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Letter from the Chairman, Energy Market Company

Dear Industry Members,

Another year of high oil prices continued to make an impact on energy markets globally, and our National Electricity Market of Singapore (NEMS) was no exception.

With steady growth in the local economy, the yearly average demand closed 3.3 percent higher than 2005, and in November the NEMS experienced the strongest monthly average demand since market start: 4,469MW. The increase in demand was not unexpected as the Energy Market Authority's (EMA) Statement of Opportunities for the Electricity Industry, published in June 2006, forecast a 53 percent rise in peak demand from 2005 to 2015.

The market continued to perform well with wholesale prices moving in line with the changes in the fundamentals of demand and supply.

Without a doubt, our market rules and governance arrangements are critical to the success of the NEMS and also help us to continue to evolve the market. An example of how we strive for greater efficiency is the reduction in gate closure from 120 minutes to 65 minutes, which allows market participants to make offers closer to the start of the trading period.

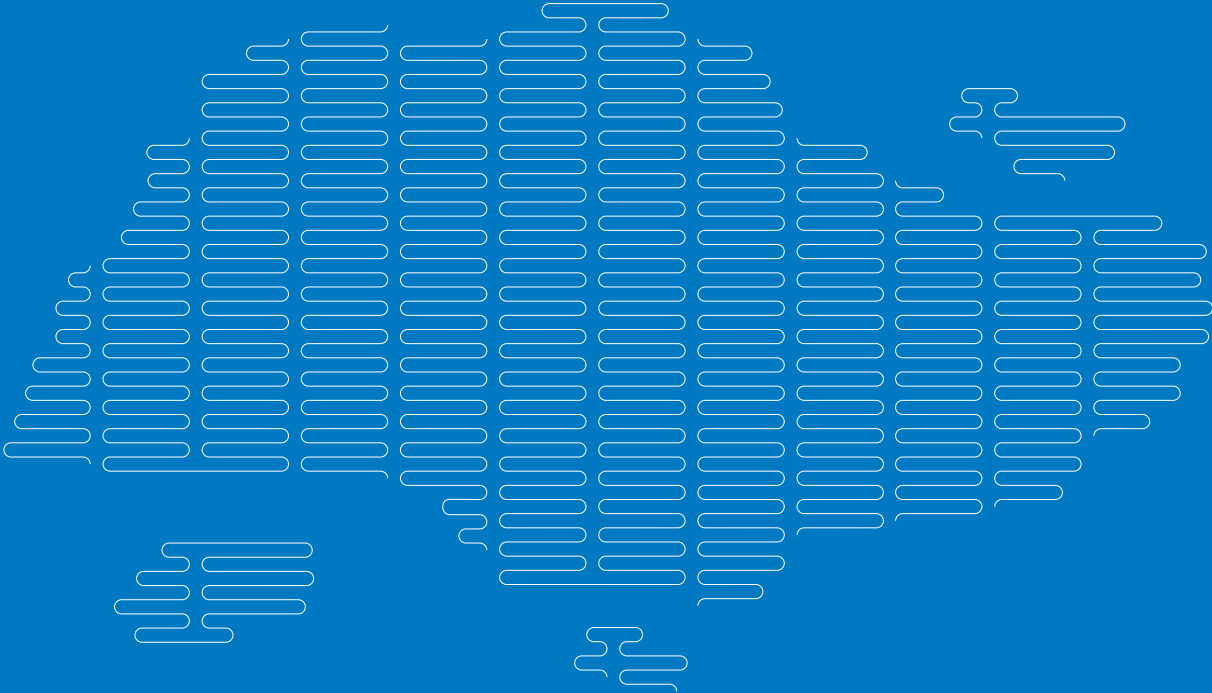
Our market also welcomed two new market participants this year. This can only lead to greater competition and more efficient market outcomes.

I am also pleased to say that the economic benefits of the NEMS for Singapore have been confirmed through an independent review. A review of the performance of the NEMS between 1 January 2003 and 31 March 2005 – commissioned by the EMA and undertaken by PricewaterhouseCoopers – revealed a net benefit of \$128.6 million to the economy due to the implementation of the NEMS in January 2003.

The improvement of competition in Singapore's electricity industry – as shown by our promotion up the ranks of electricity price competitiveness to 29 of 47 countries in 2005 from 41 out of 48 countries in 2001 (IMD–International Competitiveness Ranking) – is a credit to the NEMS and another positive signal for local consumers and potential investors.



Tan Soo Kiang,
Chairman,
Energy Market Company



The opening of the National Electricity Market of Singapore (NEMS) in January 2003 was the culmination of a number of structural reforms to Singapore's electricity industry. Singapore's journey through liberalisation started in October 1995, when industry assets were corporatised and began to be put on a commercial footing to facilitate competition and as a precursor to eventual privatisation. In 1998, the Singapore Electricity Pool (SEP), a day-ahead market, began operation. On 1 April 2001, a new legal and regulatory framework was introduced that formed the basis for a new electricity market.

The NEMS places Singapore at the forefront of an international movement to introduce market mechanisms into the electricity industry as a way of:

- attracting private investment,
- increasing the efficiency of government assets,
- sending accurate price signals to guide production and consumption decisions,
- encouraging innovation and
- providing consumer choice.

Corporatisation

1995	Electricity functions of the Public Utilities Board corporatised
	Singapore Power formed as a holding company
1996	Pool design process began

Singapore Electricity Pool

1998	SEP commenced
	PowerGrid is SEP Administrator and Power System Operator (PSO)
	Attempted sale of generator Tuas Power
1999	Review of electricity industry

National Electricity Market of Singapore

2000	Decision for further reform to obtain full benefits of competition
	New market design process began
2001	Electricity industry legislation enacted
	Energy Market Authority (EMA) established as industry regulator
	Energy Market Company (EMC) established as the NEMS wholesale market operator
	Initial phase of retail contestability
2002	Draft market rules issued
	Testing and trialling of wholesale market system began
2003	NEMS wholesale market trading began
2004	Vesting contract regime introduced
	Interruptible loads (IL) began to participate in the reserves market
2005	Further batches of large consumers introduced to retail contestability
2006	Wholesale market trader commenced trading as IL provider
	New wholesale market trader and new generation licensee joined the market
	Retail contestability expanded to 75 percent of the total electricity demand

Participants and service providers in the NEMS

Active Generators	Keppel Merlimau Cogen National Environment Agency PowerSeraya SembCorp Cogen Senoko Power Tuas Power
Wholesale Market Traders	Air Products Diamond Energy
Active Retailers	Keppel Electric SembCorp Power Senoko Energy Supply Seraya Energy Tuas Power Supply
Market Support Services Licensee (MSSL)	SP Services
Market Operator	Energy Market Company
Power System Operator (PSO)	Power System Operator
Transmission Licensee	SP PowerAssets

Singapore’s electricity industry is structured to facilitate competitive wholesale and retail markets. This was achieved by separating the ownership of the contestable parts of the industry from those with natural monopoly characteristics.

Generation Licensees

All generators that are connected to the transmission system are licensed by the EMA unless their facilities are less than 10MW. All generators with facilities of 1MW or more that are connected to the transmission system must participate in the NEMS and be registered with the PSO.

Wholesale Market Traders

Companies, other than generators or retailers, that are licensed by the EMA to trade in the wholesale electricity markets.

Retail Electricity Licensees

Retailers that sell electricity to contestable consumers are licensed by the EMA. Retailers that are registered as market participants purchase electricity directly from the wholesale market.

MSSL

An MSSL is authorised to provide market support services. Such services include consumer registration and transfer, meter reading and meter data management, retail settlements and billing for contestable consumers. SP Services is the only MSSL.

Market Operator – EMC

EMC operates and administers the wholesale market. This role includes calculating prices, scheduling generation, clearing and settling market transactions and procuring ancillary services. EMC also administers the rule change process and provides resources that support the market surveillance and compliance process and the dispute resolution process.

Transmission Licensee – SP PowerAssets

SP PowerAssets owns and is responsible for maintaining the transmission system.

PSO

The PSO (a division of the EMA) is responsible for ensuring the reliable supply of electricity to consumers and the secure operation of the power system. The PSO controls the dispatch of generation facilities, co-ordinates outages and power system emergency planning and directs the operation of the high-voltage transmission system.

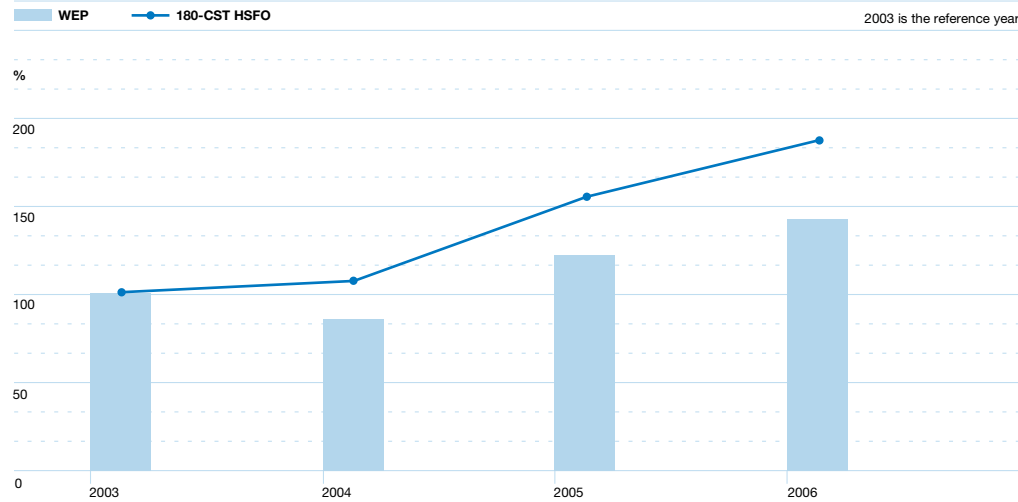
Regulator – EMA

The EMA is the regulator of the electricity industry and has the ultimate responsibility for the market framework and ensuring that the interests of consumers are protected.

Consumers

Consumers are classified as being either contestable or non-contestable, depending on their level of electricity usage. Contestable consumers may choose to purchase electricity from a retailer or directly from the wholesale market or indirectly from the wholesale market through the MSSL, SP Services. Non-contestable consumers are supplied by SP Services.

Wholesale Electricity Price vs Oil Price 2003/06

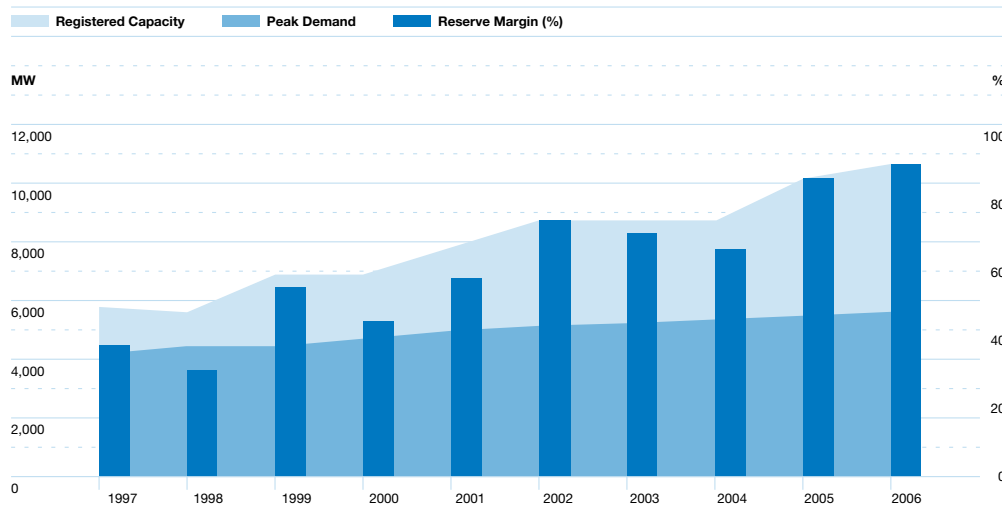


Notes:

1. The Wholesale Electricity Price (WEP) is the net purchase price paid by retailers, inclusive of all administrative costs incurred in the wholesale market.
2. 180-CST HSFO (180-centistoke high sulphur fuel oil) is commonly used in Singapore for electricity generation.

In 2006, rising oil prices continued to have an impact on global and local energy markets. With thermal-fired plants as the main source of electricity in Singapore, electricity prices increased significantly against those of 2005. However, using market start in 2003 as the reference point, the chart above shows that the wholesale electricity price has increased at only about half the rate of the fuel oil price.

Registered Capacity, Peak Demand and Reserve Margin 1997/2006

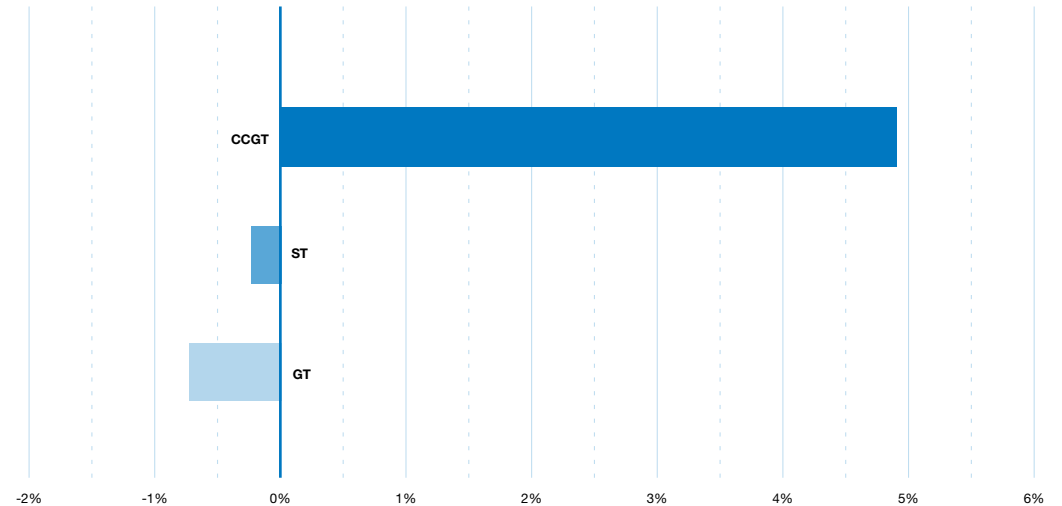


Following the de-commissioning of a 105 megawatt (MW) gas turbine on 18 January and the addition of 498MW of generation capacity (commissioning units) into the market on 31 October, the reserve margin increased about 3 percent to 88 percent in 2006.

In 2006, the registered capacity had a robust growth of 4.8 percent, while peak demand increased 2.7 percent. In line with steady growth in the local economy, the system demand continued to increase and reached a total of 36.72 terawatt hours (TWh) in 2006, an increase of 3.1 percent from 2005.

In the NEMS, generators use a mix of technologies in generating electricity for the power grid. The three basic types of generating unit are combined-cycle gas turbine (CCGT), steam turbine (ST) and open-cycle gas turbine (GT).

Change in Registered Capacity 2005-06

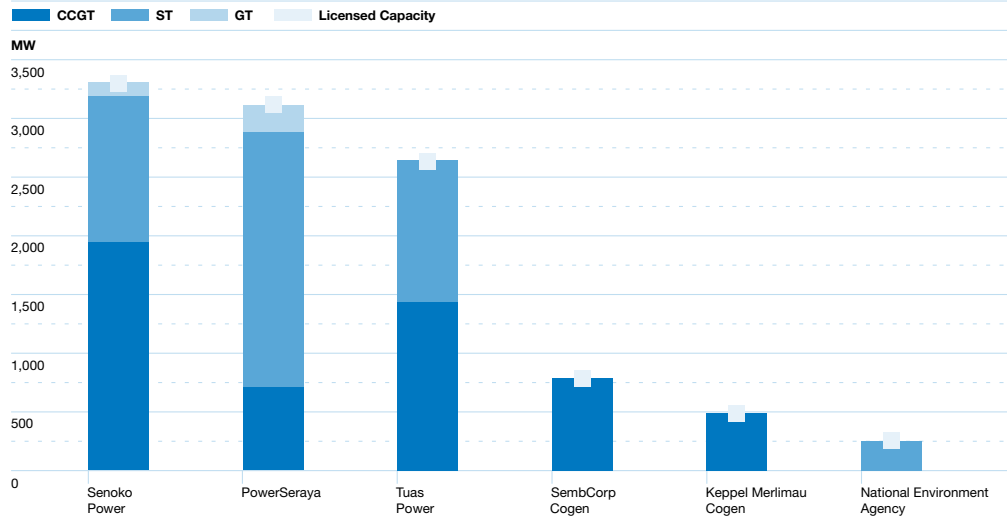


In 2006, the registered capacity of CCGT units increased by about 5 percent to 51 percent of total registered capacity. CCGT generating units typically use piped natural gas from Indonesia or Malaysia and use diesel as an alternative fuel source.

With the de-rating of an ST generating unit in January, the total registered capacity of ST generation units took a slight dip to settle at 46 percent. ST units typically run on 180-CST HSFO, but some are configured to run on Orimulsion (tar and water). The plants operated by the National Environment Agency are ST units that convert energy from refuse incineration into electricity.

Despite the de-commissioning of a unit, GT units continued to provide about 3 percent of registered capacity. They are mainly fuelled by diesel.

Registered Capacity 2006



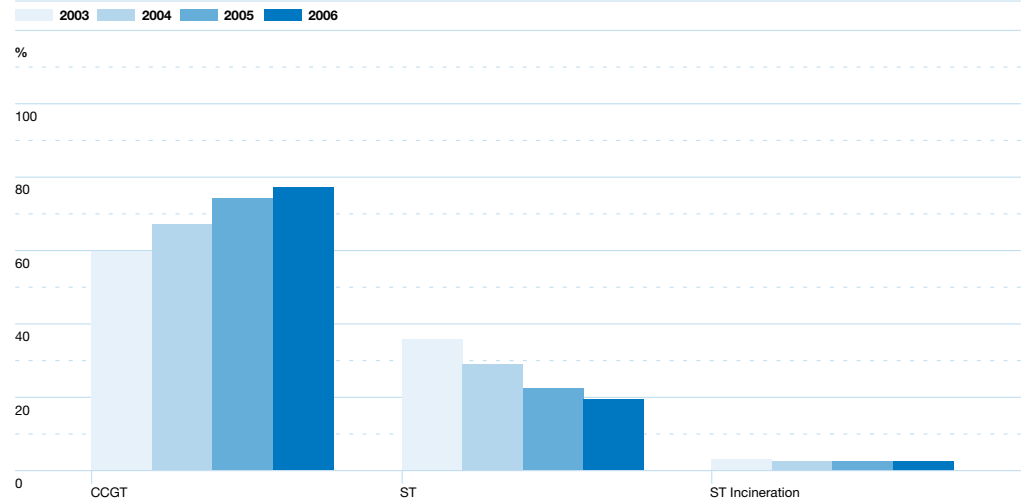
As all generating companies are now operating to their licensed capacities, the resulting keen competition should further encourage the use of fuel-cost-efficient technologies for generation.

With the features of superior fuel efficiency, flexibility and environmental performance, CCGT units continued to be the dominant source of generation. On the other hand, ST units remained a reliable and competitive source of generation and allow a diversification of energy supply.

Note:

1. Licensed capacity is the generation capacity licensed by the EMA.
2. Registered capacity is the capacity registered with EMC to participate in the real-time markets.

Market Share by Plant Type 2003/06



With higher registered CCGT capacity and stronger CCGT offer availability than the previous year, the CCGT market share rose for the fourth straight year to 78 percent.

Note:

The market share for GT units was 0.01 percent in 2006, 0.03 percent in 2005 and 0.02 percent in 2004. GT units did not participate in the energy market in 2003.

Energy, reserve and regulation products

	Description	Purchaser	Seller
Energy	Generated electricity	Retailers	Generators
Reserve	Stand-by generation capacity or interruptible load that can be drawn on when there is an unforeseen shortage of supply. Three classes of reserve are traded: <ul style="list-style-type: none"> primary reserve (8-second response), secondary reserve (30-second response) and contingency reserve (10-minute response onwards). 	Generators	Generators, Retailers and Wholesalers
Regulation	Generation that is available to fine-tune the match between generation and load	Generators and Retailers	Generators

The NEMS has a number of features that drive efficiency and make its design truly world class. These include:

- co-optimisation of energy, reserve and regulation products,
- security-constrained dispatch and nodal pricing and
- near real-time dispatch.

Co-optimisation of energy, reserve and regulation products

A sophisticated process, involving about 50,000 different equations, is used to determine the price and quantity of the energy, regulation and reserve products traded. Integral to this process is the concept of co-optimisation, where the market clearing engine (MCE) considers the costs and requirements of all products together and then selects the optimal mix of generation and interruptible load to supply the market.

Security-constrained dispatch and nodal pricing

To determine the prices for products traded on the wholesale market, offers made by generators and interruptible loads are matched with the system demand forecast and system security requirements. The MCE produces a security-constrained economic dispatch by taking into account:

- available generation capacity,
- ability of generation capacity to respond (ramping),
- relationship between the provision of energy and reserve and regulation (co-optimisation),
- power flows in the system,
- physical limitations on the flows that can occur in the transmission system,
- losses that are incurred as power is transported and
- constraints in relation to system security.

This process is run every half-hour to determine the:

- dispatch quantity that each generation unit is to produce,
- reserve and regulation capacity each generation unit is required to maintain,
- level of interruptible load that is required and the
- corresponding prices for energy, reserve and regulation in the wholesale market.

Energy prices – referred to as nodal prices – vary at different points on the network. The differences in nodal prices reflect both the transmission losses and physical constraints of the transmission system. This means that the true costs to the market of delivering electricity to each point on the electricity network are revealed.

The MCE models the transmission network and uses linear programming to establish demand and supply conditions at multiple locations (nodes) on the network. This ensures that market transactions are structured in a way that is physically feasible given the capacity and security requirements of the transmission system. For each half-hour trading period, the MCE calculates the prices to be received by generators at the 39 injection nodes and the prices at approximately 380 withdrawal or off-take nodes that are used as the basis for the price to be paid by customers. This method of price determination encourages the economically efficient scheduling of generation facilities in the short term and provides incentives to guide investment into new power system infrastructure in the long term.

EMC uses metered demand and generation from the MSSL and market prices to settle market transactions on a daily basis. Generators receive the market price for energy that is determined at their point of connection to the transmission network (injection node). Retailers pay the Uniform Singapore Energy Price (USEP) for energy, which is the weighted-average of the nodal prices at all off-take nodes.

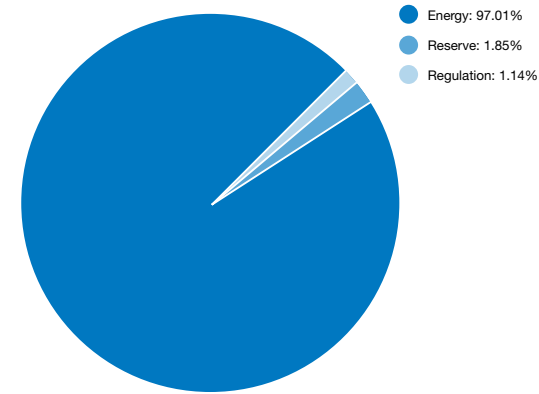
Generators pay for reserve according to how much risk they contribute to the system. Regulation is paid for by retailers in proportion to their energy purchase and by dispatched generators up to a ceiling of 5MWh for each trading period.

Near real-time dispatch

Market prices and dispatch quantities for energy, reserve and regulation are calculated five minutes before the start of each half-hour trading period. This ensures that the market outcomes reflect the prevailing power system conditions and the most recent offers made by generators. The result of near real-time calculation of dispatched generation quantities ensures as little intervention from the PSO as possible, and hence a minimal deviation from a competitive market solution.

To support near real-time dispatch, EMC produces market forecast schedules up to a week ahead of the relevant trading period. These forecast schedules increase in frequency as the trading period approaches to ensure that market participants have the information they need to adjust their trading positions prior to physical dispatch.

Share of Products Traded 2006



The total value of products traded in the wholesale market in 2006 was \$5.336 billion, an increase of 23.4 percent from 2005. For 2006, the total share of energy traded rose to 97.01 percent, while reserve and regulation fell to 1.85 percent and 1.14 percent respectively.



Governing documents and institutions

The Energy Market Authority (EMA) was established under the Energy Market Authority of Singapore Act 2001. The EMA is the electricity market regulator under the Electricity Act 2001 and is responsible for, among others:

- creating the market framework for electricity and gas supply,
- promoting development of the electricity and gas industries,
- protecting the interests of consumers and the public,
- issuing licences and
- advising the Government on energy policies.

Rule change process

The day-to-day functioning of the National Electricity Market of Singapore (NEMS) wholesale market is governed by the Singapore Electricity Market Rules.

The rule change process is the responsibility of the Rules Change Panel (RCP). Appointed by the Energy Market Company (EMC) Board, the RCP has members representing generators, retailers, wholesale market traders, the financial community, the Power System Operator (PSO), the market support services licensee, the transmission licensee and EMC to ensure that the interests of the various sectors of the industry are represented.

The process is designed to maximise both transparency and opportunities for public involvement. Rule modifications recommended by the RCP require the support of the EMC Board and the EMA. The EMA is required to consider the interests of consumers when approving changes to the Market Rules. Each year, the RCP establishes and publishes its work plan to ensure that stakeholders remain informed about the likely evolution path of the market. The work plan can be found at www.emcsg.com.

Market surveillance and compliance

A Market Surveillance and Compliance Panel (MSCP), comprising professionals independent of the market, is responsible for monitoring, investigating and reporting on the behaviour of market participants. They identify market rule breaches and assess if the market is operating in an efficient and fair manner. In circumstances where the MSCP determines that a market participant is not compliant with the Market Rules, it may take enforcement action, including levying a penalty. The MSCP also recommends remedial actions to mitigate any rule breaches or inefficiencies identified.

Dispute resolution

The Market Rules contain a process that facilitates the resolution of disputes between market participants and service providers. The dispute resolution process is designed to be a cost-effective way of resolving disputes and preserving market relationships by avoiding the need to resort to court proceedings. This process is managed by the Dispute Resolution Counsellor.

Dear Industry Members,

We began 2006 with a renewal of the RCP membership. In the new panel, we have a healthy mix of new and retained members that balances the needs for fresh perspectives and experience. In February 2006, we welcomed Dallan Kay, who is the first member to represent the class of wholesale market traders. The RCP now has 12 members.

The panel plays a vital role in evolving the NEMS, enhancing efficiency and maintaining a level playing field. With the impressive accomplishments of its predecessor (2003–2005), the panel has its work cut out for it to ensure that the Market Rules remain relevant and efficient in governing the wholesale electricity market. I am proud to report that the panel has very capably risen to the task in this past year.

By all measures, the wholesale electricity market performed very well in its fourth year of operation, a sign of a stable and maturing market. With teething issues generally out of the way, the focus of market evolution shifted to more fundamental issues. The bulk of research, analyses and debates brought to the RCP table in 2006 concerned fundamental market design. Proposals to change the Market Rules began to have potentially more wide and far-reaching impact on the long-term efficiency of the market.

I am happy to report that we have made significant progress on the following fronts:

Enhancing pricing and dispatch efficiency

- modification to the group violation penalty regime to produce more economically efficient market schedules
- modification of the Market Clearing Engine (MCE) to benefit from the constraint relieving capability of phase-shifting transformers (PST)

Improving decision-making processes

- creation of two seats on the RCP for representatives of consumers to allow them to benefit by participating in the early stages of market rule changes

Debates on allocative efficiency

- debate on whether the current default levy arrangement is efficient
- debate on whether the cost of reserve should be allocated directly to consumers
- debate on whether price re-runs are appropriate in an ex-ante market

Other rule change work and rulebook enhancements

- refinement of working mechanisms of the Market Rules
- continued use of plain English drafting for clarity and readability

The achievements of the RCP have enabled the wholesale electricity market to become the efficient and reliable market that it is today. It has been an absolute privilege for me to chair a panel of industry members who are committed to the betterment of the market. I would like to thank all panel members for their intellectual contributions and many hours spent reading voluminous papers and debating at the table. For making these fine people available, I would like to thank the respective market participants and service providers for their firm backing. I would also like to thank EMC's Market Administration Team for providing strong support to the panel.

I look forward to another year of rewarding experiences with my panel colleagues. While the tasks before us become progressively more challenging, I am confident that we have a strong panel to continue to deliver more efficiency gains to the NEMS.



Dave Carlson,
Chair,
Rules Change Panel

The RCP concluded on 13 rule change proposals in 2006. There were others that were considered but not yet concluded. The most notable market evolution initiatives were the following:

Enhanced pricing and dispatch efficiency

Improvement to violation penalty regime

The treatment of constraint violations in the linear program formulation was modified so that every violation used by the MCE would incur a penalty to NetBenefit, the objective function of the linear program.

All violations that the MCE uses for a given entity are considered together and used to determine a single group violation penalty. Prior to this change, a group violation penalty was incurred based on the largest violation used for the entity. Consequently, an initial violation would allow additional constraints associated with the same entity to be violated up to the same level without reducing NetBenefit. When such additional violations are used, market schedules become even more infeasible and more likely to require overriding.

This modification redefined group violation penalties so that each reflected the sum of all violations used for an entity. In this way, any violation triggered would incur a penalty to NetBenefit. This ensures that the MCE incurs a violation only when necessary and therefore produces more efficient pricing and dispatch schedules.

Modelling of phase-shifting transformers

The Market Rules were amended to reflect the use of PSTs on the grid. PSTs are capable of controlling power flows and therefore serve to reduce the occurrence of line constraints.

SP PowerAssets commissioned a PST in the transmission system in mid-2006. A PST is a transformer that can advance or retard the voltage phase angle. The PST creates a phase angle shift between its source voltage and load voltage by injecting quadrature voltage into the phase-to-ground voltage in the source terminal. The desired phase angle shift can be achieved through the control of the magnitude and the direction of the injected voltage.

The purpose of installing a PST is to regulate power flows. This is done by changing the phase angle difference between the source and load of the PST. By doing so, flows on parallel lines can be controlled to a certain extent and this can serve the objective of reducing line constraints. With fewer constraints, more loads can be served with the cheapest available generation, resulting in a more efficient market.

Improved decision-making process through direct consumer representation

In November 2006, the RCP recommended a change to the Market Rules to include up to two representatives of consumers on the RCP. When consumer representatives are appointed in the early part of 2007, the market can expect further improvements in the decision-making process that drives the evolution of the market.

While any interested party can participate in the rule making process by submitting rule modification proposals, there was previously no consumer representation on the RCP. Consumers have a strong interest in the efficiency of the wholesale electricity market. The inclusion of consumer representatives in the early stages of the rule change process will further enhance the position for consumers, who ultimately pay the cost of electricity.

Benefits should also arise from broader consumer understanding of the workings of the market and from an improved knowledge of the price determination process. During times of upward price pressure – as seen over the last year, with higher than normal fuel input prices – having better informed consumers would help to minimise the risk of intervention in the normal functioning of the market.

Debates on allocative efficiency

Over the course of the year, the RCP engaged in discussions and debates over several aspects of market design. While these have not necessarily resulted in modifications to the Market Rules, the views and arguments recorded contribute greatly to the thought process underlying the evolution of the wholesale electricity market. Three notable issues that were discussed at length follow:

Allocation of default levy

When invoked, a default levy is currently charged to all non-defaulting market participants (MPs), weighted by their invoice value. At the industry level, this arrangement has merit because it does not discriminate between different classes of MP. It is, however, also true that the arrangement has the effect of creating distortion within the retailer class of MP. It is also not consistent with good principles for allocating default risk.

While the RCP has reached an agreement on the principle that only creditors should bear any default levy, the Panel has had to extensively study the impact of the proposal especially in the light of the vesting contract regime. A final decision on this rule change proposal is expected in 2007.

Reserve cost allocation

It was argued that the allocation of reserve costs to generators constrains generators to operate at sub-optimal levels (so that their reserve charges are minimised). Further, it was also argued that this was inequitable since it provided load with free 'insurance' because load benefited from a reliable system.

However, it was established that having generators run at higher levels may not be optimal for the market as a whole. The higher the level a generator runs at, the greater the amount of reserve required to cover its possible failure. Where the reserve requirement is set to manage the loss of the largest generator, a system with fewer generators running at higher levels would require more reserve than an equivalently-sized system with more generators running at lower levels. A higher reserve requirement would translate into a higher cost for the market.

It was concluded that the recovery of reserve costs from generators makes generators take into account the costs that they impose. Consumers pay for reliability indirectly through electricity prices. This is efficient for the market. The alternative of not directly allocating the costs of reserve to generators (who cause the need for reserve) would eliminate the incentive for them to minimise reserve costs.

Review of price re-runs in an ex-ante market

The RCP is also in the process of reviewing the existing price revision arrangement. This arose from the contention that in an ex-ante market, prices determined prior to the start of a dispatch period should be firm and bind both sellers and buyers. Hence, ex-ante prices should not be revised (in a re-run). However, it was also contended that price revision is necessary to ensure that the prices determined by the MCE for settlement purposes are correct and reflect the prevailing underlying market conditions.

This review concerns a fundamental aspect of market design and has a far-reaching impact on the market. Hence, it is being undertaken carefully and will take into account practices and rationales from other jurisdictions.

Other rule change work and rulebook enhancements

The RCP continued its efforts to refine the workings of the Market Rules. Two notable refinements were made.

Firstly, guidelines and formulae to determine the amount of compensation allowable under the Market Rules were introduced to improve the economic and administrative efficiency of the compensation regime.

Secondly, negative injection energy quantity (IEQ) was excluded from price neutralisation calculations for embedded generators. Thus negative IEQs are treated in the same way no matter which type of price neutralisation payment is due and the charging for negative IEQ (at the relevant market energy price) is consistent with the treatment of all other (non-embedded) generation registered facilities' negative IEQs.

All modifications to the Market Rules continued to be drafted in plain English and made as simple as possible. To further enhance clarity and general readability, several sections of the rules that were previously convoluted or cumbersome were re-written in plain English. These changes are part of an ongoing concerted effort to make the Market Rules clearer and more easily understood by any reader. This serves to promote greater understanding of the way the wholesale electricity market operates.

Dear Industry Members,

Despite persistent higher fuel prices in 2006, market prices for the NEMS were generally stable apart from occasional spikes. Although there were breaches of the Market Rules for which financial penalties were issued, no major breaches were observed.

The higher Uniform Singapore Energy Prices (USEP) in 2006 were attributable to higher fuel prices and also higher system demand. Supply remained constant throughout the year until the commissioning of a 498MW generation facility in October. Nonetheless, most of the time the USEP was below the vesting contract price, indicating that vesting contracts help to moderate electricity prices in Singapore.

First hearing

The MSCP conducted its first hearing in January 2006. The hearing was held at the request of a market participant in relation to offer variations after gate closure that it submitted in April and May 2005. 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 that could have prevented the breaches from occurring. The MSCP also ordered the market participant to pay investigation and hearing costs of \$23,000.

Offer variations after gate closure

The MSCP continued to monitor offer variations after gate closure in 2006. Following the implementation on 19 January of the market rule change to reduce the gate closure time for offer variations from 120 minutes to 65 minutes, there was a reduction in the number of gate closure incidents and also a reduction in the number of rule breaches in this area.

MSCP finding

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

Our conclusion was that there was no evidence that the NEMS was inefficient or unfair during the relevant period. The higher price trend during the relevant period was attributable to fundamental market supply and demand factors. There was also consistency in applying relevant Market Rules and design features to all generators. There was no evidence of manipulation by the bigger players during the relevant period.

MSCP annual report

In July, the MSCP issued its annual report for the period April 2005 to March 2006. While the MSCP stated that it looked forward to mechanisms to effect more demand responsiveness to price, the panel was generally satisfied with the market outcomes of the NEMS in the year under review. The panel also noted that the continued structural shift from steam turbine to combined-cycle gas turbine generation was a healthy sign that the NEMS was slowly evolving into a more efficient market.

MSCP Market Watch

In response to requests from market players to share market surveillance observations and market compliance statistics, the MSCP was pleased to publish the first issue of a quarterly bulletin *MSCP Market Watch* in November 2006. Through this publication, we seek to regularly provide interested participants and observers of the NEMS with a brief update focussing on our market surveillance and compliance objectives. Your suggestions for improving this publication are most welcome.

Conclusion

It has been an eventful year, and I take this opportunity to thank market players for their co-operation and also for providing us with the useful feedback necessary to ensure robust governance of the NEMS.



Joseph Grimberg,
Chairman,
Market Surveillance and Compliance Panel

Compliance activity for 2006

Referrals or complaints received	14
Determinations by the MSCP	15
MSCP meetings	11
Gate closure revisions considered	3,186
MSCP hearing	1
Financial penalties imposed	\$88,500
Costs imposed on parties in breach	\$36,800
Total cost of the MSCP	\$115,400

Dear Industry Members,

In 2006, we made significant progress in implementing the dispute resolution process for the NEMS.

New dispute resolution rules

The new Market Rules on dispute resolution took effect on 14 February.

To support the use of the new dispute resolution process, I issued a Guidance Note for Dispute Management Systems (DMS), a Model DMS and sample forms for filing disputes at each stage of the NEMS dispute resolution process, i.e., negotiation, mediation and arbitration. These documents are intended to assist market players in developing their own DMS to resolve disputes and were therefore developed in close consultation with the DMS contacts of market players.

Dispute Resolution and Compensation Panel

Pursuant to the new dispute resolution rules, I also established a Dispute Resolution and Compensation Panel (DRCP), comprising a Mediation Panel and an Arbitration Panel. Our Mediation Panel, which currently has four members, has three Singaporean professionals, who are experienced and competent mediators, and Ms Shirli Kirschner, Dispute Resolution Advisor for the National Electricity Market of Australia. Ms Kirschner is a valuable addition to our Mediation Panel, given her familiarity with electricity markets and depth of experience as a mediator.

In setting up the Arbitration Panel, I took into account that market players had expressed that they wanted an adequate selection of independent and experienced arbitrators. In addition to the five established Singapore arbitrators, whom I had appointed under the previous dispute resolution rules, we are privileged to have secured the services of Mr LP Thean, who for many years served as a Judge of the Singapore High Court and subsequently as a Judge of Appeal of the Singapore Court of Appeal. It is also our honour to have the Honourable Sir Anthony Mason AC, KBE, a former Chief Justice of the High Court of Australia, and the Honourable Gerald Edward (Tony) Fitzgerald AC, QC, a former judge, sit on our Arbitration Panel.

These appointments ensure that should a dispute arise, the industry will have access to quality dispute resolution services provided by capable and independent individuals.

Dispute management workshop and user guide

On 24 August, a Dispute Management Workshop similar to the one held the previous year was conducted for market players. The purpose was to acquaint the new DMS contacts and those unable to attend the previous workshop with the new dispute resolution process to enable them to properly perform their roles.

The *Guide to Resolving a Dispute* was also launched at the workshop. EMC's Market Assessment Unit and I developed this user-friendly guide to help market players navigate effortlessly through the NEMS dispute resolution process.

Mediation workshop

On 19 and 20 October, a workshop on Managing Conflicts and Resolving Disputes Effectively Through Mediation took place at the EMC office. Ms Carol Liew, a manager with the Singapore Mediation Centre, and I jointly conducted the workshop for DMS contacts, during which mediation concepts and the mediation process were discussed. Through role plays as disputants and mediators, DMS contacts interacted with their peers and had the opportunity to practice dispute management skills. The DMS contacts found the workshop interesting and useful and gave feedback that they would welcome a similar session on dispute resolution in 2007.

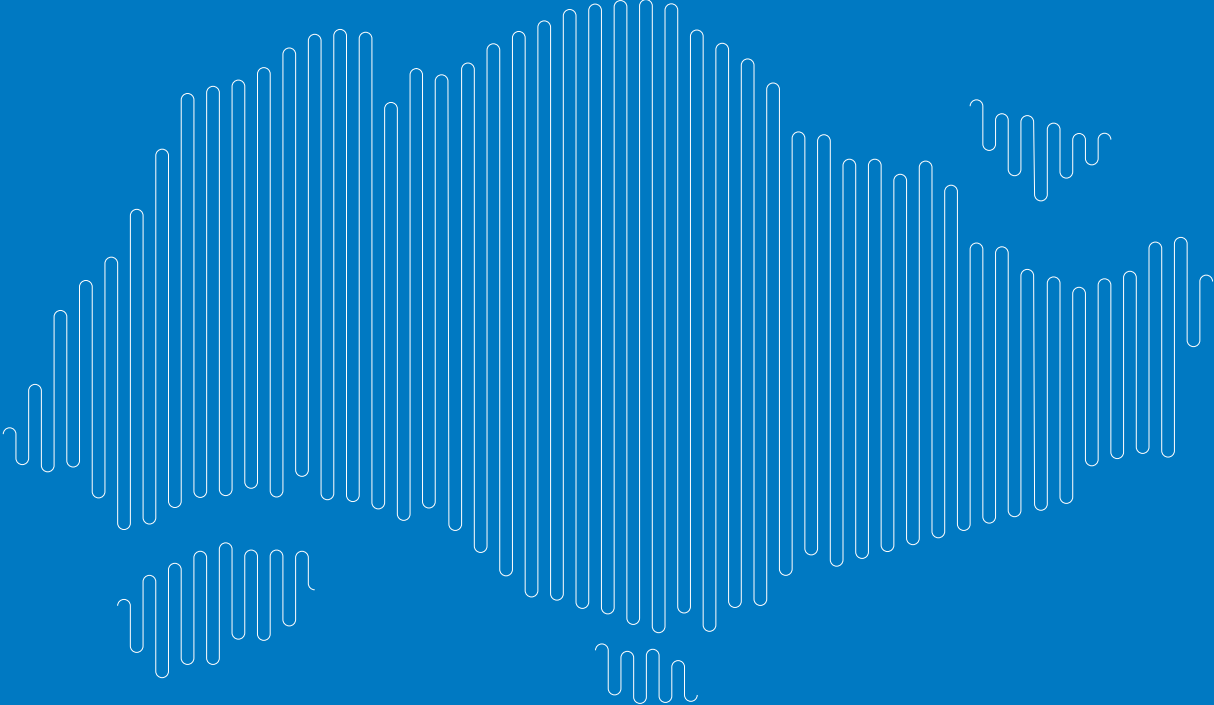
Conclusion

I am pleased with the progress made this year. This would not have been possible without the active engagement of the DMS contacts of market players, who have contributed to the process positively and with enthusiasm. For the record, I was not notified of any dispute in 2006.

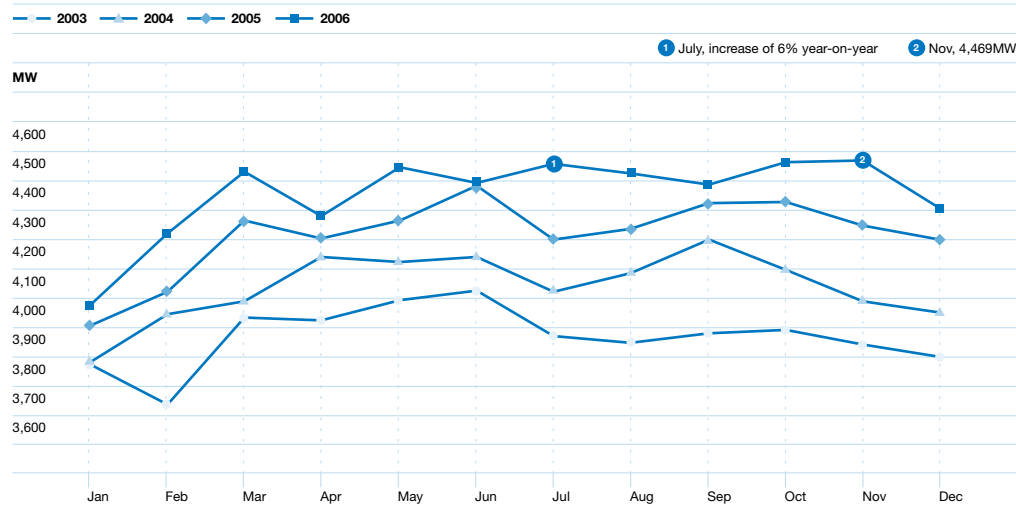
Finally, I wish to thank the Market Assessment Unit for its support and assistance.



George Lim,
Dispute Resolution Counsellor



Monthly Average Demand 2003/06



Demand

In the National Electricity Market of Singapore (NEMS), generators compete to supply the forecast system demand for the next half-hour trading period.

System demand fluctuates on account of the following factors:

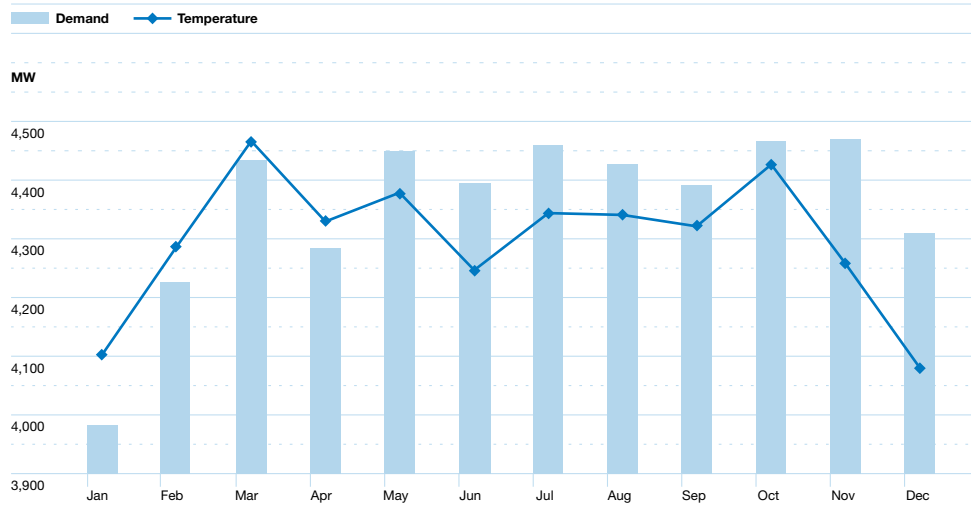
- The daily demand profile varies in accordance with business hours, with relatively flat peak demand between 10.00 am and 5.00 pm.
- The weekly demand profile also varies in accordance with business days, with Sunday typically having the lightest load.

- Public holidays (especially over the Lunar New Year period) are also typically accompanied by low demand.
- There are some seasonal demand trends, and the months between March and November are observed as peak months. This reflects both the economic business cycle as well as the influence of the weather.
- Over the longer term, economic growth is a main determinant of growth in system demand.

In 2006, electricity demand continued to display strong growth, with higher daily average demand for all twelve months than the previous years when compared year on year (YOY). The biggest increase in monthly average demand occurred in July with 6 percent YOY, and the strongest monthly average demand was recorded in November with 4,469 megawatts (MW).

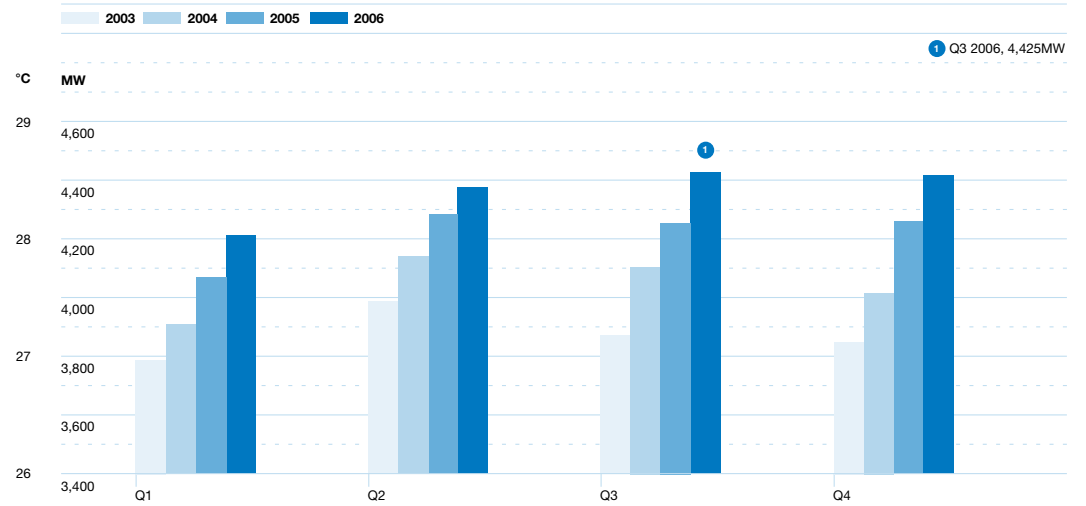
It is notable that the demand profile in 2006 was different compared with that of previous years. In particular, there were drops in demand in June and September, while there were rises in demand in July and November. The chart above illustrates the shift in electricity consumption in 2006.

Average Demand vs Average Temperature 2006



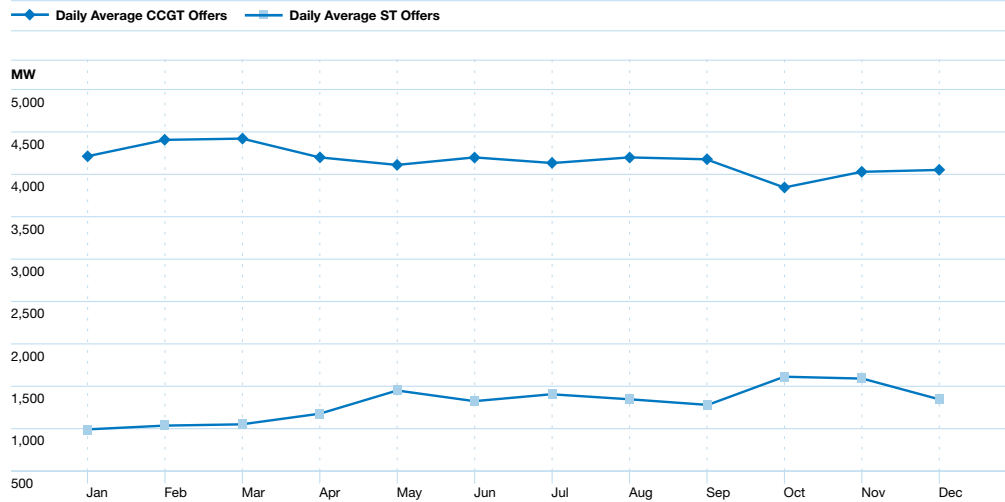
One key contributing factor to the fluctuation of demand was temperature. Demand and temperature moved closely in conjunction with each other during the year.

Quarterly Average Demand 2003/06



On a quarterly basis, demand showed the highest increase in the third quarter, with an increase of 4 percent as compared to 2005. This is in contrast with the previous three years, when the second quarter posted the highest increase. Overall, yearly average demand for 2006 closed 3.3 percent higher than 2005 at 4,357MW.

Offered Capacity by Generation Type 2006



Supply

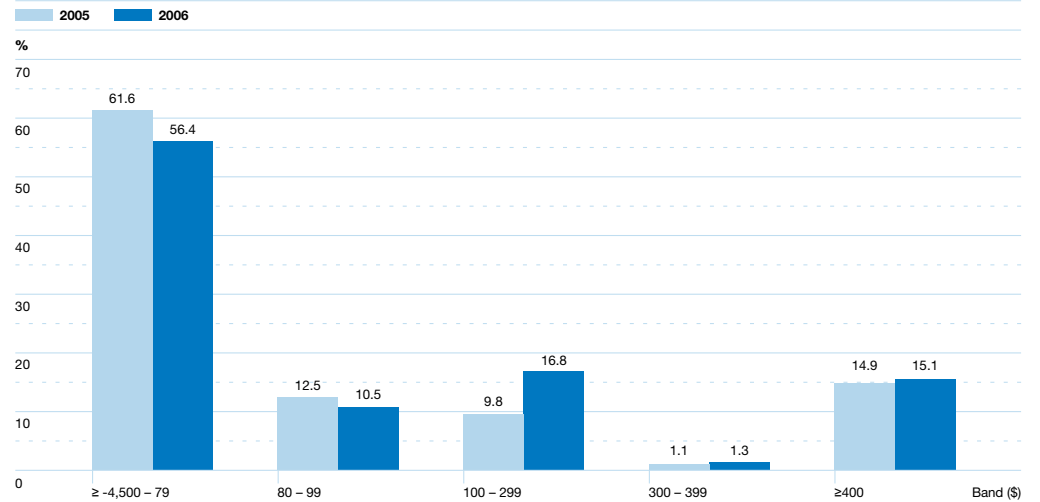
The amount of generation capacity available to the market in any trading period depends on a mixture of operational and commercial factors:

- A generating unit may not be operationally capable to bring capacity online to serve the market if it is undergoing maintenance or otherwise not prepared for operation, e.g., cold units.
- A generator may choose not to offer capacity into the market if it is not commercially viable to operate at the prevailing market price.

- The level of generation capacity available to the market over the longer term reflects the decisions of generators to invest in additional capacity or, alternatively, to retire assets that are no longer commercially viable.

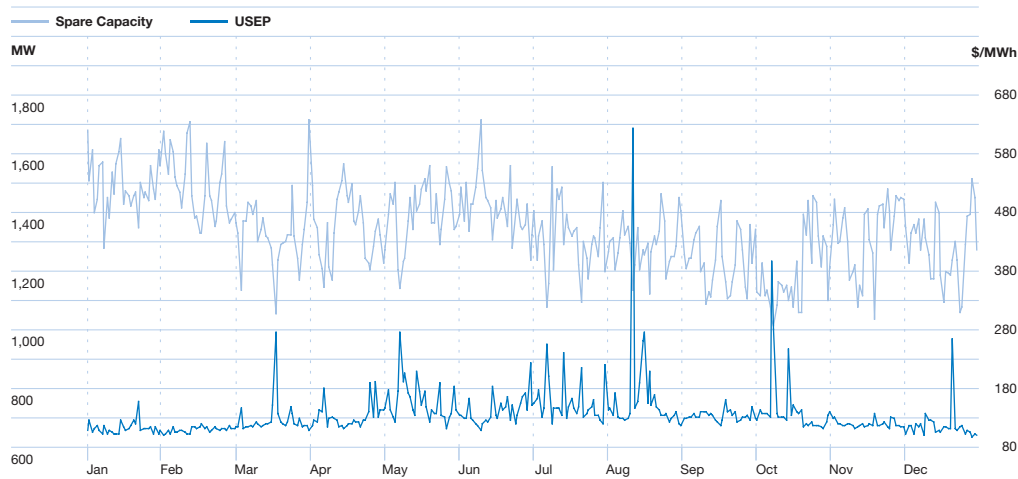
Over 2006, combined-cycle gas turbine (CCGT) offer availability began strongly, with offered capacity in February and March above 4,400MW, before declining slightly towards the end of the year. This decline was mainly due to CCGT maintenance and forced outages. The market responded to the drop in CCGT offers with higher steam turbine (ST) offers. On the whole, the annual average CCGT offer availability rose nearly 3 percent against 2005.

Offer Price Bands 2005/06



Besides the quantity of supply, the other essential factor for supply is the offer price proportion or the proportion of offers in price bands. With respect to offer price in 2006, the lower price bands of below \$100/megawatt hours (MWh) decreased while the higher price bands of equal to or above \$100/MWh increased as compared to the previous year. This reflected offer price bands moving in line with the rising oil prices.

Spare Capacity vs USEP 2006



Note:
Spare capacity equals total offer availability minus total demand.

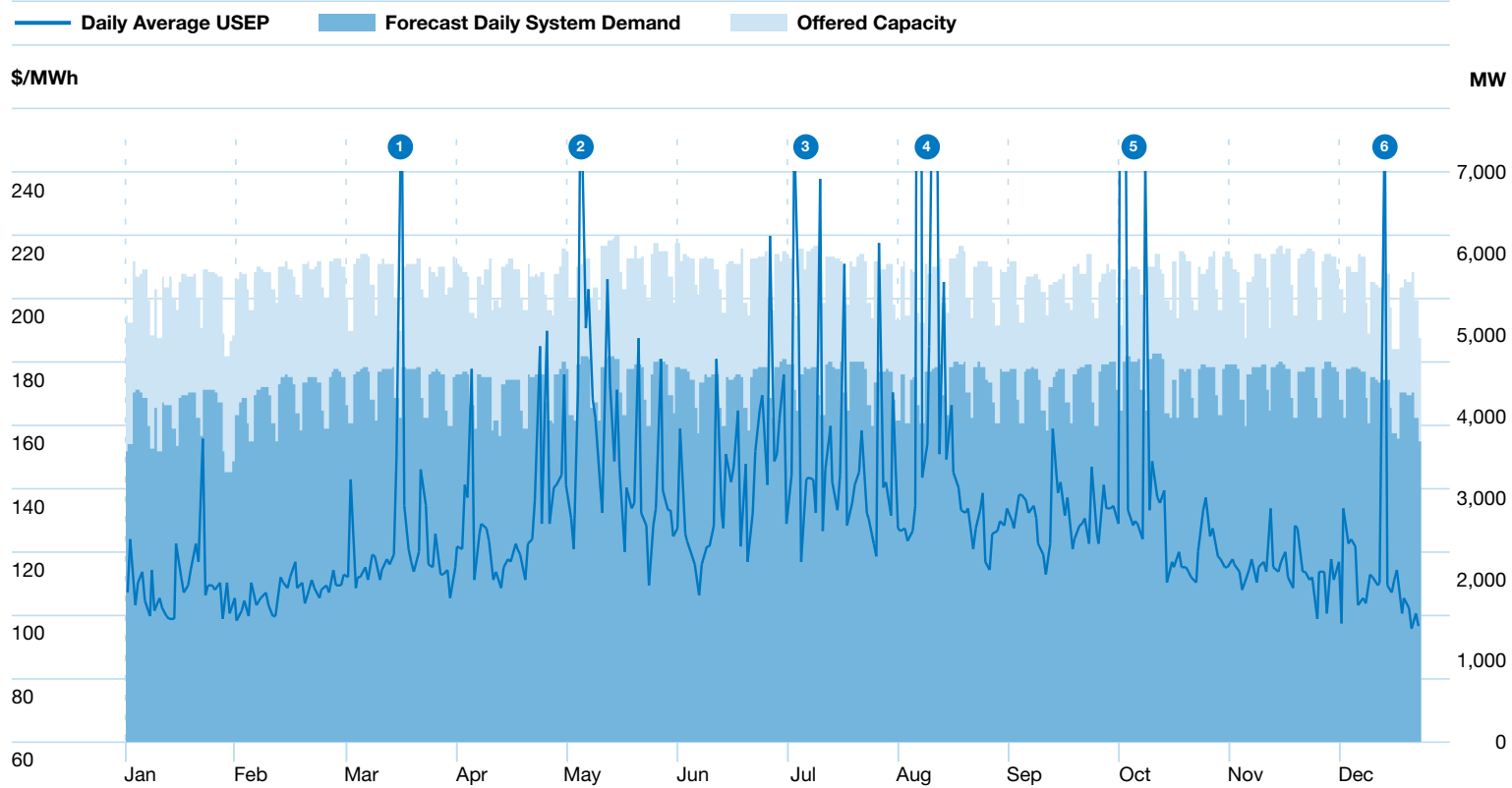
Energy prices

Market prices are influenced by the interaction of both demand and supply factors. From trading period to trading period, there are system events that may cause temporary price fluctuations. For example, forced outage of generation or transmission equipment may cause a temporary shortage in the market. The shortage will trigger a price signal to encourage additional generation capacity to be made available to the market and hence relieve the shortage. Unanticipated fluctuations in demand are rare, as Singapore's demand pattern tends to be uniform and predictable.

Retailers pay for electricity purchased from the wholesale market at a price known as the Uniform Singapore Energy Price (USEP). The USEP is calculated as the quantity-weighted average of all nodal prices in a particular trading period.

Spare capacity declined in the middle of the year resulting in a higher USEP. In August 2006, the highest monthly average USEP of all time was registered at \$167/MWh. On the whole, as compared to 2005, USEP for the year rose 20 percent to close at \$132/MWh.

USEP, System Demand and Offered Capacity 2006

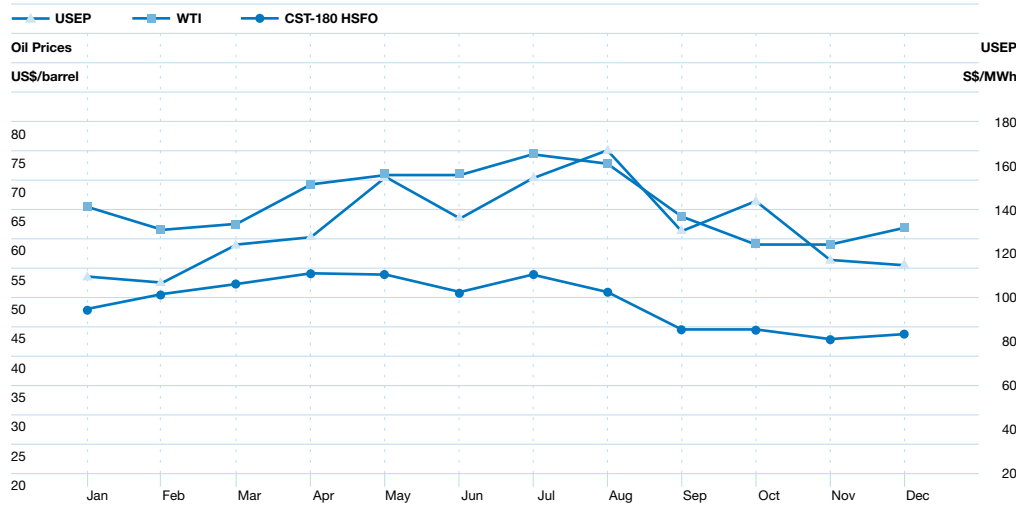


Price fluctuations

- 1** On 19 March, due to strong demand, the USEP hovered above \$130/MWh for most of the day and spiked to \$1,023/MWh when three gas turbine (GT) units were run. Overall, the daily average USEP closed at \$279/MWh.
- 2** On 9 May, average demand rose to the fourth highest level in 2006 at 4,734MW. In addition, the tight supply was further compounded by one CCGT unit being out for maintenance. The USEP held above \$500/MWh for a total of ten periods in the day and closed at a high of \$272/MWh.
- 3** Saturdays in July experienced higher price sensitivity caused by higher demand and lower ST offer availability. On the first four Saturdays (1, 8, 15 and 22 July) the daily average USEP closed at \$220/MWh, \$253/MWh, \$237/MWh and \$210/MWh respectively.
- 4** The CCGT supply disruption in August resulted in three days of the daily average USEP hitting above \$250/MWh. On 12 August, due to a forced outage and offer changes, it soared to \$619/MWh, the highest level ever. Contingency reserve and regulation markets incurred violations on that day. On 16 and 17 August, the daily average USEP closed at \$257/MWh and \$271/MWh respectively.
- 5** In October, higher demand and lower CCGT offer availability resulted in higher price sensitivity, particularly in the first three weeks of the month. The daily average USEP closed at \$393/MWh, \$277/MWh and \$243/MWh on 8, 9 and 15 October respectively.
- 6** On 21 December, the forced outage of two CCGT units, due to an unplanned disruption of the gas supply from Malaysia, resulted in an energy shortfall of 77.8MW, and the USEP hit its ceiling price of \$4,500/MWh. This led to the daily average USEP closing at \$261/MWh. Primary reserve and regulation markets also experienced shortfalls on that day.

Note:
Prices above \$240/MWh are not displayed.

Oil Prices and USEP 2006



Fuel costs

Fuel costs account for a significant proportion of the running costs of the thermal-fired generators that make up 97 percent of Singapore’s generation capacity. This means that the majority of production costs for Singapore’s generation assets are either directly or indirectly (through the pegging of natural gas prices to an oil benchmark) determined by international oil prices. Hence, changes in fuel input costs, such as the price of fuel oil or natural gas, have a significant influence on electricity prices.

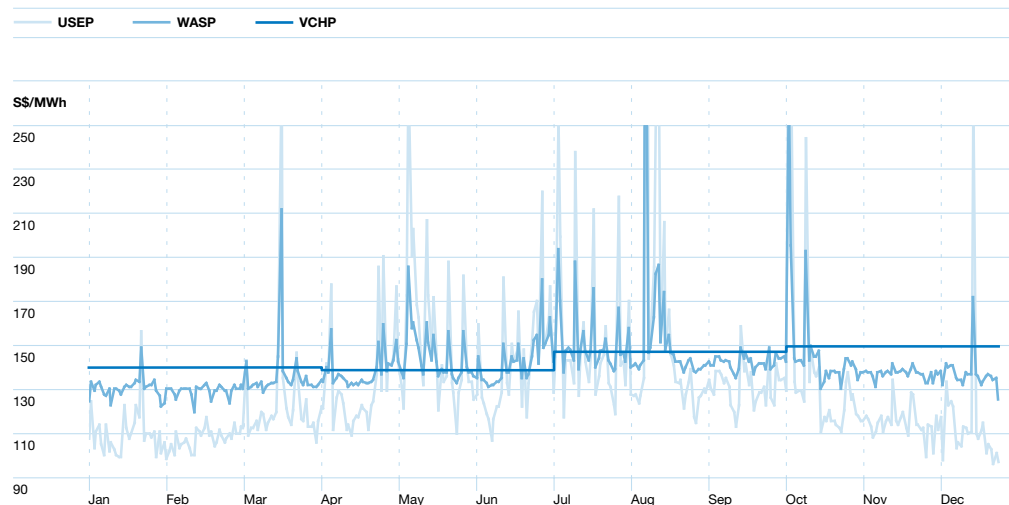
Global crude prices, as measured by the WTI (West Texas Intermediate benchmark), grew strongly in 2006, up 17 percent from 2005. In July, the WTI rose to a new high of US\$74 per barrel. The high WTI prices were mainly caused by the continued deterioration of supply-side fundamentals over the year.

For the Singapore electricity industry the most relevant oil benchmark is 180-centistoke high sulphur fuel oil (180-CST HSFO), and its price grew at a steeper rate in 2006 than the WTI or Brent benchmarks. 180-CST HSFO was up 21 percent from 2005.

However, as reflected in the chart to the left, higher fuel costs were not directly translated into proportional increases in the USEP. This was likely due to a combination of the following factors:

- the competition amongst generators for dispatch,
- the influence of vesting contracts and the hedging of fuel costs by generators and
- the success of generators in reducing non-fuel costs and realising operational efficiencies.

USEP, VCHP and WASP 2006



Note: Prices above \$250/MWh are not displayed.

Vesting contracts

Vesting contracts have been imposed on generators by the Energy Market Authority (EMA) since 1 January 2004 with the objective of mitigating the potential exercise of market power when the supply side of the industry is concentrated among a small number of generators. About 65 percent of demand is vested in mandatory contracts between generators and SP Services (on behalf of consumers).

Vesting contracts are structured like a typical contract-for-difference as follows:

- The vesting contract hedge price (VCHP) is based on the long-run marginal cost (LRMC) of the most efficient generation facility with the most economic generating technology in operation in Singapore. Currently the benchmark generation facility is a CCGT unit.
- The VCHP is recalculated by the EMA on a quarterly basis, using forward 180-CST HSFO prices for the quarter.
- The reference price for vesting contracts is the wholesale market nodal price received by generators.

Price summary 2005/06

	2006	2005	Change (%)
USEP (per MWh)	\$132.42	\$109.90	20.49
HSFO (per barrel)	US\$49.11	US\$40.63	20.87
VCHP (per MWh)	\$144.60	\$110.94	30.41
WASP (per MWh)	\$140.38	\$110.77	26.84

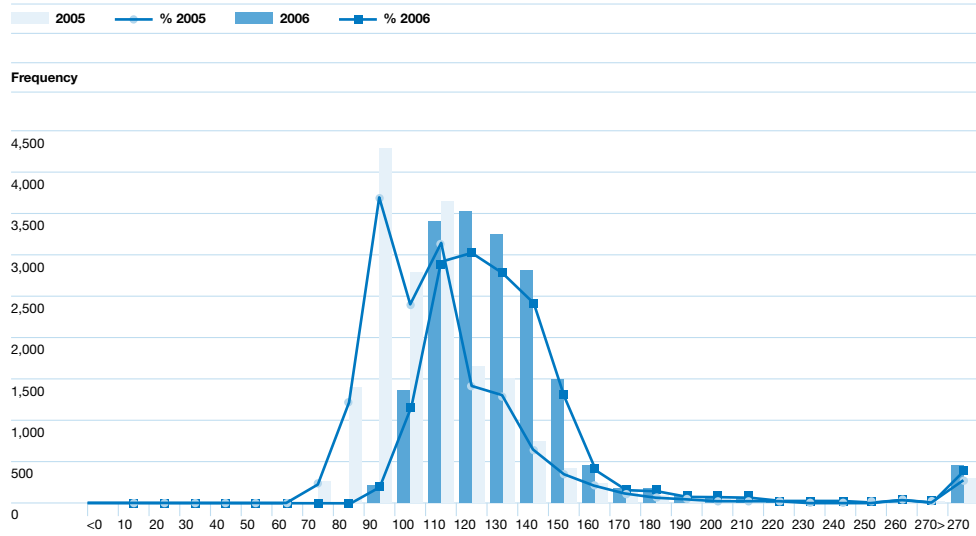
- When the reference price is higher or lower than the hedge price, SP Services refunds the difference to or recovers the difference from electricity retailers and contestable electricity consumers, which buy from the wholesale market.

The weighted average settlement price (WASP) takes into account the vested percentage of the energy market at the VCHP and the remaining un-vested percentage that is settled at the USEP.

$$WASP = (\text{Vested quantity} * \text{Quarterly VCHP}) + (\text{Non-vested quantity} * \text{USEP})$$

In 2006, the average USEP was 9.2 percent below the LRMC benchmark, i.e., the VCHP. On a quarterly basis, the average USEP in the first and fourth quarters of 2006 registered more than 19 percent below the VCHP, while in the second and third quarters the average USEP posted a small difference of 2 percent above the VCHP.

Price Frequency Histogram: USEP by Trading Period 2005/06

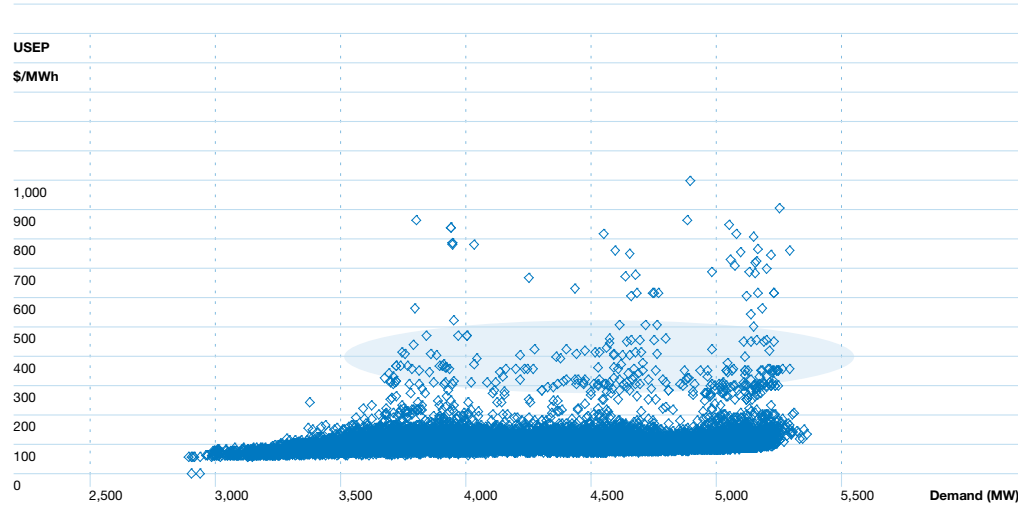


Price volatility

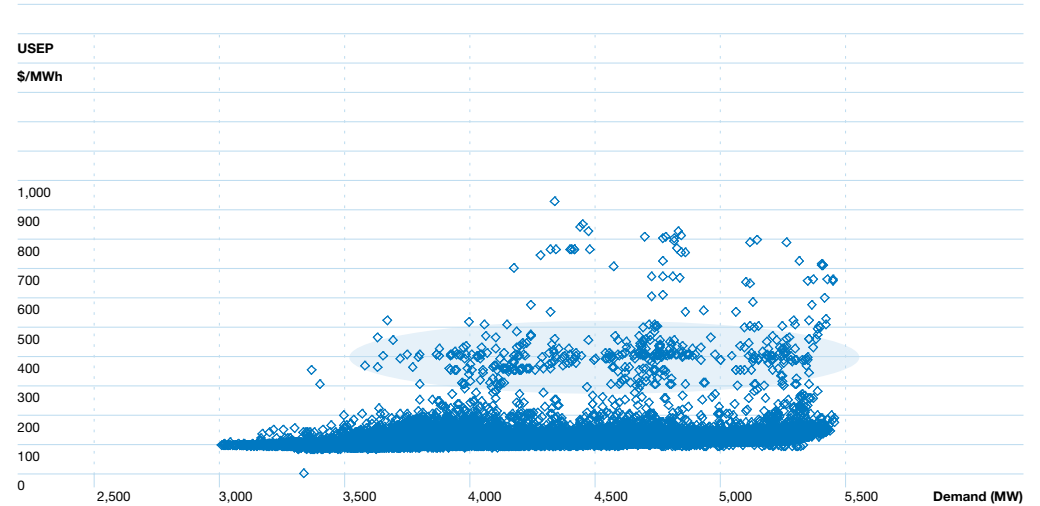
The distribution of the USEP by trading period for 2006 centred on a mean of \$132.42/MWh with a standard deviation of \$95.68/MWh. This compares with a mean of \$109.90/MWh and a standard deviation of \$85.55/MWh in 2005. The increase in standard deviation for 2006 is exhibited by higher price dispersion in contrast to the previous year.

Over the past 12 months, in 9 percent of the trading periods the USEP was lower than \$110/MWh, while in 87.41 percent the USEP was between \$110/MWh and \$200/MWh and in 3.58 percent the USEP was greater than \$200/MWh.

Correlation Between USEP and Demand 2005



Correlation Between USEP and Demand 2006

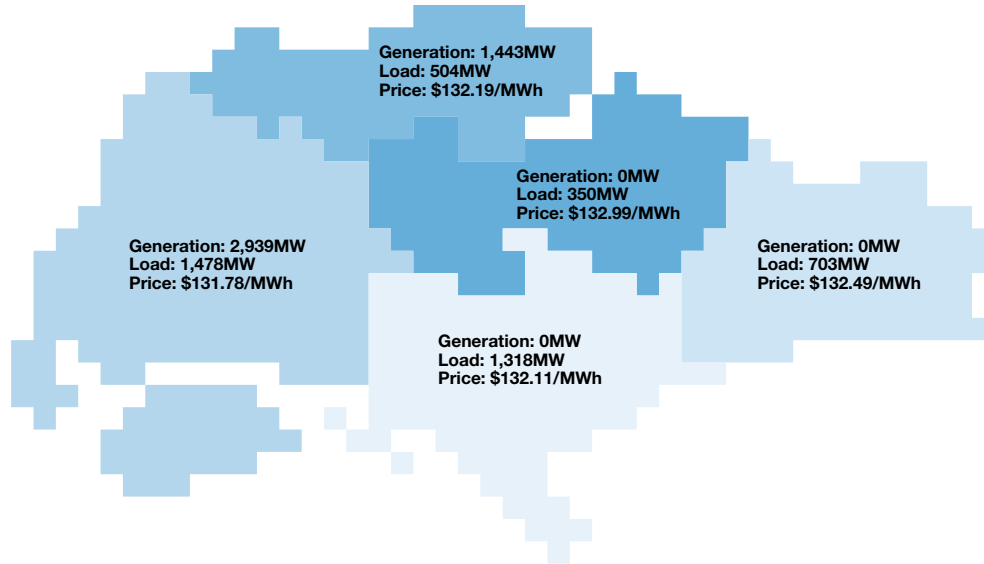


As shown in the scatterplots, price volatility in 2006 displayed higher fluctuations as compared to 2005. The likely explanations for an increasing spread of prices are:

- Record peak demand in 2006 combined with low generation availability in some trading periods resulted in price pressure.
- Changes in offer patterns could reflect more volatile oil prices.
- With usually fewer generation units during low and medium load periods, an unplanned outage or higher than expected demand could result in a sharp increase in prices if more expensive GT units were dispatched.

Note:
The prices displayed on the scatterplots fall within the range of \$0/MWh to \$1,000/MWh. Prices outside the range are few in number and have been excluded.

Locational Comparison of Generation, Load and Price 2006



Note:
Figures are the annual average.

Nodal price differences

The price that generators receive from the wholesale market for the production of energy is influenced by their location on the transmission network. The price reflects the cost of energy generation and the cost of transmission losses and grid congestion associated with transporting the energy from the generation facility to where it will be consumed. This is known as the locational marginal price, or nodal price. Transport costs arise because of transmission losses and are also occasionally influenced by line constraints. As a rule of thumb, the load points closest to a generation source would have the lowest nodal prices.

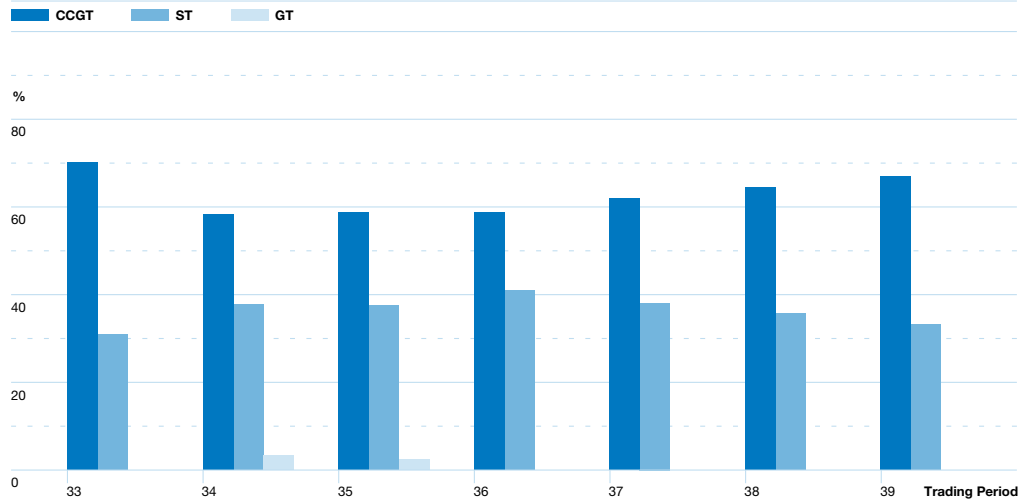
As the Singapore network is small and uses underground cables, it experiences a very low level of transmission loss. In addition, the network has a very robust lattice configuration and hence is generally a constraint free system. The result of this is a minimal divergence of price across the network.

Although the network is generally constraint free, in 2006, there were nine instances of physical grid congestion and one incident of significant load shedding.

The details are as follows:

- From 9 to 11 September, there was a binding constraint on a 230 kilovolt (kV) transmission line, following maintenance work on another 230kV transmission line. This, together with unit maintenance, resulted in price separation between market network node (MNN) prices in the north and the south of Singapore. With offer changes, prices fell after several periods.
- On 9 November, 29 November, 30 November, 7 December and 12 December, price separation occurred when a 400/230kV transformer reached 100 percent of its effective capacity. However, in each instance the situation eased after one or two periods following changes in system demand and network configuration.
- On 24 November, a binding constraint on a 230kV transmission line resulted in different MNN prices on each side of the affected transmission line. Changes in network configuration relieved the condition after one period.

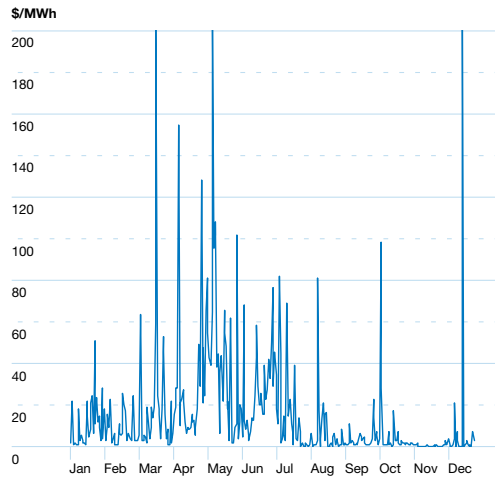
Additional Generation from ST and GT Units after Supply Disruption on 21 December 2006



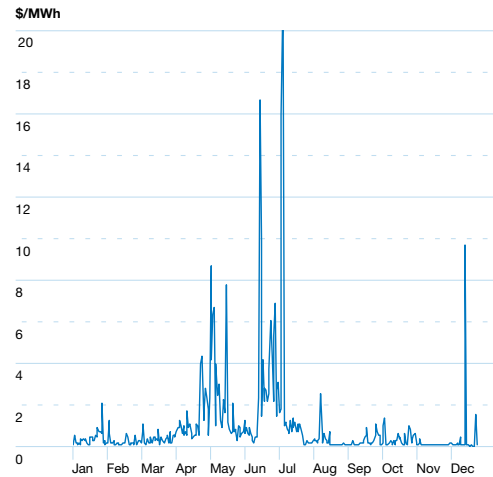
- An unplanned disruption to the piped gas supply from Malaysia on Thursday, 21 December forced outages of two CCGT units, pushing all available units to their maximum capacity and resulting in an energy shortfall of 77.8MW. The USEP hit its ceiling price of \$4,500/MWh for that trading period, even with the deployment of both available GT units and the activation of contingency reserve from load facilities. Load shedding occurred at seven locations in Singapore.

In the next two periods, as ST units ramped up and demand declined, the USEP fell to \$1,889/MWh and \$1,289/MWh. One of the tripped CCGT units returned after three periods and another after four periods. Thereafter, the USEP eased under \$142/MWh.

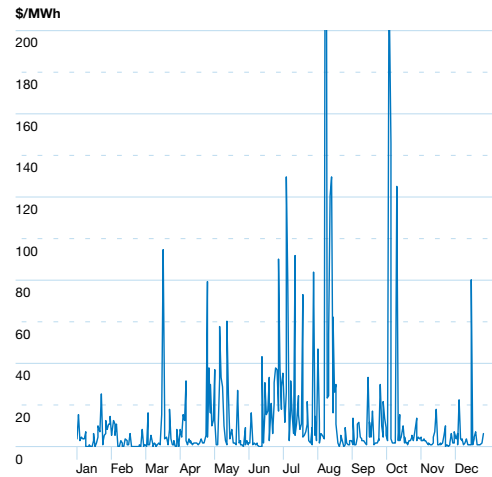
Primary Reserve Prices 2006



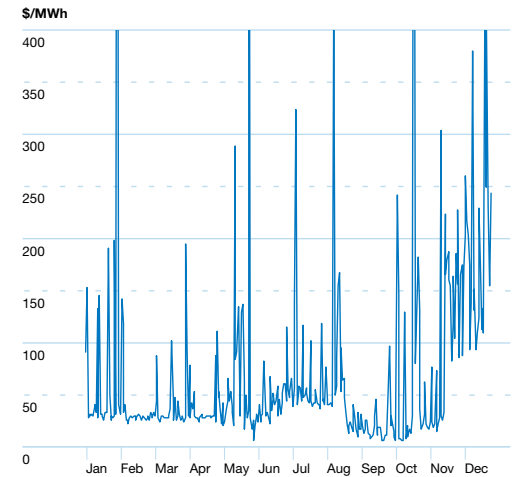
Secondary Reserve Prices 2006



Contingency Reserve Prices 2006



Regulation Prices 2006



Note: Prices in all four charts have been capped for illustrative purposes.

Reserve capacity is procured from the market to ensure that there is stand-by system capacity that can be drawn on when there is an unforeseen disruption of supply, e.g., an equipment outage.

Regulation is generation capacity that is purchased from the market and used by the Power System Operator (PSO) in real time to fine-tune the match between generation and load. The regulating generators ramp up and down in response to small fluctuations in demand and the output of other generators.

Hence, the reserve markets play an important role in facilitating the energy availability and reliability of the wholesale electricity market. It is notable that the ancillary prices are highly influenced by the energy market as a result of co-optimisation.

- The primary reserve class is used to procure 8-second reserve. The average primary reserve price for 2006 was \$15.57/MWh.
- The secondary reserve class is used to procure 30-second reserve. The average secondary reserve price for 2006 was \$0.93/MWh.
- The contingency reserve class is used to procure 10-minute reserve. The average contingency reserve price for 2006 was \$12.76/MWh.

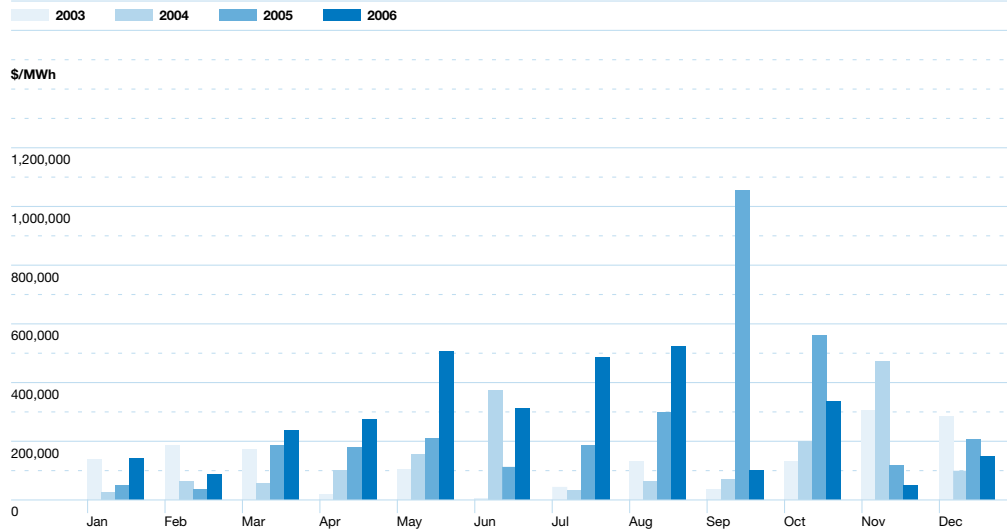
- The regulation requirement is set by the PSO to a standard level of 100MW. The average regulation price for 2006 was \$70.53/MWh.

Average price levels for each class of reserve were stable this year, with all of their annual average prices closing below \$16/MWh, a level held since market start. The regulation market, however, showed a more volatile price trend, particularly from late November onwards. The monthly average regulation price in December rose to a new high of \$189/MWh as compared to the previous high of \$148/MWh in September last year.

The main factors that contributed to the high regulation prices seen in late 2006 are:

- Seasonal low demand resulted in fewer generation units operating, and this increases the likelihood that units would fall outside of the regulation band and thus become ineligible to provide regulation.
- Periodically, generation units did not offer regulation due to operational incapacity.
- Regulation offers moved to a higher price band.
- The commissioning of units resulted in more volatile regulation prices.

Daily Average Reserve Cost 2003/06



Reserve cost

One of the benefits of the introduction of the NEMS was a dramatic reduction in the cost of reserve. These savings have persisted, although reserve costs in 2006 were higher than 2005. A key reason for this increase was the energy price spikes, which have a knock-on effect on reserve prices due to co-optimisation.

Reserve offer availability declined from November until December due to the commissioning of the Keppel Merlimau Cogen generation units. At times during the commissioning process these units were unable to provide reserve but contributed energy. This meant that the commissioning units displaced commercial units from the energy market that would have otherwise contributed to the reserve market. This reduced the availability of reserve offers, putting pressure on reserve prices.

Interruptible load

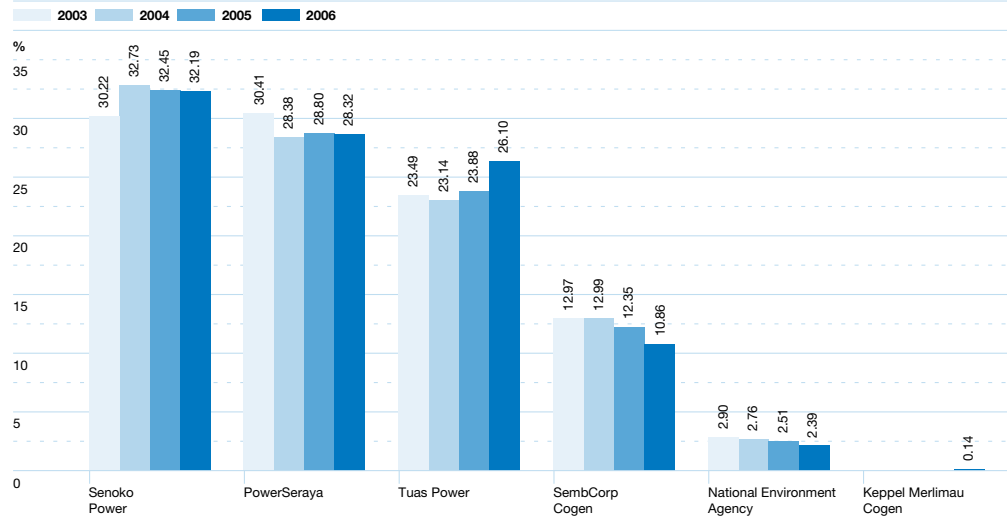
Under the interruptible load (IL) regime, a load facility can offer to have its power interrupted in the event of a power system disturbance. The load facility can choose to offer its IL through a retailer or as a direct wholesale market trader. In return for offering to have its power supply interrupted, a load facility receives a payment for every half-hour that its offer is accepted in the reserve market.

IL facilities are allowed to participate in all three classes of reserve market within the NEMS. IL provides a high quality source of reserve, as it is not dependent on a fuel source. Hence, unlike generation, IL is unaffected by fuel supply disruptions. This regime, introduced on 1 January 2004, is expected to further increase competition in the reserve market and may result in significant savings and efficiency gains in the electricity industry.

New IL provider

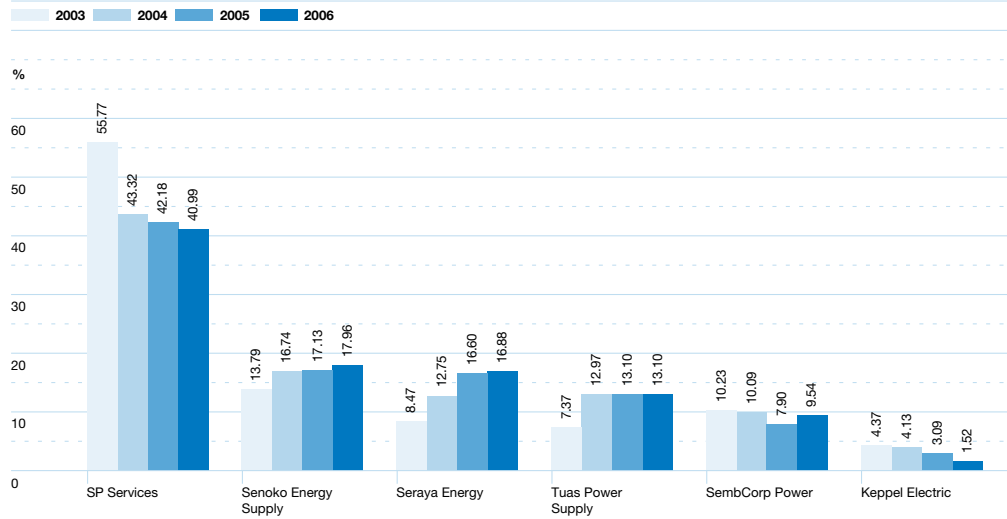
On 23 May 2006, Diamond Energy commenced trading as an IL provider. As of 31 December 2006, the total IL registered capacity was about 18MW each for all three classes of reserve, translating into a market share of about 5 percent.

Market Share by Generator 2003/06 (based on scheduled generation)



Energy market revenue was won by generators broadly in proportion to their share of total registered capacity in 2006. With the commissioning of two additional CCGT units since the third quarter of 2005, Tuas Power increased its market share further in 2006 to 26.1 percent. SembCorp Cogen had a drop of 1.5 percent in its market share due to maintenance.

Market Share of SP Services and Retailers 2003/06



Retail contestability is being introduced into the NEMS in stages. Phase 2 of retail contestability for consumers with monthly electricity consumption of 10MWh and higher was completed in early 2006. This means that about 11,000 consumers were classified as contestable and free to choose their suppliers, making 75 percent of the total electricity demand open to retail contestability. For the remaining 25 percent that comprises mainly household consumers, the EMA is exploring ways to leverage new technology that could further benefit small consumers before extending retail competition to them.

Under Singapore's approach to contestability, contestable customers can choose to buy electricity from a retailer, directly from the wholesale market or indirectly from the wholesale market through SP Services. The consumers that are not yet contestable continue to be serviced by SP Services at regulated tariffs.

A comparison of retail market shares shows:

- The percentage of consumers buying electricity from the wholesale market through SP Services dropped slightly to 41 percent in 2006 from 42 percent in 2005, indicating that more contestable consumers have opted to switch to buying electricity from retail companies.
- There have been some changes in the market shares of the five retail companies indicating active competition in the retail market.

Energy Market Company (EMC) is the financial clearing house for the wholesale market and settles the following transactions:

- energy,
- three classes of reserve (primary, secondary and contingency),
- regulation,
- vesting contracts,
- uplift charges,
- fee recovery of EMC and the PSO administration costs and
- contracted ancillary services (black-start services).

Market participants may choose to have EMC settle bilateral contracts with other participants.

The market is well secured. To cover the exposure of a debtor and the time required to manage a default, all retailers must provide on-going collateral to EMC. This prudential cover protects EMC and other market participants from payment defaults. EMC reviews the adequacy of prudential cover daily.

A margin call is issued when a retailer's estimated exposure reaches a value equal to or greater than 70 percent of the level of its prudential cover. In 2006, EMC issued eight margin calls and these calls were met within the time frame of two business days.

For 2006, the value of total retail settlement payments (net of bilateral contracts) was \$3.422 billion and the value of credit support at 31 December 2006 was \$362.7 million.

EMC negotiates and enters into contracts, on behalf of the PSO, to ensure the reliable operation of Singapore's power system. If these services are unable to be procured competitively, their prices are regulated.

In 2006, the only contracted ancillary service required was black-start capability. Based on the PSO's operational requirements, EMC procured 69MW of black-start service at a cost of \$9.798 million. The capability was sourced from PowerSeraya, Senoko Power and Tuas Power.

Black-start service ensures that there is initial generation to supply electric power for system restoration following a complete blackout.

Contracted ancillary service 2006

	Cost incl. 5% GST (million)	Quantity (MW)
Black-start service	\$9.798	68.848

The costs associated with the wholesale functions of the NEMS are recovered directly from the wholesale market or from market participants and consumers.

EMC and PSO fees are recovered from both generator and retailer class market participants in proportion to the quantity of energy that they trade.

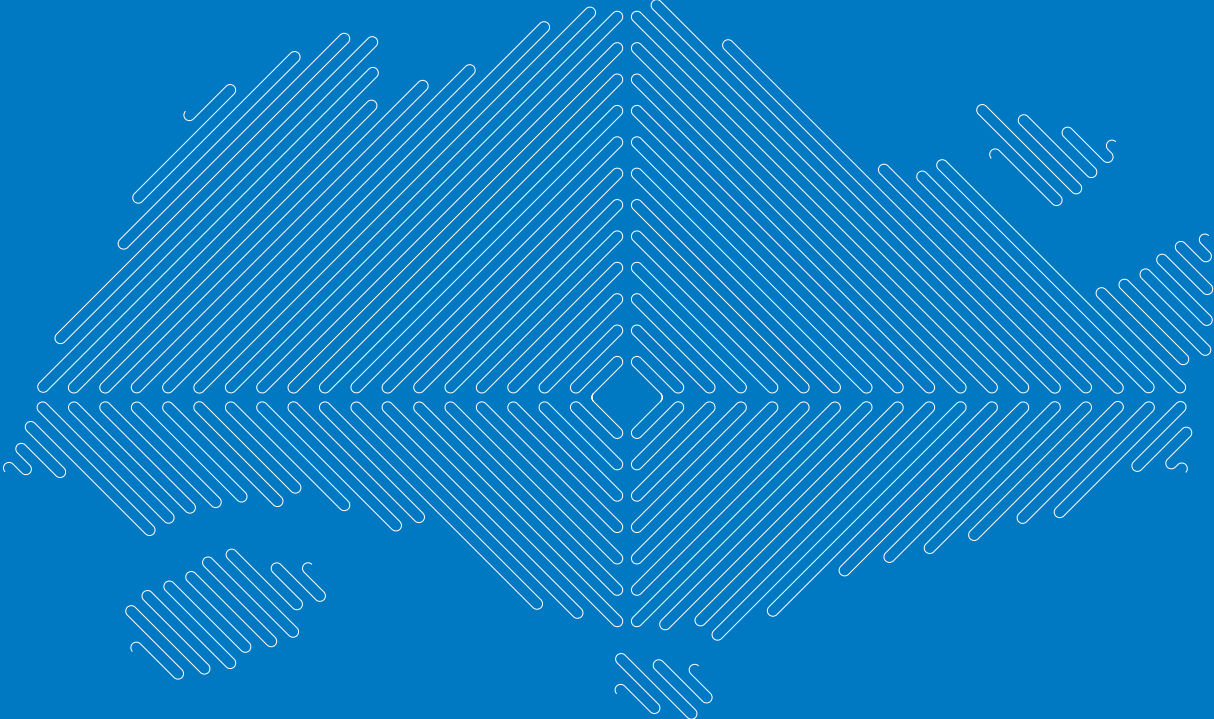
EMC and PSO fees recovered directly from the NEMS 1 April 2006 to 31 March 2007

	Fee (million)	Rate (MWh)*
EMC	\$27.970	\$0.3815
PSO	\$15.883	\$0.2166
Total	\$43.853	\$0.5981

* Assumes energy trade of 6.110TWh per month.

Fees recovered directly from market participants and consumers

Supplier	Service	Method of Assessment
SP PowerAssets	Transmission	Levied based on actual usage
SP Services	Meter reading and data management	Levied on a per meter basis



ancillary services

The additional services necessary to ensure the security and reliability of the power system. The ancillary services traded competitively on the wholesale market are regulation and the three classes of reserve. The fast-start ancillary service is procured by Energy Market Company (EMC) on contract based on regulated prices.

black-start ancillary service

A service to ensure that there is initial generation for system restoration following a complete blackout.

contestable consumers

Those consumers that have the right to choose to purchase electricity from a retail supplier, directly from the wholesale market or indirectly from the wholesale market through the Market Support Services Licensee, SP Services. Consumers qualify to be contestable based on the level of their electricity consumption.

co-optimisation

The process used by the market clearing engine to ensure that the cheapest mix of energy, reserve and regulation is purchased from the market to meet electricity demand in each dispatch period.

dispatch schedule

A schedule produced by the market clearing engine every half-hour that is the basis for the supply of energy, reserve and regulation in the market.

energy

The flow of electricity.

fast-start ancillary service

A generation facility that is able to synchronise with the power system and begin generation at a defined level within a specified time.

full retail competition (FRC)

A situation in the retail market where all consumers are contestable consumers, i.e., have the right to choose to purchase electricity from either a retail supplier, directly from the wholesale market or indirectly from the wholesale market through the Market Support Services Licensee, SP Services.

interruptible load

Contestable consumer of electricity that participates in the wholesale market and allows its supply of electricity to be interrupted in the event of a system disturbance in exchange for reserve payment.

load

The consumption of electricity.

market clearing engine (MCE)

The linear computer program used to calculate the spot market quantities and prices.

megawatt (MW)

A measure of electrical power equal to one million watts. MWh represents the number of megawatts produced or consumed in an hour.

nodal pricing

A market structure in which prices are calculated at specific locations, or nodes, in the power system to reflect the demand and supply characteristics of each location. Nodal pricing is also commonly referred to as locational marginal pricing.

non-contestable consumers

Consumers that are supplied by the Market Support Services Licensee, SP Services, at a regulated tariff. These consumers have not been given the right to choose to purchase electricity from either a retail supplier, directly from the wholesale market or indirectly from the wholesale market through the Market Support Services Licensee, SP Services.

regulation

Generation that is on stand-by to fine-tune the match between generation and load.

reserve

Stand-by generation capacity or interruptible load that can be drawn on when there is an unforeseen disruption of supply.

retail market

The transactions made between retail companies and end consumers.

terawatt (TW)

A measure of electrical power equal to one million megawatts.

USEP

Uniform Singapore energy price is the weighted-average of the nodal prices at all off-take nodes.

vesting contract

A vesting contract is a regulatory instrument imposed on generators by the Energy Market Authority (EMA) with the objective of mitigating the potential exercise of market power when the supply side of the industry is concentrated among a small number of generators.

wholesale market

The transactions made between generation companies and retail companies.

Additional Information | Market Participants' Contact Details

Active Generator Licensees	Keppel Merlimau Cogen National Environment Agency PowerSeraya SembCorp Cogen Senoko Power Tuas Power	www.keppelenergy.com www.nea.gov.sg www.powerseraya.com.sg www.sembutilities.com www.senokopower.com.sg www.tuaspower.com.sg
Wholesale Market Traders	Air Products Diamond Energy	www.airproducts.com.sg www.diamond-energy.com.sg
Active Retailer Licensees	Keppel Electric SembCorp Power Senoko Energy Supply Seraya Energy Tuas Power Supply	www.keppelenergy.com www.sembpower.com www.senokopower.com.sg www.serayaenergy.com.sg www.tpsupply.com.sg
Market Support Services Licensee (MSSL)	SP Services	www.spservices.com.sg
Market Operator	Energy Market Company (EMC)	www.emcsg.com
Power System Operator (PSO)	Power System Operator	www.ema.gov.sg
Transmission Licensee	SP PowerAssets	www.powergrid.com.sg

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Energy Market Company

9 Raffles Place
#22-01 Republic Plaza
Singapore 048619
T +65 6779 3000
F +65 6779 3030
www.emcsg.com

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