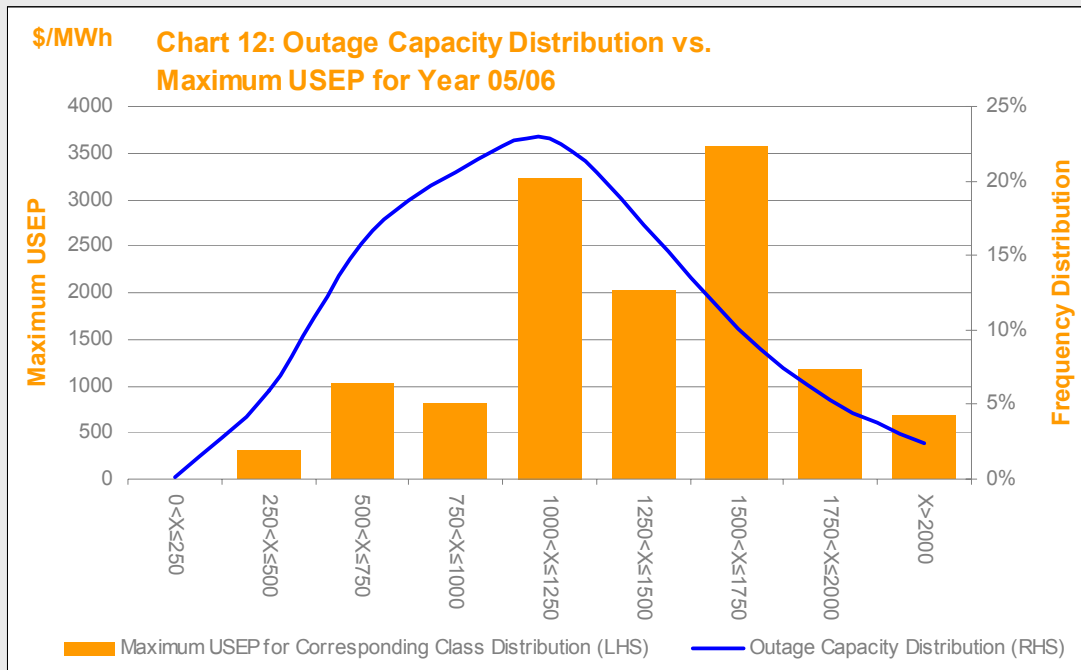
	Correlation Coefficient, <i>r</i>
All Generation Planned Outages	0.01
CCGT Planned Outages	0.08
ST Planned Outages	-0.07

Significant Price Spikes and Outages

Although average spot prices (USEP) were 34.5 percent higher than in the previous year, the occurrence of price spikes above the \$1000/MWh threshold remained relatively unchanged at 0.09 percent.

Chart 12 shows the frequency distribution for outages this year, and the corresponding maximum USEP for each class. The chart indicates that:

- Median of outages – the median was in the 1000MW to 1250MW range; and
- Prices exceeding \$1000/MWh – with the exception of 19 March 2006, price spikes above the \$1000/MWh threshold occurred when outages were at or in excess of the median.



Note: X represents outages in MW

Table 3 below shows all the 16 periods of USEP exceeding the \$1000/MWh threshold and their corresponding outages and supply cushions. These price spikes coincided with low supply cushions, which were well below the average of 25.1 percent for the year. As shown in table 3, the price spikes were mainly concentrated on three trading days (14 May 2005, 23 September 2005 and 28 December 2005):

- 14 May 2005 – With an average of more than 1700MW of capacity on outage, the supply conditions on 14 May were already tight prior to the price spikes that began in period 16 and were seen again in period 18. The forced outage of a CCGT in period 19 pushed total outage capacity close to 2000MW. With demand also rising during this period, the lower supply cushion pushed USEP above the \$1000/MWh level between periods 20 and 22.
- 23 September 2005 – Although no forced outages were reported, up to three CCGTs were on planned maintenance. With average demand also higher by more than 1 percent and a 4 percent drop in ST availability compared to the previous trading day, USEP hit a high of more than \$3000/MWh in period 20. The supply cushion of less than 10 percent in periods 22 and 23 were the lowest in the year.

- 28 December 2005 – The forced outage of a CCGT in period 29 coincided with the peak demand of 4953MW. As a result, USEP spiked from \$142.21/MWh to \$3409.55/MWh. The tight supply saw USEP remaining above \$1000/MWh for the next four periods. Although supply never returned to the level prior to the forced outage, the subsiding demand after period 29 helped lower USEP.

Other significant price spikes:

- 8 April 2005 – Although the level of outages remained at 1729MW, the offer change from a CCGT saw the supply cushion dropping to 10.17 percent in period 32 and resulted in a price spike to \$3569.63/MWh.
- 19 March 2006 – With the average supply cushion dropping from 24.81 percent on 12 March 2006 in the previous week to 20.81 percent on 19 March 2006, as a result of lower availability and higher demand, the market was already in tight supply. Although there was no sudden drop in supply due to forced outages, the drop in the supply cushion to 14.85 percent was sufficient to trigger a price spike to \$1023.25/MWh in period 40.

Table 3: List of High Price Incidents in Year 2005/06

Period	Date	USEP (\$/MWh)	Supply Condition	
			Total Outage (MW)	Supply Cushion (%)
32	8-Apr-05	3569.63	1,729	10.17
16	14-May-05	2229.61	1,648	17.31
18	14-May-05	1628.70	1,648	15.64
20	14-May-05	1020.66	1,953	17.45
21	14-May-05	1168.05	1,953	16.67
22	14-May-05	1063.53	1,953	15.60
20	23-Sep-05	3224.19	1,144	11.03
22	23-Sep-05	1187.24	1,276	9.44
23	23-Sep-05	2023.39	1,276	9.30
24	23-Sep-05	1069.16	1,276	10.39
29	28-Dec-05	3409.55	1,316	11.72
30	28-Dec-05	2257.85	1,680	12.14
31	28-Dec-05	1807.54	1,680	12.41
32	28-Dec-05	1212.86	1,680	12.68
33	28-Dec-05	1001.64	1,680	13.46
40	19-Mar-06	1023.25	630	14.85

2. Demand Indices

2.1 Accuracy of pre-dispatch and short-term load forecast

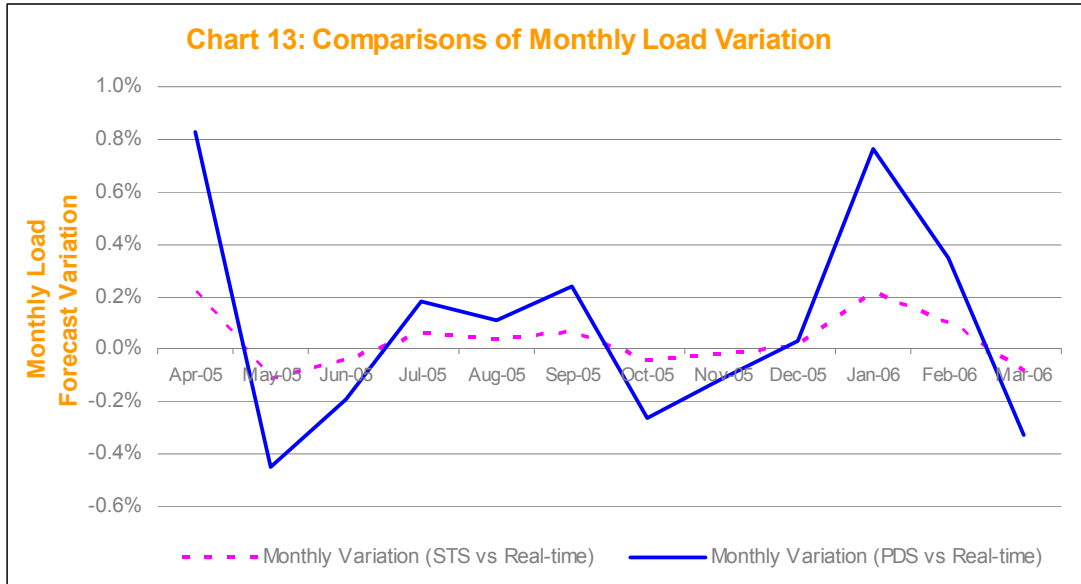
In NEMS, three forecast schedules with different time horizons are made available to generators, retailers and to some consumers. For generating companies, the accuracy of the schedules is important, so that their plants are able to respond appropriately in real time. The forecast schedules also serve as an indication of prices that retailers and consumers may face in real-time. The accuracy of these forecast schedules depends on many factors, such as load forecast and other data.

Table 4 shows the accuracy of the load forecast as measured by the mean and standard deviations of the variations between forecast and actual real time figures. The variation between STS forecast and real time was smaller than that between PDS forecast and real time by nearly 4 times (see chart 13). This was to be expected as STS forecasts are updated every half-hour with a forecast horizon of up to 6 hours compared to PDS forecasts which are updated every 2 hours with a forecast horizon of between 12 to 36 hours.

For both STS and PDS forecasts, variations between forecasts and real time were smaller compared to the previous year (see Table 4) which reflects an improvement in forecast schedules.

	Year 04/05				Year 05/06			
	Variation between PDS & Real-time		Variation between STS & Real-time		Variation between PDS & Real-time		Variation between STS & Real-time	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Apr-05	42	29	13	7	51	26	13	6
May-05	62	28	16	7	36	25	9	7
Jun-05	43	25	12	6	36	24	9	6
Jul-05	51	26	13	7	28	19	7	5
Aug-05	31	21	9	6	44	28	11	7
Sep-05	33	26	9	7	31	22	8	6
Oct-05	38	24	10	6	36	23	9	5
Nov-05	34	22	10	6	44	36	12	9
Dec-05	38	30	10	8	36	26	9	7
Jan-06	38	21	11	6	48	36	12	10
Feb-06	45	33	12	9	28	23	7	5
Mar-06	38	25	10	6	24	16	6	4
Average:	41	26	11	7	37	25	9	6

Note: All figures shown in table 4 are in MW



Note: A negative figure indicates that load in real-time was higher than forecast

2.2 Accuracy of real-time load forecast

The accuracy of the load forecast used in generating real-time dispatch and pricing schedules is important for pricing outcomes and system security.

Although a small forecast variation is expected between forecast and actual demand (metered energy quantities), there were a number of factors contributing to the accuracy of forecasts. 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. Other factors include loss factors and metering errors. As shown in table 5, the difference in actual demand from forecast demand remains small, at below 4 percent.

	Monthly Variation (%)	
	Year 04/05	Year 05/06
Apr	4.29	3.33
May	3.91	3.62
Jun	3.78	3.73
Jul	4.03	3.85
Aug	3.72	4.10
Sep	3.83	4.27
Oct	3.8	4.24
Nov	3.74	4.23
Dec	3.62	4.38
Jan	3.65	3.96
Feb	3.64	4.28
Mar	3.78	3.88
Average:	3.82	3.99

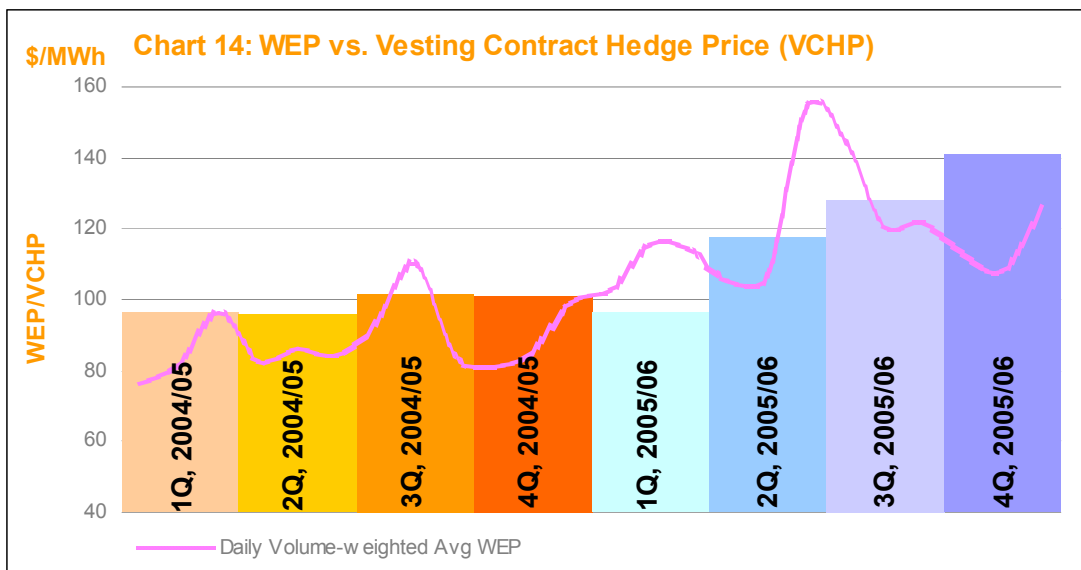
3. **Price Indices**

3.1 **Vesting contract hedge price**

The VCHP is set at the LRM of the most efficient generation technology available. The LRM includes the cost of assets, running costs and financing costs of the generation licensee, computed on the basis of a formula determined by the EMA. The actual vesting contract hedge price and quantities are calculated by the MSSL on a quarterly basis.

With the benchmark HSFO 180 cst price rising more than 50 percent in the current year, the average VCHP rose by 22 percent during the same period. The VCHP hit a new high of \$140.70/MWh in the fourth quarter.

The WEP, or the price that retailers pay for energy, exceeded the VCHP on five occasions, compared to only two occasions the previous year (see chart 14).

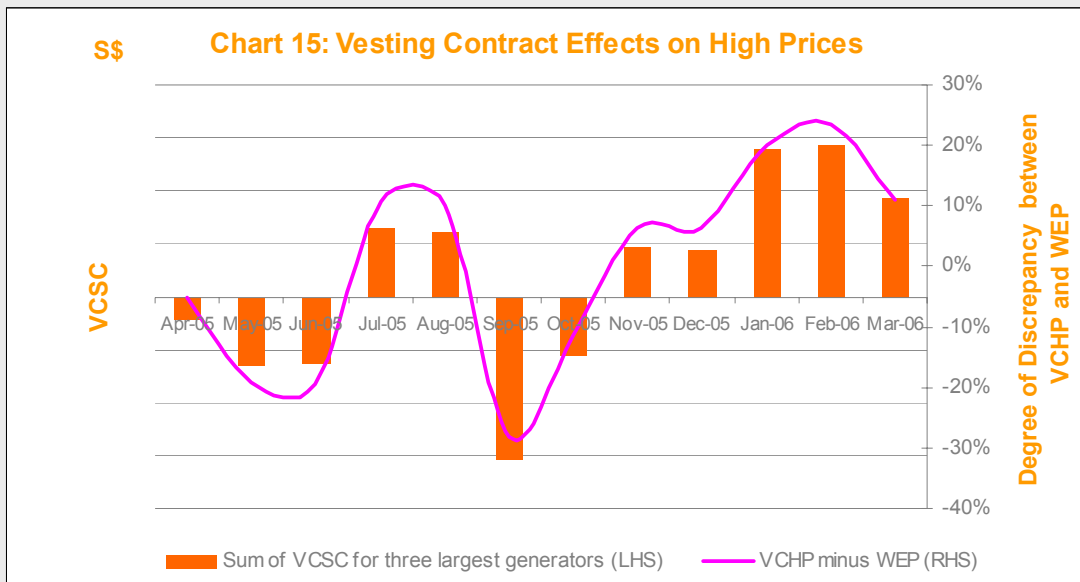


The Importance of Vesting Contracts during Period of High Prices

In Singapore, the supply side of the market consists of five generation companies with the three largest players controlling nearly 90 percent of the market share based on maximum capacity. In recognition of this market concentration, Singapore's EMA implemented vesting contracts on 1 January 2004. The aims of the vesting contract regime are to manage generator market power and protect non-contestable consumers against price spikes. Under the regime, generators are allocated contracts for differences covering around 65 percent of demand, with the strike price based on the LRMC of operating a CCGT. This means that only 35 percent of energy payment is based on spot prices.

Hence, during periods of high spot prices, which exceed the VCHP set by MSSL on a quarterly basis, a generator is required to repay the differences between spot and VCHP. This helps to reduce the incentive for generators to push spot prices higher.

The chart below summarises the VCSC for the three largest generation companies in NEMS. The VCSC indicates the net amount paid to generators on vesting contract hedge quantities. The chart shows that in each of the five months (from April 2005 to June 2005, September 2005 and October 2005) where WEP exceeded VCHP, these generators ended up repaying money to the market. The most significant amount recorded was in the month of September 2005 when WEP hit more than \$150/MWh (see page 15 for reasons for high prices in September 2005). The net VCSC to generators this year dropped nearly 90 percent compared to the previous year.



Note: The amount of VCSC paid to the three largest generation companies has been masked to protect confidentiality.

3.2 WEP

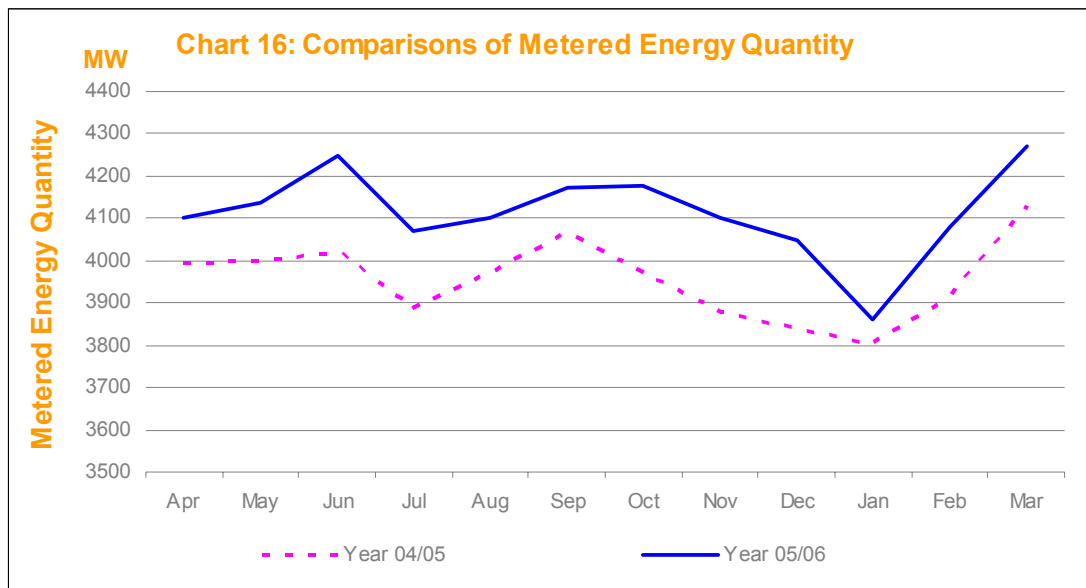
USEP makes up the bulk of WEP or the price that retailers pay for energy in \$/MWh. The rest of the components are the AFP, HEUC, MEUC, EMC administrative fees and PSO administrative fees.

3.2.1 Metered energy quantity

Average metered demand grew by 4 percent this year compared to 5.3 percent growth registered for the previous year. However, peak demand registered a new high on 11 October 2005.

Despite a slowing rate of growth in metered demand, the demand trend shows some similarity compared to the previous year, as indicated in the chart below. In addition:

- Average monthly demand was consistently stronger than the previous year;
- Demand reached a trough in January as a result of the long holiday break including Chinese New Year; and
- Demand peaked in March as the weather turned hotter.



3.2.2 Correlation between WEP and metered energy quantity

The correlation coefficient (r) in Table 6 measures the strength of the relationship between WEP and metered energy quantity. A positive correlation indicates that as demand increases, the energy price tends to increase as well. The square of the correlation coefficient (r^2) can be interpreted as the proportion of variance in prices that can be explained by variation in the demand.

On average (see last row in table 6), both r and r^2 are smaller this year compared to the previous year. In particular, they are respectively 0.30 and 0.12 compared to the previous year's 0.52 and 0.29 respectively. Moreover, about 34 percent of the daily correlation coefficients are above 0.5 compared to 60 percent the previous year.

The low correlation (r) between demand and prices can be explained by the following factors:

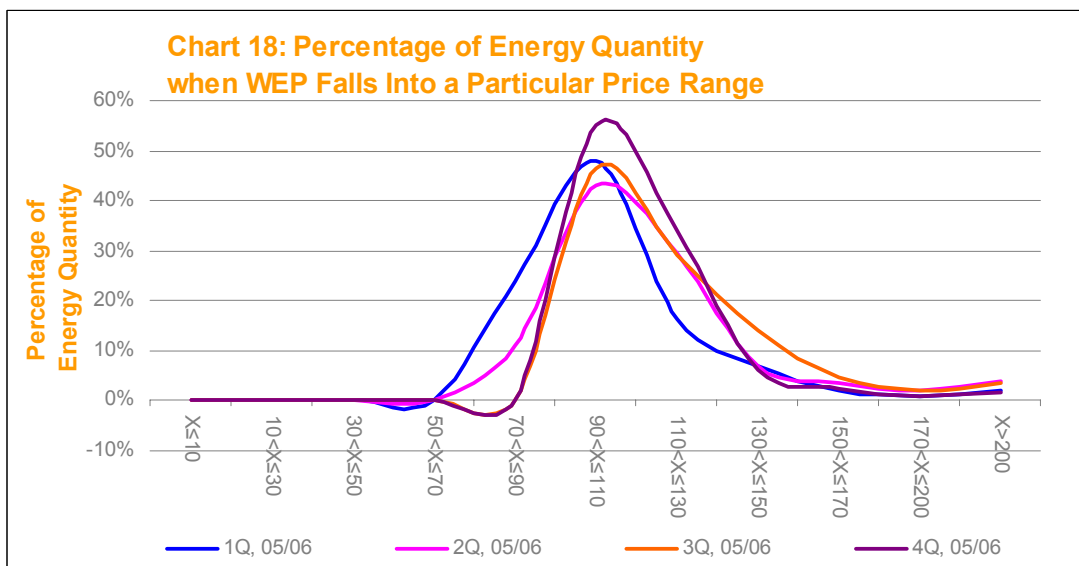
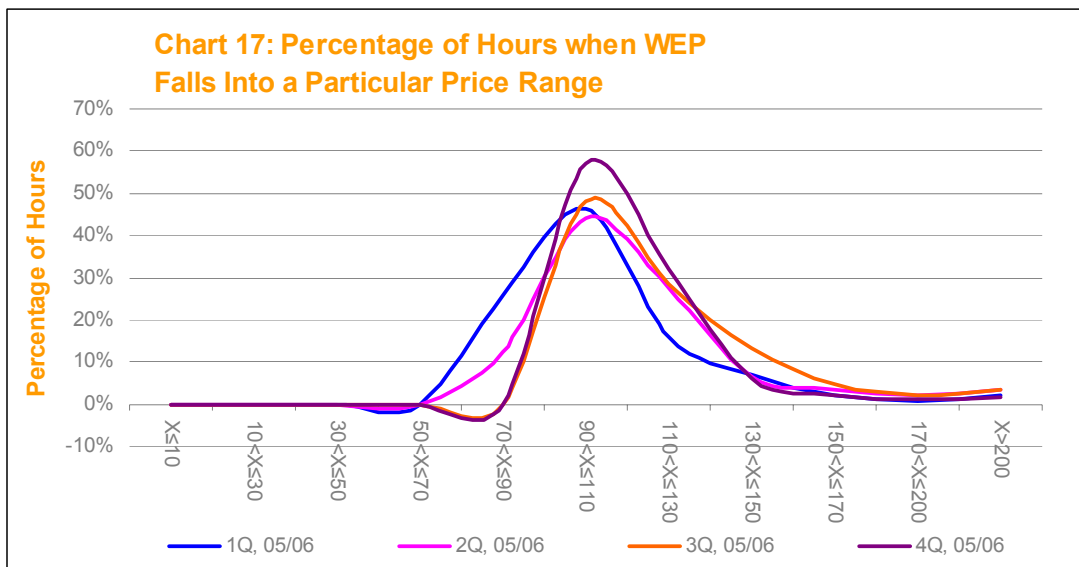
- Fixed price retail contracts. Some retail contracts offered to contestable consumers are fixed price contracts. This weakens the correlation between demand and price.
- Price spikes. Due to a special characteristic of electricity markets where demand is inelastic, occasional price spikes due to supply disruptions will weaken the correlation as spot prices jump without an increase in demand. Another reason for price spikes is the commissioning of new plants which offer energy but cannot offer reserves. Due to the co-optimisation of energy and reserves, a tight supply of reserves may sometimes lead to energy being used to provide reserves, resulting in spikes in energy prices.

	Year 04/05			Year 05/06		
	Correlation Coefficient, r	r^2	Number of Days with $r > 0.5$	Correlation Coefficient, r	r^2	Number of Days with $r > 0.5$
Apr	0.56	0.31	20	0.35	0.12	11
May	0.75	0.57	29	0.12	0.01	5
Jun	0.61	0.37	22	-0.14	0.02	2
Jul	0.49	0.24	14	0.43	0.19	13
Aug	0.57	0.32	19	0.35	0.12	11
Sep	0.56	0.31	19	0.40	0.16	8
Oct	0.45	0.20	17	0.39	0.15	16
Nov	0.40	0.16	12	0.32	0.10	8
Dec	0.72	0.52	25	0.39	0.15	13
Jan	0.64	0.41	24	0.32	0.10	11
Feb	0.26	0.07	9	0.45	0.20	15
Mar	0.23	0.05	8	0.23	0.05	7
Average:	0.52	0.29	218	0.30	0.12	120

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

As shown in chart 17, the price distribution curve in the last three quarters of the year shifted to the right, and raised the mean from the \$70-90/MWh range in the previous year to the \$90-\$110/MWh range this year.

The frequency distribution of WEP according to percentage of energy quantity (see chart 18) mimicked the percentage of hours. The mean for all quarters of the year was in the \$90-\$110/MWh range.

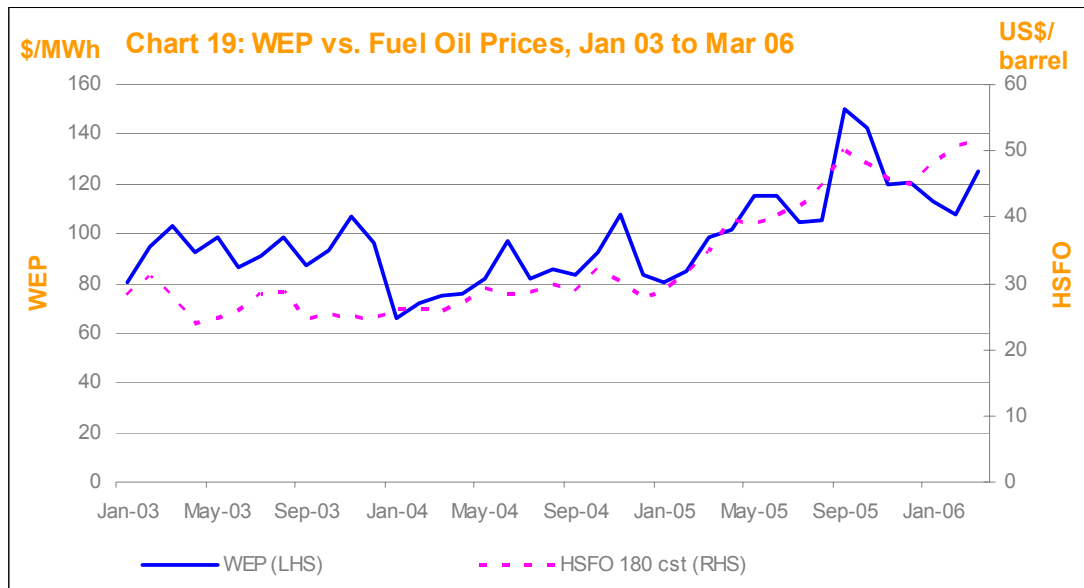


3.2.4 Correlation between WEP and fuel oil prices

Average prices for HSFO 180 cst, the most relevant oil benchmark for NEMS, surged slightly more than 50 percent this year, averaging more than US\$45 a barrel. Fuel oil prices at the end of the year rose to nearly 85 percent higher than when NEMS commenced trading in January 2003. The WEP was also higher by 34.9 percent compared to the previous year. As shown in chart 19 below, the upward momentum for WEP accelerated in January 2005 along with surging fuel oil prices.

As a result, energy prices such as WEP have trended higher since oil makes up the bulk of generation companies' cost of production. Despite reduced reliance on STs to meet demand in recent years, gas prices which affect CCGT plants are pegged to the HSFO.

Besides the wholesale electricity markets, end consumer tariffs have also increased along with higher fuel oil prices. Household tariffs⁴ average more than 14.6 percent higher than during the previous year.



⁴ Base on average tariff for domestic low tension supplies.

3.2.5 Periods with WEP above \$180/MWh

The benchmark price to assess high price periods was increased from \$150/MWh to \$180/MWh⁵ due to higher fuel costs and WEPs. Based on the new benchmark price of \$180/MWh, 3.2 percent of energy prices can be classified as high, compared with a mere 1.7 percent the previous year when the benchmark price of \$150/MWh was used. If the previous benchmark price of \$150/MWh was applied, the proportion of high price periods for the year would more than double from the current 3.2 to 7.3 percent. As shown in table 7, the most significant jump in the number of high price periods was observed during off-peak periods. This number more than doubled from 161 in the previous year, to 384. In particular, September and October 2005 saw a high frequency of high prices (302 of the 609 registered).

	Year 04/05				Year 05/06			
	Peak		Off-peak		Peak		Off-peak	
	>\$150	>\$180	>\$150	>\$180	>\$150	>\$180	>\$150	>\$180
Apr	2	0	0	0	33	31	19	16
May	0	0	2	1	15	3	56	25
Jun	24	11	22	12	18	5	78	34
Jul	4	1	0	0	1	0	55	4
Aug	10	8	7	7	22	5	51	18
Sep	6	1	1	1	144	109	124	59
Oct	34	13	23	8	57	31	202	103
Nov	45	40	41	36	19	5	82	28
Dec	5	5	11	9	23	20	69	19
Jan	0	0	20	20	16	6	70	26
Feb	1	1	7	5	16	5	3	2
Mar	4	4	27	24	14	5	97	50
Sum:	135	84	161	123	378	225	906	384

⁵ The benchmark price adopted for each year of review is twice the average WEP for the three months immediately preceding the year under review.

	Year 04/05		Year 05/06		Change over Same Period of Previous Year	
	Peak	Off-peak	Peak	Off-peak	Peak	Off-peak
	Average Plant Availability (MW)	6156	5292	6283	5465	2.1%
Average Metered Demand (MW)	4673	3706	4852	3858	3.8%	4.1%
Total Forced Outages (MW)	-	-	112,478	354,319	NA	NA
Total Planned Outages (MW)	-	-	4,911,726	14,640,436	NA	NA
Average Supply Cushion (%)	21.9	27.8	20.3	27.1	-1.3%	-0.6%
Offers <\$100/MWh (%)	80.0	77.6	74.8	71.3	-4.2%	-5.9%

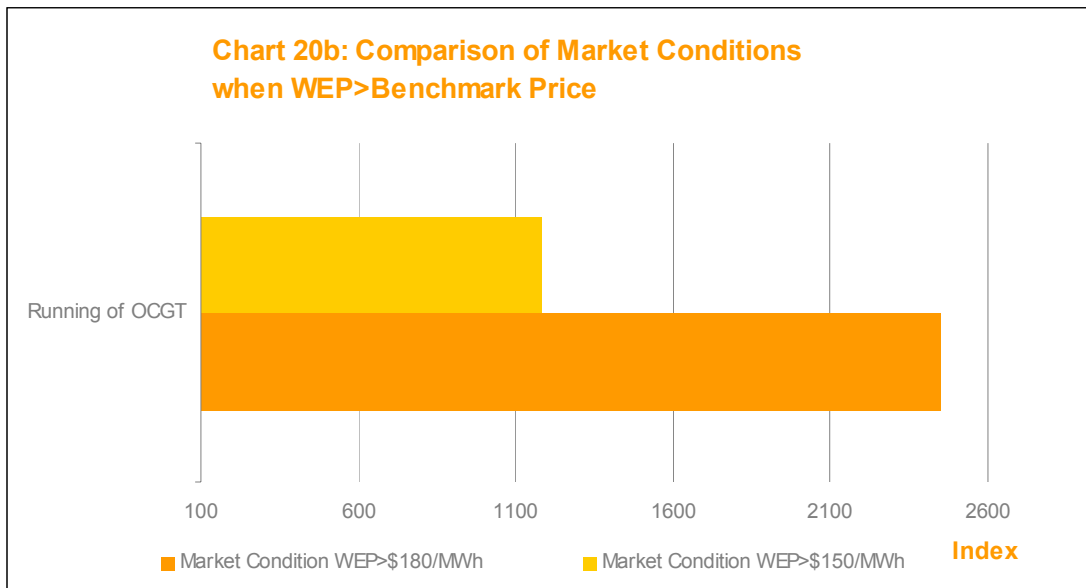
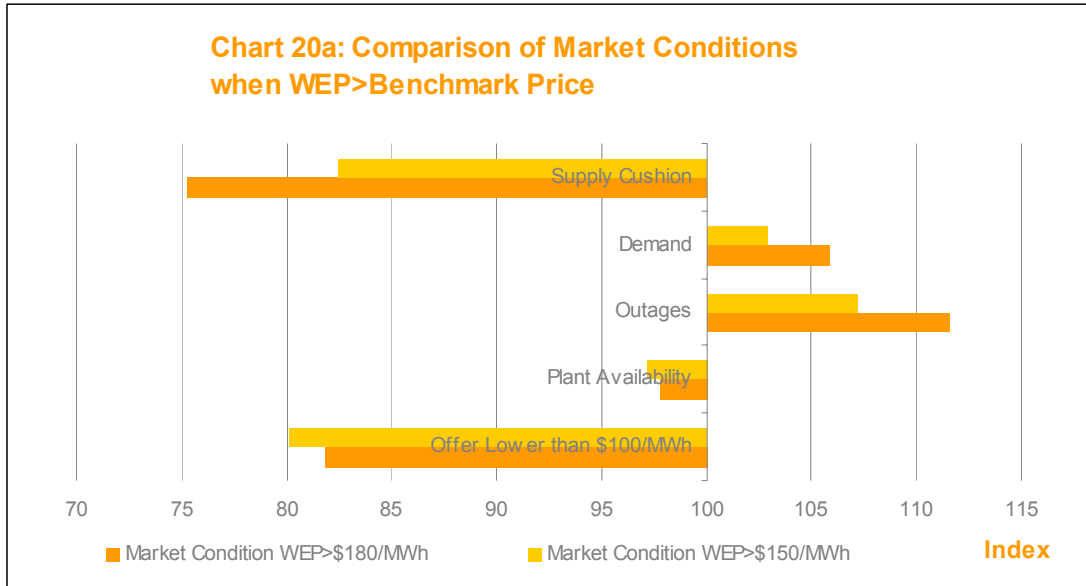
Note: The outages information for Year 04/05 was not available due to incomplete data.

There are several possible factors that contributed to high prices:

- A tighter supply cushion;
- Higher than average demand;
- Higher capacity on outage;
- Lower plant availability;
- Fewer offers that were lower than \$100/MWh; and
- Running of OCGT plants.

These factors can be inferred from Table 8, which shows changes in demand and supply conditions for peak and off-peak periods compared to the previous year. Charts 20a and 20b show the indices⁶ of various market conditions when WEP exceeded the benchmark prices of \$150/MWh and \$180/MWh.

⁶ Figures for normal conditions were calculated based on the average figures for the year. For comparison, these figures were set to 100.



1. Supply Cushion

The supply cushion, which indicates spare capacity available, depends on demand and plant availability. As a result, changes to any of these factors affect the supply cushion. As shown in chart 20a, the following trends were observed:

- The supply cushion index dropped to 75.32 and 82.48 during periods when prices exceeded \$180/MWh and \$150/MWh respectively;
- The supply cushion was tighter when price exceeded the benchmark price of \$180/MWh compared to \$150/MWh; and
- The supply cushion during peak periods (see Table 8) was tighter than that during off-peak periods.

2. Stronger than normal demand

As shown in chart 20a, in periods when prices exceeded \$180/MWh and \$150/MWh respectively, the average demand index was higher at 105.90 and 102.94.

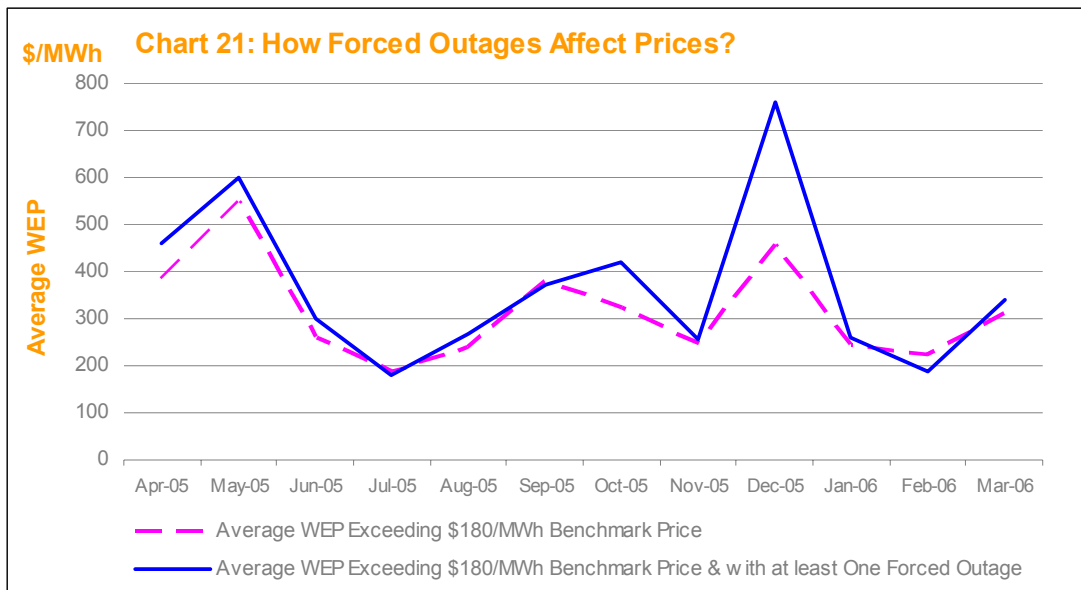
Although average demand in high price periods was generally stronger, as shown in chart 20a, its impact on prices varied depending on other factors such as supply conditions. For example, although demand in June 2005 was at its strongest, both in absolute terms and relative to average demand, only a total of 39 high price periods were identified. On the other hand, higher than normal demand conditions in September and October resulted in a much higher frequency of high price periods. This was partly due to higher than average supply in June, compared to the two months of September and October.

3. Higher outage capacity

As shown in chart 20a, during periods when prices exceeded \$180/MWh and \$150/MWh, the index on average outages was 111.64 and 107.24 respectively. For example, the higher number of CCGT plants on maintenance was one of the reasons that pushed prices higher in September and October 2005.

Besides planned outages, forced and unplanned outages were also a contributing factor to high price periods. As shown in chart 21 below, high prices that coincided with at least one generation forced outage were consistently higher on average than the high prices that occurred without forced outages. For instance, the outage of a CCGT unit in December saw average prices soar to \$1956/MWh for five dispatch periods.

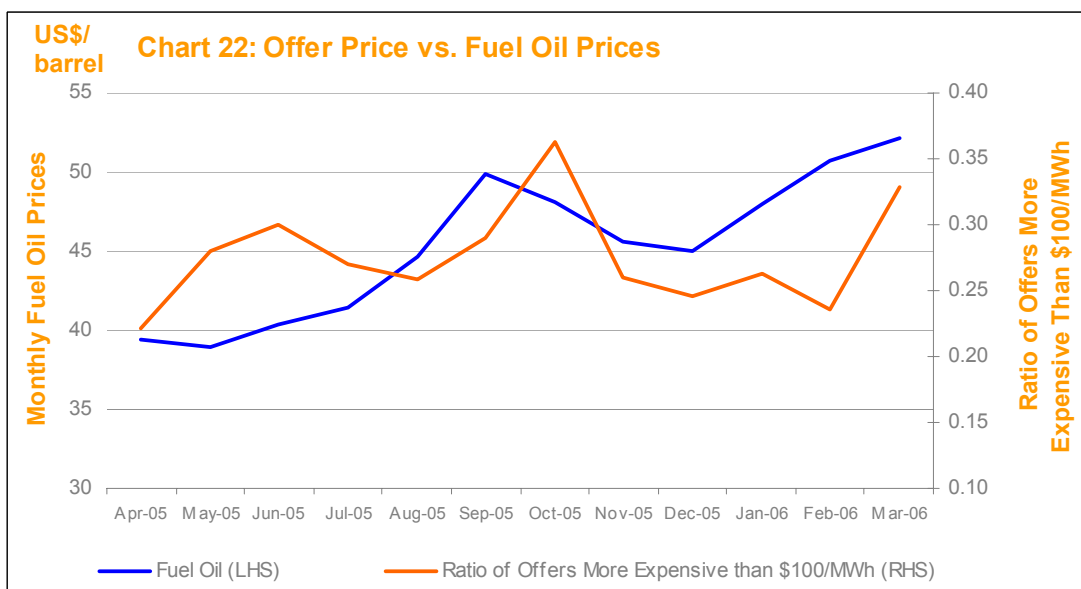
Table 8 shows that outages, both planned and unplanned, were greater in off-peak periods. This may have largely contributed to the greater frequency of high prices during off-peak periods for the year.

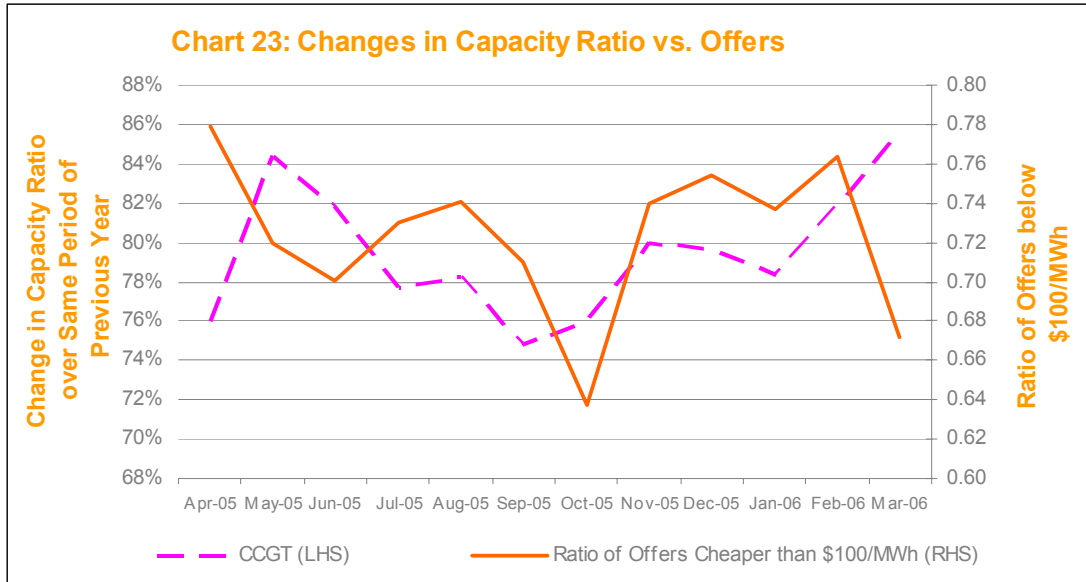


4. Offers

Besides plant availability and demand, which affected the supply cushion, offer prices by generation companies also had an impact on WEP. As shown in chart 20a, during periods when prices exceeded \$180/MWh and \$150/MWh, the index for offers lower than the reference price of \$100/MWh dropped to 81.87 and 80.13 respectively.

Possible reasons for this included higher fuel oil prices as shown in chart 22 (which, depending on plant type, may contribute between 50 to 80 percent of generation costs), the drop in CCGT capacity ratio due to commissioning of new CCGT units (see chart 23) and higher outages of CCGTs.



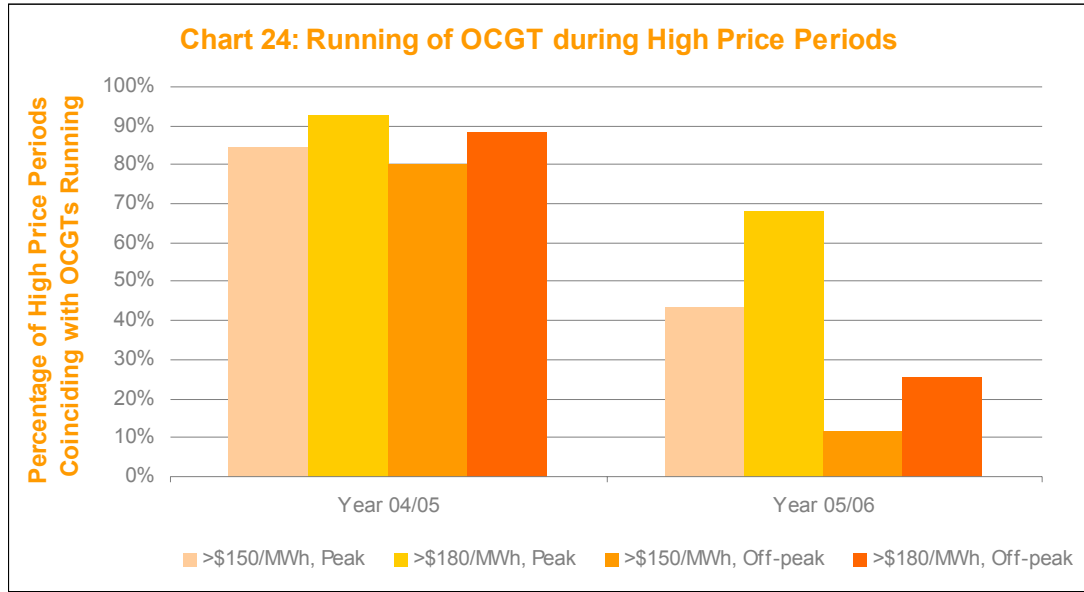


5. Running of OCGT

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 the CCGT and ST offers are close to maximum capacity. Hence, the running of OCGTs is another indication of a tight supply condition.

As shown in chart 20b, the index on running of OCGTs during periods when prices exceeded \$180/MWh and \$150/MWh respectively were 2449 and 1185.

During the previous year, close to 87 percent of high price periods coincided with the running of OCGT units. During the year under review, the percentage dropped to slightly more than 30 percent. The main reason was the upwards revision in OCGT price offers as fuel oil prices soared, making OCGTs more expensive to dispatch. Other contributing factors included the decommissioning of one OCGT unit and the higher installed capacity for base load CCGT plants.



In summary, there were more frequent periods of high prices compared to the previous year. They occurred more often during off-peak than during peak periods. There were many possible reasons, including high fuel oil prices, a tighter supply cushion and stronger demand which occasionally had to be met by the running of expensive OCGTs.

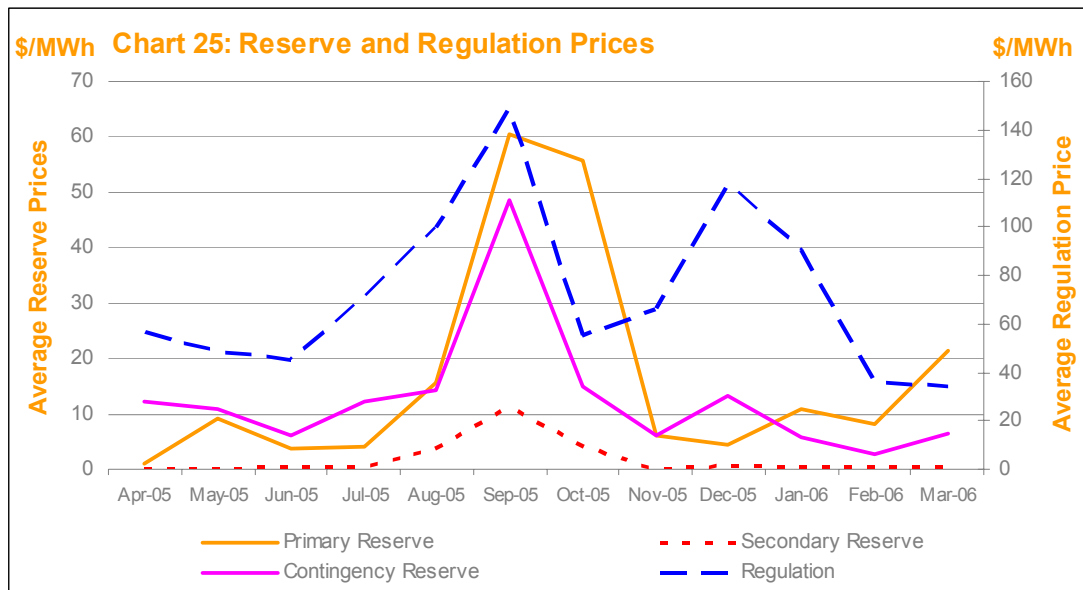
3.3 **WEP and ancillary prices**

Wholesale electricity markets include real-time markets for ancillary services (i.e. 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. There are three classes of reserves: primary reserve, secondary reserve and contingency reserve. Reserve can be offered by generation companies or by consumers in the form of interruptible load (IL). 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.

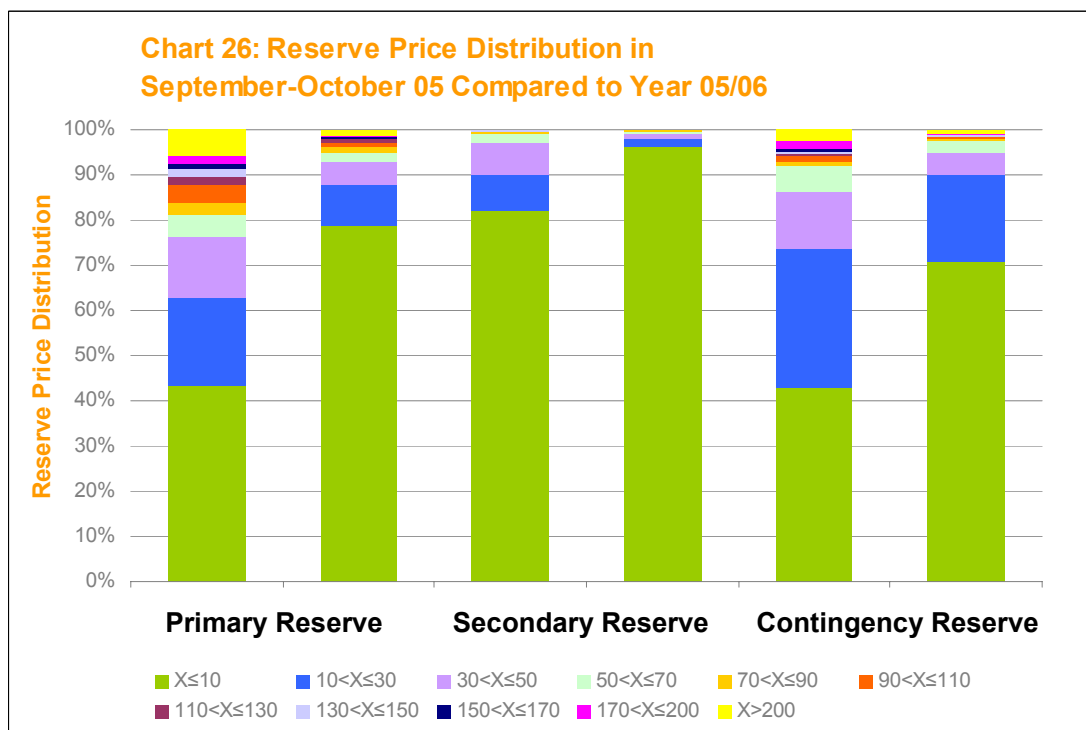
1. Higher reserve cost

The total reserve cost was 85 percent higher compared to the previous year, averaging more than \$283,000 per day.

However, reserve prices only reached a price cap once, compared to a total of 18 times during the previous. This was mainly due to the absence of major outages such as the gas interruption which occurred in June 2004. The contingency reserve class was the worst affected reserve class in percentage terms, with the average price (\$12.86/MWh) nearly twice that of the previous year (see chart 25).

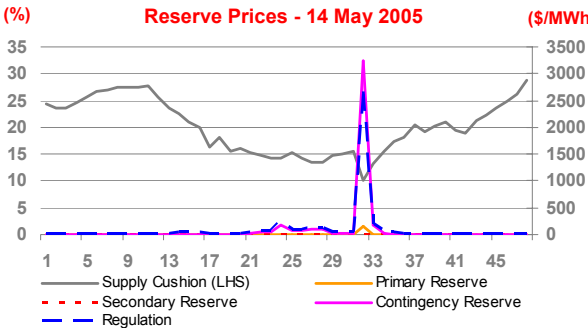
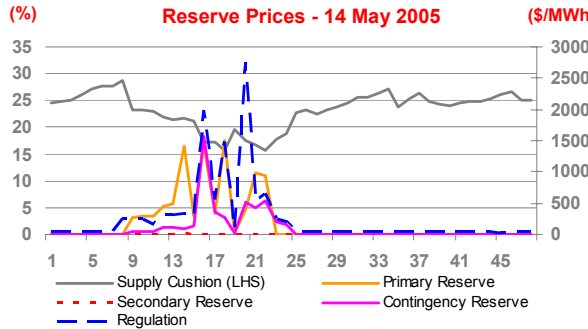


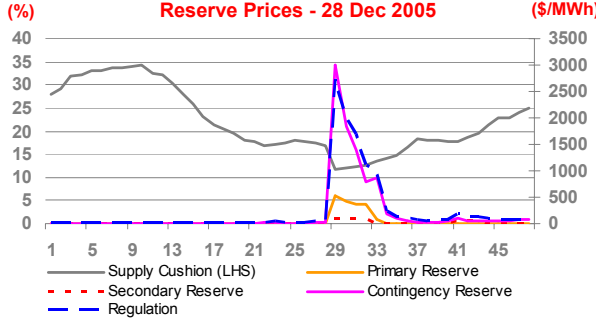
The higher reserve cost was mainly due to high prices in September and October 2005, which accounted for more than half of the total reserve cost during the year. As shown in chart 26, prices in the lower price range shrank significantly in September and October for all classes of reserve compared to the average. For example, only 43 percent of primary reserve prices were cheaper than \$10/MWh compared to 79 percent for the year. Primary reserve prices that were higher than \$200/MWh in September and October also jumped to 6 percent from 1.3 percent for the year.



Note: X represents reserve prices in \$/MWh

As in the case of the energy market, the reserve market faced significant pressure due to tight supply conditions in September and October 2005, when up to three CCGTs were on maintenance as peak demand hit a record high. Other high price events:

Date	Causes	Effect on Reserve Prices
8 April 05	<p>Pre-condition: Low plant availability due to the maintenance of two CCGTs.</p> <p>Unexpected event: CCGT supply deteriorated further with the offer change of a generator (including reserve and regulation offers) in period 32.</p>	<p>Tight supply saw contingency reserve and regulation prices hitting the price caps of \$3250/MWh and \$2750/MWh respectively in period 32. However, the price effect was temporary as the generator restored its offer to full capacity in period 34.</p>  <p>The chart displays five data series: Supply Cushion (LHS) as a solid grey line, Primary Reserve as a solid orange line, Secondary Reserve as a dashed red line, Contingency Reserve as a solid purple line, and Regulation as a solid blue line. The left y-axis represents percentage (%) from 0 to 35, and the right y-axis represents price in \$/MWh from 0 to 3500. A significant spike in Contingency Reserve and Regulation occurs at period 32, reaching their respective price caps.</p>
14 May 05	<p>Pre-condition: Low availability of ST due to weekend shutdown.</p> <p>Unexpected event:</p> <ul style="list-style-type: none"> • A CCGT unit was de-rated between period 3 and 16 as it tried unsuccessfully to come back from maintenance; • Forced outage of a CCGT, leading to the unit being placed on ad-hoc maintenance between period 9 and 24. 	<p>Although supply dropped 2.4 percent immediately after the CCGT was de-rated in period 3, the energy supply cushion actually increased due to lower demand in the off-peak period. As a result, reserve prices remained stable.</p> <p>However, with the forced outage of another CCGT in period 9, the energy supply cushion dropped immediately from 29 to 23 percent. This saw multiple reserve price spikes with the regulation price also hitting the price cap in period 20.</p> <p>Prices only returned to the normal range in period 25 when the supply cushion improved as a result of falling demand and the return of one of the CCGTs from outage.</p>  <p>This chart uses the same axes and legend as the first chart. It shows multiple price spikes between periods 9 and 24, with the most prominent ones in Regulation (blue) and Contingency Reserve (purple) hitting their price caps.</p>

Date	Causes	Effect on Reserve Prices
28 Dec 05	<p>Pre-condition: A CCGT was on planned maintenance between 23 December 05 and 1 January 06.</p> <p>Unexpected event: Forced outage of a CCGT unit in period 29.</p>	<p>The force outages saw the energy supply cushion dropping to a low of 11.7 from 16.8 percent in period 29, as they coincided with peak demand. As a result, multiple reserve price spikes were observed between periods 29 to 35, with the regulation price also hitting the price cap in period 29. Despite no improvement in supply with the outage unit remaining on the sideline after period 29, prices returned to the normal range due to declining demand.</p>  <p>The chart displays five data series over 45 periods. The left y-axis represents percentage (0-40%), and the right y-axis represents price in \$/MWh (0-3500). The x-axis shows periods from 1 to 45. The Supply Cushion (LHS) is shown as a grey line, fluctuating between 10% and 35%. The Primary Reserve (orange), Secondary Reserve (red dashed), and Contingency Reserve (purple) are shown as lines near the bottom of the chart, mostly below 500 \$/MWh. The Regulation price (blue) shows a significant spike at period 29, reaching approximately 3500 \$/MWh, coinciding with a sharp drop in the Supply Cushion to 11.7%.</p>

2. Incidents of regulation price spikes

The average regulation price more than doubled from \$35.49/MWh the previous year to \$72.43/MWh. This was accompanied by a sharp increase in the number of price spikes as shown in table 9 and chart 27, from a total of 72 to 311 using \$500/MWh as the benchmark price. In fact, the biggest jump in price spike periods was in cases exceeding the \$2000/MWh benchmark price. 171 cases were observed compared with a mere 25 the previous year.

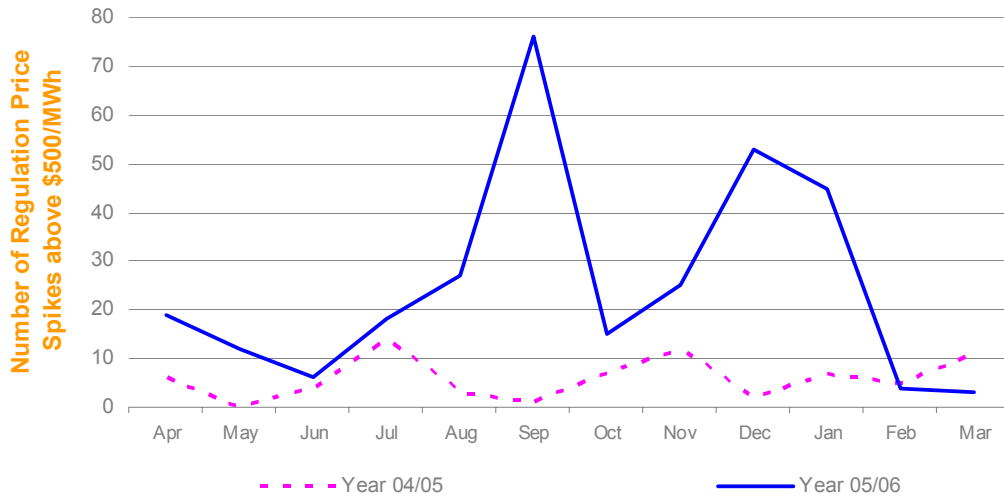
Major reasons for the rise in frequency of price spikes were:

- Effect of commissioning units – During the year under review, in addition to two new CCGT units, three ST plants running on orimulsion were re-powered. To take advantage of the commissioning units, the respective market participants reduced their offering of ST units running on fuel oil. This coupled with the fact that plants under commissioning were not AGC capable, and hence not able to offer regulation and reserve into the market, resulted in a drop in regulation availability. Although energy availability was not greatly affected as market participants substituted the less efficient ST plants with the commissioning plants, the average regulation availability suffered, as generation plants previously capable of providing regulation and reserve were replaced by plants that were unable to provide these products during the commissioning period.
- Tighter supply in the energy market – Since energy, reserve and regulation are co-optimised, the tighter supply cushion in the energy market meant there was less capacity available for reserve and regulation, and this had a negative price impact on the regulation market.

Table 9: Regulation Price Spikes by Price Range

	Year 04/05			Year 05/06		
	\$1000>X	\$2000>X		\$1000>X	\$2000>X	
	>\$500	>\$1000	X>\$2000	>\$500	>\$1000	X>\$2000
Apr	0	4	2	6	4	9
May	0	0	0	6	3	3
Jun	0	1	3	3	1	2
Jul	1	13	0	0	0	18
Aug	1	2	0	1	1	25
Sep	0	0	1	18	36	22
Oct	2	3	2	8	5	2
Nov	1	7	4	8	3	14
Dec	0	0	2	7	3	43
Jan	1	4	2	16	0	29
Feb	1	0	4	0	1	3
Mar	6	0	5	2	0	1
Sum:	13	34	25	75	57	171

Chart 27: Cases of Regulation Price Spikes by Month



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, 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.

The MAU has prepared statistics (table 10) to reflect the position in regard to 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 31 May 2006:

Table 10: Investigation and Enforcement Statistics

Rule Breaches

(A) Total number of offer variations after gate closure	21, 571
Total number of cases closed	19, 932
<ul style="list-style-type: none"> ■ number where MSCP determined a breach ■ number where MSCP determined no breach ■ number where MSCP decided to take no further action 	104 1, 890 17, 938
(B) Total number of cases (excluding offer variations after gate closure) of which :	99
<ul style="list-style-type: none"> ■ number of self-reports ■ number of referrals or complaints ■ number initiated by MSCP 	85 8 6
Total number of cases closed	89
<ul style="list-style-type: none"> ■ number where MSCP determined a breach ■ number where MSCP determined no breach ■ number where MSCP decided to take no further action 	61 7 21
(C) Number of formal MSCP hearings	1
(D) Enforcement Action	
<ul style="list-style-type: none"> ■ Highest financial penalty imposed on a party in breach ■ Total financial penalties imposed on parties in breach 	\$66,000 \$131,000
(E) Costs	
<ul style="list-style-type: none"> ■ Highest award of costs imposed on a party in breach ■ Total costs imposed on parties in breach 	\$23,000 \$76,000

Market Efficiency and Fairness

Total number cases on investigation of market efficiency of which: <ul style="list-style-type: none">■ number of referrals or complaints■ number initiated by MSCP	1 0	1
Total number of cases closed		1

Reports of determinations of breach made by the MSCP are published in accordance with the market rules on 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 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 are under the purview of the EMA.

In the course of monitoring and investigative activities carried out from April 2005 to March 2006, 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

Under the market rules, the MSCP is required to provide a general assessment as to the state of competition and compliance within, and the efficiency of, the wholesale electricity markets. Our assessment is as follows:

State of Competition and Efficiency of the Wholesale Electricity Markets

Recent developments in the market

After the liberalisation of the electricity market in 2003 and the implementation of vesting contracts in early 2004, EMA proposed amendments to the Electricity Act this year to enhance its regulation of the electricity market.

In relation to market surveillance and compliance, the new Act addresses an issue previously raised by the MSCP. It now provides the legislative basis for EMC, the market operator, and the MSSL to be subject to financial penalties.

A well-functioning NEMS

Table 11 summarises the positive signals shown by the supply indicators, of a well-functioning NEMS.

Table 11: Performance of Supply Indicators for the Year

No.	Supply Indicators	Positive Market Signals
1.	Capacity Ratio	The emergence of a relatively high CCGT ratio compared to ST indicates an increasing competitive pressure in NEMS, as more efficient CCGT plants are installed to replace the less efficient ST plants.
2.	Supply Cushion	The inverse relationship between prices and supply cushion reflects price responsiveness to supply and demand conditions.
3.	Market Share	The market continued to favor the running of the more efficient CCGT plants.
4.	Outages	There were occasional price spikes mainly due to maintenance and outages and a highly inelastic demand. No prolonged period of price spikes was observed, indicating that the market is working well in responding to price signals.

Although the MSCP recognises that there are positive signals shown by the supply indicators, two areas warrant special attention:

- Market concentration – The NEMS remained highly concentrated with the three largest generators controlling nearly 90 percent of the market based on maximum capacity. Since all the new capacity came from large generation companies, their combined market share by installed capacity and dispatch quantity have increased compared to pre-liberalisation;
- Supply cushion - With the commissioning of new CCGT capacity and surging fuel oil prices, the availability of ST has dropped dramatically in recent years, as market participants adjusted their offer strategy. This has resulted in a tightening supply cushion despite new installed capacity from CCGTs. The tightening supply cushion was the main reason for the increase in high price periods.

Market Concentration

After three years of operation, the market remains highly concentrated with the three largest generators commanding nearly 90 percent of market share by maximum capacity. The commissioning of new CCGT capacity by these generators in recent years has worsened the market concentration issue.

Although the excess capacity in NEMS played a major role in imposing market discipline, the fact that a significant amount of this excess capacity is owned and controlled by just three generators remains a concern, since this potentially allows generators greater flexibility and power to withhold capacity and influence high prices.

As discussed earlier, the implementation of vesting contracts by EMA in 2004 has gone some way towards mitigating market power risk. The MSCP will continue to monitor the supply behavior of generators and request relevant information when necessary.

Supply Cushion – current situation and future supply

Since the inception of the NEMS in 2003, a total of 1450MW of new capacity has been added by existing market players, bringing the total installed capacity for the NEMS to beyond the 10,000MW mark. The total installed capacity is more than twice the average demand of 4253MW for the year.

The market share for CCGTs by maximum capacity has risen to a level comparable to that of STs, due to the commissioning of four CCGTs since 2003. Although this has helped increase the average CCGT capacity available for dispatch to slightly more than 4000MW, the average availability of STs has dropped to a mere 1282MW this year, a far cry from the 2000MW level observed in 2003. In addition to the commissioning of new CCGT capacity, surging fuel oil prices have also contributed to the sharp drop in ST availability in recent years.

As a result, despite about 10,000MW of installed capacity, the average daily capacity available for dispatch (from all types of generators) was in the region of 5700MW for the year. Taking into account that the average demand was 4253MW for the year, there is on average only a 25 percent excess of actual supply over demand.

In the last few years, the market has entered into a transitional phase, shifting from a market dominated by STs to CCGTs. Although the new capacity is more cost efficient, it has minimal impact on the supply cushion as market participants have replaced the less efficient ST plants with new CCGT capacity.

The commissioning of two CCGTs by a new entrant in the near future (probably in late 2006) not only offers alternative supply to the market, but may have an effect in the following areas:

- Competition - In recent years, all new capacity and plant re-powering were seen in the three largest generators. This has resulted in their combined market share, in terms of maximum capacity and dispatch quantity, rising compared to the pre-liberalisation period. Additional base load capacity from a new player may inject more competition into the market.
- Supply cushion - Besides surging fuel oil prices that saw higher average offer prices from generators, the tightening supply cushion was also a factor contributing to an increased number of high price periods this year. This happened as existing market players continued to reduce the availability of ST plants. The introduction of base load capacity by the new market participant may force existing players with ST capacity to reconsider their offer strategy and improve the supply cushion.

Lack of Demand Response to Price

In any liberalised electricity market, the ideal is for both supply and demand conditions to be responsive to prices. While the supply side is price responsive, demand side responsiveness is still lacking.

In NEMS, the current design does not provide for buyers to respond to prices. The existence of fixed price retail contracts also provides little incentive for consumers to respond to prices.

Market Risk Mitigation

Due to inelastic demand, price volatility is a common feature in all liberalised electricity markets. As a result, some form of financial hedging is necessary to ensure market stability and protect consumers from price volatility, especially during periods of high prices.

As in the case of other electricity markets, prices in the NEMS usually become volatile when the supply cushion is tight. This year, as result of soaring fuel oil prices and a tighter supply cushion, average spot prices (USEP) went up by 34.5 percent compared to the previous year, with the number of high price periods also jumping from 1.7 to 3.2 percent, based on the new benchmark reference price of \$180/MWh.

During periods of high prices, the availability of financial hedging instruments such as vesting contracts and bilateral contracts were important in managing market risk for market participants and consumers while the requirement for credit support ensured market stability. Each of these tools was designed to deal with specific risks during high price periods:

Tools	Parties	Purpose	Impact
Vesting contracts	Non-contestable Consumers (NCC)	NCCs are fully hedged through vesting contracts.	NCCs are not directly subjected to fluctuations in spot prices. They pay their bill based on a regulated tariff, revised quarterly by SP Services, the MSSL.
	Contestable Consumers (CC)	CCs are partially hedged with the level of hedged quantity limited to VHP.	Since the hedged proportion is restricted by VHP, CCs who are customers of the MSSL will to a certain extent be exposed to spot price volatility. For CCs who are customers of retailers, their level of exposure to spot price volatility will depend on the terms and conditions of the contracts they have entered into with their retailer.
Bilateral contracts	<ul style="list-style-type: none"> • Generators • Retailers 	Contracts for differences (CFDs) mainly for retailers to manage their exposure to the spot market.	Retailers negotiate fixed price contracts with generators. The contracts provide price certainty and limit the exposure of retailers to spot price volatility.
Credit support	<ul style="list-style-type: none"> • EMC • Retailer 	To ensure the financial integrity of the wholesale electricity markets.	The current credit support arrangements limit the potential of payment default during periods of prolonged high prices, since a market participant will be faced with a margin call when its estimated net exposure reaches 70 percent of the value of the credit support it has provided to the market operator.

Market Participant Request for Investigation into Market Abnormalities

In late October 2005, the MSCP received a request for investigation into market abnormalities from a market participant. The market participant raised concerns over spikes in wholesale electricity prices during the maintenance period for one of its units during the late September to early October period.

The market participant alleged that with the high level of total installed capacity in the market, the withdrawal of its generation unit for maintenance should not have resulted in a price hike that eventually led to it absorbing an adverse financial impact. The market participant therefore believed that the market may not be fair and efficient to the extent that a generation company could be penalized during its maintenance period.

As part of its investigation, the MSCP considered the following allegations:

- That market outcomes were not efficient because the bigger players seized the opportunity during the relevant period to influence energy and reserve prices for their own advantage; and
- That market outcomes were not fair because the bigger players had a pool of backup units and had the ability and flexibility to ensure that energy and reserve prices remained stable when their units were scheduled for maintenance works.

The MSCP found that:

- There was no evidence that the NEMS was inefficient or unfair during the relevant period.
- On the issue of market efficiency, the higher price trend during the relevant period was the result of:
 - lower CCGT availability due to more units being on maintenance;
 - higher offer prices which coincided with surging fuel oil prices and higher dependency on the more costly STs to meet demand; and
 - a tighter supply cushion as a result of strengthening demand.
- On the issue of fairness, there was consistency in applying relevant market rules and design features to generators; and
- There was no evidence of manipulation by the bigger players during the relevant period.

Conclusion

In conclusion, the MSCP observed that:

- The supply indicators signalled the continued proper functioning of NEMS, and there was evidence of competitive pressures and price responsiveness of supply conditions;
- The NEMS remained highly concentrated, but vesting contracts helped to mitigate market power risk;
- There was a continued lack of a mechanism for demand to respond to prices in NEMS;

- Price spikes were observed despite the fact that installed capacity was around 10,000MW, against, an average demand of 4253MW and the maximum peak demand of 5359MW. This was due largely to the inelastic demand in the electricity market;
- The availability of financial hedging instruments such as vesting contracts, bilateral contracts and credit support were important in the management of market risk, and to ensure market stability, especially during high price periods; and
- The market went through a healthy process of continual structural shift, in which the inefficient STs were increasingly replaced by more efficient CCGT units.

State of Compliance within the Wholesale Electricity Markets

Ensuring compliance with the market rules is important in the operation of a competitive and reliable electricity market. Market participants who breach the rules may be subject to sanctions if the MSCP considers it appropriate.

Our assessment as to the state of compliance within the wholesale electricity markets is set out below.

Offer Variations After Gate Closure

On 19 January 2006, the market rules were amended to reduce the gate closure period from 2 hours to 65 minutes. 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 1 April 2005 to 18 January 2006 (2-hour gate closure period)	4,466
No of offer variations made after gate closure from 18 January to 31 May 2006 (65-minutes gate closure period)	547
% reduction per month of offer variations made after gate closure since the implementation of 65-minutes gate closure period	72.86% ⁸

On 6 April 2005, the MSCP issued a statement clarifying the scope of the rule regarding offer variations after gate closure and the prohibition of 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.

During the year, the MSCP was satisfied that the offer variations after gate closure that the Panel reviewed were generally permissible under the market rules. However, the MSCP made a determination against a market participant for offer variations after gate closure for the period from 16 April 2005 to 30 May 2005.

⁸ The figure is derived by computing the average number of incidents per month for the period 1 April 2005 to 18 January 2006, assuming the incidents occur with the same frequency over a 365-day year, and comparing it with the corresponding figure for the period 19 January 2006 to 31 March 2006.

During this period, the market participant submitted a number of offer variations and revisions to standing offers after gate closure that were potentially market rule breaches. At the request of the market participant, the MSCP conducted its first hearing. After the hearing, the MSCP concluded that the market participant had breached the market rules. In imposing a financial penalty of \$66,000 on the market participant, the MSCP commented that the market participant had committed many offer variation breaches within a short period of time, its initial responses to requests for information were unsatisfactory, and there was a lack of due diligence in setting up procedures which could have prevented the breaches from occurring. The MSCP also ordered the market participant to pay investigation and hearing costs in the sum of \$23,000.

The MSCP continues to review offer variations after gate closure from month to month as they occur.

Rule Breaches

For the period 1 April 2005 to 31 March 2006, the MSCP made 18 determinations against a market operator for rule breaches.

The rule breaches by the market operator were for its failure to determine or release and publish information relating to dispatch schedules on time. It is noteworthy that these breaches were all self-reported. They occurred due to IT problems and were found not to have had any significant impact on the wholesale electricity markets. The MSCP issued letters of non-compliance in 16 cases and imposed financial penalties of \$5,000/- and \$10,000/- in 2 cases. Financial penalties were imposed because the MSCP considered that the market operator had failed to exercise due diligence in those cases, and that the action of staff posed a risk to the market although there was no significant market impact. Investigation costs of \$1000 were imposed in each of the 27 cases.

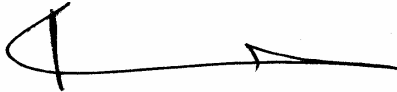
The market operator has also carried out disaster recovery exercises. Advance notice has been given to the MSCP where there may be potential breaches of the market rules due to missed schedules. The MSCP takes the view that these exercises are part of an important risk management process for the wholesale electricity markets.

CONCLUSION

While we look forward to mechanisms to effect more demand responsiveness to price, the MSCP is generally satisfied with the market outcomes of the NEMS in the year under review.

The higher prices observed were the result of tighter supply cushions due to both higher demand and lower ST availability as a consequence of the transition from ST to CCGT technology. Higher market prices were also attributable to higher offer prices brought about by increased fuel costs. There were occasional price spikes, due to the inelastic nature of the demand for electricity.

The market monitoring indices continue to signal the existence of competitive pressure and the price responsiveness of the supply in the NEMS. Vesting contracts have helped to mitigate market power risk. Financial hedging instruments and credit support have also been important in managing price volatility and ensuring market stability during periods of high prices. The continued structural shift towards more CCGT plants is a healthy sign that the NEMS is slowly evolving into a more efficient market.

A handwritten signature in black ink, consisting of a large, stylized 'J' followed by a long horizontal line that ends in a small upward-pointing tick.

Joseph Grimberg
Chair, Market Surveillance and Compliance Panel
18 July 2006