Layer upon layer of translucent light bands suggest the infinite possibilities that lie within the living energy of electricity. Our design team created the images for this report using a translucent light band in a darkened studio to draw images captured on camera.
Dear Industry Members,

The global financial crisis affected economies in 2009, including Singapore’s, and the National Electricity Market of Singapore (NEMS) was not exempt. Nevertheless, in the main the NEMS continued to be efficient, and prices overall reflected the fundamentals of supply and demand.

The first half of 2009 was difficult for the NEMS, as the recession affected prices and demand. The second half of 2009 saw a strong recovery, with both demand and prices climbing. Despite its volatility, the Uniform Singapore Energy Price (USEP) was still lower compared to 2008. Price spikes occurred but were typically linked to tight supply conditions. However, April saw some sustained high prices, noted by the Market Surveillance and Compliance Panel (MSCP) in its 2009 Annual Report. Supply was affected by a high level of generation maintenance. Demand was below 2008 levels in the first five months, but for the year it ended slightly above the 2008 level. However, 2009 saw the slowest demand growth rate (0.4 percent) since market start. All reserve prices ended higher and the reserve requirement was slightly increased. The regulation price cap was revised in May and the regulation price also ended higher.

The market has continued to attract new investment. Several new market participants (MPs) joined the NEMS and new generation facilities were registered. In addition, we saw the transfer of one incineration plant, and the deregistration of several less-efficient generation units and one incineration plant. All these changes are signs of a healthy market, encouraging competition and the move to more efficient energy generation.

Our government bodies play an important part in maintaining a fair and efficient market. I would like to thank the members of these bodies for their ongoing commitment and significant contributions to evolving the NEMS market framework and overseeing market activities. The Rules Change Panel (RCP) continues to address rule changes to market design that will benefit both industry and consumers. The MSCP continues to play an important role in monitoring and reporting on market behaviour. A more in-depth assessment of market behaviour is provided in the MSCP Annual Report, published at the same time as this report.

In addition to providing a competitive platform, the NEMS is well-positioned to play its part in energy efficiency, energy security, sustainability and response to climate change as part of Singapore’s quest to become a smart energy economy.

Wong Meng Meng
Chairman
Energy Market Company
Market Overview
Market Overview: Market History

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 do the following:

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

### Market Reform Milestones

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corporatisation</td>
<td>1995</td>
</tr>
<tr>
<td>Electricity functions of the Public Utilities Board corporatised Singapore Power formed as a holding company</td>
<td></td>
</tr>
<tr>
<td>Singapore Electricity Pool (SEP), design process began</td>
<td></td>
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<tr>
<td>Singapore Electricity Pool (SEP)</td>
<td>1998</td>
</tr>
<tr>
<td>SEP commenced PowerGrid is SEP Administrator and Power System Operator (PSO)</td>
<td></td>
</tr>
<tr>
<td>Review of electricity industry</td>
<td></td>
</tr>
<tr>
<td>National Electricity Market of Singapore (NEMS)</td>
<td>2000</td>
</tr>
<tr>
<td>Decision for further reform to obtain full benefits of competition New market design process began</td>
<td></td>
</tr>
<tr>
<td>National Electricity Market of Singapore (NEMS)</td>
<td>2001</td>
</tr>
<tr>
<td>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</td>
<td></td>
</tr>
<tr>
<td>National Electricity Market of Singapore (NEMS)</td>
<td>2002</td>
</tr>
<tr>
<td>Draft Market Rules issued Testing and trialling of wholesale market system began</td>
<td></td>
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<tr>
<td>National Electricity Market of Singapore (NEMS)</td>
<td>2003</td>
</tr>
<tr>
<td>NEMS wholesale market trading began Further batches of large consumers introduced to retail contestability</td>
<td></td>
</tr>
<tr>
<td>National Electricity Market of Singapore (NEMS)</td>
<td>2004</td>
</tr>
<tr>
<td>Vesting contract regime introduced Interruptible loads (IL) began to participate in the reserves market</td>
<td></td>
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<tr>
<td>National Electricity Market of Singapore (NEMS)</td>
<td>2005</td>
</tr>
<tr>
<td>New wholesale market trader joined the market and commenced trading as IL provider</td>
<td></td>
</tr>
<tr>
<td>National Electricity Market of Singapore (NEMS)</td>
<td>2006</td>
</tr>
<tr>
<td>Keppel Merlimau Cogen joined the market and started trading Retail contestability expanded to 75 percent of total electricity demand</td>
<td></td>
</tr>
<tr>
<td>National Electricity Market of Singapore (NEMS)</td>
<td>2007</td>
</tr>
<tr>
<td>Removal of the Market Registration Application Fee</td>
<td></td>
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<tr>
<td>National Electricity Market of Singapore (NEMS)</td>
<td>2008</td>
</tr>
<tr>
<td>Sale of Tuas Power to China Huaneng Group in March, Senoko Power to Lion Consortium in September, and PowerSeraya to YTL Power in December Embedded generations participate in the market</td>
<td></td>
</tr>
<tr>
<td>National Electricity Market of Singapore (NEMS)</td>
<td>2009</td>
</tr>
<tr>
<td>On 14 May, implementation of revised regulation price cap of $300/MWh New embedded generation, small generators and incineration plants joined and started trading</td>
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</tbody>
</table>
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.

**New Embedded Generation, Small Generators and Incineration Plants Joined the Market**

2009 saw the entry of one new generator into the market. ISK Singapore joined the NEMS on 2 June with a 9.6MW cogeneration facility. ISK has been granted net settlement and price neutralization by the Energy Market Authority (EMA), and is the third embedded generator in the market after Schering-Plough and Pfizer Asia Pacific. ISK is treated as a non-injecting facility.

In addition, Banyan Utilities, which registered as a market participant (MP) on 13 November 2008, started operations of its 5MW cogeneration facility on 16 March 2009.


The 55MW Senoko Waste-to-Energy incineration plant, formerly owned by the National Environment Agency (NEA), was transferred on 7 September. On 6 October an incineration plant was registered by Keppel Seghers Tuas Waste-to-Energy. On 13 October the NEA deregistered an existing 16MW incineration unit from the NEMS. By year’s end, the total incineration plant installed capacity stood at 2.63 percent.

### Participants and Service Providers in the NEMS

<table>
<thead>
<tr>
<th>Active Generators</th>
<th>Keppel Merlimau Cogen</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Keppel Seghers Tuas Waste-to-Energy</td>
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<tr>
<td></td>
<td>National Environment Agency</td>
</tr>
<tr>
<td></td>
<td>PowerSeraya</td>
</tr>
<tr>
<td></td>
<td>Sembcorp Cogen</td>
</tr>
<tr>
<td></td>
<td>Senoko Power</td>
</tr>
<tr>
<td></td>
<td>Senoko Waste-to-Energy</td>
</tr>
<tr>
<td></td>
<td>Tuas Power Generation*</td>
</tr>
<tr>
<td>Wholesale Market Traders</td>
<td>Air Products</td>
</tr>
<tr>
<td></td>
<td>Banyan Utilities</td>
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<tr>
<td></td>
<td>Diamond Energy</td>
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<tr>
<td></td>
<td>IUT Singapore</td>
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<tr>
<td></td>
<td>ISK Singapore</td>
</tr>
<tr>
<td></td>
<td>Pfizer Asia Pacific</td>
</tr>
<tr>
<td></td>
<td>Schering-Plough</td>
</tr>
<tr>
<td>Active Retailers</td>
<td>Keppel Electric</td>
</tr>
<tr>
<td></td>
<td>Sembcorp Power</td>
</tr>
<tr>
<td></td>
<td>Senoko Energy Supply</td>
</tr>
<tr>
<td></td>
<td>Seraya Energy</td>
</tr>
<tr>
<td></td>
<td>Tuas Power Supply</td>
</tr>
<tr>
<td>Market Support Services Licensee (MSSL)</td>
<td>SP Services</td>
</tr>
<tr>
<td>Market Operator</td>
<td>Energy Market Company</td>
</tr>
<tr>
<td>Power System Operator (PSO)</td>
<td>Power System Operator</td>
</tr>
<tr>
<td>Transmission Licensee</td>
<td>SP Power Assets</td>
</tr>
</tbody>
</table>

* Tuas Power changed its name to Tuas Power Generation in September 2009.
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.

Energy, Reserve and Regulation Products

<table>
<thead>
<tr>
<th>Description</th>
<th>Purchaser</th>
<th>Seller</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>Generators</td>
<td>Generators</td>
</tr>
<tr>
<td>Reserve</td>
<td>Generators,</td>
<td>Generators, Wholesalers</td>
</tr>
<tr>
<td>Regulation</td>
<td>Generators and Retailers</td>
<td>Generators</td>
</tr>
</tbody>
</table>

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.

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.
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.
Dear Industry Members,

I am proud to announce that the Rules Change Panel (RCP) has addressed a series of rule changes in 2009, and tackled a wide range of technical, financial and administrative issues. These changes to the market design will benefit both industry and consumers in Singapore’s evolving electricity landscape, and complement rule changes directed by the EMA.

The Market Clearing Engine (MCE) plays a crucial role in the NEMS by clearing offers and scheduling MPs, while taking into account physical system conditions. Given its important role in balancing economic efficiency with system security constraints, EMC consistently applies great effort to enhance the MCE. I am pleased to announce that one such enhancement, discussed and approved by the RCP, is the “Mixed Integer Programming (MIP)-Based Modeling of Reserve Constraints”. This change involves using an advanced branch of linear programming to model more accurately the reserve capability of generating units. Such advance modeling enhances system security by ensuring that generating units scheduled for reserve are able to respond when needed.

In addition to improving the NEMS’s technical capabilities, the RCP also strives to ensure that the Market Rules remain relevant. A case in point is the rule change on “Amendments to the Requirements for Transfer of Registration of Registered Facilities”. Previously, MPs faced a dilemma in a corporate restructuring, involving transferring market licences and registered facilities between subsidiaries. Under the previous Market Rules, the new subsidiary would need to hold a market licence for 10 business days before generation facilities could be transferred. At the same time, the old subsidiary would cease to hold a licence, thus resulting in a 10-day shut-down period when the MP could not generate. Such an interruption has serious commercial implications for the transferor/transferee, as well as the market, if the transfer capacity is large. The Market Rules were thus amended for greater flexibility, such that EMC can commence the transfer of registered facilities if it is satisfied that the applicant is likely to meet all the requirements for MP registration on the proposed date of transfer.

In a similar rule change, there were concerns that if the existing Conflict of Interest (COI) rules were overly restrictive, the MSCP could lose suitable and interested candidates. A rule change was thus passed to more flexibly manage such potential conflict for MSCP candidates or members, without compromising their independence.

In addressing rule change proposals, the RCP adopts a holistic perspective and considers how changes would affect all MPs and the market as a whole. We remain cognizant of the additional costs that such changes could impose, and strive for pragmatism by subjecting all rule changes to a cost-benefit analysis where applicable. For example, a recent rule change proposal considered shortening the settlement cycle, streamlining certain processes so that debtors in the wholesale electricity market could be paid earlier to reduce business risks. Our analysis found that costs negate the benefits: although creditors would enjoy interest savings from receiving payments earlier, and debtors could reduce their credit support, the high overall system implementation costs and higher interest costs that debtors would incur from making earlier payments negated the benefits. As such, the panel decided to postpone consideration of this proposal until such time when it could become feasible.

This year also marked the replacement for one member of the RCP, with Mr Yu Tat Ming being replaced by Mr Brendan Wauters as Senoko Power’s representative on the RCP. I would like to thank Mr Yu for his valuable contributions to the RCP, and look forward to working with the new Panel on the upcoming challenges.

I would like to express my thanks to all who have contributed in one way or another to making 2009 such an eventful year for the RCP, from my fellow panel members for expressing their diverse views and willingness to enter into constructive discussion and debate during the RCP meetings, to our EMA regulators and EMC Board for their open and collaborative approach in considering RCP’s rule change proposals, and to all MPs who have contributed by providing comments or data to the rule change process. I would also like to thank EMC’s Market Administration Team for their diligent efforts and insightful analyses, which were a great help to the RCP in arriving at decisions.

As I look forward to the new year ahead, I have every confidence in the continued support of all parties as the Panel continues to contribute to the evolution of the Singapore electricity market.

Dave Carlson
Chair,
Rules Change Panel
The following rule changes were discussed and approved, as part of the RCPs continual efforts to guide the evolution of the electricity market.

Mixed Integer Programming (MIP)-Based Modeling of Reserve Constraints

The amount of reserve that a generating unit can provide varies with its energy output; below a certain energy output threshold, a generating unit is incapable of providing any reserve. However, due to existing modelling limitations, the generating unit’s reserve capability is not set to zero even when its energy output is below the threshold. This modelling limitation causes system security risks, as generating units operating below the threshold could be scheduled for reserve, yet are unable to do so when needed. It also raises equity issues, as generating units are paid for a service which they are unable to provide.

This rule change introduces the use of mixed-integer programming (MIP), an advanced branch of linear programming that allows the MCE to set to zero the reserve capability of generating units if their energy output is below the threshold. The MIP formulations will apply only to primary and secondary reserves but not to contingency reserves. This is because the generating unit’s reserve capability is not set to zero even when its energy output is below the threshold. This modelling limitation causes system security risks, as generating units operating below the threshold could be scheduled for reserve, yet are unable to do so when needed. It also raises equity issues, as generating units are paid for a service which they are unable to provide.

Amendments to the Requirements for Transfer of Registration of Registered Facilities

Under current Market Rules, a MP can transfer the registration of its registered facilities under the following circumstances:

- the person has applied to the EMC for registration as a MP; and
- the registration of its registered facilities under the following key changes:
- the transfer request is submitted at least 10 business days before the proposed date of transfer.

These rules create a dilemma in the event of a corporate restructuring, when an existing MP transfers its generation business to transferee. Since B must be a MP for at least 10 business days before the proposed transfer date, and B must have a generation license before it can be registered as a MP, this implies that both A and B would each need to hold a generation licence for the same facilities during these 10 business days. This is clearly not a feasible outcome.

To address this issue, the Market Rules were changed to allow a non-MP to be identified as the proposed transferee if:

- the person has applied to the EMC for registration as a MP, and
- the applicant is likely to meet all the requirements for MP registration on the proposed date of transfer.

The transferee would be required to hold a valid and relevant electricity licence, and become a MP only on the date of transfer. However, generation can begin on the exact day that the transfer is effected.

Conflict of Interest Management for the MSCP

Given the MSCP’s role as an independent body, existing Market Rules govern potential conflict of interest (COI) for MSCP members. However, with the small pool of suitable and interested candidates to the MSCP, there are concerns that the rules for candidacy could be overly restrictive.

A review of the COI rules was conducted, with the following key changes:

- Previously, a MSCP candidate or member was disqualified so long as he/she or his/her spouse or any of their relatives had any form of commercial affiliation with EMC, the PSO, the MSSL, a MP or any of their affiliates. This requirement is now relaxed so that the MSCP candidate or member is disqualified only if the commercial affiliation is deemed to be substantial and meaningful by the EMC Board.
- Similarly, a MSCP candidate or member was previously disqualified so long as he/she or any of his/her relatives had any form of commercial affiliation with EMC, the PSO, the MSSL, a MP or any of their affiliates. This requirement was also relaxed such that COI arising from relatives is no longer a reason for outright disqualification from MSCP appointment, unless the relatives have substantial and meaningful commercial affiliation with EMC, the PSO, the MSSL, a MP or any of their affiliates.

After appointment, if the MSCP member has a potential conflict, including but not limited to cases whereby his relative is employed or has a commercial affiliation with any parties involved in a specific MSCP case, he/she shall declare the conflict. If he/she does not voluntarily step down for that case, then he/she may continue to be involved in the case only if other non-conflicted MSCP members decide, by a simple majority, that the conflict does not prevent him/her from acting independently and impartially in respect of the case.

Review of “Application Form for Load Facility Registration” and “Request for Transfer of Load Registered Facility”

This issue deals with amendments to the two registration-related forms: “Application Form for Registration of Load Facility” and the “Request for Transfer of Load Registered Facility”, which were drafted in 2003 to introduce interruptible load (IL) into the market. The changes to these forms and corresponding sections of the Market Rules improve clarity and ensure consistency with other governing documents.

Change in the NEMS Settlement Clearing Bank

The Market Rules provide for EMC to change the settlement clearing bank on condition that the EMC Board deems that the new bank is reasonably acceptable and MPs are informed in writing at least 60 business days before the change takes effect.

On 26 March, the EMC Board decided to change the NEMS settlement clearing bank from Citibank to OCBC. This change to the Market Manual was needed to implement the EMC Board’s decision.
Extension of Exemption to Allow Affiliates of Temasek Holdings to be Represented on the RCP

The composition of the RCP is intended to be a fair and balanced representation of the industry; thus, affiliated companies should ideally not be concurrently represented on the RCP. However, an exemption currently allows MPs or the MSSL and their affiliates to be concurrently represented on the RCP if they are affiliates of Temasek Holdings Pte Ltd. The deadline for exemption was until 31 December 2009.

Given that a number of companies in the NEMS are still affiliated under Temasek Holdings Pte Ltd (i.e., the transmission licensee, the MSSL, Sembcorp Cogen Pte Ltd, Sembcorp Power Pte Ltd, Keppel Merlimau Cogen Pte Ltd and Keppel Electric Pte Ltd), this exemption was extended to 31 December 2010.

Other Issues

In addition to the earlier rule changes that were implemented, the Panel discussed the following proposals, deciding that the timing was not right for implementation, or the potential benefits did not justify the costs.

Shortening of the Settlement Cycle

This proposal explored options to shorten the current settlement cycle in the NEMS, with the twin goals of managing business risks in the market and reducing the credit support required from MPs for their trading exposure. Analyzing the different phases of the settlement cycle, EMC proposed the following:

- Remove the Preliminary Settlement Statement and bring forward the Final Settlement Statement. Currently, MPs are given a Preliminary Settlement Statement six business days (BD) after the trade date (T+6BD), so that they can identify and raise any errors before the Final Settlement Statement at T+10BD. This proposal removes the Preliminary Settlement Statement, and brings forward the Final Settlement Statement to T+6BD, resulting in a time savings of 4BD.
- Bring forward the payment by debtors and receipt of funds by creditors to 2BD and 3BD (from the previous 4 and 6BD) after receipt of Final Settlement Statement.

This proposal would incur one-time system implementation costs and higher interest costs for debtors having to make payments earlier. However, creditor MPs earn higher interest by receiving their payment earlier, while debtor MPs (MSSL and retailers) receive a 20 percent reduction in the credit support they are required to provide, since they now make earlier payments.

Based on the industry’s inputs, the proposal fails the cost-benefit assessment. The Panel thus decided to postpone the proposal until such time when the proposal’s feasibility changes, contingent on the following factors:

- the cost and availability of banker guarantees (BGs), which would affect the potential savings from the proposal;
- full retail competition, which could affect the billing cycle for non-contestable consumers or the additional interest costs borne by the MSSL arising from having to pay earlier for non-contestable consumers;
- an increased number of MSSL contestable consumers, which would increase the recurrent costs of increasing metering frequency from weekly to daily, and increase the interest costs borne by the MSSL from having to pay earlier for contestable consumers.

Disqualification of Banker’s Guarantees Issued by the NEMS Clearing Bank as Credit Support

To manage credit risks in the NEMS, MPs are required to provide credit support for their potential trading exposure. Under existing rules, the acceptable forms of credit support include the following:

- BGs issued by financial institutions rated “A” or better by Standard & Poor’s (S&P),
- cash deposits, and
- Singapore government treasury bills.

Currently, most credit support held by EMC is in the form of BGs, which leads to concentration risks when BGs are drawn from the NEMS Clearing Bank (currently OCBC). If the clearing bank defaults, the funds in the NEMS settlement accounts could be frozen and, in the event a MP defaults, EMC would be unable to draw upon BGs issued from the same clearing bank. To diversify this risk, EMC proposed to disqualify BGs drawn from the clearing bank.

The RCP noted that the diversification achievable is relatively limited; and that the largest concentration risk stems from SP Services drawing its whole BG amount from the same bank. In addition, the risk manifests itself only if both the issuing bank and the retailer/MSSL default, which is unlikely. Further, safeguards exist in the requirement that BGs have to be drawn from banks with an S&P rating of “A” and above.

Given the significant costs and minimal benefits, the RCP decided not to support the proposal to disqualify BGs drawn from the clearing bank. The Panel decided instead to closely monitor the BG concentration and financial health of the BG-issuing banks.

The System Operation Manual (SOM) is a set of technical operation procedures that the PSO and relevant MPs must comply with when operating in the NEMS environment. Under the current Market Rules, proposed changes to the SOM are published for consultation with the MPs and the RCP at least ten days before they take effect, with the PSO having the right of final approval.

EMC received a proposal to subject SOM amendments to the same process as Market Rule changes so as to ensure consistency, as SOM amendments have a material commercial impact on the relevant stakeholders. EMC did not agree with the original proposal but instead proposed that SOM amendments be subjected to the EMA's approval, in the following process:

1. the PSO proposes changes to the SOM;
2. the MPs comment on the impact of the changes, and possible alternatives; and
3. the PSO's proposal and the MPs' comments are submitted to the EMA, which gives final approval.

The EMA responded to the proposal by stating that the PSO's decision on implementing SOM changes already constitutes the EMA's approval, and that the EMA is of the view that the current process for changes to the SOM is appropriate and necessary to enable the EMA to discharge its functions. Based on the EMA's response, the RCP decided not to follow up with the proposal. Instead, the Panel requested that the PSO looks into enhancing the consultation process for SOM changes, so that all stakeholders could engage the PSO in a meaningful and constructive discussion on proposed changes.

Review of EMC Fees on Interruptible Load (IL) Providers

Currently, the majority of EMC's administrative costs are recovered from energy trade by apportioning the fees over energy injection and withdrawal quantities. The Panel received a proposal to charge EMC fees to IL providers of reserve, since they utilize EMC services. For consistency, if EMC fees were recovered from IL providers, EMC would also have to charge fees to other buyers and sellers of reserve and regulation.

EMC's analysis found that from the perspective of fairness, there is a reasonable basis to charge EMC fees to reserve and regulation to reflect correctly their respective costs. However, such fees would have no material impact on economic efficiency, since reserve and regulation price tend to be inelastic and EMC fees would be eventually passed on to consumers. Weighing the minimal benefits with the likely system costs and resources required to implement the change, the RCP voted to maintain the current method of charging EMC fees.

EMA-Directed Rule Changes

In addition to the rule changes considered by the RCP, EMC also implemented the following EMA-Directed changes pursuant to Section 46 (2)(b) of the Electricity Act:

Revision of Regulation Price Cap

The NEMS was characterised by a prolonged period of high regulation prices from late 2006 to early 2007. The EMA directed EMC to modify the Market Rules to reflect the EMA's policy decision to revise the price cap for regulation offer and settlement from the existing $2,750/MWh to $300/MWh. The revision is intended to avoid the recurrence of such high regulation prices.

Tender of Vesting Contract

The EMA has decided to tender out a portion of the load of the non-contestable consumers to competitive bids from the gencos. This tendering brings the benefits of competitive pricing to these customers, and constitutes an incremental step towards the longer-term objective of full retail contestability.

Initially, the tender will be for three percent of the total load, comprising three tranches of one percent each. The tender was called and awarded in fourth quarter 2009. The supply contracts for the first tender will be for the period from second quarter 2010 to fourth quarter 2010.

Exemption of Contestable Consumers from Licensing to Trade in the Wholesale Electricity Markets

The EMA decided to exempt contestable consumers from licensing requirements, if they intend to be registered as MPs to trade in the wholesale electricity markets wholly to purchase electricity for their own consumption.
Dear Industry Members,

Dispute Resolution and Compensation Panel

The Dispute Resolution and Compensation Panel (DRCP) was established under the Market Rules to provide dedicated dispute resolution services to the NEMS when required.

This past year, I have continued to expand the panel of local and foreign members of the DRCP to ensure that NEMS market players always have access to a pool of capable and qualified professionals who are able to assist the industry when necessary.

DMS Contacts

Pursuant to the Market Rules, each market participant has nominated a Dispute Management System (DMS) contact to be the first point of engagement in the event of a dispute.

As part of my responsibilities, I help to provide training in dispute resolution and the Market Rules for DMS contacts.

On 15 May, a workshop entitled “Managing Difficult Conversations” was conducted by Associate Professor Joel Lee for all DMS contacts. Professor Lee teaches Dispute Resolution at the Faculty of Law, NUS. The DMS contacts for the market are as follows:

1. Air Products Asia - Tay Wee Ann
2. Air Products Asia - Shawn Zhang
3. Diamond Energy - Mohammed Rozaiman Rosidi
5. Energy Market Company - Coco Choo
6. Keppel Energy - Annie Tan
7. Keppel Energy - Joelyn Wong
8. Keppel Energy - Suniihro Kawamura
9. Keppel Energy - Janice Bong
11. National Environment Agency - Roland Tan
12. Pfizer Asia Pacific - Tan Meng Tong
13. Pfizer Asia Pacific - Lee Chin Hoo
15. Power System Operator - Kwok Foo Seng
16. PowerSeraya - Albert Siah
17. PowerSeraya - Toh Hui Ting
18. Schering-Plough - Kanagasabai Ravichandran
19. Seraya Energy - Elaine Syn
20. Seraya Energy - Daniel Lee
21. Sembcorp Cogen - Loh Chin Seng
22. Sembcorp Industries - Chua Gwei Heng
23. Sembcorp Industries - Aeron Hong
24. Senoko Energy - Eveline How
25. Senoko Energy - Sim Mei Ling
27. Senoko Energy Supply - Michelle Lim
28. SP Powergrid - Chan Hung Kwan
29. SP Services - Lawrence Lee
30. SP Services - Budiman Rosli
31. Tuas Power Generation - Philip Tan
32. Tuas Power Generation - Priscilla Chua
33. Tuas Power Supply - Jazz Feng

Conclusion

I am happy to report that no disputes were filed with me in 2009. I thank the DRCP panel members and DMS contacts for their contributions, and look forward to continuing to support the dispute resolution needs of all NEMS market players in the coming year.

George Lim
Senior Counsel
Dispute Resolution Counsellor
Market Performance
Market Performance: Overview of the Year

The USEP fell in 2009, but all ancillary prices rose across the board.

In 2009 the Uniform Singapore Energy Price (USEP) fell, while the four ancillary prices rose across the board in the National Electricity Market of Singapore (NEMS). The USEP declined by 8.9 percent in 2009 despite demand edging up and supply dipping. The drop in the USEP was in line with a lower oil price, which fell from its peak in 2008. On the other hand, all four ancillary prices climbed in 2009, with the secondary and contingency reserve prices setting their new annual highs.
Market Performance: Overview of the Year

Total Value of Products Traded 2003/09

With a lower USEP, the total products traded in the NEMS declined against 2008.

With the USEP declining in 2009, the value of all products traded for 2009 fell 6.6 percent against 2008, totalling $6.46 billion dollars for the year. For 2009, the energy market represented 97.7 percent of all products traded, while the reserve market represented 1.7 percent and the regulation market, 0.6 percent.

Annual Metered Demand 2003/09

Annual electricity consumption growth rate slowed to its lowest level since the NEMS’ inception in 2003.

Electricity purchased by MPs is settled using metered demand provided by the Market Support Service Licensee (MSSL). Metered demand measures the electricity consumption at the withdrawal nodes but excludes transmission losses and exempted embedded generators.

Total metered demand was lower for the first quarter of 2009 than for the same period in the previous two years, reflecting that the economy was in recession. Though total metered demand reached 39 terawatt hours (TWh) for 2009— the highest level since market start in 2003 — the 2009 growth rate of 0.4 percent was the slowest since 2003.
During 2009, the total registered generation capacity varied, especially for the National Environment Agency (NEA) and small generators (generation capacity below 10MW). Small generators are registered as Generation Settlement Facilities (GSFs) in the NEMS.

With a new market entrant (Keppel Seghers), as well as the privatisation of an incineration plant (Senoko WTE) and deregistration of another (Ulu Pandan; see details on page 6 of this report), the total registered capacity for incineration plants increased in 2009 to a total installed capacity of 259MW. The total registered capacity of small generators rose from 17MW in 2008 to 31MW in 2009 with the entrants Banyan Utilities and ISK Singapore.

In 2009, PowerSeraya repowered two new CCGT units (both units are in the commissioning stage) and deregistered one ST unit. These units will boost the total CCGT capacity by 13.7 percent to 6,132MW. The first repowered CCGT unit is tentatively due for commercial operation in March 2010, while the second is scheduled for operation in May 2010.

Senoko Power’s gas turbine was reinstated in 2009 after being deregistered since 2005. In addition, one interruptible load (IL) provider deregistered in 2009. Nevertheless, the total installed capacity expanded by 1.2 percent in 2009.
Annual Generation Offer Capacity by Plant Type 2003/09

CCGT offer capacity fell in 2009

The CCGT offer capacity grew steadily since 2003 and reached its peak in 2008. Despite an increase in the CCGT registered capacity during the year, 2009 saw the first small decline after six years of steady growth, as the CCGT offer capacity declined by 0.9 percent to 4,700MW.

The drop in the 2009 CCGT offer capacity partially reflects the slight increase in the CCGT’s maintenance during the year.

Annual Market Share by Plant Type 2003/09

The CCGT market share growth also saw a slight dip in 2009 to 81.4 percent from 81.5 percent in 2008. This decline was in line with the dip in the CCGT offer capacity.

Based on scheduled generation. The market share for GT units was 0.02 percent in 2009, 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.
Market Performance: Energy Demand

Monthly Forecasted Demand 2003/09

Demand declined in the first five months of 2009, then climbed in June.

Starting in June, demand rose steadily, with positive YOY growth for the rest of the year. December hit the highest YOY growth for the year with 9.2 percent. The June demand of 4,841MW set a new record-high since market start.

Quarterly Metered Demand 2008/09

Compared with the same quarter in 2008, electricity consumption dipped in Q1 2009 before recovering.

As compared quarter-to-quarter (QOQ), metered demand posted negative growth in the first two quarters of 2009, then showed positive growth in the second two quarters.

System demand forecast is a key component in determining the USEP. Provided in real-time by the Power System Operator (PSO), the system demand forecast is the forecasted electricity consumption of Singapore, excluding transmission losses and exempted embedded generators.

The economic downturn weakened demand at the start of 2009, with levels for the first five months of 2009 falling below 2008 levels. As a result, negative year-on-year (YOY) growth was recorded for the first five months of 2009, with January registering the largest drop of 8.6 percent.
Monthly Generation Offer Capacity by Plant Type 2009

Offer capacity fluctuated due to demand and generation maintenance conditions

Similar to 2008, CCGT units contributed 78 percent of the total offer capacity in 2009, with an average offer capacity of 4,700MW. ST and GT units supplied 18 and 4 percent, respectively. January recorded both the lowest YOY growth in total offer capacity as well as the highest level of generation maintenance, reflecting the lowest YOY growth in demand, minus 8.6 percent.

Monthly Generation Maintenance 2009

Generation maintenance continued to exert its influence on the offer capacity

For 2009, the maintenance generation averaged 1,283MW, a 16 percent increase from 2008. CCGT units comprised 0.4 percent of the increase in total maintenance, while the rest were ST and GT units.
Changes in the 180-CST HSFO influenced the offer prices in the energy market

The relevant fuel oil price for the Singapore electricity industry [180-centistoke high sulphur fuel oil (180-CST HSFO)] climbed in 2009, starting from US$40 per barrel (bbl) in January, and peaking at US$74/barrel in November.

With fuel oil or natural gas (natural gas price contracts are pegged to the 180-CST HSFO oil benchmark) as a major operational cost, this climb in the 180-CST HSFO pressured the prices of the offer capacity. The percentage of the energy offer price proportion below $80 per megawatts per hour (MWh) descended from 78 percent in January to 59 percent in December.

Stronger demand in the second half of 2009 helped support a higher ST utilisation rate, while the CCGT utilisation rate remained steady throughout the year

Low demand kept the ST utilisation rate below 20 percent in the first three months of 2009. As demand recovered, the ST utilisation rate rose, reaching a high of 28 percent in October. With a steady flow of CCGT supply, the CCGT utilisation rate ranged steadily between 66 and 76 percent in 2009.
As a result of lower spare capacity, the USEP rose above VCHP from April to October 2009. Higher spare capacity and low demand kept the USEP low during the first quarter of 2009. As the spare capacity dropped between April and October, the USEP rose.

The USEP averaged $148/MWh for the year. This is the first time in the history of the NEMS that the annual average USEP was higher than the vesting contract hedge price (VCHP), which averaged $146/MWh for 2009.

Despite lower peak demand, the USEP grew more volatile in 2009, with levels reaching close to $4,500/MWh. In 2009, the USEP registered its highest volatility since market start, with the standard deviation measuring $140/MWh for the year as compared to $58/MWh in 2008. Except for January and November, the USEP spiked over $500/MWh in every month in 2009.

The highest USEP for a single period was recorded in April at $4,499/MWh.
Daily USEP, System Demand and Offer Capacity 2009

Periodical mismatch of demand and supply resulted in a series of price spikes
The key observations on USEP fluctuations during 2009 are as follows:

A. The USEP hit its record daily high and second daily high on 21 and 22 April, at $848/MWh and $666/MWh accordingly. In addition, the daily average USEP rose above $400/MWh on two more days in April. Three CCGT units out on maintenance, forced outages or temporary de-ration of generation units coincided with strong demand to tighten supply and raise prices.

B. The USEP hit two peaks in the month of May, reaching $390/MWh on 13 May and $299/MWh on 26 May. On 13 May, the price spike was the result of three back-to-back CCGT forced outages; 26 May saw tight supply conditions.

C. The USEP surged above $240/MWh for seven days in June. These high USEPs occurred between 1 June and 18 June, with price ranging between $242/MWh and $342/MWh. The tight supply conditions in June, the result of one CCGT unit under maintenance, coincided with demand near its peak for the year.

D. Two CCGT units were concurrently on maintenance on 16 August, resulting in tight supply conditions; the USEP averaged $241/MWh that day.

E. Two notable price spikes were recorded in September. On 4 September, tight supply conditions created by one ST forced outage and one CCGT unit on maintenance pushed the USEP to an average $302/MWh. On 13 September, the USEP averaged $312/MWh when demand rose to its peak for that day.

F. Seven days in October registered high USEPs, averaging between $244/MWh and $368/MWh. Tight supply conditions in October were the result of four instances of CCGT forced outage while other CCGT units were on planned maintenance.

G. On 2 December, one CCGT unit was on maintenance, tightening supply; the USEP averaged $241/MWh for that day.
Total reserve cost scaled to a new high in 2009 as reserve prices rose across the board

Ancillary markets continued to serve as the pillar of reliability in the NEMS to match periodical imbalances between demand and supply. All four forms of ancillary products: primary, secondary and contingency reserves plus regulation are vital requirements in the NEMS to run a safe and reliable electricity market. In 2009, the ancillary markets made up 2.3 percent of total market transactions.

In 2009, reserve prices showed an upward trend; both secondary and contingency reserve prices rose to new annual highs. These rises in the reserve prices pushed up the total reserve cost to its highest level of all time at $107 million for the year (approximately 1.7 percent of all products traded in the NEMS).

Primary reserve price peaked in May accompanying tight supply conditions

The primary reserve price hit a high and a low in 2009, reaching a two-year high in May at $6.40/MWh after experiencing tight supply conditions, and falling to a fifteen-month low in November at $0.08/MWh for the month.

In 2009 the primary reserve price averaged $1.70/MWh.
Monthly Secondary Reserve Price, Requirement and Offer Capacity 2009

Higher secondary reserve price seen between April and October

The secondary reserve price rose between April and October. Under the same similar tight supply conditions that affected the primary reserve market, the monthly secondary reserve price peaked in May, reaching its monthly pinnacle for the year at $23.02/MWh.

The rising secondary reserve price reflects changes in requirements, offer capacity, offer prices and co-optimisation with other markets in the NEMS.

Annual Secondary Reserve Price, Requirement and Offer Capacity 2004/09

A drop in the offer capacity in the secondary reserve market led to higher price

Overall, the secondary reserve price averaged its highest annual price of all times at $8.46/MWh, partly due to lower offer capacity in the secondary reserve market.
Contingency reserve price hit twin peaks in 2009

The contingency reserve price continued to rise and fall closely with the energy market, registering similar twin peaks for the year, in April and June. These highs were partly due to the energy price spikes which affected the contingency reserve price under co-optimisation.

The contingency reserve price averaged $17.52/MWh in 2009.

A drop in IL activities in 2009 was partly due to the departure of one IL provider

As of 31 December 2009, the total registered capacity for IL was about 18MW for each class of reserve, a drop from 26MW in 2008. One IL provider was decommissioned on 2 July, reducing the total number of IL providers in the NEMS from three to two.

The IL market share for 2009 was 3 percent for the primary reserve, 2.3 percent for the secondary reserve and 1 percent for the contingency reserve.

Since its inception in 2004, the IL was activated in 2006, 2008 and 2009, based on advisory notices from the PSO. 2009 saw a drop in the IL activation for the contingency reserve, with eight instances of activation and a total of fourteen periods. Typically, each instance of IL activation lasted for about one hour, or two periods, in 2009. In 2009, no IL activation occurred for primary and secondary reserve.
The "reserve provider group effectiveness" guidelines stipulate the grouping of reserve responsiveness of all reserve providers in the NEMS. Group A reflects the highest level of reserve response at 0.95 and Group E reflects the lowest level of 0.55.

Generation units receive incentives for remaining in the higher category of reserve provider group effectiveness. Generation units categorised under Group A receive reserve payments at 95 percent of their scheduled reserve.

Over the last seven years, the weighted average failure probability declined in each passing quarter, reflecting steadier running of generators as well as fewer generation forced outages.
Decline in the regulation offer capacity sent the regulation price rising

From January to December 2009, the monthly average regulation price ranged from $25/MWh and $96/MWh. The regulation price rose above $60/MWh in April, May, June and October due to co-optimisation as well as changes in the offer capacity. The regulation requirement was revised from 87MW in January to 82MW in February for the rest of the year.

The two measures set in the regulation market, between November 2007 and May 2009, allowed the regulation price to trend steadier

In 2009, the regulation price continued to remain the highest ancillary market price, averaging $55/MWh for the year. The regulation price was also higher than last year's, despite the revision of the regulation cap price implemented on 14 May under the EMA's directed rule change. The regulation cap price was revised from $2,750/MWh to $300/MWh.

In conjunction with the higher regulation price in 2009, the total regulation payment expanded from $26 million in 2008 to $44 million in 2009.
PowerSeraya was the leader in generation market share for 2009. Senoko Power dipped to the second position and Tuas Power Generation held the third.

SP Services remained the dominant player in 2009, with its increased market share halting its sliding trend in 2009. The retail market enjoyed continuous competition in 2009. Seraya Energy continued to increase its retail market share while Senoko Energy and Tuas Supply continued to shed their shares. After holding on to the smallest market share since 2003, Keppel Electric surpassed Sembcorp Power in 2009.
Energy Market Company (EMC) is the financial clearing house for the wholesale market and settles the following transactions:

- energy,
- ancillary market products - three classes of reserve (primary, secondary and contingency) and regulation
- bilateral and vesting contracts,
- uplift charges,
- financial adjustments,
- fee recovery of EMC and the PSO administration costs and
- contracted ancillary services not provided through the ancillary market (black-start services).

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 credit support protects EMC and other market participants (MPs) from payment defaults. EMC reviews the risk exposure of MPs on a daily basis.

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 credit support. In 2009, EMC issued 60 margin calls and these calls were met within the time frame of two business days.

For 2009, the value of total retail settlement payments (excluding bilateral contracts between MPs) was $2.621 billion and the value of credit support at 31 December 2009 was $349.26 million.

EMC negotiates and enters into ancillary services 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 2009 to 31 March 2010, 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 $12.25 million. The capability was sourced from PowerSeraya, Senoko Power and Tuas Power Generation.

### Contracted Ancillary Services 1 April 2009 to 31 March 2010

<table>
<thead>
<tr>
<th>Service</th>
<th>Cost incl. GST (million)</th>
<th>Quantity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black-start Service</td>
<td>$12.25</td>
<td>68.848</td>
</tr>
</tbody>
</table>
The costs associated with the wholesale functions of the NEMS are recovered directly from the wholesale market or from MPs and consumers.

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

### EMC and PSO Fees Recovered Directly From the NEMS 1 April 2009 to 31 March 2010

<table>
<thead>
<tr>
<th></th>
<th>Amount</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMC</td>
<td>$28.641 million</td>
<td>$0.369/MWh</td>
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<tr>
<td>PSO</td>
<td>$17.147 million</td>
<td>$0.221/MW/h</td>
</tr>
<tr>
<td>Total</td>
<td>$45.788 million</td>
<td>$0.591/MWh</td>
</tr>
</tbody>
</table>

* Total volume of electricity assumed at 38,758GWh

### Fees Recovered Directly From MPs and Consumers

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Service</th>
<th>Method of Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP Power Assets</td>
<td>Transmission charges</td>
<td>Levied based on actual usage</td>
</tr>
<tr>
<td>SP Services (MSSL)</td>
<td>Meter reading and data management</td>
<td>Levied on a per meter basis</td>
</tr>
</tbody>
</table>
The flow of electricity.

energy

the market.

supply of energy, reserve and regulation in

each half-hour that is the basis for the

dispatch schedule

A schedule produced by the market clearing

dispatch period.

market to meet electricity demand in each

reserve and regulation is purchased from the

co-optimisation

The process used by the market clearing engine

to ensure that there is initial generation

contestable consumers

Those consumers that have the right to choose

to purchase electricity from a retail supplier,

directly from the wholesale market or indirectly

fast-start ancillary service

A generation facility that is able to synchronise

full retail competition (FRC)

A situation in the retail market in which all

interruptible load (IL)

Contestable consumer of electricity that

load

The consumption of electricity.

market clearing engine (MCE)

The linear computer program used to calculate

market participant (MP)

Person who has an electricity licence issued by

megawatt (MW)

A measure of electrical power equal to one million

net treatment of non-reserve charges for

non-injecting embedded generators

Since December 2007, non-reserve charges

vesting contract

A vesting contract is a regulatory instrument

vesting contract hedge price (VCHP)
The VCHP is calculated by the MSSL every

white market

The transactions made between generation

Additional Information : Glossary

ancillary services

The additional services necessary to ensure the

A generation facility that is able to synchronise

A situation in the retail market in which all

Contestable consumer of electricity that

The consumption of electricity.

A linear computer program used to calculate

A person who has an electricity licence issued by

A measure of electrical power equal to one million

The transactions made between retail companies

retail market

The transactions made between retail companies and end consumers.

consumer who has an electricity licence issued by

Generation that is on stand-by to fine-tune the

Stand-by generation capacity or interruptible

A market structure in which prices are calculated at

A market structure in which prices are calculated at

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

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

The transactions made between retail companies and end consumers.

A measure of electrical power equal to one million

The Uniform Singapore Energy Price is the weighted-average of the nodal prices at all off-

take nodes.

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

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The transactions made between retail companies and end consumers.
### Additional Information : Market Participants’ Contact Details

<table>
<thead>
<tr>
<th>Category</th>
<th>Licensee</th>
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<tbody>
<tr>
<td><strong>Active Generator Licensees</strong></td>
<td>Keppel Merlimau Cogen</td>
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<td>Keppel Seghers Tuas Waste-to-Energy</td>
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</tr>
<tr>
<td></td>
<td>PowerSeraya</td>
<td><a href="http://www.powerseraya.com.sg">www.powerseraya.com.sg</a></td>
</tr>
<tr>
<td></td>
<td>Sembcorp Cogen</td>
<td><a href="http://www.semb.utilities.com">www.semb.utilities.com</a></td>
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<tr>
<td></td>
<td>Senoko Power</td>
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</tr>
<tr>
<td></td>
<td>Senoko Waste-to-Energy</td>
<td><a href="http://www.keppelseghers.com">www.keppelseghers.com</a></td>
</tr>
<tr>
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<td>Tuas Power Generation</td>
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