

Contents

Letter from the EMC Chairman	01	Market Governance	Market Performance	Additional Information			
Market Overview		Overview of Governance	11	Energy Prices	17	Glossary	35
		Letter from the Chair, Rules Change Panel	12	Fuel Costs	19	Market Participants' Contact Details	36
Market History	03	Market Evolution 2003-2005	13	Vesting Contracts	20		
Singapore's Electricity Industry	04	Letter from the Chair, Market Surveillance and Compliance Panel	14	Price Volatility	22		
Market Features	07	Letter from the Dispute Resolution Counsellor	15	Nodal Price Differences	24		
				Reserve and Regulation Prices	26		
				Reserve Costs	27		
				Interruptible Load	29		
				Competition in the Generation Market	30		
				Competition in the Retail Market	31		
				Settlement and Prudential Management	32		
				Contracted Ancillary Services	33		
				Market Fees	33		

Please click on the buttons above to navigate through the market report

Dear Industry Members,

During 2005, the energy markets globally were affected by pressure from rising oil prices. The National Electricity Market of Singapore (NEMS) was no exception. However, it is a testament to the efficiency and competitiveness of the NEMS that electricity prices did not rise to the same degree as oil prices.

The market experienced a 3.71 percent increase in peak demand. This was more than offset by the introduction of new combined-cycle gas turbine capacity and the reintroduction of steam turbine units that have been converted to run on an alternative and cheaper fuel source.

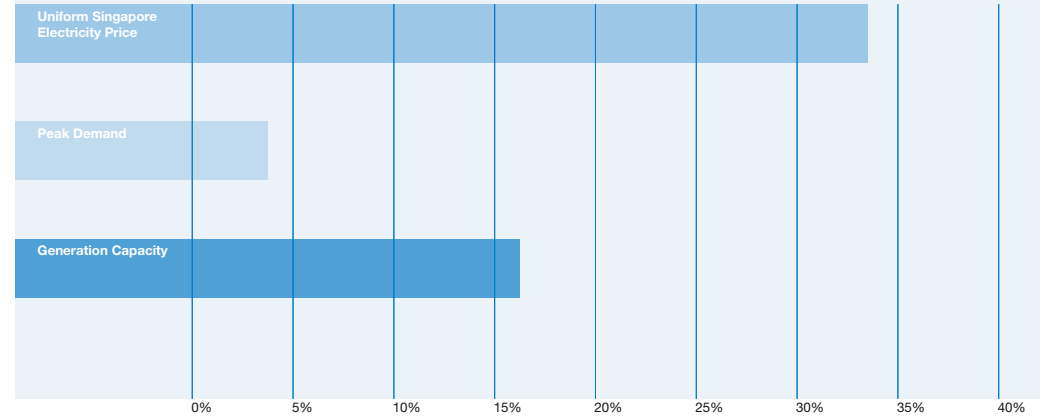
It was also heartening to observe that the NEMS is showing signs of maturing, with rules and governance arrangements continually evolving with valuable input from the industry.

The NEMS continues to play a vital role in ensuring the ongoing competitiveness of Singapore's economy by encouraging efficient operation and investment in the Nation's electricity industry.



Tan Soo Kiang,
Chairman,
Energy Market Company

Summary of Market Trends: Growth in Price, Peak Demand and Generation Capacity 2004-05





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 cost based 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
	1996	Singapore Power formed as a holding company Pool design process begun
Singapore Electricity Pool (SEP)	1998	SEP commenced PowerGrid is SEP Administrator and Power System Operator Attempted sale of generator Tuas Power
	1999	Review of electricity industry
National Electricity Market of Singapore (NEMS)	2000	Decision for further reform to obtain full benefits of competition New market design process begun
	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 begun
	2003	NEMS wholesale market trading begun
	2004	Vesting contract regime introduced Interruptible loads began to participate in the reserves market
	2005	Further batches of large consumers introduced to retail contestability

Participants and service providers in the NEMS

Active Generators

PowerSeraya
SembCorp Cogen
Senoko Power
Tuas Power
National Environment Agency

Active Retailers

Keppel Electric
SembCorp Power
Senoko Energy Supply
Seraya Energy
Tuas Power Supply

Wholesale Market Trader

Diamond Energy

Market Operator

Energy Market Company (EMC)

Market Support Services Licensee (MSSL)

SP Services

Transmission Licensee

SP PowerAssets

Power System Operator

Power System Operator (PSO)

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. To promote the entry of new participants, licenses have also been granted to parties that intend to establish new businesses to participate as electricity generators or as retailers.

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.

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.

Wholesale Market Trader

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

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 SP Services. Non-contestable consumers are supplied by SP Services.

Interruptible Loads

Interruptible loads are contestable consumers of electricity that participate in the wholesale market and allow their supply of electricity to be interrupted in the event of a system disturbance in exchange for reserve payments.

Energy Market Company

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 assists the Market Surveillance and Compliance Panel.

SP PowerAssets

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

Power System Operator

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.

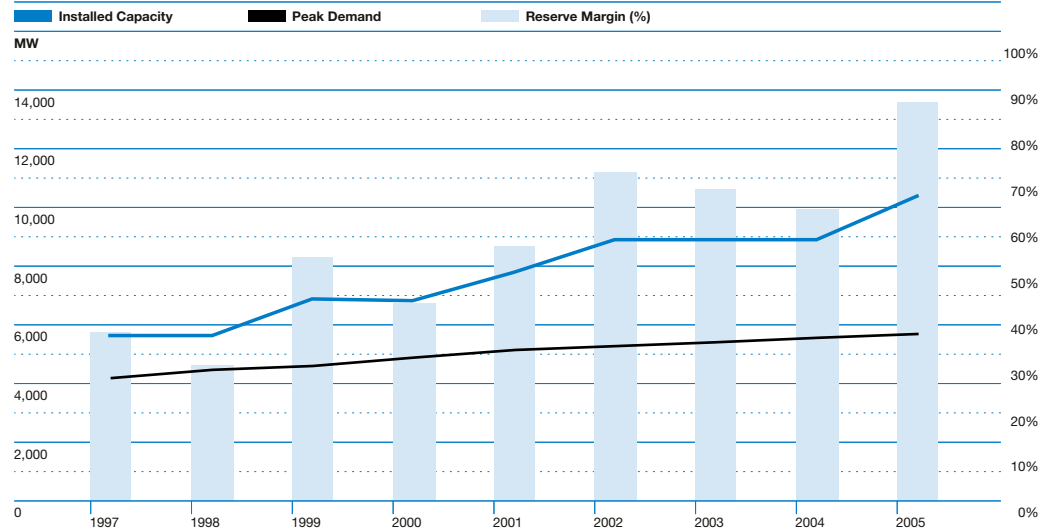
Market Support Services Licensee

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.

Energy Market Authority (EMA) - The Regulator

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.

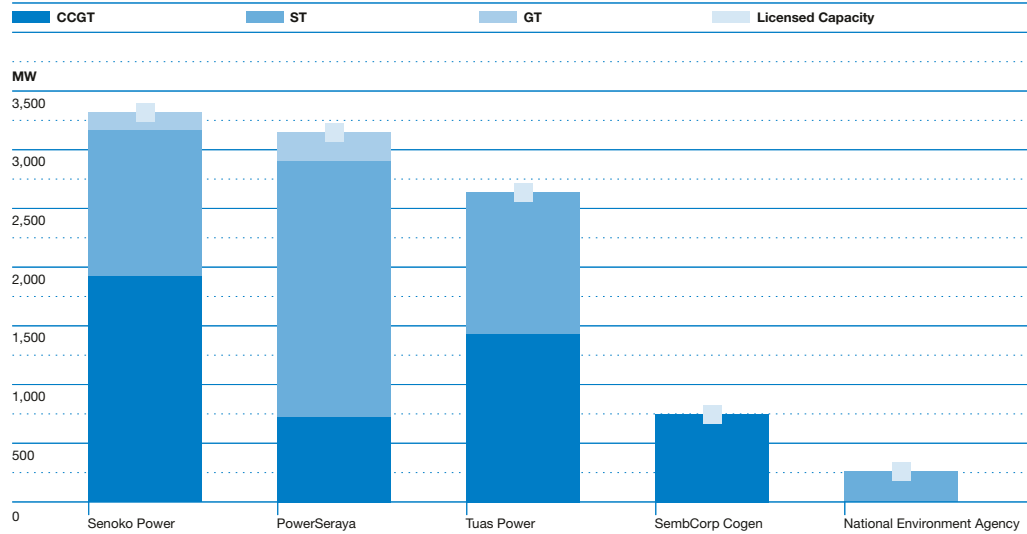
Installed Capacity and Peak Demand 1997/2005



The NEMS continues to enjoy a healthy reserve margin, with installed generation capacity exceeding peak demand by 85 percent. The reserve margin widened significantly in 2005 as 720MW of new generation capacity was introduced to the market. In addition, 750MW of capacity rejoined the market after it underwent conversion so that it could operate with Orimulsion (tar and water).

In 2005 there was a 16 percent growth in available generation capacity and a 3.71 percent increase in peak demand. Total system demand was 35.63 terawatt hours in 2005, up 4.15 percent from 2004.

Registered Installed Capacity 2005



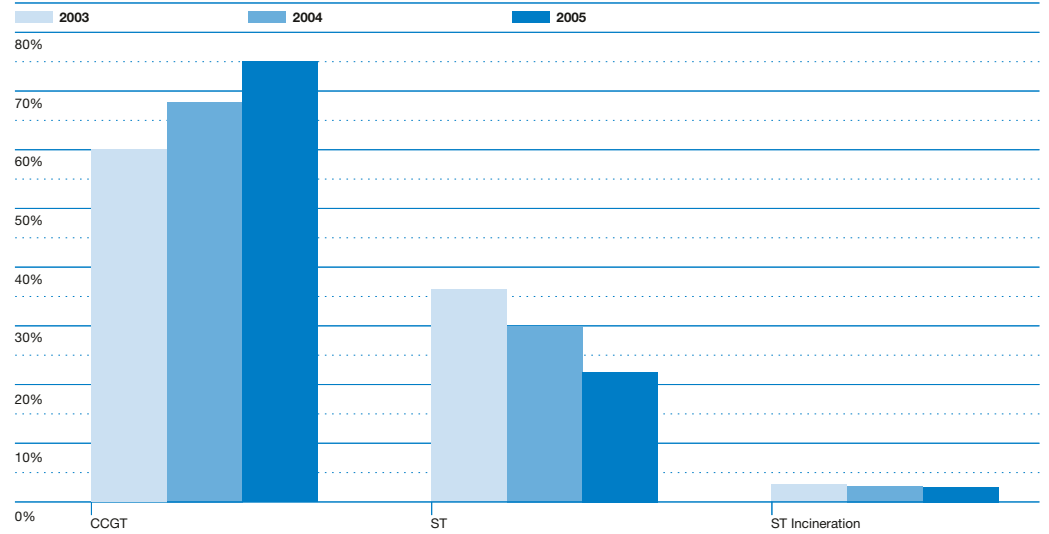
The generators supplying the NEMS use a mix of technology to generate electricity.

Combined-cycle gas turbine (CCGT) units make up 49 percent of installed capacity and typically use piped natural gas from Indonesia or Malaysia. CCGT units can use diesel as an alternative fuel source.

On an installed capacity basis, steam turbine (ST) generation units make up 48 percent of the market. ST units typically run on high sulphur fuel oil (180-CST HSFO) but can also run on diesel or Orimulsion. The plants operated by the National Environment Agency are ST units that convert energy from refuse incineration into electricity.

Open-cycle gas turbine (GT) units provide 3 percent of installed capacity and are fuelled by diesel.

Market Share by Plant Type 2003/05



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

Since the commencement of the NEMS in 2003, CCGT units have been the dominant source of generation, whereas in the SEP they were a secondary source to ST units. CCGT units have proven more competitive in the NEMS due to their superior fuel efficiency and flexibility when compared to ST units.

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,
- near real-time dispatch and
- security-constrained dispatch and nodal pricing.

Energy, reserve and regulation products

	Description	Purchaser	Seller
Energy	Generated electricity	Retailers	Generators
Reserve	Stand-by capacity 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 and Retailers
Regulation	Generation that is available to fine-tune the match between generation and load	Generators and Retailers	Generators

Co-optimisation

A sophisticated process is used to determine the price and quantity of each product 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 generators to supply the market.

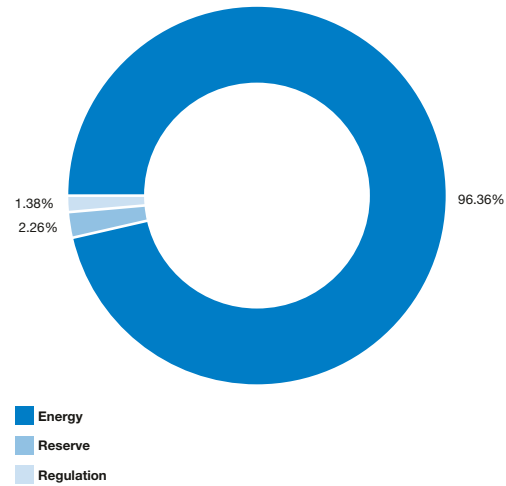
The total value of products traded in the wholesale market in 2005 was \$4.326 billion.

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 outcome reflects 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 Power System Operator 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 2005



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 the:

- available generation capacity,
- ability of generation capacity to respond (ramping),
- relationship between the provision of energy and reserve and regulation (co-optimisation),
- physical limitations on the flows that can occur in the transmission system,
- power flows in the 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. For each half-hour trading period, the MCE calculates the prices to be received by generators at the 40 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 consumers.

This modelling ensures that market transactions are structured in a way that is physically feasible given the capacity and security requirements of the transmission system. 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.



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 licenses 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 (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, the financial community, the Power System Operator, the market support services licensee, the transmission licensee and EMC to ensure that the interests of the various sectors of the industry are adequately 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. It identifies market rule breaches and assesses 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. This process is managed by the Dispute Resolution Counsellor (DRC) should a dispute arise between market participants or 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.

Dear Industry Members,

The Singapore Electricity Market Rules govern the wholesale operations of the NEMS. These rules, and the market framework they represent, are subject to constant evaluation to ensure their relevance and the ongoing efficiency of the NEMS. The RCP holds a central role in evolving the NEMS, enhancing efficiency and maintaining a level playing field.

The year 2005 saw the wholesale market operating smoothly. Nevertheless, the wheels of market evolution never stopped. The RCP fulfilled the tasks laid out in its work plan for 2005/2006. The environment remained challenging as the RCP tackled issues that often had little or no clear-cut solution. Trade-offs, impact analyses and the need for compromises became ever more commonplace. Given this tall order, I want to congratulate and express my admiration to all panel members for displaying both professionalism and enthusiasm in discharging their duties in the best interest of our market.

Some highlights of the RCP's major achievements in 2005 include:

- improving the dispute resolution process by introducing mediation, streamlining it and bringing about greater overall consistency,
- changing the basis for allocating reserve cost to reflect the design intent of 'causer pays' and
- further shortening the offer gate closure to one hour to improve the efficiency of market clearing and price discovery.

A major theme in the 2005 RCP tasks was the adoption of plain English drafting for rule changes. The use of plain English in the Market Rules markedly improved their clarity and readability. The use of plain English will be applied in all future rule changes, which should ensure that our rule book incrementally improves over time.

With the close of 2005, the first three-year term of the RCP also concluded. These three years of labour by the RCP have bore fruit in a more efficient and transparent wholesale electricity market place. The industry owes a debt of gratitude to all RCP members for their contributions. I am deeply honoured to have chaired a panel of this calibre. I thank each member for three years of hard work as well as the market participants and service providers for providing these able people to serve on the RCP. I wish to also thank EMC's Market Administration Team for its role in supporting the panel.

A new RCP has been appointed by the EMC Board for the term 2006 to 2008. The new panel is a healthy mix of new and retained members. New members will undoubtedly supply new ideas while retained members will ensure the continuity of experience. I am confident that the continued evolution of the wholesale electricity market is in capable hands.



Allan Dawson,
Chair,
Rules Change Panel

In its first three years of operation, the wholesale electricity market of the NEMS evolved steadily on well-grounded design principles. Besides achieving operational stability, continuous improvements were made to various aspects of the market. The most notable results of market evolution were in the following areas:

Improved efficiency of market clearing

The most significant improvement in the first three years of market operation was in the overall efficiency of market clearing. The gate closure period was shortened from four hours to one hour, short term schedules were added and dynamic load participation factors were implemented to enable dispatch and pricing schedules to best reflect the latest available information. These measures improved the short-term or static efficiency of market clearing, i.e., the interaction of market demand and supply. The Constraint Violation Penalty regime was also fine-tuned to ensure that prices reflecting market fundamentals are used for settlement. This sends the correct economic signals to market participants and enhances the dynamic efficiency of the market.

Improved efficiency of market settlement

The wholesale settlement re-run project was a major undertaking due to the inevitability of metering errors. The RCP took over when the Task Force on Settlement Re-runs failed to come to a consensus. The end result was the adoption of an Automated Partial Wholesale Settlement

Re-run with Nominated Days regime that would eradicate the past inefficiencies and risks associated with manual settlement re-runs. Electronic invoicing was also introduced by EMC to reduce the amount of paper processing.

Increased competition in the reserve market

The introduction of Interruptible Load (IL) as a source of reserve provided several benefits to the market. Firstly, an increase in the availability of operating reserves and the diversification of the source of reserve improves system security. Secondly, it helps to lower reserve prices due to increased competition in the reserve market. Thirdly, IL helps to, in the long run, reduce investment in generation and transmission needed to satisfy peak demands.

Improved system security

The reserve modelling portion of the Market Clearing Engine (MCE) was refined to improve the accuracy of the modelling of the reserve capability of generators. The change prevents a generator from being dispatched to provide reserve at a level that is higher than its capability. It has the effect of preventing a system security crisis when there is a significant contingency event by ensuring that the actual reserves that could be provided by generators are sufficient to prevent the system frequency from falling below the acceptable limit.

Improved efficiency of market governance

The market rule change process was streamlined and shortened substantially from 155 business days to 93 business days. These changes improved the robustness and efficiency of governance and reduced transaction costs for market participants. The dispute resolution regime was also improved with the introduction of mediation, streamlining of the process and greater overall consistency in the regime.

Changed reserve cost allocation

The basis for allocating the cost of reserve among generators was changed from metered energy quantity to scheduled energy quantity. This brought about a closer match of allocating cost to causer, such that generators pay for the reserve they create the need for, giving them the incentive to revise their offers quickly following a forced outage and removing any disincentive for generators to respond to energy shortages, thus helping to maintain system security.

Improved rule book

A major theme in RCP tasks in 2005 was the use of plain English in the drafting of rule changes. The use of plain English in the Market Rules has proven to be effective and well received and will continue to be applied in the future.

Acknowledgement:

Conclusion of first RCP term

The evolution of the wholesale electricity market from 2003 to 2005 would not have been the success it was without the stewardship of the RCP and the support of EMC's Market Administration team. The first three-year term of the RCP ended on 31 December 2005. During this time, the RCP considered over 100 rule change proposals, 70 of which were implemented.

It is hence fitting to acknowledge the significant contributions of the rules change panel members whom have been instrumental in the evolution process.

RCP members 2003-2005

Allan Dawson, Chair
 Eu Pui Sun, Senoko Energy
 Francis Gomez, SembCorp Cogen
 Tan Boon Leng, Keppel Energy
 Kok Shook Kwong, Power System Operator
 Ben Lau, Tuas Power Supply
 Low Boon Tong, PowerSeraya
 T P Manohar, SP Services
 Robin Langdale, Independent
 Daniel Cheng, SP Power Assets
 Yip Pak Ling, Energy Market Company

Dear Industry Members,

The wholesale electricity market functioned satisfactorily in 2005. Apart from occasional spikes, market prices were generally stable. No major breaches of the market rules were observed.

Annual report

In July 2005, the MSCP issued its annual report for the period April 2004 to March 2005. In assessing the state of competition of the wholesale electricity market, the MSCP noted that supply remains concentrated. However, the market also has excess capacity and expects new entrants, both important factors in market discipline.

While there is currently no demand side bidding, EMC has begun publishing forecast and real-time price and demand data on its website. Consumers may take advantage of this information to plan and adjust their electricity usage over the long term.

The MSCP has observed that when a market is highly concentrated, efficiency is not automatically assured, and some discipline by a market regulator is necessary. Vesting contracts introduced in 2004 have the effect of mitigating the exercise of market power and allow for some degree of competition. How much of the market should be vested however remains controversial and depends on the objectives for designing vesting contracts. This is an issue, which will no doubt come under review.

Offer variations after gate closure

In early 2005, the MSCP continued to observe offer variations after gate closure, which were potentially in breach of the market rules. On 6 April 2005, we issued a statement clarifying the scope of the rule prohibiting price change and indicated that enforcement action would be taken in appropriate cases involving rule breach.

A market participant has since requested a hearing in relation to gate closure incidents and we are expecting this hearing to take place in early 2006.

Except for specific cases, which the MSCP and the Market Assessment Unit (MAU) of EMC are closely monitoring, we have seen a general reduction in the number of potential rule breaches associated with offer variations after gate closure.

Capability enhancement

During the course of the year, there were several developments, which contributed to the enhancement of our monitoring and investigation capability.

In May 2005, my colleagues and I welcomed David Wong to the MSCP. David brings from his banking background a sound knowledge of markets. I am pleased to report that panel discussions on market issues continue to witness vigorous exchanges on issues of law, economics, electrical engineering and trading.

Over the year, the MAU has been implementing an IT based monitoring system for data mining and reporting and an investigation case management system. We look forward to the efficiencies these facilities will bring as we remain focused on the effective discharge of our role.

Conclusion

I take this opportunity to thank the market participants for their co-operation and also for providing us with useful feedback as we work with you to uphold the integrity of the NEMS.



Joseph Grimberg,
Chairman,
Market Surveillance and Compliance Panel

Compliance activity for 2005

Referrals or complaints received	15
Determinations by the MSCP	19
MSCP meetings	12
Gate closure revisions considered	8,677
Financial penalties imposed	0
Costs imposed on parties in breach	\$19,000
Total cost of the MSCP	\$130,943

Dear Industry Members,

The year 2005 proved to be eventful in the development of the dispute resolution process for the National Electricity Market of Singapore (NEMS).

Rule change proposal

In October 2004, I had, after industry consultation, submitted a rule change proposal with the aim of creating a fair, efficient and cost-effective dispute resolution process.

The proposed dispute resolution rules made their way through the rules change governance bodies comprising the Rules Change Panel, the EMC Board and the EMA over the course of 2005.

I am pleased to report that the new rules were finally approved in November 2005 and will take effect on 14 February 2006.

Dispute management workshop

While the proposed rules were going through the rule change process, we recognised that the market had also to be equipped with the necessary knowledge and skills for the rules to be successfully implemented.

I therefore worked with the Market Assessment Unit to organise a Dispute Management Workshop on 23 and 24 August 2005. With Ms Shirli Kirschner, Dispute Resolution Advisor for the National Electricity Market of Australia, we explored dispute resolution skills and the new dispute resolution process with participants through role play, videos and exercises. Participants also shared their views as to what would be appropriate components in a dispute management system (DMS) for the NEMS.

Based on the very positive feedback from workshop participants, we will organise further skills training sessions to meet the requests and needs of the industry.

DMS contact network

Under the new rules, each market entity will have to implement a DMS. Each market entity has to nominate a first point of contact for the notification of disputes. The DMS also has to be consistent with the guidance notes of the DRC.

Most market entities have nominated representatives who will be their main or alternate DMS contacts when the new rules take effect. This network of DMS contacts first met at the end of 2005. It is important that we not only equip DMS contacts with the necessary skills for responding to a dispute, but also provide them with opportunities to interact.

Should any market dispute arise, there will be a better chance of resolution between colleagues who have already built a relationship in a non-contentious setting.

DMS contacts will also be instrumental in helping to implement the new rules. Some DMS contacts have volunteered to be part of a working group and we are currently working with them to put in place the necessary DMS guidance note, model DMS and forms with which to implement the new rules.

Mediation panel and arbitration panel

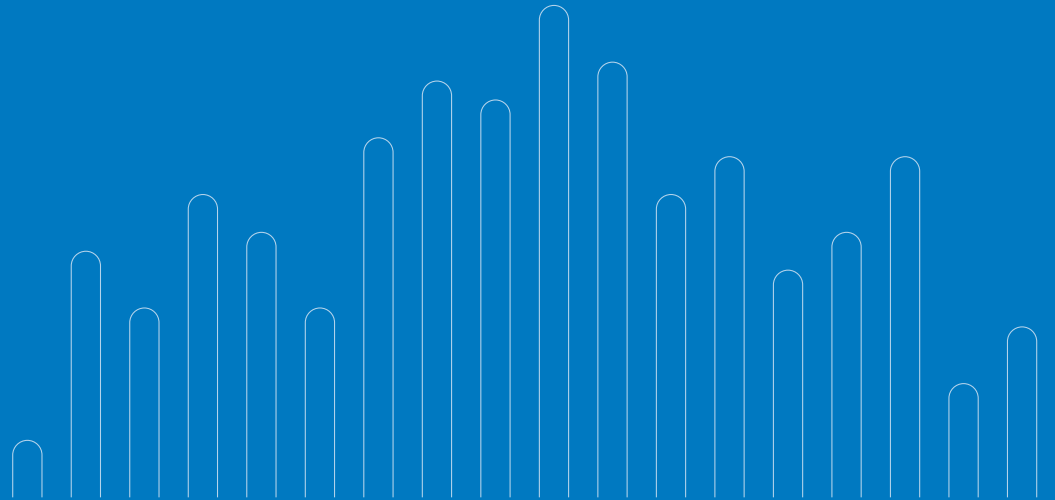
The new rules contemplate that the DRC will appoint a Mediation Panel and an Arbitration Panel. Upon the approval of the new rules, I have invited the industry to nominate suitable candidates to these panels. I have also been approaching experienced mediators and arbitrators to serve on our panels. My aim is to provide the industry with a good mix of qualified and independent panel members in the event that disputes need to be mediated or arbitrated.

Conclusion

To all industry representatives who have provided many valuable ideas and suggestions to us and have thus helped to shape our dispute resolution process, I look forward to working with you in the coming year.



George Lim,
Dispute Resolution Counsellor



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 10.00am and 5.00pm.
- The weekly demand profile 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 observed seasonal demand trends, with March to October being peak months. This reflects both the economic business cycle as well as the influence of the weather.
- Over the longer term, economic growth is the main determinant of growth in system demand.

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

- A generator 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 economically 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 economically viable.

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.

These include:

- Forced outages 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.

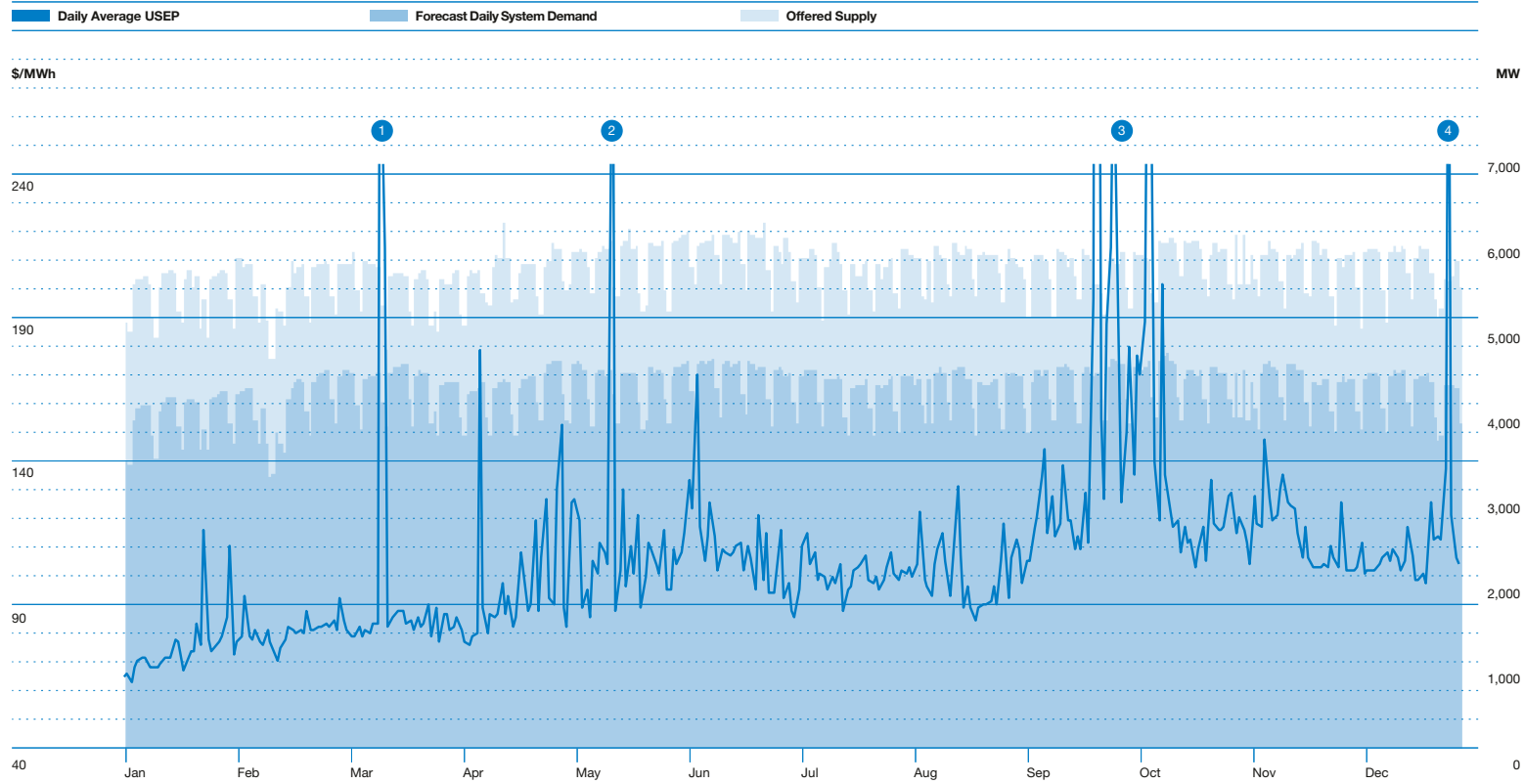
- Unanticipated fluctuations in demand. These are rare, as Singapore's demand patterns tend to be uniform and predictable.

Retailers and SP Services 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.

The key energy price trends for 2005 were:

- Prices were 33 percent higher than 2004 reflecting the influence of high fuel costs and vesting contract hedge prices.
- Prices were more volatile than in 2003 and 2004.
- There was little divergence between nodal prices.

USEP, Demand and Offered Capacity 2005



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

1. On 12 March, USEP rose to \$3,552.26 per MWh and \$4,430.65 per MWh for two trading periods. Deficits in contingency reserve and regulation were also observed. These price spikes reflected tight supply conditions as a result of unplanned maintenance of two CCGT units coupled with low availability of ST units at that time.

2. On 14 May, the daily average USEP rose to \$313.80 per MWh since five trading periods cleared with a USEP above \$1,000 per MWh. A deficit in regulation in one trading period resulted in the regulation price hitting its cap of \$2,750 per MWh. This was caused when a CCGT unit had an unplanned outage during a period of tight supply.

3. From 22 September to 11 October, high prices were experienced with an average USEP of \$193.95 per MWh. This was a period of record demand reaching a peak of 5,359MW on 11 October. Strong demand coincided with a decline in CCGT availability. Three CCGT units were not available for dispatch and ST units responded with increased availability, thus pushing the ST market share to 26 percent, the highest since April 2005.

4. On December 28, daily average USEP hit a high of \$3,409.55 per MWh due to the unplanned outage of a CCGT unit. This was followed by four trading periods clearing above \$1,000 per MWh. This outage also affected the prices for ancillary services. In particular, the prices for contingency reserve and regulation hit their caps of \$3,000 per MWh and \$2,750 per MWh respectively.

Fuel costs make up a significant proportion of running costs for the thermal generators that are 97 percent of Singapore's generation capacity. This means that the bulk 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.

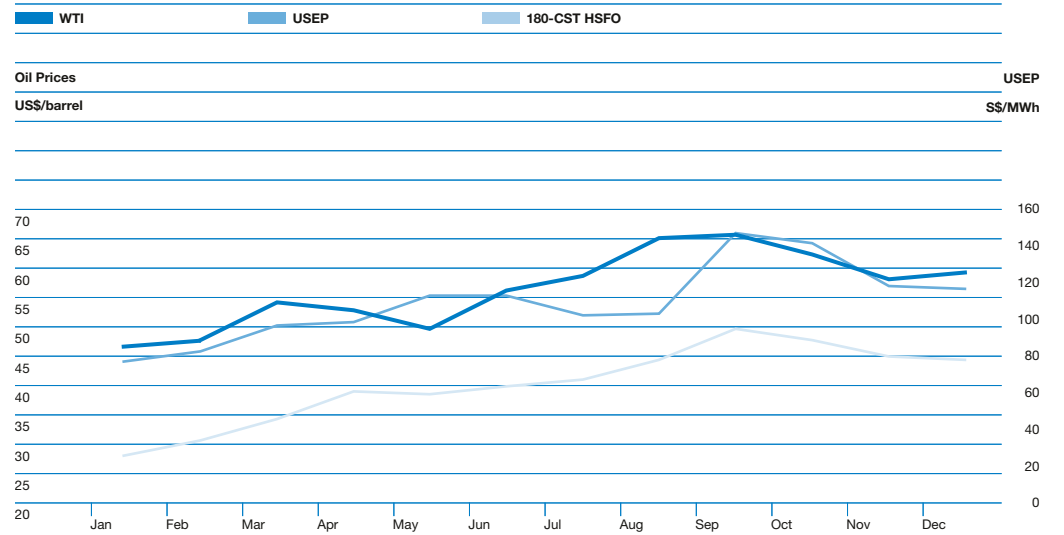
Global crude prices, as measured by the WTI (West Texas Intermediate) benchmark, grew strongly in 2005, up 36 percent from 2004 on a year on year basis. However, the most relevant oil benchmark for the Singapore electricity industry is 180-centistoke high sulphur fuel oil (180-CST HSFO). 180-CST HSFO prices grew at a steeper rate through 2005 than the WTI or Brent benchmarks, up 43 percent from 2004 on a year on year basis. During 2005, the monthly average 180-CST HSFO price grew from US\$28.88 per barrel in January to US\$44.74 in December representing a 55 percent increase over the year.

Higher fuel costs were not directly translated into increases in USEP. This was likely due to a combination of the following factors:

- the excess generation capacity and 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.

When commenting on electricity prices paid by consumers, the Monetary Authority of Singapore observed that the direct impact of high global oil prices had been muted in 2005 and that the subdued pass-through reflected the fact that fuel costs only account for a portion of the final electricity price.

Monthly Oil Prices and USEP 2005



Vesting contracts have a significant impact on wholesale market prices. 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.

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

- About 65 percent of demand is vested in mandatory contracts between generators and SP Services (on behalf of consumers).
- 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 combined-cycle gas turbine (CCGT) unit.
- The VCHP is recalculated by the EMA on a quarterly basis, mainly to reflect changes in fuel prices.
- The reference price for vesting contracts is the wholesale market nodal price received by generators.

- 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 that buy from the wholesale market.

In 2005, the wholesale market price was on average very close to (0.95 percent below) the LRMC benchmark, i.e., the VCHP. This is to be expected given the excess capacity in the market and it shows that the vesting regime is generally containing prices. Given the dominance of CCGT units in terms of market share (75 percent) it shows that the bulk of the market is earning sufficient revenues to cover LRMC.

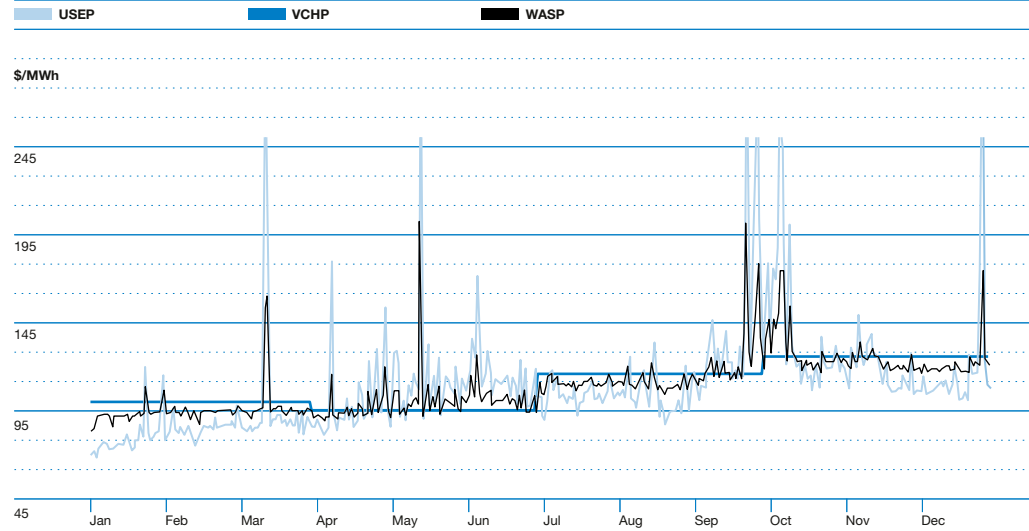
Interestingly, in the second quarter of 2005 the wholesale market price was on average 12 percent above the hedge price. The VCHP is set every quarter, one month in advance using forward 180-CST HSFO prices. The divergence between USEP and the VCHP may reflect that the actual fuel costs of generators (either hedged or unhedged) were materially different to that used in the vesting contract model.

Vesting contracts mean that the USEP no longer completely reflects the sum of prices received by generators for supplying energy to the wholesale market. The weighted average settlement price (WASP) provides a better indication of this. It takes into account the 65 percent of the energy market that is vested at the VCHP and the remaining 35 percent of volume that is settled at the wholesale market energy price.

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

As the USEP and the VCHP were so close on average in 2005, the WASP was also very similar.

USEP, VCHP and WASP 2005

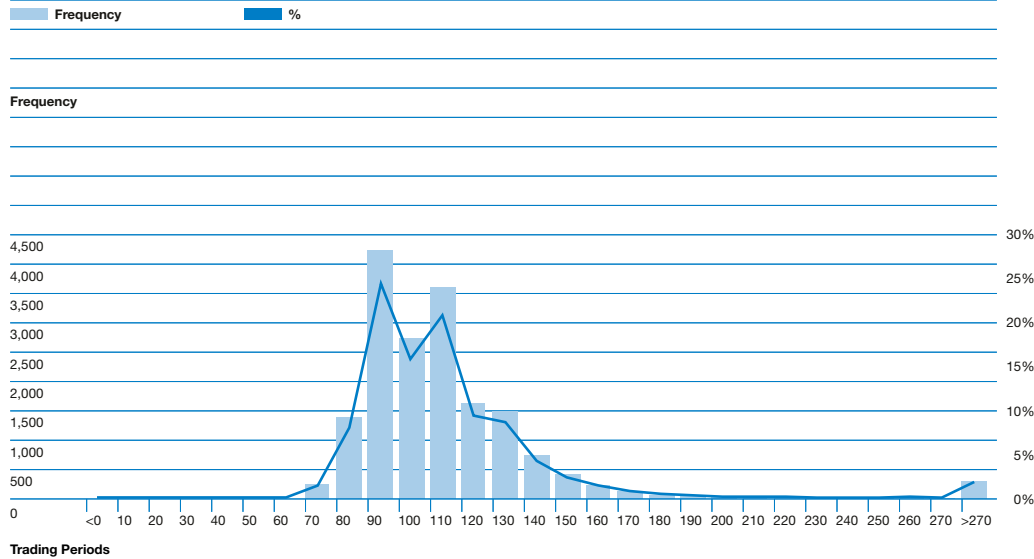


Note: Prices above \$245/MWh are not displayed

Summary of price trends

	2005	2004	Change
USEP (per MWh)	\$109.90	\$82.35	33.50%
HSFO (per barrel)	US\$40.63	US\$28.35	43.31%
VCHP (per MWh)	\$110.94	\$96.95	14.48%
WASP (per MWh)	\$110.77	\$91.24	21.41%

Price Frequency Histogram: USEP by Trading Period 2005



The distribution of the USEP by trading period for 2005 centred on a mean of \$109.90 per MWh with a standard deviation of \$85.55. This compares with a USEP mean of \$82.35 per MWh and a standard deviation of \$70.30 in 2004.

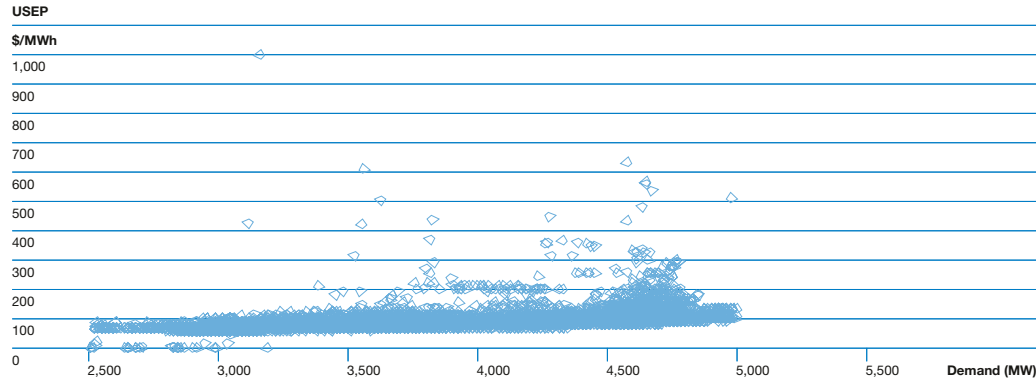
In 2005, energy prices were between \$50.00 and \$200.00 per MWh in 97.55 percent of trading periods, lower than \$50.00 per MWh in 0.01 percent of trading periods and greater than \$200.00 per MWh in 2.44 percent of trading periods.

There was an increase in both price and price volatility in 2005 compared to 2003 and 2004. This is apparent when price and demand for each trading period are presented on a scatterplot.

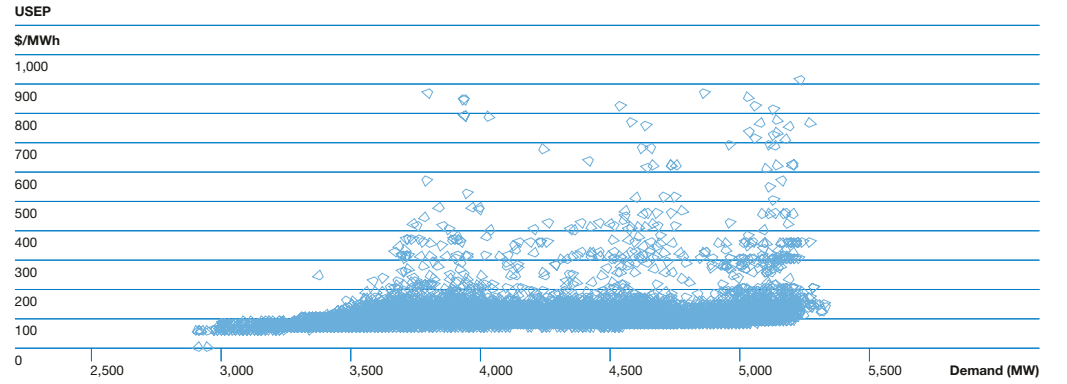
The scatterplots show the expected upward sloping market supply curve, representing higher prices in higher load periods as more expensive generation sources are used. The scatterplots also show an increasing spread of prices in 2005 compared to 2003 and 2004. The likely explanations for this are:

- Record peak demand in 2005 combined with low generation availability in some trading periods caused price pressure.
- Generators changed their offering patterns with a trend towards narrower offer price bands and offers structured to reduce the likelihood of near zero prices.
- A greater incidence of price spikes that were not linked to peak demand. There has been an increase in high prices in low load trading periods. This is because in low and medium load periods, there are generally fewer generation units available than in high load periods. Hence, an unplanned outage or higher than expected demand can result in a sharp increase in prices as more expensive open-cycle gas turbine (GT) units are dispatched.

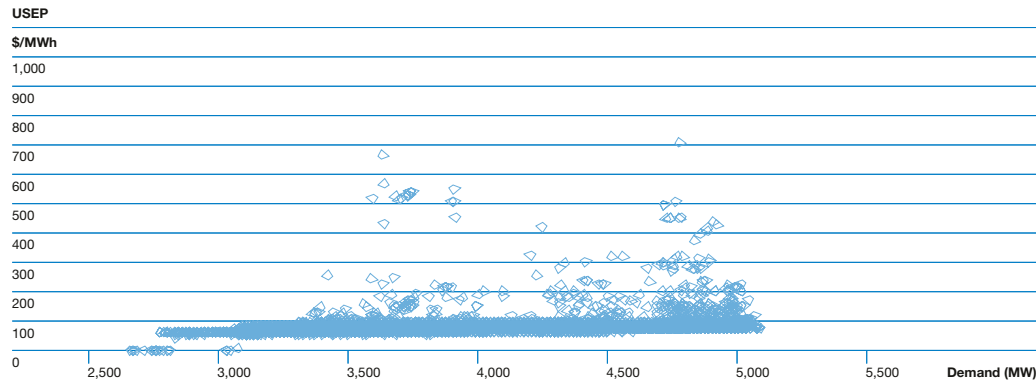
Correlation Between USEP and Demand 2003



Correlation Between USEP and Demand 2005

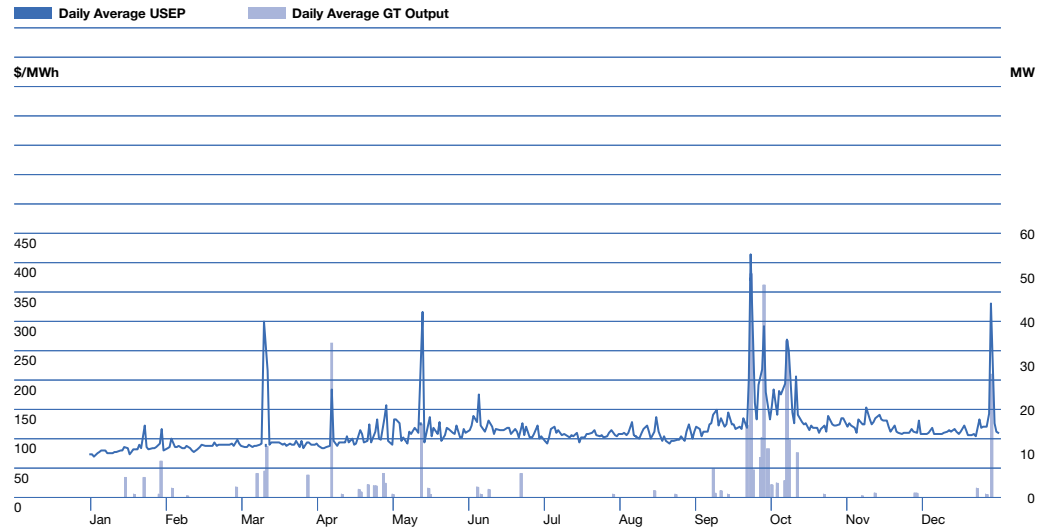


Correlation Between USEP and Demand 2004



Note: The prices displayed on the scatterplots are only those that are within the \$0/MWh to \$1,000/MWh range. Prices outside this range are excluded, as they are few in number.

USEP and GT Output 2005



Nodal Price Differences

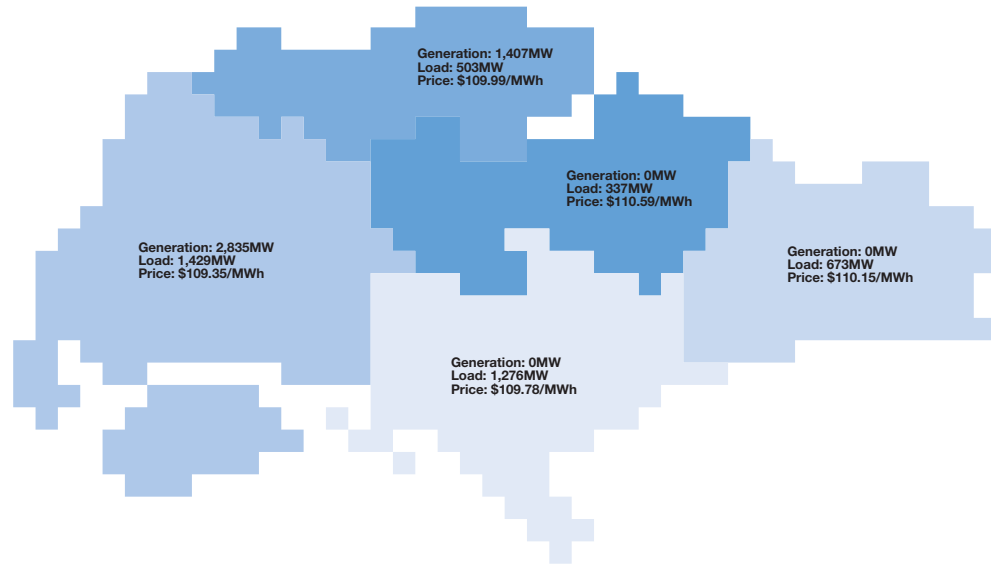
The price that generators receive from the wholesale market for the production of energy is influenced by their location on the transmission network. The price reflects the market clearing price and the costs associated with transporting the energy from the generation facility to where it will be consumed. 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, load points closest to a generation source will have the cheapest nodal prices.

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

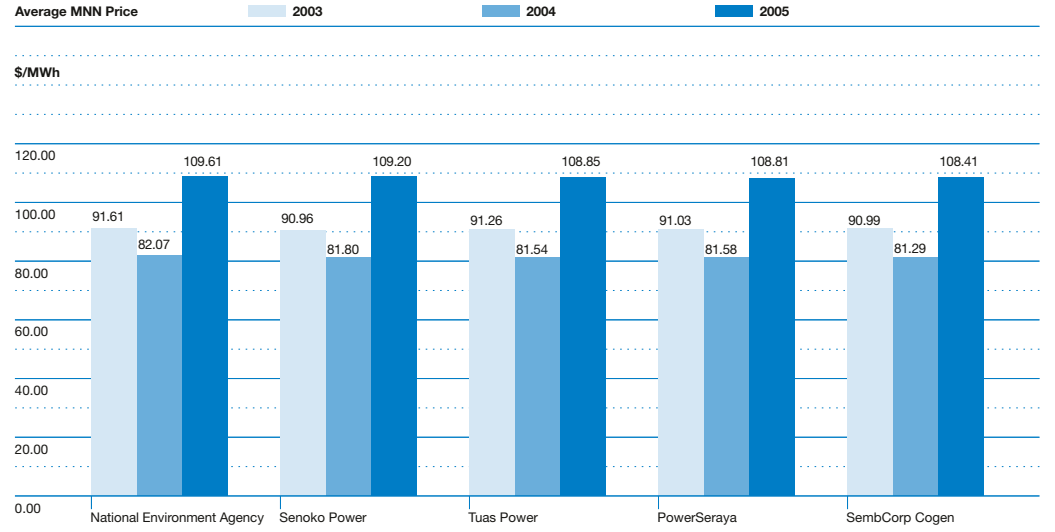
In 2005, there were two instances of physical grid congestion and no incidents of significant load shedding. These are explained below:

- On 17 May there was a binding constraint on a 230kV transmission line following maintenance work on a parallel circuit. This caused generation at one end of the line to become constrained and resulted in different market network node (MNN) prices for each side of the affected transmission line.
- A similar incident occurred on 1 September with a binding constraint on another 230kV transmission line due to maintenance work on a parallel circuit. This resulted in price separation between MNN prices in the north and the south of Singapore.

Locational Comparison of Generation, Load and Price 2005



Energy Prices Received by Generators 2003/05



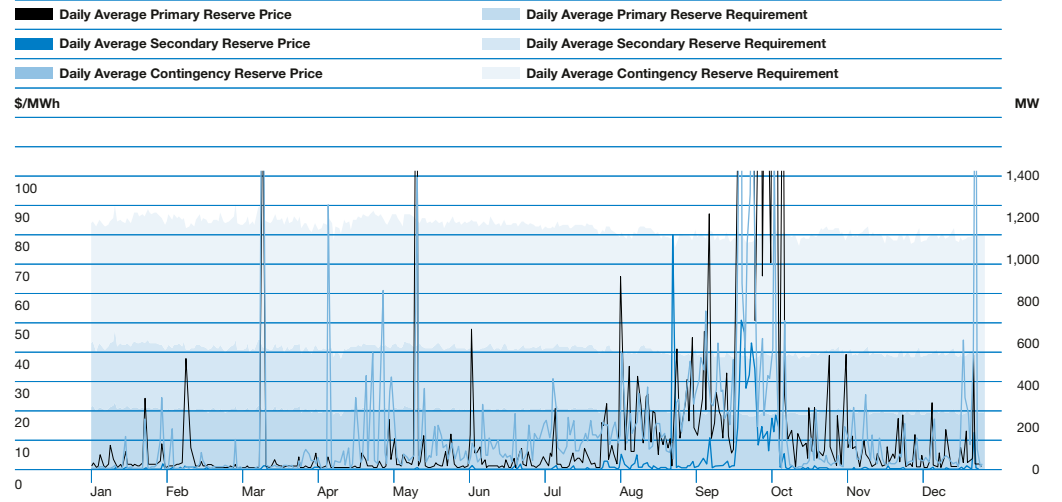
Reserve capacity is procured from the market to ensure that there is stand-by system capacity that can be drawn on when there is an unforeseen disruption of supply, e.g., an equipment outage.

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.

Reserve and regulation prices are highly influenced by energy price trends as a result of co-optimisation:

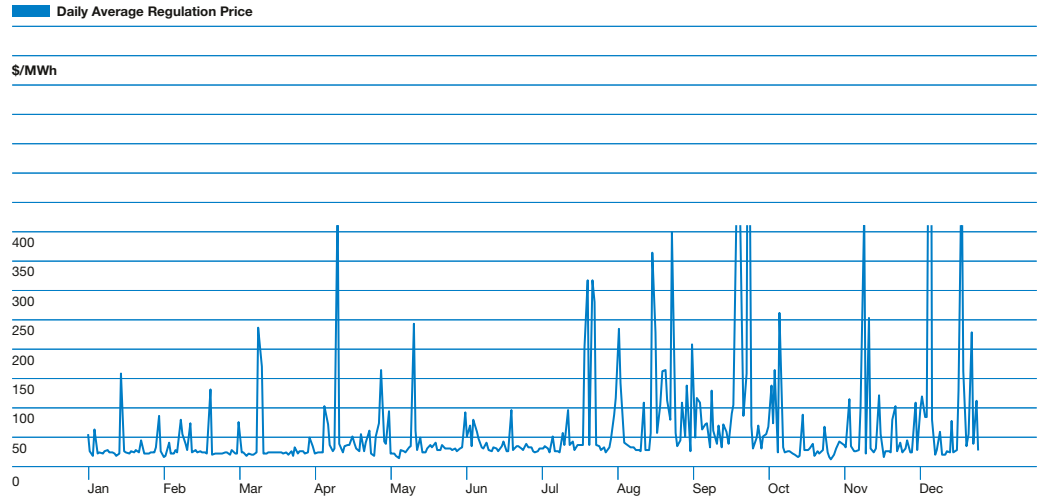
- The primary reserve class is used to procure 8-second reserve. The average primary reserve price for 2005 was \$14.57 per MWh.
- The secondary reserve class is used to procure 30-second reserve. The average secondary reserve price for 2005 was \$1.76 per MWh.
- The contingency reserve class is used to procure 10-minute reserve. The average contingency reserve price for 2005 was \$12.76 per MWh.
- The regulation requirement is set by the PSO at a standard level of 100MW. The average regulation price for 2005 was \$68.84 per MWh.

Reserve Prices and Requirements 2005



Note: Prices above \$100/MWh are not displayed

Regulation Price 2005

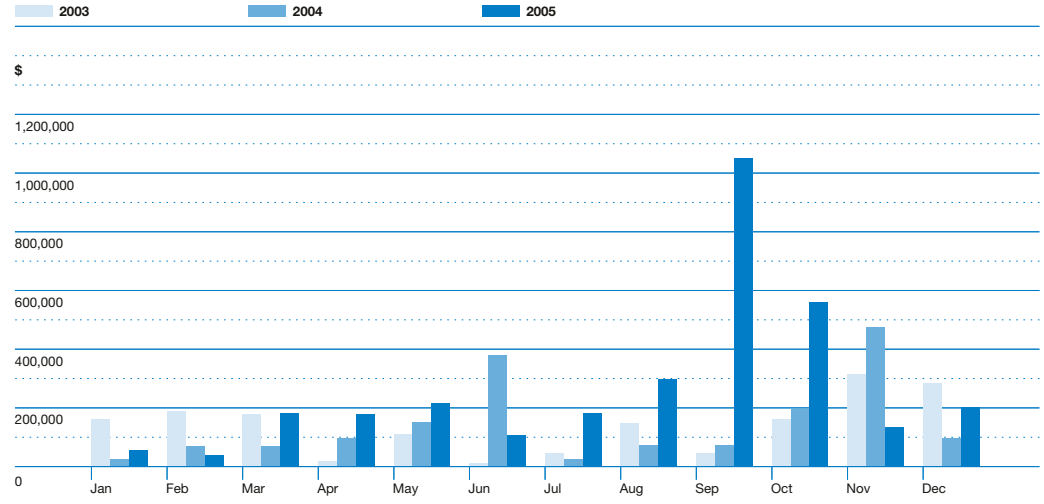


Note: Prices above \$400/MWh are not displayed

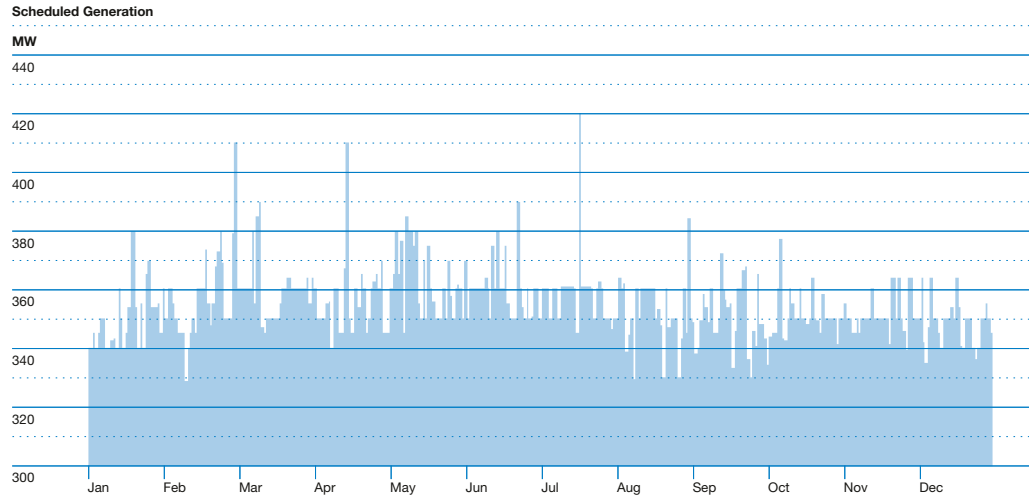
One of the benefits of the introduction of the NEMS was a dramatic reduction in the cost of reserve. These savings have persisted, although reserve costs in 2005 were higher than in 2003 and 2004. A key reason for this increase was the energy price spikes observed in late September to mid October having a knock-on effect on reserve prices due to co-optimisation.

Reserve offer availability declined from May until December due to the commissioning of the Tuas Power and PowerSeraya 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 reserve offer availability put pressure on reserve market prices.

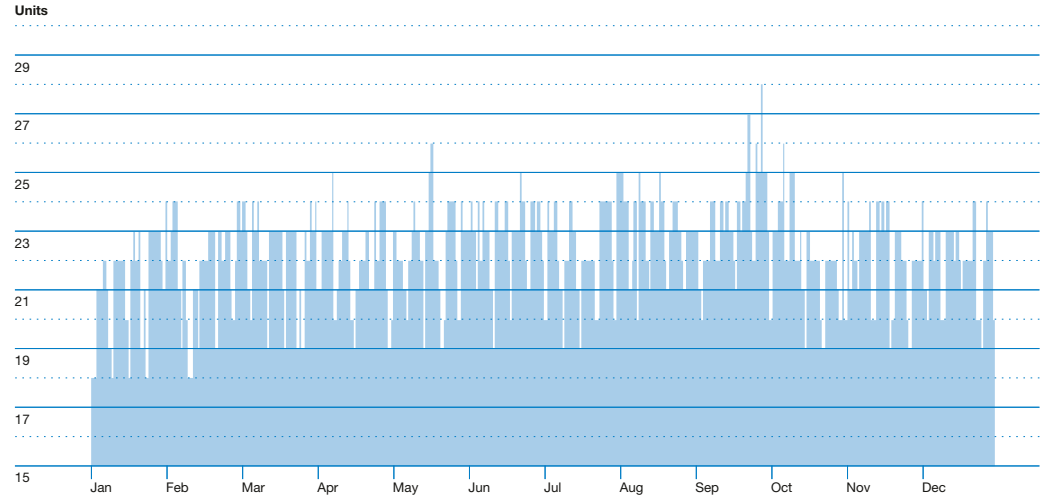
Daily Average Reserve Costs by Month 2003/05



Largest Scheduled Generation Unit by Trading Period 2005



Number of Generation Units Scheduled by Trading Period 2005



It is noteworthy that the reserve requirement, i.e., the quantity of reserve procured in each trading period, decreased during 2005. This occurred as additional generation units entered the market thereby reducing the average size of the largest generating unit. Therefore, the risk to be covered by reserves effectively reduced during the year.

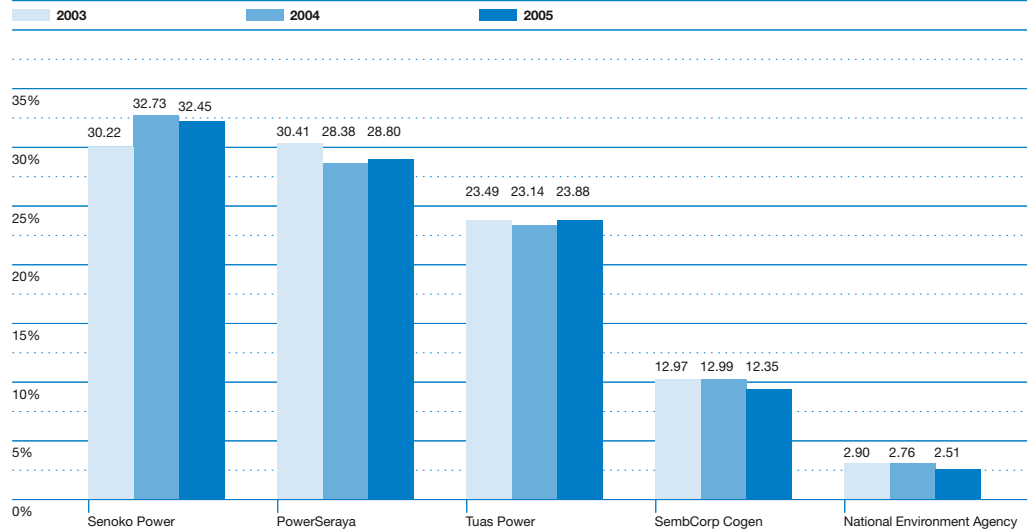
A milestone was achieved in developing demand-side participation in the NEMS wholesale market in 2004. Under the Interruptible Load (IL) regime, a load facility can offer to have its power interrupted in the event of a power system disturbance. The load facility can choose to offer its IL through a retailer or as a direct wholesale market participant. 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 within the NEMS – primary, secondary and contingency reserve. IL provides a high quality source of reserve, as it is not dependent on a fuel source. Hence, unlike generation facilities, IL is unaffected by fuel supply disruptions.

In 2005, 14.7MW of IL capacity was made available in each class of the reserve market and was able to capture 2.33 percent of the reserve market share. There were no IL activations in 2005.

IL capacity is expected to increase in future years, since Diamond Energy has stated its intention to participate in the reserve market with IL. This is expected to further increase competition in the reserve market and will bring about significant savings and efficiency gains for the electricity industry and thus the Singapore economy.

Market Share by Generator 2003/05 (based on scheduled generation)

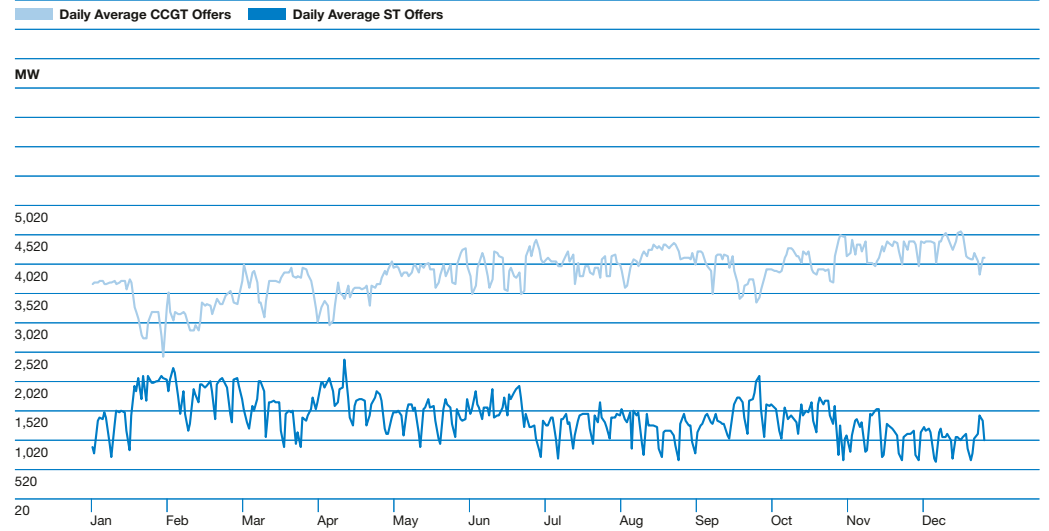


Energy market revenue was won by generators broadly in proportion to their share of total installed generation capacity.

In 2005, Senoko Power had a relative decline (37.96 percent in 2004 to 32.66 percent in 2005) in its share of total installed capacity due to investments made by other generators. This marginally decreased its market share in 2005 to 32.45 percent.

PowerSeraya increased its share of total installed capacity from 28.04 to 30.96 percent with the reintroduction of three 250MW ST units that have been converted to run on Orimulsion. The reintroduction in December meant that its market share only increased modestly in 2005 to 28.80 percent.

Comparison of Offered CCGT and ST Capacity 2005



Tuas Power increased its share of total installed capacity from 22.08 to 26.13 percent with the commissioning of two new 360MW CCGT units in June and August. This enabled Tuas Power to increase its market share for 2005 to 23.88 percent.

SembCorp Cogen won a 12.35 percent energy market share despite holding only 7.77 percent of the total installed capacity. SembCorp's capacity consists solely of CCGT technology, providing an edge over the generators with mixed technology portfolios. SembCorp uses a cogeneration process to produce both electricity and steam.

The requirement for steam for commercial customers may also explain its high level of facility utilisation.

The importance of CCGT generation in determining market share can be seen in the increasing amount of CCGT capacity offered into the market in 2005.

Retail contestability is being introduced into the NEMS in stages. From July 2001, consumers with a maximum power requirement of 2MW have had the freedom to choose their supplier.

By the end of 2005, nearly 9,000 consumers were classified as contestable and free to choose their supplier, making about 75 percent of the market open to retail contestability.

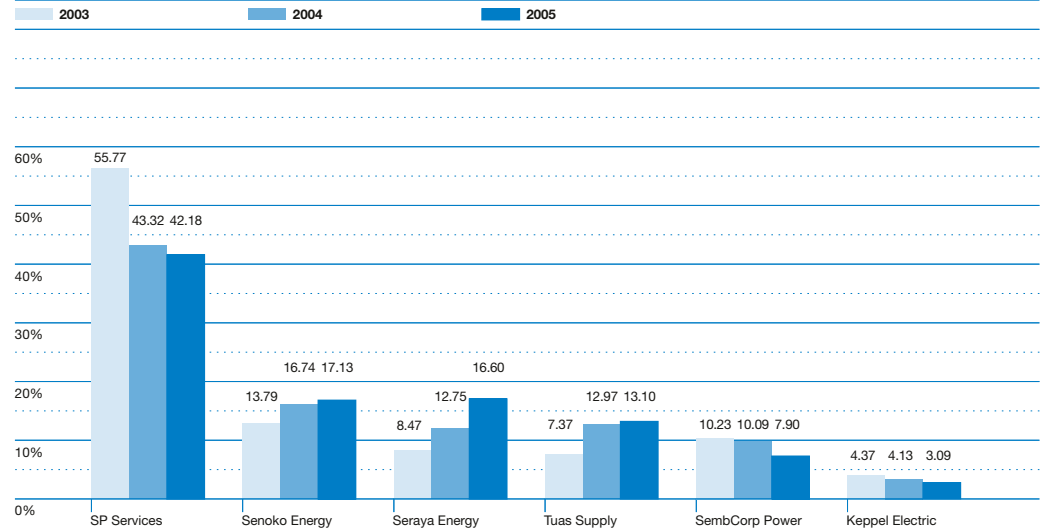
Under Singapore's approach to contestability, contestable consumers can choose to buy electricity from a retailer, directly from the wholesale market or indirectly from the wholesale market through SP Services.

The consumers that are not yet contestable continue to be serviced by SP Services at regulated tariffs. The timing for bringing these remaining customers into the competitive retail supply model is currently under consideration by the Government.

A comparison of retail market shares shows:

- The percentage of consumers buying electricity from the wholesale market through SP Services remained relatively constant from 2004 to 2005, indicating that few of the newly contestable consumers have yet 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, with Seraya Energy making a significant gain in market share since 2003.

Market Share of SP Services and Retailers 2003/05



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

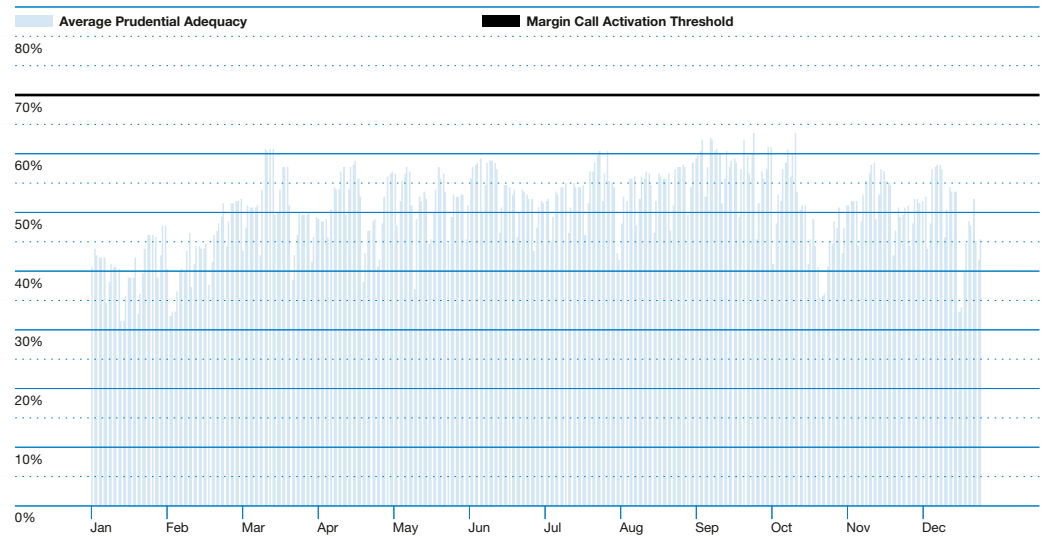
- energy,
- three classes of reserve (primary, secondary and contingency),
- regulation,
- bilateral contracts between market participants,
- vesting contracts,
- contracted ancillary services (black-start services) and
- fee recovery of EMC and the PSO administration costs.

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 2005, the market was well secured. EMC issued 19 margin calls. These calls were met within the two business day time frame.

The average level of prudential exposure for the market as a whole remained well below the 70 percent threshold for margin call activation.

Prudential Cover Adequacy 2005



Settlement statistics: Figures for 2005

Value of total retail settlement payments	\$2,915,625,350
Settlement statements issued	9,490
Settlement errors	0
Value of credit support at 31 December 2005	\$313,880,000

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 2005, the only contracted ancillary service required was black-start capability. Based on the PSO's operational requirements, EMC procured 69MW of black-start services at a cost of \$11.086 million. The capability was sourced from PowerSeraya, Senoko Power and Tuas Power.

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

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 based on the quantity of energy that they trade.

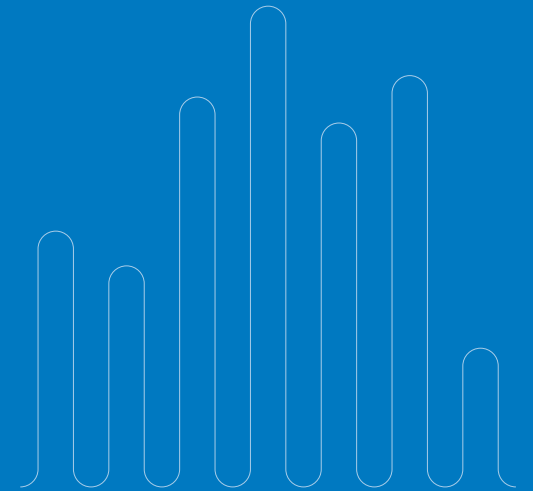
EMC and PSO fees recovered directly from the wholesale market 2005-06

1 April 2005 to 31 March 2006	EMC	\$28.60 million	\$0.39/MWh*
	PSO	\$17.19 million	\$0.23/MWh*
	Total	\$45.79 million	\$0.62/MWh*

*Assumes energy traded of 6.13TWh per month

Fees recovered directly from market participants and consumers

Supplier	Service	Method of Assessment
SP Services (MSSL)	Fees associated with meter reading and data management	Levied on a per meter basis
SP PowerAssets	Transmission charges	Levied based on actual usage



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 black-start ancillary service is procured by EMC under contract based on regulated prices.

black-start ancillary service

A service to ensure that there is initial generation to supply electricity for system restoration during complete blackouts.

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 trading 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).

load

The consumption of electricity.

market clearing engine (MCE)

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

megawatt (MW)

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

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 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.

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

Disclaimer

Energy Market Company Pte Ltd has used every effort to ensure that the information contained in this Report is accurate. This Report is prepared and provided for general information purposes only. As such, you should always consult a suitably qualified professional and independently assess the information provided in this Report. If you have any specific queries about this Report or its contents, you should contact us at info@emcsg.com.

Copyright Notice

© Energy Market Company Pte Ltd 2006. All Rights Reserved. Reproduction, transmission and distribution of this Report for reference purposes only is authorised provided that such reproduction, transmission and distribution is in respect of the whole and complete Report. This Report shall not be reproduced, transmitted or distributed in parts. Full acknowledgement of Energy Market Company Pte Ltd as the source of this Report must be given at all times.