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Letter from the Chairman

Energy Market Company

Dear Industry Members,

Since becoming Chairman of Energy Market Company (EMC) in 2008, I am pleased to have found the National Electricity Market of Singapore (NEMS) a very robust and efficient market. Nevertheless, in 2008 volatile external market factors affected energy markets around the globe — and the NEMS was no exception.

In the NEMS, demand saw significant variations throughout the year, and the annual growth rate of 1 percent was lower than in previous years. Yet despite the Uniform Singapore Energy Price (USEP) reaching a new high for its yearly level, our market has helped to keep electricity prices competitive, as the annual increase in the wholesale electricity price was markedly lower than the increase seen in the fuel oil input prices this year. Competitive prices are testimony to the soundness of our market design and model. Greater usage of the more efficient combined cycle gas turbines (CCGTs), greater efficiency gains, and competition among generation companies have helped, in this year as in previous years, to cushion the impact of high oil prices.

In addition, nearly 17MW of new generation settlement facilities entered the market in the form of embedded generation and a bio-methanisation plant. We expect this trend of diversified fuel sources to continue, with more renewables and embedded generation planning to participate in the wholesale electricity market.

I would like to thank the governance bodies for their ongoing efforts to evolve the market and for overseeing market activities. The NEMS has established transparent governance arrangements ensuring a stable and efficient market. Rule change proposals are carefully deliberated, and decisions are always based on sound design principles taking into account the existing market structure. One example of this is the decision by the Rules Change Panel not to publish offer and dispatch data of generators, a decision to be reviewed in due course as circumstances change.

Finally, this year's successful sales of the three largest generation companies by Temasek Holdings to private investors illustrates the confidence investors around the world have for the NEMS as a stable, transparent, competitive, and efficient market. I am pleased to see that the NEMS has helped achieve one of the reform milestones Singapore wanted to accomplish with a liberalised electricity market.

We all know that 2009 will not be an easy year but I know that the NEMS will play its part in contributing to the ongoing competitiveness of Singapore's economy by encouraging efficient operations, continuous innovations and further investments in the wholesale electricity market.



Wong Meng Meng
Chairman
Energy Market Company

Market History

Market Overview

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 put on a commercial footing. 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 alongside an international movement to introduce market mechanisms into the electricity industry as a way to:

- increase economic efficiency through competition,
- attract private investment,
- send accurate price signals to guide production and consumption decisions,
- encourage innovation and
- provide consumer choice.

Sale of generation companies

One of the major changes in the NEMS this year was the sale of the three largest generation companies by Temasek Holdings. The sale of Tuas Power, producing 2,670 megawatts (MW), to the China Huaneng Group for \$4.2 billion was announced in March, followed by the sale of Senoko Power, producing 3,300MW, to the Lion Power Consortium (led by Japan's Marubeni Group and France's GDF Suez) for about \$4 billion in September, and PowerSeraya, with a licensed capacity of 3,100MW, to YTL Power for \$3.8 billion in December.

Market reform milestones

Corporatisation	1995	Electricity functions of the Public Utilities Board corporatised Singapore Power formed as a holding company
	1996	Singapore Electricity Pool (SEP), design process began
Singapore Electricity Pool (SEP)	1998	SEP commenced PowerGrid is SEP Administrator and Power System Operator (PSO)
	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 began
	2001	Electricity industry legislation enacted Energy Market Authority (EMA) established as industry regulator and PSO 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 Further batches of large consumers introduced to retail contestability
	2004	Vesting contract regime introduced Interruptible loads (IL) began to participate in the reserves market
	2005	New wholesale market trader joined the market
	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 total electricity demand New generation licensee started trading
	2007	Sales process of Tuas Power, Senoko Power and PowerSeraya commenced by their owner, Temasek Holdings Removal of the Market Registration Application Fee EMA started pilot of Electronic Vending System (EVS)
	2008	Sale of Tuas Power to China Huaneng Group in March, Senoko Power to Lion Consortium in September, and PowerSeraya to YTL Power in December

Industry Structure

Market Overview

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 Pfizer Asia Pacific Schering-Plough IUT Singapore Banyan Utilities
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. Competitiveness is achieved by separating the ownership of the contestable parts of the industry from those with natural monopoly characteristics.

More generation joined the market

2008 saw the entry of three new generators into the market. Schering-Plough registered Singapore's second tri-generation embedded generator in June; Pfizer Asia Pacific had registered the first tri-generation facility (4.8MW) in December 2007. Schering-Plough has two generating units, each 4.9MW in size, generating electricity for self-consumption.

In July, IUT Singapore registered the first generator below 10MW that is not an embedded generator. At 2.126MW, it is the smallest generating unit currently registered in the NEMS, and uses a bio-methanisation plant to create energy from food waste. Energy not consumed on-site is released into the grid.

In addition, Banyan Utilities has also registered as a market participant (MP), with effect from 13 November 2008.

Generation Licensees

All generators that are connected to the transmission system are licensed by the Energy Market Authority (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 Energy Market Company (EMC).

Wholesale Market Traders

Companies other than generators or retailers 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

A Market Support Services Licensee (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

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 provides resources that support the market surveillance and compliance process and the dispute resolution process.

Transmission License — 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. The PSO controls the dispatch of generation facilities, co-ordinates scheduled 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 for 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, directly from the wholesale market or indirectly from the wholesale market through the MSSL, SP Services. Non-contestable consumers are supplied by SP Services.

Market Features

Market Overview

Energy, reserve and regulation products

	Description	Purchaser	Seller
Energy	Generated electricity	Retailers	Generators
Reserve	Stand-by generation capacity or interruptible load (IL) that can be drawn upon 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 mathematical 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, wherein the market clearing engine (MCE) considers the overall costs and requirements of all products, then selects the optimal mix of generation and IL 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 ILs are matched with the system demand forecast and system security requirements. The MCE produces 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 IL 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 transmission losses and the 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. Modelling 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 37 injection nodes and the prices at approximately 653 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 5 megawatt hour (MWh) for each trading period.

Market Features

Market Overview

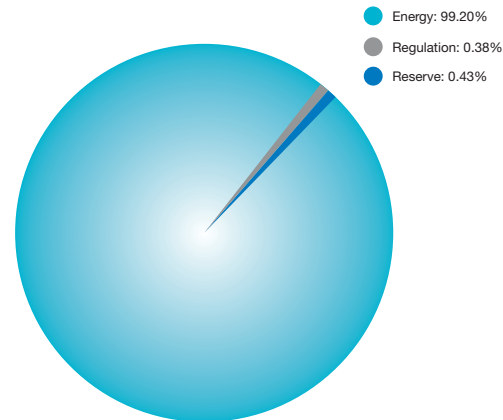
Near real-time dispatch

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 real-time intervention as possible, and hence 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 MPs have the information they need to adjust their trading positions prior to physical dispatch.

Mix of products traded 2008

The total value of products traded in the wholesale market in 2008 was \$6.92 billion, a rise of 31.5 percent from 2007. For 2008, the breakdown of products traded was 99.2 percent for energy, 0.43 percent for the reserve and 0.38 percent for regulation.



The share of products traded does not add up to 100% due to rounding.

Overview

Market Governance

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 other mandates:

- 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 members represent generators, retailers, wholesale market traders, the financial community, the Power System Operator (PSO), the Market Support Services Licensee (MSSL), the transmission licensee, electricity consumers and EMC, ensuring representation for the many sectors of the industry.

The rule change 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 of the market. The work plan can be found at www.emcsg.com.

Market surveillance and compliance

The Market Surveillance and Compliance Panel (MSCP), comprised of professionals independent of the market, is responsible for monitoring, investigating and reporting on the behaviour of market participants (MP) and the structural efficiency of the market. The panel identifies market rule breaches and assesses market operations for efficiency and fairness. In circumstances in which the MSCP determines that a MP 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. The panel publishes an annual report; since 2007 the MSCP Annual Report has been published together with the NEMS Market Report.

Dispute resolution

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

Letter from the Chair, Rules Change Panel

Market Governance

Dear Industry Members,

2008 was another eventful year for the Rules Change Panel (RCP), as we tackled a wide spectrum of economic, financial and administrative issues. I am heartened to report that as a team, the RCP applied sound design principles in assessing Singapore's changing electricity landscape, implementing rule changes that will benefit the market.

In assessing rule changes, the panel is always mindful of instances in which theoretical assumptions of a perfect market do not hold. One good example is the procurement of ancillary service contracts, in which the small number of potential providers makes it difficult to achieve a perfectly competitive outcome. To address this situation, the RCP recommended two rule changes this year: the first, to ensure that price and quantity information of ancillary service contracts is not disclosed in non-competitive procurement outcomes, in order to prevent collusion; and the second, to introduce the provision of an independent assessment, ensuring that ancillary service proposals do not over-provide and are cost effective.

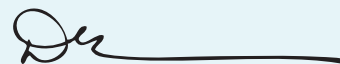
Further, the RCP grappled with whether or not offer and dispatch data of generators should be released. Several other electricity markets publish such data at either the facility or aggregated level, sometimes with a time lag. However, the RCP made a conscious decision not to publish such data, given the present high market concentration in the Singapore electricity market, and given that offer patterns do not vary significantly over time. The panel will keep this issue in mind, and review its decision as the market concentration, using the vesting contract level as a proxy, falls.

The RCP continually strives to streamline and enhance the operations of the wholesale market. As part of its efforts to enhance service delivery, EMC proposed to implement self-billing, whereby EMC, as the customer, prepares the MP-supplier's (e.g., generators) tax invoice, and forwards a copy to the supplier. This service is possible since all settlement information is centralized at EMC, and removes the need for MP-suppliers to issue tax invoices at their end.

This year also marks the end of term for the current Panel, which ran from 2006 to 2008. For their invaluable contributions to the RCP, I would like to thank outgoing members: Dr Kang Cheng Guan (PSO), Mr Low Boon Tong (PowerSeraya), Mr Tay Swee Lee (Senoko Power), Dr Daniel Cheng Tai Yip (SP Power Assets) and Mr Henry Gan Wee Teck (EMC), as well as those continuing service on the next panel: Mr Philip Tan (Tuas Power), Ms Annie Tan (Keppel Electric), Mr Ng Meng Poh (Sembcorp Power), Mr Dallan Kay (Diamond Energy), Mr Lawrence Lee (SP Services), Mr Robin Langdale (ICPAS), Dr Goh Bee Hua (CASE) and Mr Michael Lim (SICC). I also would like to welcome Mr Yeo Lai Hin (PSO), Mr Sim Meng Khuan (PowerSeraya), Mr Yu Tat Ming (Senoko Power), Mr Chan Hung Kwan (SP PowerGrid) and Mr Kenneth Lim Khoon Seng (EMC) to the new 2009-2011 Panel. I have full confidence that with the mix of experience from the incumbent members and fresh perspectives from the new members, the RCP will be well-equipped to tackle upcoming challenges.

I would like to take this opportunity to express my gratitude to all who have contributed to making 2008 such a fruitful year for the RCP; from my fellow RCP colleagues who have been a pleasure to work with, to our EMA regulators and EMC Board for considering RCP's rule change proposals, and to the MPs who have actively contributed constructive feedback during the rule change process. Last but not least, I would like to thank EMC's Market Administration Team for their tireless efforts and insightful analyses, which were a great help to the RCP in arriving at decisions.

I look forward to continued support from all quarters in the new year ahead, as we continue to guide market evolution amidst changes to the industry landscape.



Dave Carlson
Chair
Rules Change Panel

Market Evolution

Market Governance

2008 was an eventful year for the RCP, which worked productively on the following rule change proposals:

Ancillary services

EMC procures contracted ancillary services (e.g., black start) on behalf of the PSO. Given the small number of such service providers, and the location-specific nature of these services, additional effort is taken to ensure competitive outcomes and reasonable rates in the procurement process. This year, two rule changes were made to enhance the procurement process:

Publication of ancillary service contracts

This rule change looked at the publication of information associated with the procurement of ancillary services.

Previously, the amount of information that EMC published on ancillary service contracts depends on whether or not EMC contracts ancillary services in the presence of market power, as determined by the MSCP. However, the MSCP felt that it is not the appropriate body to make such an assessment, as it is not vested with powers under the Market Rules or Electricity Act to adjudicate market power issues.

To address this question, the RCP recommends that if EMC employs a competitive tendering or negotiation process to identify multiple potential ancillary service providers to determine competitive prices and other contract terms, then the commercial terms of such contracts shall be treated as confidential information. Otherwise, EMC shall have to publish the relevant terms and conditions of the contracts in order to encourage competition among various potential providers. This change thus leverages the existing process for contracting ancillary service to determine the presence of market power, removing the need for the MSCP to determine market power.

The EMC Board, having considered the RCP's proposal, countered that if the ancillary service is procured through a competitive tendering or negotiation process with multiple potential ancillary service providers, the price of the ancillary service shall be published. However, in a non-competitive market situation, the EMC Board recognises that the disclosure of prices and quantities of individual winning contracts may facilitate collusion and gaming amongst suppliers, to the detriment of the market. Thus, in this non-competitive situation, the price and quantity of the ancillary service shall not be published. The Board further suggested that the key requirements pertaining to an ancillary service contract should be made known at the onset of the procurement process.

Auditing of contracted ancillary services proposals

In procuring contracted ancillary services, EMC will conduct a competitive tender or negotiate with multiple potential ancillary service providers (PASP) to determine competitive prices and the terms for such services. Where this is not feasible, EMC will negotiate ancillary service contracts directly with a single provider.

As future contracted ancillary services could entail significant capital investment, EMC proposed introducing a provision for the independent assessment of the PASP proposals, to ensure that their proposals do not over-provide and are cost effective. This rule change introduced the provision of an audit, which will be conducted for cases in which the PSO or EMC would like an independent view of the proposals. The audit will be carried out by a consultant engaged by EMC, with inputs from the PSO and the respective PASP. The consultant fees will be recovered from the market through the Monthly Energy Uplift Charges (MEUC).

While the independent findings will not be binding on the PASP, it is envisioned that the findings will serve to facilitate the negotiation process between the PSO, EMC and the PASP.

System security

Registration of generation facilities at the same generating station

In the NEMS, generation facilities are classified as either Generation Settlement Facilities (GSF) or Generation Registered Facilities (GRF). Unlike GRFs, GSFs are not subject to the PSO's dispatch and can generate electricity according to their needs. (These generators can start or stop of their own accord.)

Under the existing rules, only generation facilities with nameplate ratings of less than 10 megawatts (MW) can be registered as GSF. This is because the operations of multiple GSFs with aggregate capacities of 10MW or more at the same physical location, which are not subjected to dispatch, could destabilize the power system and compromise system security.

A generation facility is defined in the Market Rules as "one or more generating units at the same physical location". Hence, to determine if a generation facility qualifies as a GSF, the aggregate nameplate rating of all generating units at the same physical location has to be less than 10MW. However, some MPs and potential MP misunderstood that the 10MW threshold applied to each generating unit's individual nameplate rating, and may have attempted to register the units individually as GSFs, even though their aggregate nameplate rating exceeded 10MW.

The RCP supported this rule change to make it explicit in the Market Rules that multiple generating units at the same physical location must be registered as GRFs and be subject to PSO's dispatch, if their aggregate nameplate rating is 10MW or more.

Market Evolution

Market Governance

Administrative changes

[Modification to market manual for EMC to perform self-billing](#)

Under the current market structure, EMC acts as a middleman, whereby it purchases electricity, ancillary services and other electricity products and services from MP-suppliers (e.g., generators), and sells them to MP-buyers (e.g., retailers/MSSL). Correspondingly, EMC collects payment from MP-buyers, and makes payments to MP-suppliers. Before an MP-supplier can issue a tax invoice to EMC, EMC has to notify the MP-suppliers of the amount to be invoiced.

To enhance service delivery, EMC proposed to implement self-billing, since all settlement information is centralized at EMC. Self-billing is essentially an arrangement between a GST-registered supplier (i.e., MP-supplier) and a GST-registered customer (i.e., EMC), in which the customer prepares the supplier's tax invoice, and forwards a copy to the supplier. Since EMC has all the information required to determine the value of the goods and services provided by all MP-suppliers, EMC can issue itself buyer-created tax invoices on the MP-suppliers' behalf and provide each MP-supplier with a copy. This process removes the need for the MP-suppliers to issue tax invoices at their end.

The proposed modification to the Market Operations Market Manual (Settlement) ensures that EMC meets the conditions required by the Inland Revenue Authority of Singapore (IRAS) for self-billing. The RCP unanimously recommended this proposal to enhance the efficiency of the invoicing process.

[Review of qualifications for members of the dispute resolution and compensation panel](#)

The Singapore Electricity Market Rules provide for a set of Dispute Resolution Procedures which aim to resolve disputes between parties amicably, avoid incurring unnecessary costs, and maintain relationships that are important in Singapore's electricity market community. These procedures are administered by the Dispute Resolution Counsellor, who appoints two separate panels, a mediation panel and an arbitration panel (collectively known as the Dispute Resolution and Compensation Panel) from which he will select suitable mediators or arbitrators for future disputes.

During a review of the Dispute Resolution Procedures, it was proposed to broaden the selection criteria for the Dispute Resolution and Compensation Panel. Current Market Rules require candidates with legal backgrounds to have practiced as advocates and solicitors of the Supreme Court of Singapore. EMC assessed the current selection criteria for candidates with legal backgrounds and found that it was restrictive in comparison to comparable arrangements at organizations such as the Singapore Mediation Centre (SMC) and the Singapore International Arbitration Centre (SIAC).

As such, the RCP supported the proposal to include an additional criterion for greater flexibility, by qualifying candidates with legal backgrounds, so long as they have experience as arbitrators or mediators in previous disputes.

[Update of market operations market manual – standing offers, offer variations and standing data \(chapter 6, Market Rules\)](#)

The current issue of the Market Manual was last updated and published in May 2004. Since then, there have been changes to both the Market Rules and market operations. The Market Manual was thus reviewed and updated to align it with the current Market Rules. The Market Manual was then rewritten for greater readability, clarity and logical organisation.

In addition, a timetable for submissions of offer variations for energy, reserve and regulation in Appendix 6A.2 of Chapter 6 of the Market Rules was put up for a rule change, to ensure that the representation of applicable periods noted in the timetable coordinates accurately and consistently with other timetables in the same Appendix.

Publication of market information

[Publishing generation offers and dispatch quantities](#)

Currently, generator offers and dispatch quantities in the Singapore wholesale electricity market are not published at either the generation facility-level or the aggregated level. Some MPs requested that EMC review the question of whether or not releasing such data would be beneficial to the market.

EMC's review noted that, in line with economic theory, the release of more information enhances transparency and reduces the cost of risk management for generators. However, given the highly concentrated nature of the electricity market, the release of such strategic information at either the facility or aggregated level could facilitate collusion and the exercise of market power. In addition, the availability of such data could erode the incentive for generators to be guided only by their true marginal cost in their offers, which was the market design intent. On balance, EMC proposed not to release such data while the market remained concentrated.

Practices in other electricity markets suggest that introducing a time-lag dilutes the strategic content of offer information. Among markets that make offer information available, such lags range from one day to six months. However, given Singapore's relatively stable and predictable load pattern, it was observed that offer patterns do not vary significantly over the years. Since the strategic value of delayed offer information does not diminish, EMC felt that it would not be appropriate to release even delayed data.

The RCP concurred with EMC's proposal not to publish the data, although this decision would be reviewed when the level of market concentration is lowered. The RCP decided to monitor the vesting contract level as a gauge of market concentration, and will review this decision as needed.

Letter from the Dispute Resolution Counsellor

Market Governance

Dear Industry Members,

In the past few years, we have focused our efforts on putting in place a comprehensive dispute resolution system for the National Electricity Market of Singapore.

We have been fortunate in that no disputes have been referred to us so far.

However, this does not mean that we can let our guard down. It is incumbent on a market like ours to have a proper dispute resolution system in place, which is able to manage disputes in a fair, effective and transparent manner when the need arises.

In fact, with the recent divestment by Temasek Holdings of its interests in its various generation companies, market watchers are predicting that disputes are now more likely to be referred to the Dispute Resolution and Compensation Panel (DRCP).

Appointment of new members to the DRCP

In the course of the last year, I appointed three new members to the DRCP:

Mr Philip Harris

Mr Harris is an energy industry veteran; he was the President and CEO of PJM Interconnection and Chairman of the PJM Board for 15 years. Mr Harris was a speaker at EMC's Singapore Electricity Roundtable in 2007.

Dr Robert Gaitskell, Q.C.

Dr Gaitskell is both a professional engineer and a lawyer. Appointed Queen's Counsel to the UK Bar in 1994, he practices at Keating Chambers, London. Dr Gaitskell chairs various International Chamber of Commerce (ICC) arbitral tribunals dealing with disputes relating to power stations, petro-chemical work and complex engineering projects.

Mr Giam Chin Toon, S.C.

Mr Giam is Senior Partner at Wee Swee Teow & Co, and a Senior Counsel. He has been in legal practice for almost 40 years and is on the panel of arbitrators of the Singapore International Arbitration Centre, Hawaii Panel of the Centre for International Commercial Dispute Resolution and the Korean Commercial Arbitration Board.

In the coming year, I intend to appoint more panel members to the DRCP so that in the event that disputes arise, the market will have the benefit of a pool of highly qualified and professional mediators and arbitrators.

Finally, I would like to thank Ms Liew Siok Fang for so ably supporting the work of the DRCP. Ms Liew left EMC last year, and Mr Poa Tiong Siaw is now assisting me. I look forward to working closely with Mr Poa and his team.



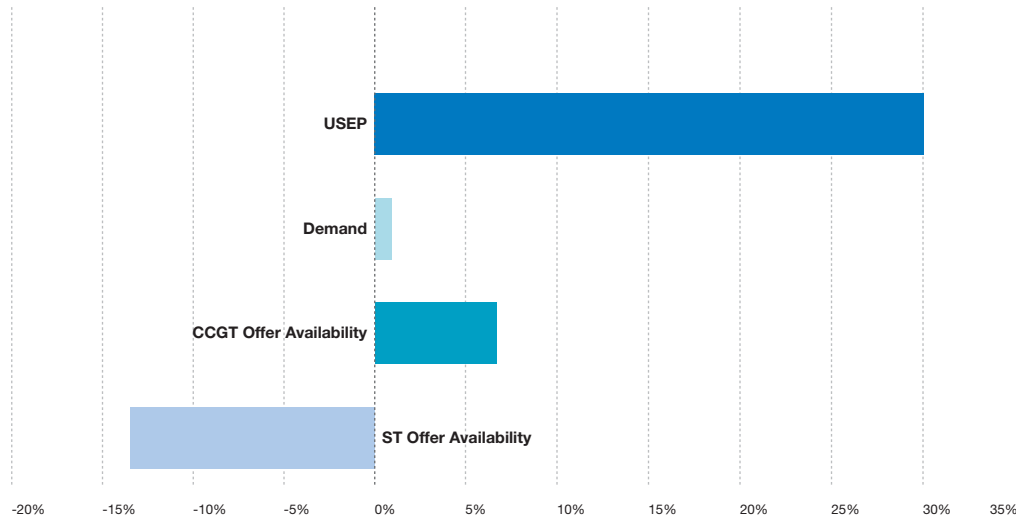
George Lim
Dispute Resolution Counsellor



Overview of the Year

Market Performance

Major Market Indicators 2008 (% changes from 2007)

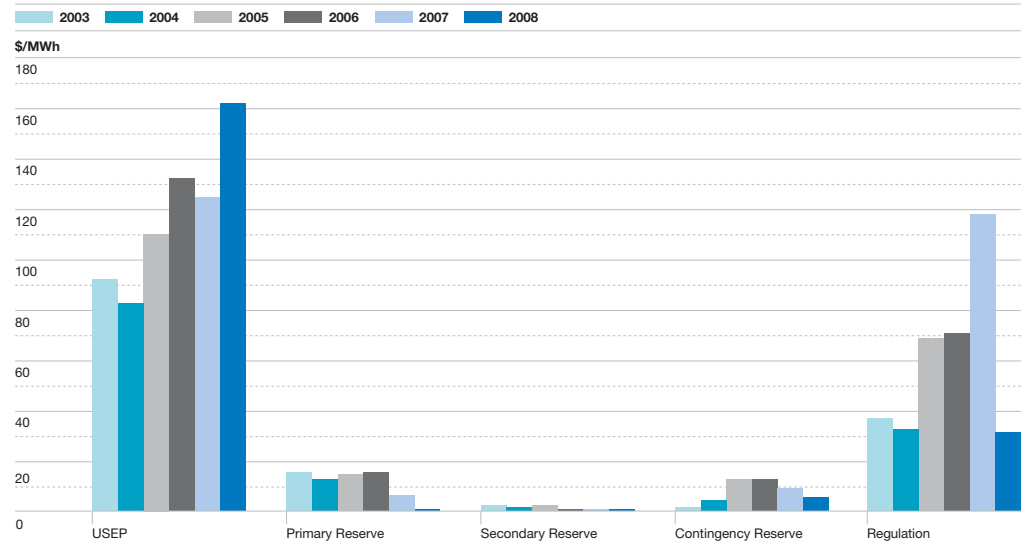


CCGT = combined-cycle gas turbine
ST = steam turbine

2008 is marked as a year when demand displayed significant variations while supply registered new embedded generators (EG) in the National Electricity Market of Singapore (NEMS).

Also, volatile external market factors, such as the fuel oil price, led the energy offer price to respond with considerable shifts throughout the year.

The USEP and Ancillary Prices 2003/08

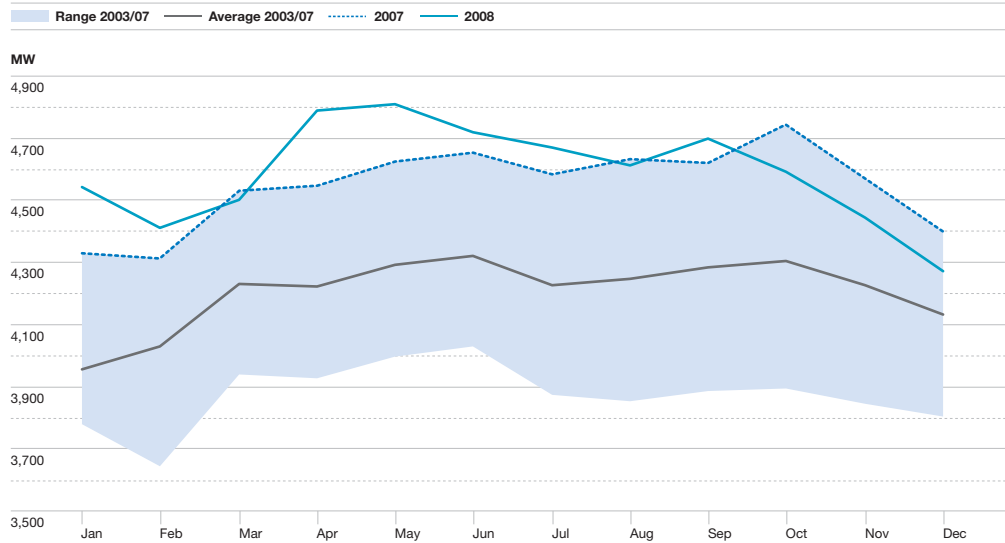


In addition to reaching highs and lows during 2008, the Uniform Singapore Energy Price (USEP) for 2008 surpassed all preceding years and set a new highest yearly level since market start. Compared to 2007, the USEP increased slightly over 30 percent. The ancillary prices eased across the board in 2008, with both primary reserve and regulation prices averaging at their lowest levels since market start.

Demand

Market Performance

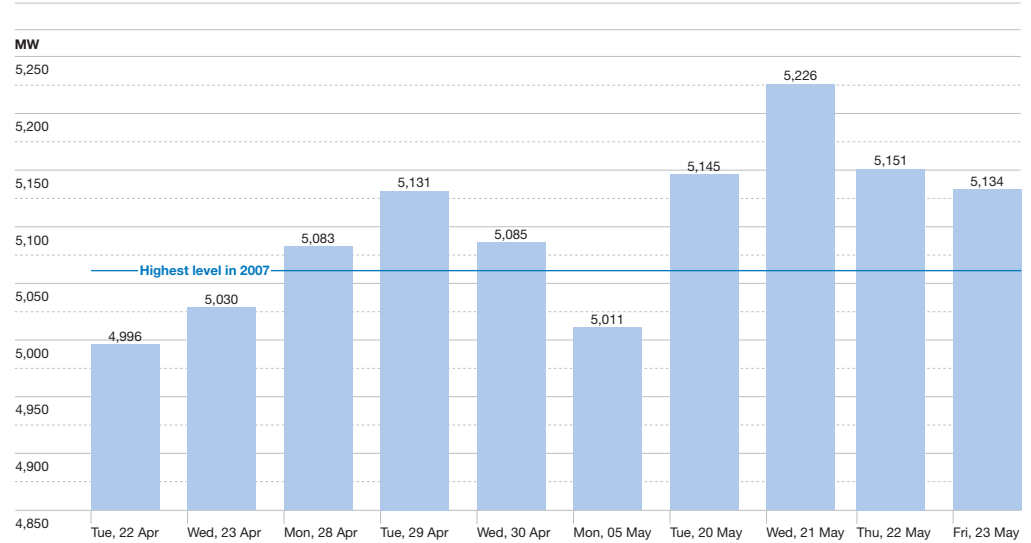
Monthly Average System Demand Overview 2008



Electricity demand peaked in April and May and eased thereafter, especially during the last three trading months of the year. Also, for the first time since 2003, the monthly average demand registered negative year on year (YOY) growth: in March, August, October, November and December 2008.

On the whole for 2008, the rate of demand growth was 1 percent compared to an annual growth rate of over 3 percent in the preceding five years.

Top Ten Daily Average System Demand 2008

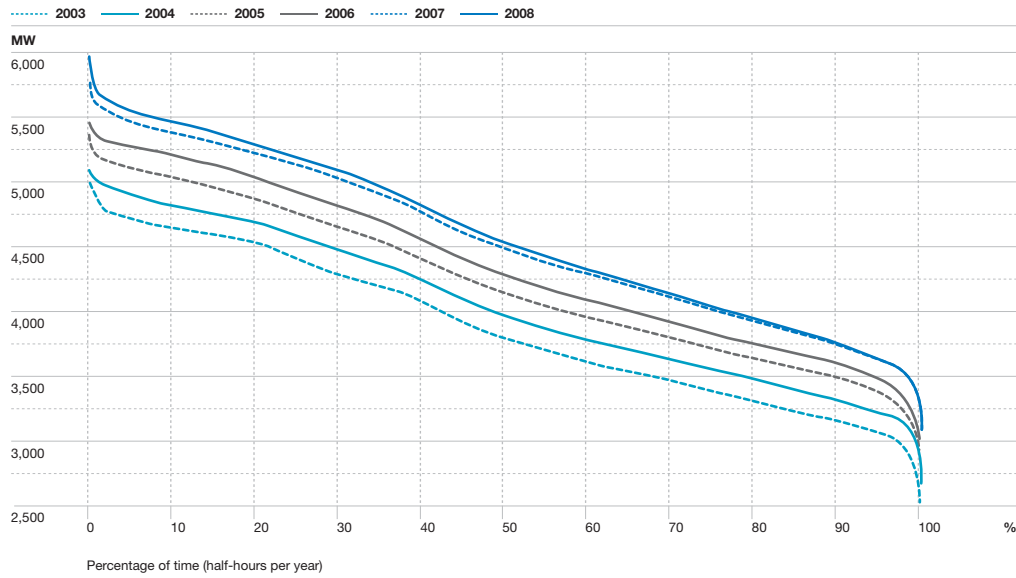


During 2008, the top ten system demand levels were concentrated in April and May, reflecting the stronger demand growth rate in these two months. These top ten 2008 levels largely exceeded the highest level in 2007. Such market behaviour is in contrast to the top ten levels in 2007, all of which surpassed the highest level in 2006.

Demand

Market Performance

System Demand Duration Curves 2003/08



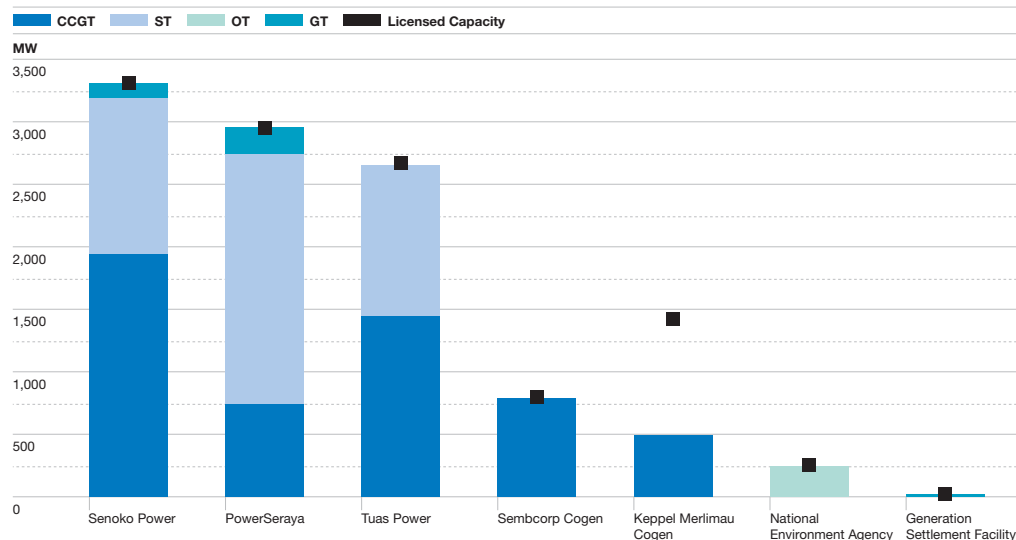
With slower demand growth in 2008, the demand duration curve for 2008 plotted closely to the duration curve for 2007 and fell beneath the duration curve for 2007 after the 87.7 percent mark. The shifts in the demand duration curve for 2008 are related to the negative YOY demand growth rates observed in five trading months of 2008.

In 2008, demand reached a total of 38.9 terawatt hours (TWh), a 1.5 percent increase from 2007.

Supply

Market Performance

Registered Generation Capacity as of 31 December 2008



Note: Licensed capacity is the generation capacity licensed by the EMA. Registered capacity is the capacity registered with EMC to participate in the real-time market.

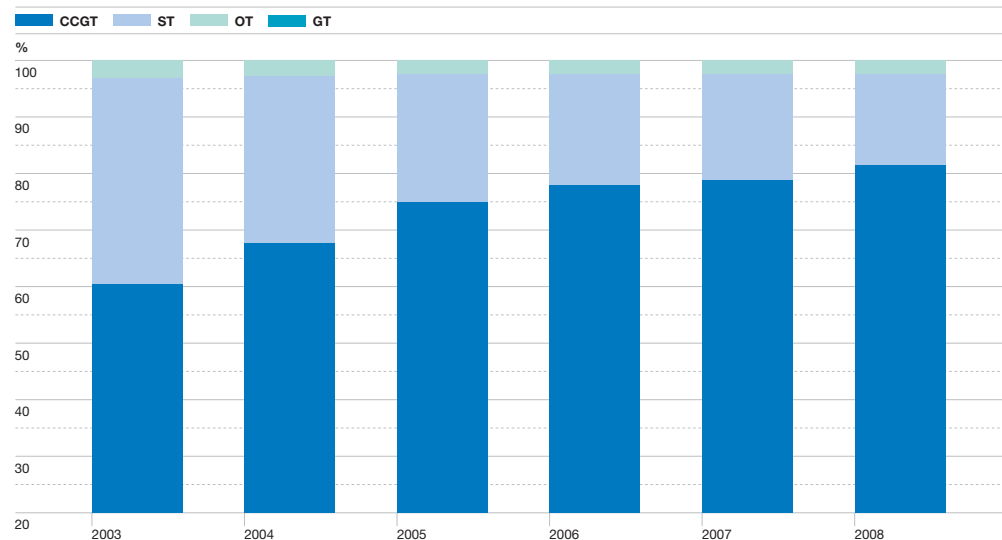
OT = other facilities, i.e., incineration plants operated by the National Environment Agency that convert energy from incinerated refuse

GT = open-cycle gas turbine

The NEMS recorded minor changes in registered capacity in 2008, with marginal capacity adjustments made on existing facilities as well as the introduction of nearly 17 megawatts (MW) of generation settlement facilities (GSF) capacity. As of 31 December 2008, the generation units registered as GSFs in the NEMS were IUT Singapore, Pfizer Asia Pacific and Schering-Plough.

In the context of the NEMS, the main specifications of a GSF are as follows: First, a GSF has a capacity below 10MW. Second, a GSF can generate electricity according to its own needs and is not subject to dispatch by the PSO. Third, a GSF acts as a price taker and does not submit any offers into the NEMS. Fourth, the GSF is registered as a market participant (MP) with Energy Market Company (EMC) and is connected to the grid. Finally, the MP of the GSF will receive payment according to the Market Energy Price at the designated injection node against its metered value. For more information on GSFs, see the Market Governance/Market Evolution section of this report.

Annual Market Share by Plant Type 2003/08



Based on scheduled generation

Note: The market share for GT units was 0.01 percent in 2008, 2007 and 2006, 0.03 percent in 2005 and 0.02 percent in 2004. GT units did not participate in the energy market in 2003.

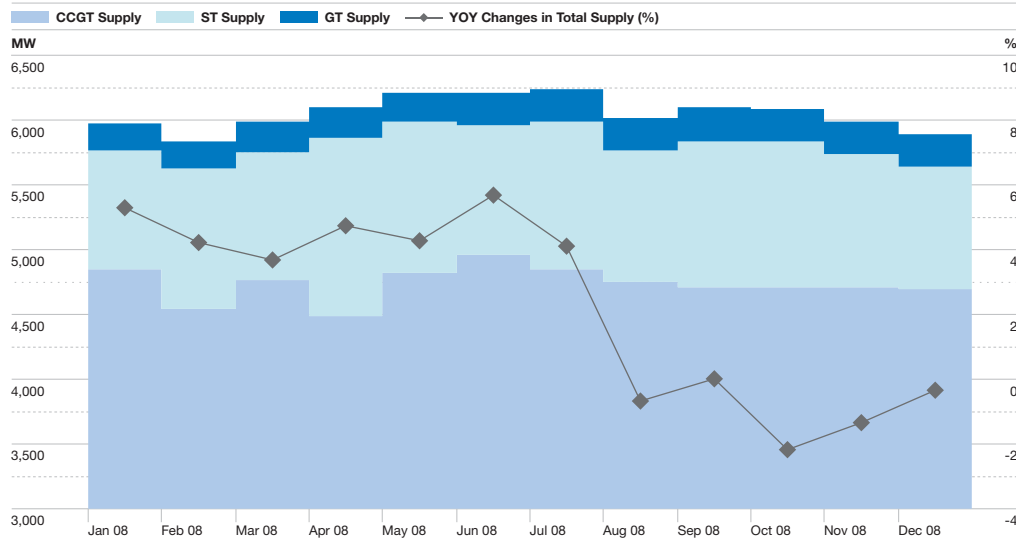
Both Pfizer Asia Pacific and Schering-Plough are EGs, which produce electricity for self-consumption. These EGs are registered as non-injecting generation facilities characterised by price neutralisation and the net treatment of non-reserve market charges. For more details on the net treatment of non-reserve charges, see the glossary on page 30.

The CCGT market share crossed the 80 percent mark for the first time since 2003, in tandem with an increase in CCGT offer availability and lower ST offer availability during 2008.

Supply

Market Performance

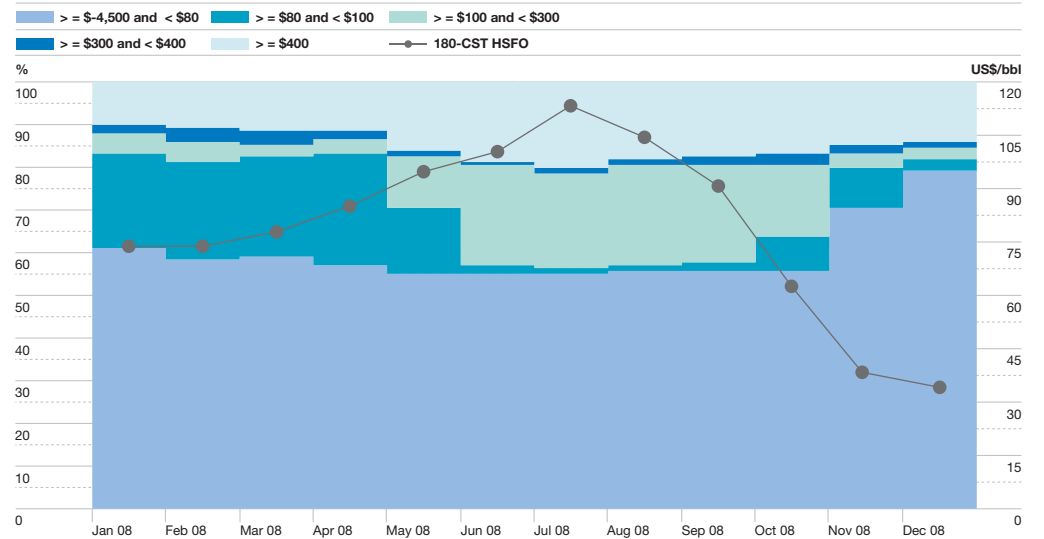
Monthly Average Generation Offer Availability by Types 2008



The monthly average combined-cycle gas turbine (CCGT) supply ranged mostly between 4,500MW and 5,000MW during 2008, while steam turbine (ST) and gas turbine (GT) supplies continued to maintain their pivotal roles as buffers for the total supply. During the second half of 2008, as demand began to decline, the total supply responded by contracting with records of negative YOY changes from August to December 2008.

Although overall demand growth softened in 2008, the total supply improved by 2.7 percent compared to 2007, with the CCGT supply expanding 6.6 percent. This was despite a 14.2 percent contraction in the ST supply during 2008.

Monthly Average Energy Offer Price Band (percentage) and Fuel Oil Price 2008



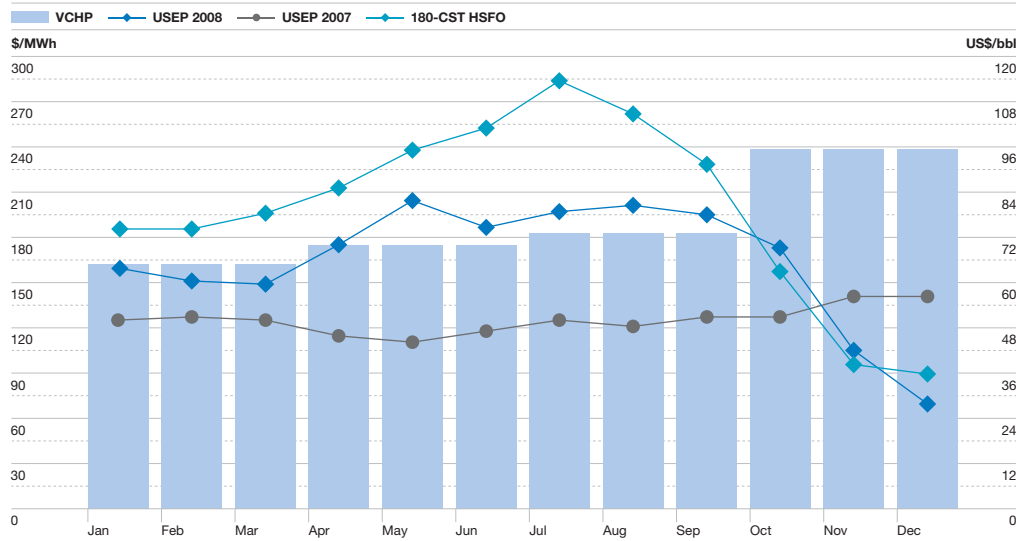
During 2008, the energy offer pricing shifted to reflect changes in operational costs, particularly fuel oil prices. From 61 percent in January, the percentage of the energy offer price band below \$80 megawatt per hour (MWh) scaled down to 55.3 percent in July then rose to 79.8 percent in December.

This movement was in line with fuel oil price movements [180-centistoke high sulphur fuel oil (180-CST HSFO)], which peaked at US\$113 per barrel (bbl) in July before plunging to a three year low of US\$35/bbl in December.

Energy Prices

Market Performance

Monthly Average USEP, VCHP and Fuel Oil 2007/08

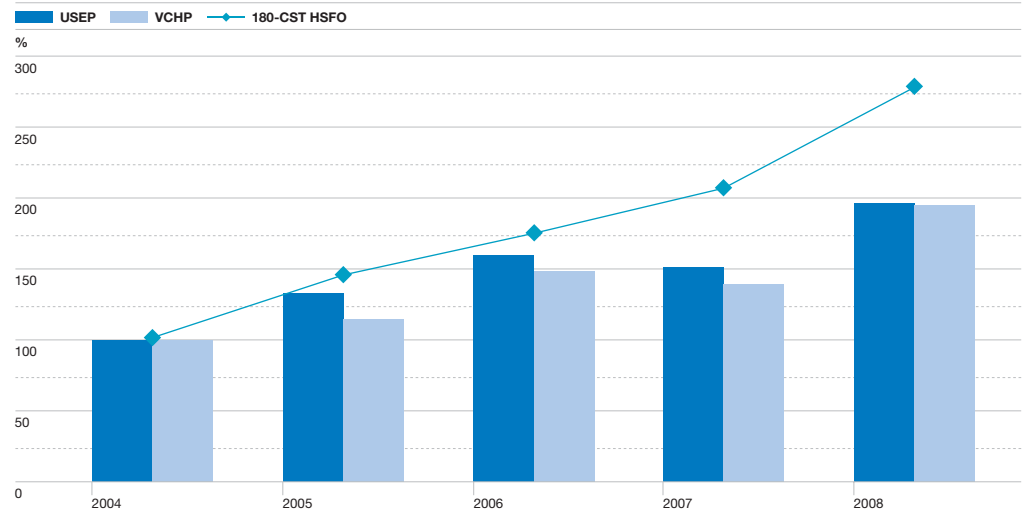


In 2008, the USEP averaged \$162/MWh for the year, 30.2 percent higher than in 2007. Compared YOY with 2007, the USEP in 2008 was higher for the first ten months, before registering lower thereafter. During 2008, the monthly average USEP for seven trading months surpassed the previous record-high level of \$167/MWh set in August 2006. The USEP in May 2008 set the new highest record since market start at \$203/MWh. On the other hand, in December 2008, the USEP set the second lowest level since market start at \$68/MWh.

The vesting contract hedge price (VCHP) averaged \$190/MWh in 2008, 16.9 percent higher than the USEP in 2008. Between May and September, the USEP traded higher than the VCHP. The largest absolute difference between the USEP and the VCHP occurred in December 2008 when the USEP was \$68/MWh and the VCHP was \$239/MWh. This difference reflects abrupt fluctuations in the fuel oil price throughout the year.

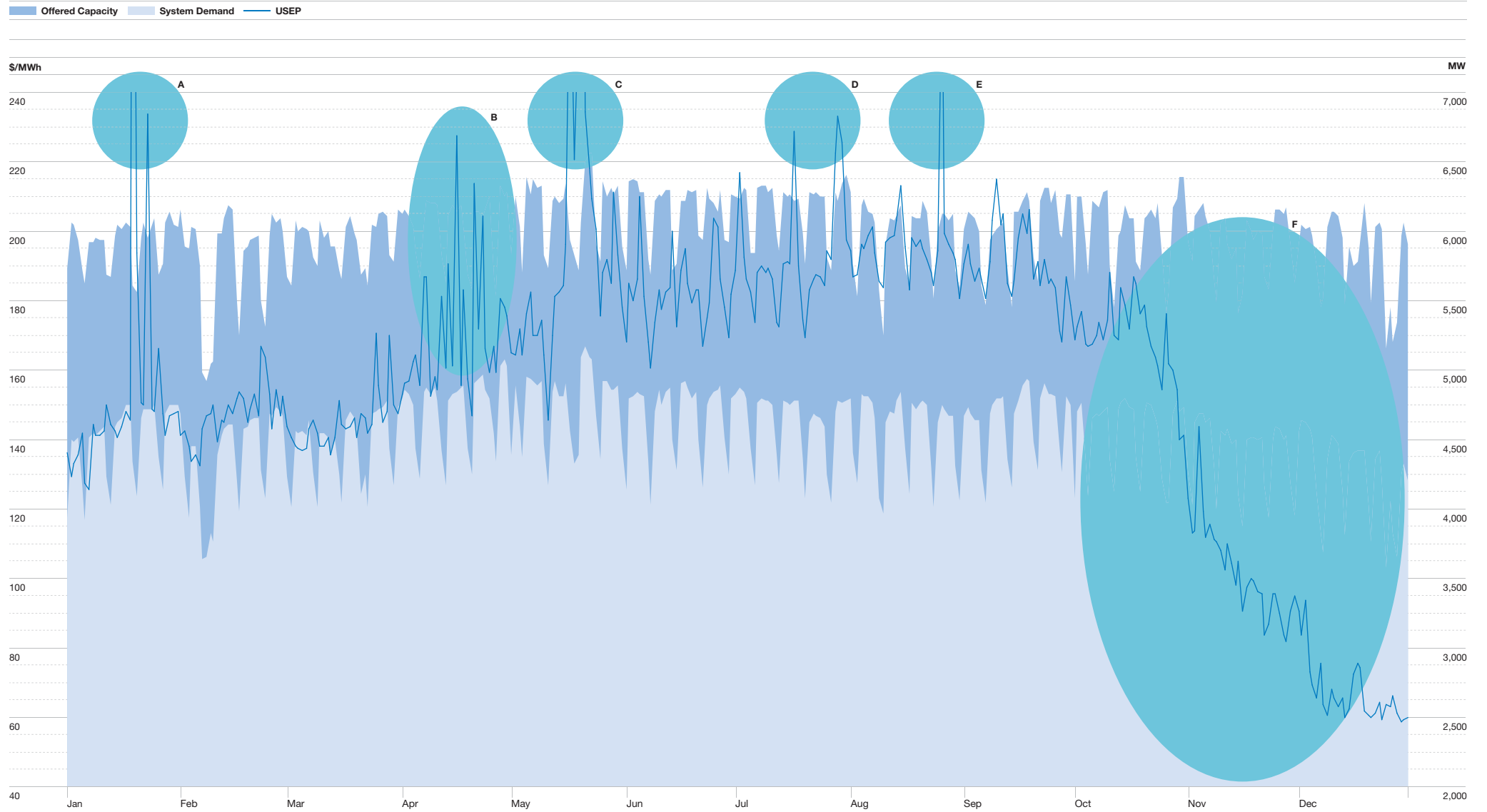
One of the components in the methodology of the VCHP is the Fuel Cost Index. The Fuel Cost Index is calculated each quarter using the average 3-month forward fuel oil price (180-CST HSFO). This difference reflects the abrupt fluctuations transacted or quoted at the Intercontinental Exchange (ICE) in the first month of the preceding quarter of the quarter for which the vesting price is calculated.

Percentage Change in the USEP, VCHP and Fuel Oil 2004/08 (with 2004 as the reference year)



The relevant oil benchmark for the Singapore electricity industry is 180-CST HSFO. In 2008, the 180-CST HSFO price averaged 35.3 percent higher compared to 2007. Using 2004 as the reference year, the USEP and the VCHP did not rise to the same extent as the 180-CST HSFO over the last five years.

Daily Average USEP, System Demand and Offered Capacity 2008



*Prices above \$240/MWh are not displayed.

Energy Prices

Market Performance

The key observations on USEP fluctuations during 2008 are:

Point A:

Between the second half of January and early February, the USEP traded upward, the result of intermittent north-south price separation caused by transmission grid congestion. On 19 January, the USEP averaged its fifth highest level since market start at \$401/MWh. Grid congestion also caused the USEP to climb on 23 January, averaging \$238/MWh.

Point B:

From 16 to 23 April 2008, the USEP averaged above \$200/MWh on three separate days, the result of supply crunches from CCGT units out for maintenance or not offering, CCGT forced outages, and changes in the energy offers. During these eight trading days, higher demand levels were recorded, with two trading days registering in the top-ten levels of daily average demand for 2008.

Point C:

The USEP ranged between \$222/MWh and \$477/MWh from 17 May to 22 May, under tight supply conditions when demand was near its 2008 pinnacle. Tight supply was exacerbated by a chain of outages, with three CCGT units under maintenance as well as five separate occurrences of CCGT forced outage during these six trading days.

Point D:

On 17 July, the USEP averaged \$233/MWh, after experiencing a CCGT forced outage in addition to changes in the energy offer for that day. On 29 and 30 July, the USEP averaged \$237/MWh and \$229/MWh respectively, due to a planned gas outage, as the affected generation units had to switch to a more expensive fuel type.

Point E:

The USEP averaged \$283/MWh on 26 August, after facing tight supply conditions from two CCGT units out for maintenance and one CCGT forced outage.

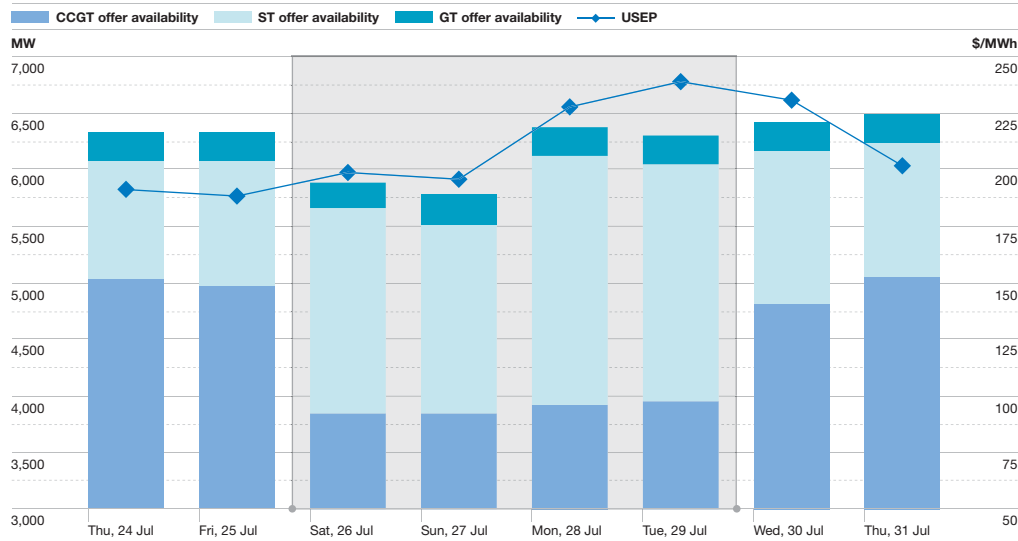
Point F:

From October to December, the USEP plummeted due to lower levels of demand, significant shifts in the energy offers, and a virtually unchanged CCGT offer availability. On 4 November, the market experienced an unplanned gas supply disruption. However, owing to the dual-fuel capability of the generating units, the unplanned gas supply disruption did not result in any major power supply issues in Singapore. Despite peaking at \$453/MWh, the USEP averaged \$146/MWh on 4 November.

Energy Prices

Market Performance

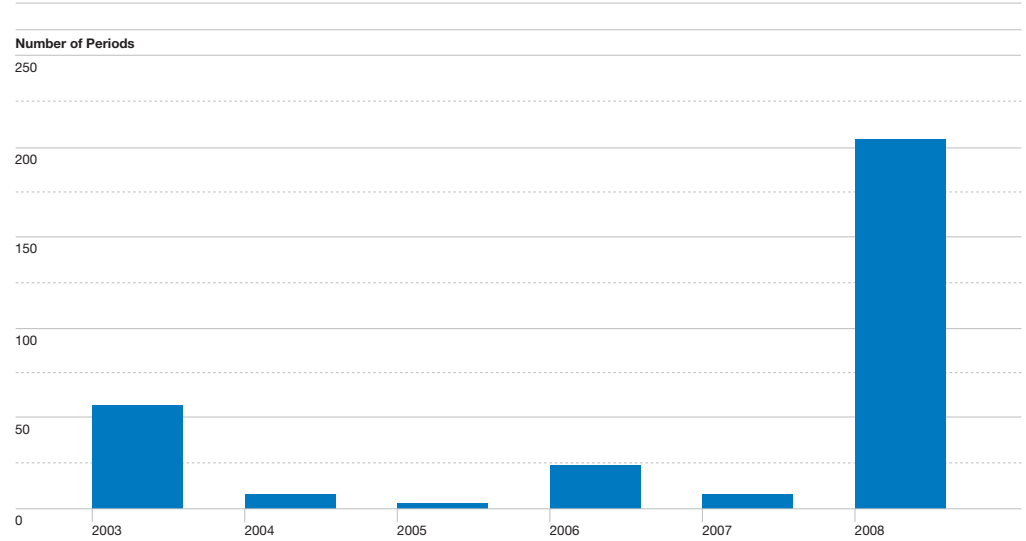
Planned Gas Pipe Outage on 26 to 29 July 2008



From 26 to 29 July 2008, the gas pipe from West Natuna was shut down for planned maintenance. The shut-down led to a gas supply disruption affecting the Singapore electricity market, during which most of the affected CCGT units switched their generation fuel source from gas to the costlier alternate fuel source, diesel fuel oil.

During these four days of gas disruption, CCGT offer availability declined below the 4,000MW mark and ST offer availability expanded to make up for the decline in CCGT offer availability. Between 26 and 29 July, the daily USEP averaged between \$195/MWh and \$237/MWh compared to the average of \$195/MWh in July 2008.

Number of Periods of Grid Congestions reported by the Market Clearing Engine (MCE)



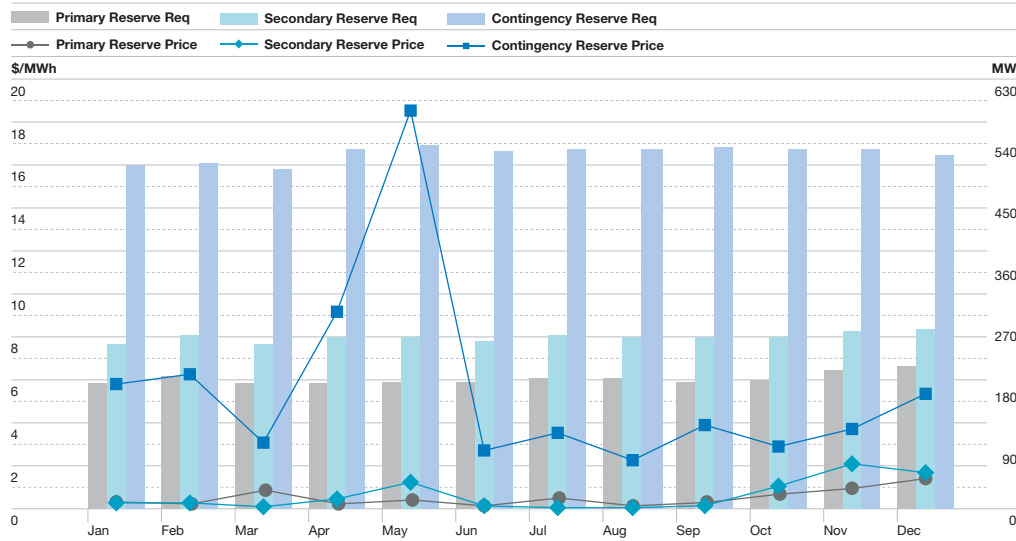
Transmission grid congestion is a reflection of one or more transmission circuits at 100 percent effective capacity. During transmission grid congestion, the price separation condition between the sending and receiving nodes is reported in the market clearing engine (MCE).

Based on the results from the MCE, transmission grid congestion surged to a total of 205 periods in 2008, over 90 percent of which occurred between the second half of January and early February.

Ancillary Markets

Market Performance

Reserve Prices and Requirements 2008

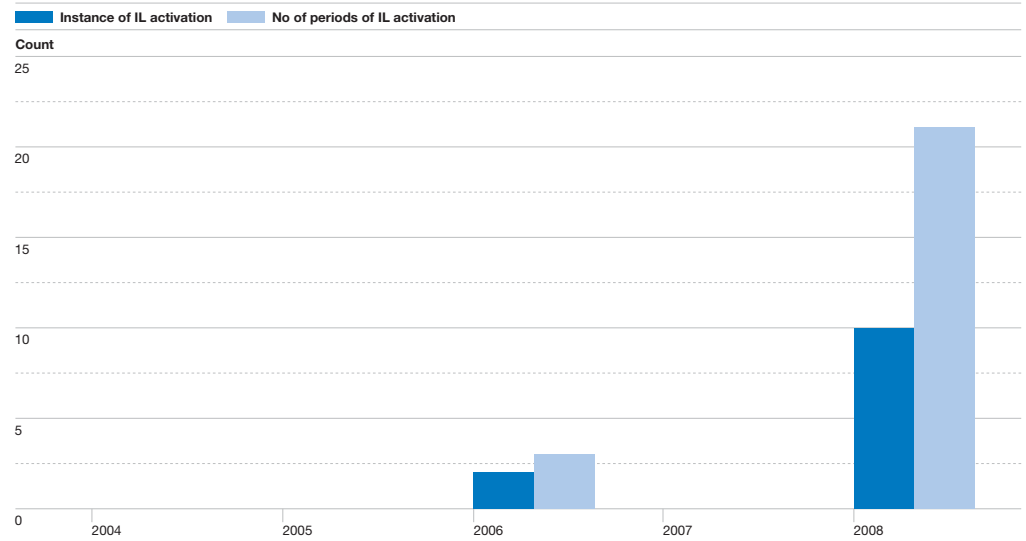


A revision of the primary reserve requirement parameters since 14 November 2007 allowed the primary reserve requirement to decline in 2008. The primary reserve requirement averaged 191MW in 2008, down from 243MW in 2007. This decline provided a downward pressure on the primary reserve price, which eased during 2008 to end at the lowest level since market start, averaging \$0.39/MWh for the year.

The secondary reserve price continued to average below \$1/MWh for the third consecutive year, averaging \$0.64/MWh in 2008. The contingency reserve price traded lower in 2008, averaging \$5.61/MWh. However, the contingency reserve price rose during April and peaked in May, when the energy market faced stronger demand, leading to co-optimisation.

From \$60 million in 2007, the total reserve cost decreased to \$29.5 million in 2008.

Interruptible Load (IL) Activations for Contingency Reserve 2004/08



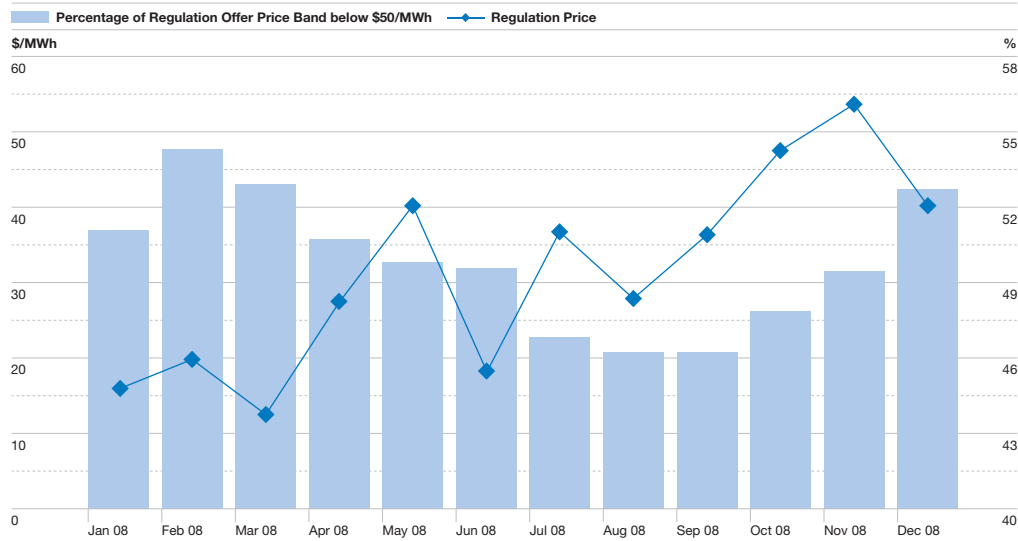
As of 31 December 2008, the total registered capacity for interruptible load (IL) was about 26MW for each class of reserve. The IL market share for 2008 was 5.6 percent for the primary reserve, 4.2 percent for the secondary reserve and 2.2 percent for the contingency reserve.

Since its inception in 2004, the IL was activated in 2006 and in 2008, based on advisory notices from the PSO. 2008 saw the highest frequency of IL activation for contingency reserve, with ten instances of activation and a total of twenty-one periods. Typically, each instance of IL activation lasted for about two periods in 2008. There was no IL activation for primary and secondary reserve.

Ancillary Markets

Market Performance

Regulation Price and Offer Price Band below \$50/MWh (%) 2008



From January to December 2008, the monthly average regulation price ranged from \$13/MWh to \$54/MWh. In November 2008, the regulation price rose to \$54/MWh under circumstances of lower available regulation offer capacity, despite shifts in percentage of regulation offer pricing.

In 2008, the regulation price continued to remain the highest ancillary price, averaging \$31/MWh for the year. However, with the implementation of the period-based regulation requirement since 22 November 2007, the regulation price had eased, and 2008 represents the lowest yearly level for the regulation price since market start.

Regulation Requirement and Available Offer Capacity 2008

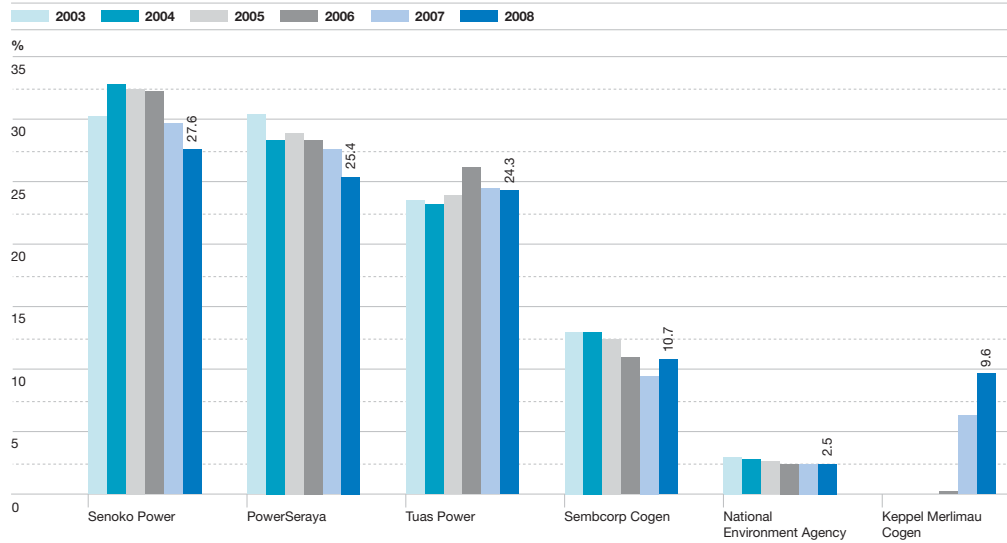


In conjunction with the lowest regulation price since 2003, the total regulation payment contracted from \$102 million in 2007 to \$26 million in 2008.

Competition in the Generation and Retail Markets

Market Performance

Market Share by Generator 2003/08 (based on scheduled generation)

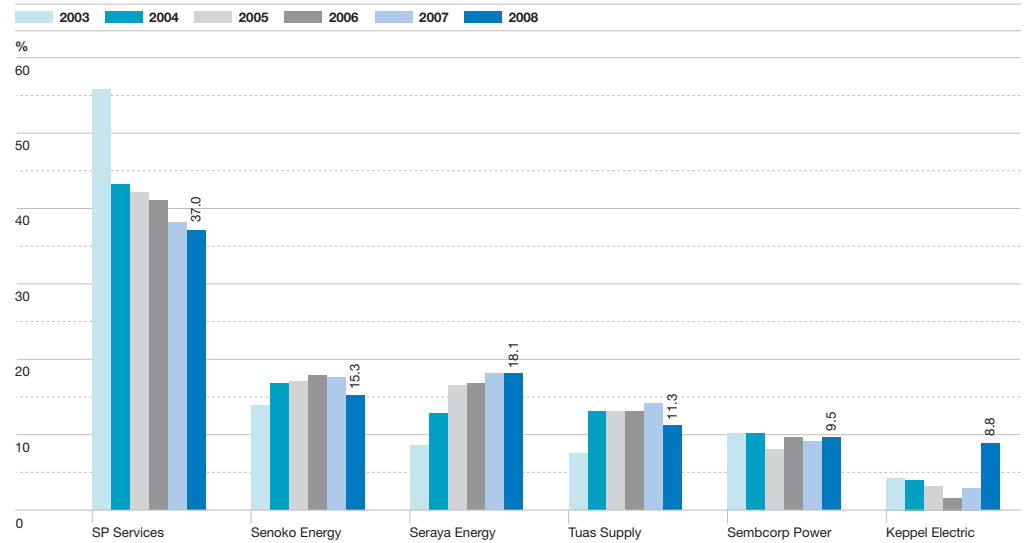


The market share by generator does not add up to 100% due to rounding.

Senoko Power continued to remain the leader in the generation market for the sixth consecutive year. Keppel Merlimau's 2008 increase in market share led to contracting market shares for the top two players. At the same time, Tuas Power maintained its position from 2007.

In the retail market, moderate changes continued to be observed in 2008. Apart from SP Services, the market share for Seraya Energy topped for the second year in a row, with 18 percent in 2008. The market share for Keppel Electric marched closer to the 10 percent mark during 2008.

Market Share of MSSL and Retailers 2003/08



Settlement and Prudential Management

Market Performance

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 for EMC and PSO administrative costs and
- contracted ancillary services (black-start services).

Market participants (MP) 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 2008, EMC issued 21 margin calls and these calls were met within the time frame of two business days.

For 2008, the value of total retail settlement payments (net of bilateral contracts) was \$3.633 billion and the value of credit support at 31 December 2008 was \$411.7 million.

Contracted Ancillary Services

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, e.g., due to a limited number of available suppliers, their prices are regulated.

From 1 April 2008 to 31 March 2009, the only contracted ancillary service required was black-start capability. Black-start service ensures that there is initial generation to supply electric power for system restoration following a complete blackout.

Based on the PSO's operational requirements, EMC procured 68.848MW of black-start service at a cost of \$10.136 million. The capability was sourced from PowerSeraya, Senoko Power and Tuas Power.

Contracted ancillary services 1 April 2008 to 31 March 2009

	Cost incl. GST (million)	Quantity (MW)
Black-start Service	\$10.136	68.848

Market Fees

Market Performance

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 2008 to 31 March 2009

EMC	\$28.450 million	\$0.328/MWh*
PSO	\$16.605 million	\$0.192/MWh*
Total	\$45.055 million	\$0.520/MWh*

* Assumes energy trade of 43,332 gigawatt hours (GWh) per year.

Fees recovered directly from market participants and consumers

Supplier	Service	Method of Assessment
SP Power Assets	Transmission charges	Levied based on actual usage
SP Services (MSSL)	Meter reading and data management	Levied on a per meter basis

ST: 22%

Glossary

Additional Information

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 (MSSL), SP Services. Consumers qualify to be contestable based on their level of 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 in which 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 MSSL, SP Services.

gigawatt (GW)

A measure of electrical power equal to one thousand megawatts. GWh represents the number of gigawatts produced or consumed in an hour.

interruptible load (IL)

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.

market participant (MP)

A person who has an electricity licence issued by the Energy Market Authority (EMA); and has been registered with EMC as a market participant.

megawatt (MW)

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

net treatment of non-reserve charges for non-injecting embedded generators

Starting December 2007, non-injecting generation facilities will be assessed non-reserve charges (EMC fees, PSO fees and Monthly Energy Uplift Charges [MEUC]) based on their net withdrawal (consumption) from the grid. To qualify for this treatment, an embedded generator requires approval from the EMA and registration with EMC as a non-injecting generation facility.

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 MSSL, 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 MSSL, 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 upon 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 produced or consumed in an hour.

USEP

The 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 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.

vesting contract hedge price (VCHP)

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

wholesale market

The transactions made between generation companies and retail companies.

Market Participants' Contact Details

Additional Information

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
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 Traders	Air Products Diamond Energy IUT Singapore Pfizer Asia Pacific Schering-Plough Singapore Banyan Utilities	www.airproducts.com.sg www.diamond-energy.com.sg www.iutglobal.com www.pfizer-pappl-sg.com www.schering-plough.com.sg www.banyan-utilities.com
Market Operator	Energy Market Company (EMC)	www.emcsg.com
Market Support Services Licensee (MSSL)	SP Services	www.spservices.com.sg
Power System Operator	Power System Operator (PSO)	www.ema.gov.sg
Transmission Licensee	SP PowerAssets	www.powergrid.com.sg

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