MARKET REPORT 2014

National Electricity Market of Singapore

CONTENTS

Dear Industry Members

After more than ten years of operation, I am happy to note that the National Electricity Market of Singapore (NEMS) continued to attract new investments in 2014. We are also reaping other benefits of market liberalisation as competition in Singapore's electricity sector continues to keep wholesale prices competitive and drive economic efficiency.

We welcomed three new market participants and five new generating facilities in 2014. The majority of the new facilities were combined-cycle gas turbine (CCGT) units. Collectively, with the new facilities, total generation registered capacity in the NEMS rose to a record level of 12,884MW, marking an increase of 3.7 percent compared to the previous year.

With the new facilities coming on board, the total amount of electricity offered in the NEMS – known as total generation supply – saw a 9.3 percent year-on-year (YOY) increase in 2014. This is the biggest YOY growth since the market started and it drove total annual supply in the NEMS close to the 8,000MW mark, the highest level since 2003.

Electricity consumption also rose in 2014 at a rate of 3.2 percent, to 46.7 terawatt hours.

With the growth in supply outpacing the growth in consumption, coupled with lower oil prices in 2014, the Uniform Singapore Energy Price (USEP) fell for the second consecutive year to an average figure of $137 per megawatt hour (MWh). This is a 20.8 percent drop from the previous year. With the exception of 2009, when the NEMS was impacted by the global financial crisis, we have not seen the annual average USEP fall below $150/MWh since 2007.

The USEP's movements continue to be driven by prevailing demand and supply conditions and are signs of a well-functioning, efficient and competitive market. Aside from prices, the NEMS' effectiveness is evident in the ongoing move towards more efficient generation, with the market share of the more efficient CCGT units hitting a new high of 97.5 percent in 2014.

We also saw a further reduction in market concentration as a result of the keen competition in Singapore's electricity market. The market share of the three largest generation companies declined from 69.7 percent in 2013 to 61.5 percent in 2014. In the retail market, the market share of the top three retailers, excluding SP Services which supplies all non-contestable consumers, dropped 5.6 percentage points compared to the previous year.

At this point, I would like to thank the governance panels of the NEMS for their continuous efforts in developing the market, monitoring the market's activities and supporting the dispute resolution needs of the market. Together, the Rules Change Panel, Market Surveillance and Compliance Panel and Dispute Resolution and Compensation Panel have contributed to the stability and efficiency of the NEMS, and made it into the world-class electricity market that it is today.

As Singapore strives to maintain a balance of the three energy policy objectives of economic competitiveness, energy security and environmental sustainability, the NEMS will have to continue to evolve to meet new challenges and opportunities. With the support of all our stakeholders, I am confident that the NEMS will remain relevant and continue to contribute towards the competitiveness of Singapore's economy.

Wong Meng Meng
Chairman
Energy Market Company

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 to liberalisation started in October 1995, when industry assets were corporatised and put on a commercial footing. In 1998, the Singapore Electricity Pool, a day-ahead market, began operations. On 1 April 2001, a new legal and regulatory framework was introduced that formed the basis for a new electricity market.

The NEMS is an integral part of Singapore's overall energy policy framework which seeks to maintain a balance of the three policy objectives of economic competitiveness, energy security and environmental sustainability. 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.

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 First phase of retail contestability
	2002	Testing and trialling of wholesale market system began
	2003	NEMS wholesale market trading began
	2004	Vesting contract regime introduced Interruptible loads (IL) began to participate in the reserves market
	2006	First wholesale market trader joined the market and commenced trading as IL provider First commercial generator since 2003 joined the market and started trading Retail contestability expanded to 75 percent of total electricity demand
	2007	Removal of the Market Registration Application Fee
	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 Embedded generators (EG) joined the market
	2009	Revised regulation price cap of $300/MWh was implemented New EGs, small generators and incineration plants joined and started trading
	2010	Vesting tender was introduced to tender out a percentage of non-contestable electricity demand to generation companies for bidding
	2012	NEMS completed ten successful years of trading
	2013	Singapore's Liquefied Natural Gas (LNG) terminal started commercial operations LNG vesting contract introduced

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.

Three New Market Participants Joined the Market

In 2014, three new market participants (MPs) registered in the NEMS as wholesale market traders. One of the three MPs further obtained a retailer license later in the year.

CGNPC Solar-Biofuel Power (Singapore) joined the NEMS in April and its 9.9MW biomass facility started commissioning in the last quarter of the year. CPvT Energy Asia registered as a NEMS wholesale trader for interruptible load service in February, and as a retailer in October. Finally, Sunseap Leasing joined the NEMS in September. It is the first MP dedicated to solar leasing since the market started.

With these additions, there are now 13 wholesale market traders and nine retailers in the NEMS. The number of generation companies remains at 13.

Participants and Service Providers in the NEMS

Generators	ExxonMobil Asia Pacific Keppel Merlimau Cogen Keppel Seghers Tuas Waste-To-Energy Plant (Tuas DBOO Trust) National Environment Agency PacificLight Power Sembcorp Cogen Senoko Energy Senoko Waste-to-Energy Shell Eastern Petroleum TP Utilities Tuas Power Generation Tuaspring YTL PowerSeraya
Wholesale Market Traders	Air Products Banyan Utilities CGNPC Solar-Biofuel Power (Singapore) CPvT Energy Asia Diamond Energy ECO Special Waste Management Glaxo Wellcome Manufacturing – GlaxoSmithKline Biologicals Green Power Asia MSD International GmbH (Singapore Branch) Pfizer Asia Pacific Singapore LNG Corporation Singapore Oxygen Air Liquide Sunseap Leasing
Retailers	CPvT Energy Asia Diamond Energy Supply Hyflux Energy Keppel Electric PacificLight Energy 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

Generation Licensees

All generators with facilities of 1MW or more that are connected to the transmission system must participate in the NEMS and be registered with EMC. Generation licensees are companies with generating facilities that are 10MW or more that are connected to the transmission system and licensed by the EMA to trade in the wholesale electricity market.

Wholesale Market Traders

Wholesale market traders are generators with facilities of 1MW or more but less than 10MW that are connected to the transmission system and licensed by the EMA to trade in the wholesale electricity market. This category includes consumers that offer their own load to be interrupted, as well as companies that provide services to other consumers interested in offering their load to be interrupted.

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.

Market Support Services Licensee – SP Services

A Market Support Services Licensee (MSSL) is authorised to provide market support services. Such services include facilitating customer transfers between retailers, meter reading and meter data management. SP Services is the only MSSL. In addition to its market support services function, SP Services also facilitates access to the NEMS for contestable consumers who have not appointed a retailer, and supplies electricity to non-contestable consumers.

Market Operator – EMC

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

Transmission Licensee – SP PowerAssets

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

Power System Operator

The Power System Operator (PSO), a division of the EMA, is responsible for ensuring the security of 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.

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, and then selects the optimal mix of generation and interruptible loads (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 a security-constrained economic dispatch by taking into account the:

- available generation capacity;
- ability of generation capacity to respond (ramping);
- relationship between the provision of energy, 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 that each generation unit is required to maintain;
- level of IL that is required; and
- 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 and mixed integer 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 56 injection nodes, and the prices at up to 766 withdrawal or off-take nodes[1] 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 new investment into the 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 hours for each trading period.

Energy, Reserve and Regulation Products

	Description	Purchaser	Seller
Energy	Generated electricity	Retailers	Generators
Reserve	Stand-by generation capacity or IL that can be drawn upon when there is an unforeseen shortage of supply. Three classes of reserve are traded: 1) primary reserve (8-second response) 2) secondary reserve (30-second response) and 3) contingency reserve (10-minute response)	Generators	Generators, Retailers and Wholesalers
Regulation	Generation that is available to fine-tune the match between generation and load	Generators and Retailers	Generators

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.

[1] Numbers of injection and withdrawal nodes are as of 31 December 2014.

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, 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 by all the key sectors of the industry.

The rule change process is designed to maximise transparency and opportunities for public involvement. Rule modifications recommended by the RCP require the support of the EMC Board and the EMA. When approving changes to the Market Rules, the EMA is required to consider whether the proposed rule modifications (i) unjustly discriminate in favour of or against a market participant (MP) or a class of MPs; or (ii) are consistent with the functions and duties of the EMA under subsection 3(3) of the Electricity Act. 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), comprising professionals independent of the market, is responsible for monitoring, investigating and reporting the behaviour of MPs 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 an MP is not compliant with the Market Rules, it may take enforcement action, which may include levying a penalty. The MSCP also recommends remedial actions to mitigate any rule breaches or inefficiencies identified. The panel produces the MSCP Annual Report, which has been published together with the NEMS Market Report since 2007.

Dispute Resolution

The Market Rules contain a process that facilitates the resolution of disputes between MPs 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 (DRC).

Dear Industry Members

The industry has entrusted the Rules Change Panel (RCP) the challenging task of guiding the evolution of the Market Rules that govern the wholesale electricity market of Singapore. Against the backdrop of an increasingly competitive and dynamic industry, the Panel ensures that the Market Rules remain relevant and balanced in achieving diverse objectives.

The Market Clearing Engine (MCE) is often examined by the Panel for areas of fine-tuning in order to unlock efficiencies in the scheduling process. This year, the Panel introduced the option for generation facilities to have their minimum stable load (MSL) levels modelled by the MCE, which would improve the stability of the facilities' operation and enhance system security. In addition, the Panel enhanced the MCE to model line flows, based on the exact constituent units of a multi-unit generation facility, that are connected to the grid. A more precise modelling of line flows would result in more accurate price signals.

The Panel also strived tirelessly to improve the status quo through the review of existing processes. For the dispute resolution procedures, existing time limits were adjusted to fast-track the resolution of disputes. In addition, the Panel studied a rule change proposal on the existing compensation guidelines, to provide greater clarity to generators when they are directed by the Power System Operator (PSO) to deviate from their dispatch schedules. While it was important to maintain the trust and confidence of investors through compensation, the rule change was proposed so that generators did not have the scope to manipulate the market by restricting their ability to submit offer changes while under such direction by the PSO.

Transparency is an important trait for well-functioning markets as it allows key stakeholders to make informed decisions in both the short and long term. The Panel has always advocated market transparency and this year, it supported proposals for Energy Market Company (EMC) to analyse hourly energy uplift charge values in the monthly trading report, and for the PSO to publish actual and forecast load data for comparison.

As always, the Panel is careful to ensure that market enhancements justify the associated costs that will be incurred. In the Panel's deliberation on the proposed regulation effectiveness factor to redistribute payments based on providers' performances, the Panel recognised the benefits of incentivising better performance. However, given that most providers are already operating at a high performance level, further differentiation did not justify the high implementation costs. As such, the Panel decided not to proceed with the proposal.

The close of 2014 marked the end of the current Panel's term. I would like to take this opportunity to thank the outgoing Panel members for their dedicated contributions over the years: Kng Meng Hwee, Chan Hung Kwan, Koe Pak-Juan, Michael Wong Ho Ming and Loh Chin Seng. At the same time, I would like to welcome Soh Yap Choon, Lim Han Kwang, Grace Chiam I-Ling, Priscilla Chua Peizhen and Marcus Tan Yam Ngee to the new Panel. This is part of the Panel's rejuvenation process, and I look forward to the fresh perspectives that these new members will bring to our discussions.

Beyond the Panel, I would like to express my gratitude to others who have contributed to making 2014 a fruitful year, including the EMA, the EMC Board, EMC's Market Administration team and all other market participants whose valuable inputs have contributed to the success of the rule change process.

Paul Poh
Chair
Rules Change Panel

Rule Changes Supported by the RCP

The following rule changes were discussed and approved, as part of the RCP's continual efforts to guide the evolution of the wholesale electricity market.

Modelling of Minimum Stable Load

Generators have a technical limitation in that they need to operate at their minimum output level (known as the minimum stable load or MSL) in order to maintain stable operation. The market clearing engine (MCE), however, could schedule generators for energy at any output level without taking into consideration their MSLs.

A rule change was thus proposed to give MPs the choice to limit the MCE to schedule their generators at either above their MSL levels, or at zero. With the proposed constraint, there could be times when a generator is scheduled at its MSL but the clearing prices are below the generator's offers. To address this, a compensation framework for generators which are scheduled out-of-merit order at their MSLs was also introduced as part of this rule change.

Increasing the Transparency of Energy Uplift Charges

The monthly and hourly energy uplift charges (MEUC and HEUC) are charges imposed on loads based on their actual consumption in each settlement interval. It was proposed that EMC increase the transparency of these charges by conducting qualitative and quantitative analyses on a monthly basis.

EMC's review concluded that there is sufficient transparency on the MEUC, since the breakdown of the MEUC is published in the monthly MEUC statements and also verifiable using other information on EMC's website. There is, however, scope to enhance the transparency of the HEUC, as its final values are published without any explanation.

EMC thus recommended a framework to identify and analyse settlement intervals with outlier HEUC values arising from metering errors, transmission constraints and metering adjustments, and proposed that this analysis be provided in the existing monthly trading reports.

The RCP, by majority vote, supported the proposal to increase the transparency of the HEUC and its corresponding implementation cost. The proposal will be implemented from February 2015 and EMC will start providing the analysis of the outlier HEUC values in the January monthly trading report.

Reconciliation of the Demand Forecast

An MP proposed that EMC publish a comparison between the PSO's load forecasts used in the preparation of forecast and dispatch schedules, and the actual metered load. This comparison should show the load values for each dispatch period and provide reasons for variance where applicable. This will enhance the industry's understanding of the accuracy of the load forecasts and factors that influence them.

After some deliberation, the RCP unanimously agreed that both the Very Short Term Load Forecast (VSTLF) and SCADA (supervisory control and data acquisition) data of actual gross generation should be made available by the PSO to the MPs for the latter's analyses of the demand forecasts. The PSO has started publishing both data on the EMA's website on a weekly basis.

Review of Dispute Resolution Procedures

As part of its three-yearly review of the dispute resolution procedures, the RCP received two proposals to improve the current compensation application procedures, which delineate the processes through which a claimant can seek compensation under the Market Rules.

Proposal 1: Extension of time limit for making a determination

After receiving a compensation request, the current rules require EMC or the PSO to notify the claimant of its eligibility for compensation within 20 business days. However, as EMC or the PSO may need to seek further information to support the claimant's application, it was suggested that the 20 business days commence from the later of the two dates – the date of receipt of the compensation request or date of receipt of further information requested.

The RCP supported the rule change to extend this time limit, so as to allow EMC or the PSO to have sufficient time to assess the compensation request.

Proposal 2: Stipulate time limit for acceptance of compensation and submission of matter for arbitration

After EMC or the PSO has made a determination on the claimant's eligibility and compensation amount, claimants can either accept the determination or disagree and submit the matter for arbitration. However, the rules at present do not set a time limit for them to do so. A rule change was thus made to require that claimants either accept the compensation amount or submit the matter for arbitration within 20 business days of EMC or the PSO's determination.

Remodelling of Multi-Unit Facilities

A proposal was received to refine the modelling of Multi-Unit Facilities (MUFs) in the MCE, to better account for situations when any of the Constituent Generating Units (CGUs) comprising either steam turbines or gas turbine units are disconnected from the dispatch network.

When a CGU is disconnected, the MCE will notionally connect it back to cater for the possibility that it could be re-connected to the grid in future periods. The MCE currently apportions the line flows from an MUF's energy schedule across all of its individual CGUs (even those that are only notionally connected), and sets its gas turbine CGUs' output as a proportion of its steam turbine CGUs' output. This leads to potential problems whereby the whole MUF may not be scheduled if its steam turbine CGU is not connected. This poses system risk by reducing supply, and impedes market efficiency.

To overcome this, a rule change was made to implement a conditional check to decide whether to connect each non-synchronised CGU back to the dispatch network. In addition, two constraints used to allocate line flows proportionally to the CGUs were revised to more accurately reflect the reduced capacity of a steam turbine when one of the two gas turbines that drive it is disconnected.

Review of Compensation Guidelines

This year, the Panel reviewed the compensation guidelines in the Market Rules intended to provide guidance on the compensation due to generators, when they were directed by the PSO to deviate from their schedule.

The dispatch schedule generated by the MCE is the most economically efficient outcome and should generally be adhered to for dispatch purposes. However, in real-time, the PSO may need to intervene and direct certain generators to deviate from the MCE's schedule. Such generators should then be compensated if PSO's directions lead them to incur costs not recoverable from market revenue.

The Panel agreed that upon PSO's direction, generators should not be allowed to change their offers so as not to affect the clearing price or take advantage of their "must-run" status. To ameliorate the potential that their offers were not reflective of their costs, that there were no offers for the instructed quantities, or that the market clearing price was lower than their offers, generators would be given the ex-post choice of either using an offer-based or cost-based methodology to calculate the compensable quantum.

A rule change was thus proposed such that when the PSO has issued a direction relating to the provision of energy to a generator, the generator would not be allowed to change its offers for those dispatch periods.

Rule Changes Not Supported by the RCP

The RCP also discussed the following proposal but decided not to support it because the potential benefits did not justify the costs.

Introduction of Regulation Effectiveness Factor

The proposal involved introducing the Regulation Effectiveness Factor (REF), which measures the responsiveness of a given regulation provider and in turn, translates into share of regulation payments. This ensures that these providers are appropriately incentivised to be responsive to regulation signals.

In a 2010 RCP paper, EMC found that while there was no evidence of excess regulation provision on a system-wide level, some Generation Registered Facilities (GRFs) were more responsive and correspondingly provided regulation in excess of their schedules. However, given the challenges involved with a comprehensive regulation responsiveness assessment, the RCP unanimously agreed not to pursue it.

At the RCP Work Plan Prioritisation Exercise 2014, a proposal was received to re-evaluate the REF proposal. It was also observed that markets such as PJM and NYISO already have mechanisms in place whereby regulation resources with the highest value to system control were given the highest payments.

This review focused on coming up with an assessment scheme that minimised implementation costs. However, based on simulation results, most regulation providers were already operating at a high performance level. The Panel agreed that further differentiation among different providers would be minimal and did not justify the high implementation costs. It thus decided not to proceed with the proposal.

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.

DMS Contacts

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

The current DMS contacts are:

1. Air Products - Shawn Zhang
2. Air Products - Tang Siew Wai
3. CGNPC Solar-Biofuel Power - Nelson Ong
4. CGNPC Solar-Biofuel Power - Zhang Hua
5. Diamond Energy - Muhammed Iqbal
6. ECO Special Waste Management - Ethiraj Thirumalai
7. ECO Special Waste Management - Vincent Tang
8. Energy Market Company - Ambrose Chia
9. Energy Market Company - Tan Phaik Kim
10. ExxonMobil - Elaine Lee
11. ExxonMobil - Teddy Yong
12. GlaxoSmithKline Biologicals - Chew Siou Ping
13. GlaxoSmithKline Biologicals - Wong Joon Jee
14. Green Power Asia - Daniel Ma
15. Hyflux Energy - Calvin Quek
16. Hyflux Energy - Chin Si En
17. Keppel Electric - Janice Bong
18. Keppel Electric - Joelyn Wong
19. Keppel Merlimau Cogen - Sean Chan
20. Keppel Merlimau Cogen - Tini Mulyawati
21. National Environment Agency - Siew Weng Soon
22. National Environment Agency - Teresa Tan
23. PacificLight Power - Calvin Tan
24. PacificLight Power - Linda Wen
25. Pfizer Asia Pacific - Lee Chin Hoo
26. Pfizer Asia Pacific - Tan Meng Tong
27. Power System Operator - Agnes Tan
28. Power System Operator - Loh Poh Soon
29. Sembcorp Cogen - Chua Gwen Heng
30. Sembcorp Cogen - Loh Chin Seng
31. Sembcorp Cogen - Ramesh Tiwari
32. Sembcorp Power - H C Chew
33. Senoko Energy - Eveline How
34. Senoko Energy - Loo Hui Hua
35. Senoko Energy Supply - Eu Pui Sun
36. Senoko Energy Supply - Michelle Lim
37. Seraya Energy - Daniel Lee
38. Seraya Energy - Elaine Syn
39. Singapore LNG Corporation - Lam Zheng Xin
40. Singapore LNG Corporation - Vincent Lam
41. Singapore Oxygen Air Liquide - Lim Yong Yi
42. SP PowerAssets - Chan Hung Kwan
43. SP PowerAssets - Ong Sheau Chin
44. SP Services - Budiman Roesli
45. SP Services - Lawrence Lee
46. Tuas Power Generation - Priscilla Chua
47. Tuas Power Supply - Jazz Feng
48. Tuas Power Supply - Zhang Ai Jia
49. YTL PowerSeraya - Daniel Lee
50. YTL PowerSeraya - Elaine Syn
51. YTL PowerSeraya - Jonathan Chew
52. YTL PowerSeraya - Mark New

DRCP Members

The DRCP members are:

Mediation Panel

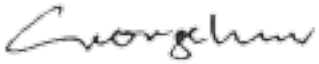
1. Chandra Mohan
2. Daniel John
3. Danny McFadden
4. Geoff Sharp
5. Associate Professor Joel Lee
6. Associate Professor Lim Lei Theng
7. Dr Peter Adler
8. Robert Yu
9. Shirli Kirschner

Arbitration Panel

1. Ang Cheng Hock, Senior Counsel
2. Chelva Rajah, Senior Counsel
3. Giam Chin Toon, Senior Counsel
4. Gregory Thorpe
5. Harry Elias, Senior Counsel
6. Kenneth Tan, Senior Counsel
7. Professor Lawrence Boo
8. N Sreenivasan, Senior Counsel
9. Naresh Mahtani
10. Philip Jeyaretnam, Senior Counsel
11. Phillip Harris
12. Raymond Chan
13. Dr Robert Gaitskell, Queen's Counsel
14. Tan Chee Meng, Senior Counsel
15. Professor Tan Cheng Han, Senior Counsel

Conclusion

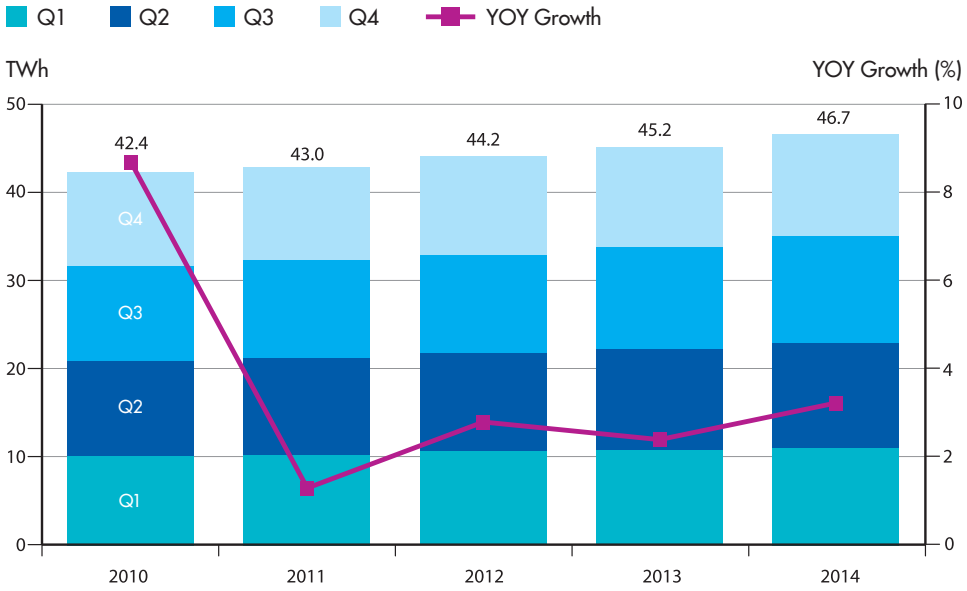
I thank the DRCP members and DMS contacts for their contributions, and look forward to continuing to support the dispute resolution needs of all NEMS market entities in the coming year.



George Lim
Senior Counsel
Dispute Resolution Counsellor

MARKET PERFORMANCE

Annual Electricity Consumption 2010 – 2014



Electricity consumption continues to increase in 2014

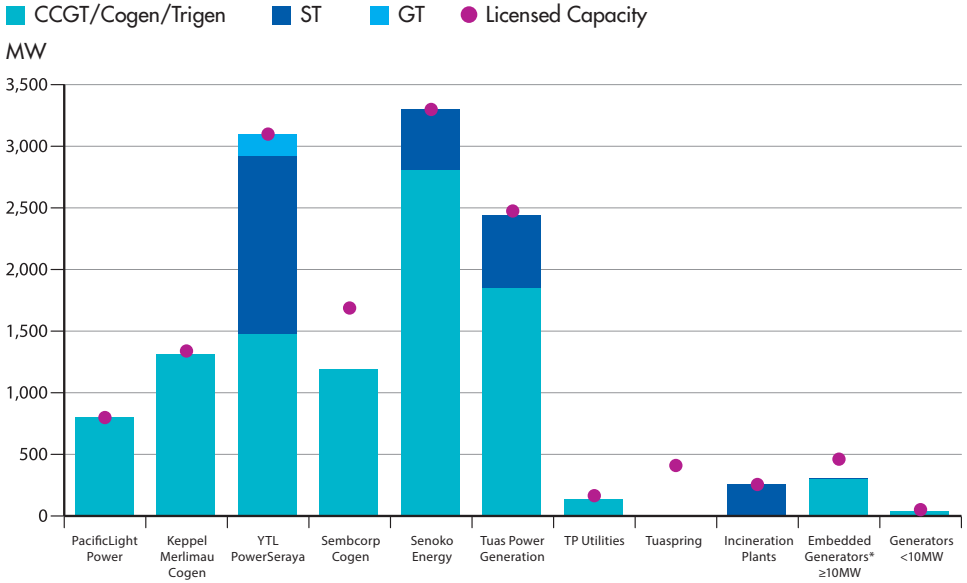
Electricity purchased by market participants (MPs) is settled using electricity consumption data provided by the Market Support Services Licensee (MSSL).

Electricity consumption rose at a higher rate of 3.2 percent in 2014 to 46.7 terawatt hours (TWh), compared to the 2.4 percent increase in 2013. This was despite a slower growth in Singapore's economy in 2014 at 2.9 percent[2] compared to 4.4 percent in 2013.

On a quarterly basis, all four quarters in 2014 saw higher year-on-year (YOY) electricity consumption compared to the same periods in 2013. Similar to 2013, the third quarter of 2014 had the highest electricity consumption at 12.1TWh. This was the first time since the market started that electricity consumption for a quarter had surpassed the 12TWh mark.

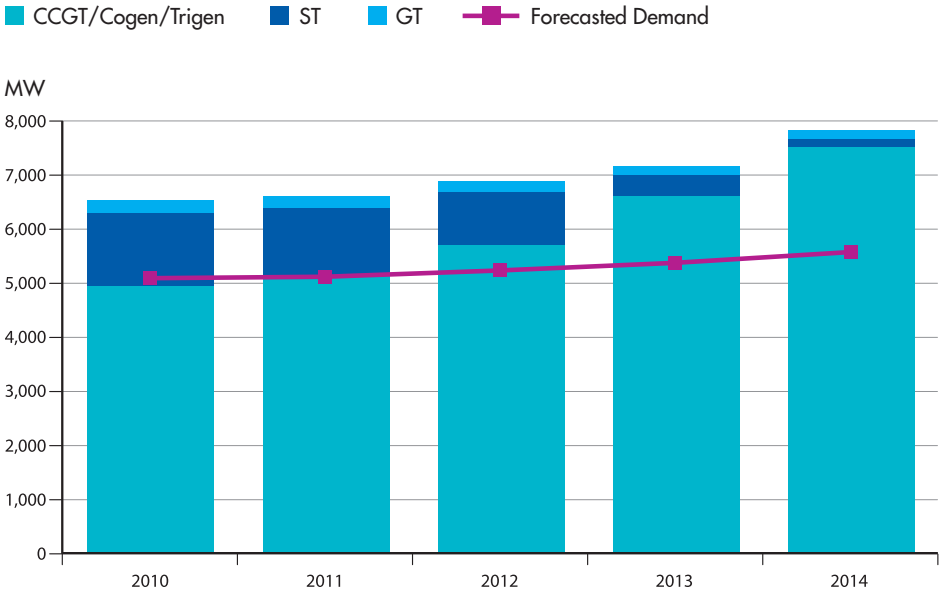
[2] Based on the Singapore Ministry of Trade and Industry press release on 17 February 2015: *MTI Maintains 2015 GDP Growth Forecast at 2.0 to 4.0 Per Cent.*

Generation Capacity as of 31 December 2014: Registered Versus Licensed



*Embedded generators exclude TP Utilities

Annual Generation Supply by Plant Type 2010 – 2014



Gap between registered and licensed capacity[3] narrows

There was minimal change to the licensed capacity in the National Electricity Market of Singapore (NEMS) which stood at 14,053MW in 2014 compared to 14,049MW in 2013.

Registered capacity, on the other hand, rose 3.7 percent to 12,884MW. Sembcorp Cogen's third generator and TP Utilities' second generator made up most of the increment, at 403.8MW and 32.5MW respectively. Registered capacity stood at 91.7 percent of licensed capacity at the end of the year, an increase from 2013's 88.4 percent.

The proportion of CCGT/cogen/trigen registered capacity to total registered capacity increased from 76.0 percent in 2013 to 76.8 percent in 2014, while that of ST registered capacity to total registered capacity dropped from 22.6 percent in 2013 to 21.8 percent in 2014. This was because all the facilities registered in 2014 were of the CCGT generation type.

CCGT/cogen/trigen = Combined-cycle gas turbine/ cogeneration/trigeneration (combined category)

ST = Steam turbine

GT = Gas turbine

Embedded generators (EG) = Generation units that generate electricity to their onsite load principally for self-consumption.

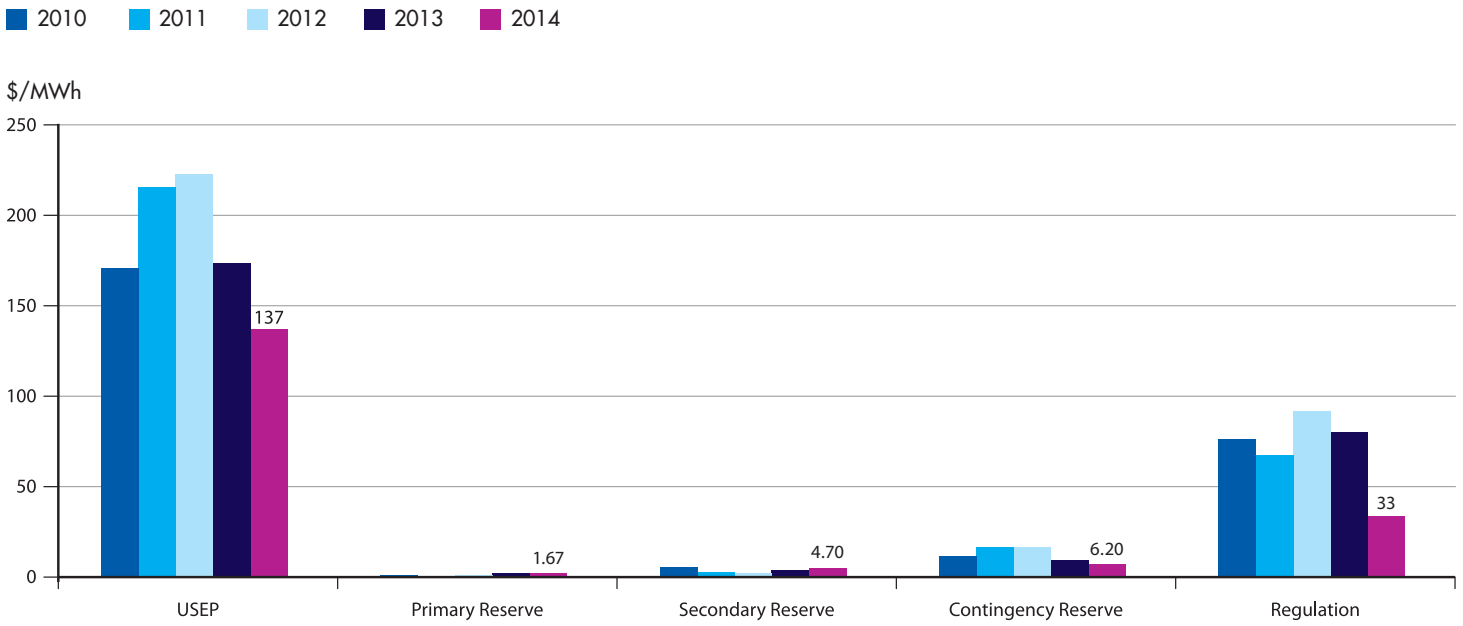
[3] Licensed capacity calculated from the Energy Market Authority's data and Schedule A published on its website as of 31 December 2014.

Supply rises at a faster rate than forecasted demand

Total generation supply surged by 9.3 percent in 2014 as the newer facilities registered from late 2013 to 2014 increased the supply pool. This was the largest YOY increase in supply since the market started, surpassing the previous record YOY increase seen in 2010 at 8.1 percent.

CCGT/cogen/trigen supply grew 13.7 percent YOY and made up 96.0 percent of total supply at the end of 2014. At an average of 7,522MW for the year, CCGT/cogen/trigen supply alone was sufficient to cover forecasted demand, which rose 3.6 percent YOY to 5,493MW. The annual average CCGT supply surpassed even the highest half-hourly forecasted demand in 2014 which was 6,850MW seen on 7 May, Period 29.

Annual USEP and Ancillary Prices 2010 – 2014



USEP falls for the second straight year, dragging two ancillary prices down

As the growth in supply outpaced that of forecasted demand, the Uniform Singapore Energy Price (USEP) fell from $173 per megawatt hour (MWh) in 2013 to $137/MWh in 2014. This was the lowest level since 2007 when it registered $125/MWh. The USEP traded at a discount of more than 18 percent below the Balance Vesting Price[4] in all months in 2014.

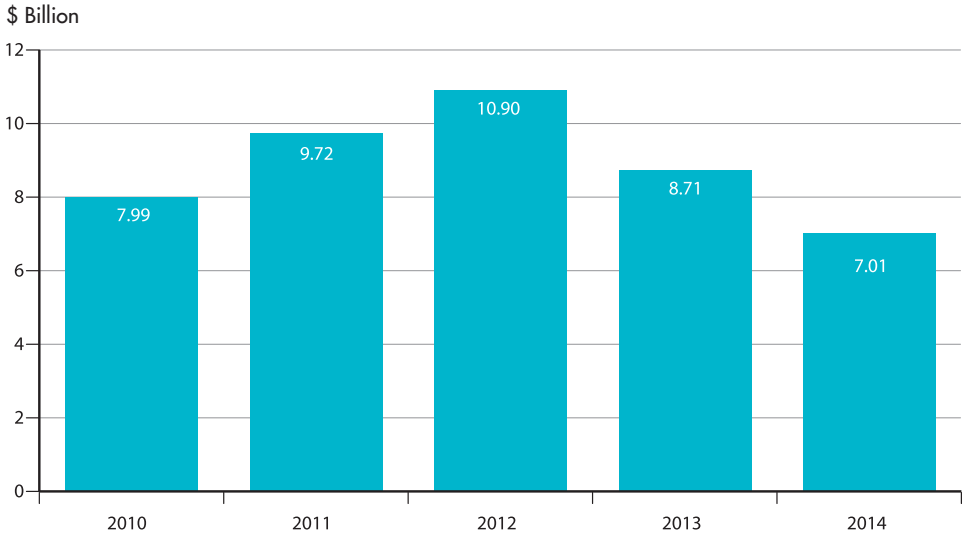
Primary and secondary reserve prices increased by $0.16/MWh and $1.60/MWh to $1.67/MWh and $4.70/MWh respectively. The average supply for primary reserve dropped 5.0 percent while that for secondary reserve dropped 5.8 percent. Requirements were higher at 4.6 percent for primary reserve and 1.3 percent for secondary reserve.

Contingency prices on the other hand fell from $9.12/MWh in 2013 to $6.20/MWh in 2014. Contingency requirement was lower by 1.4 percent in 2014, while contingency supply was higher by 10.5 percent.

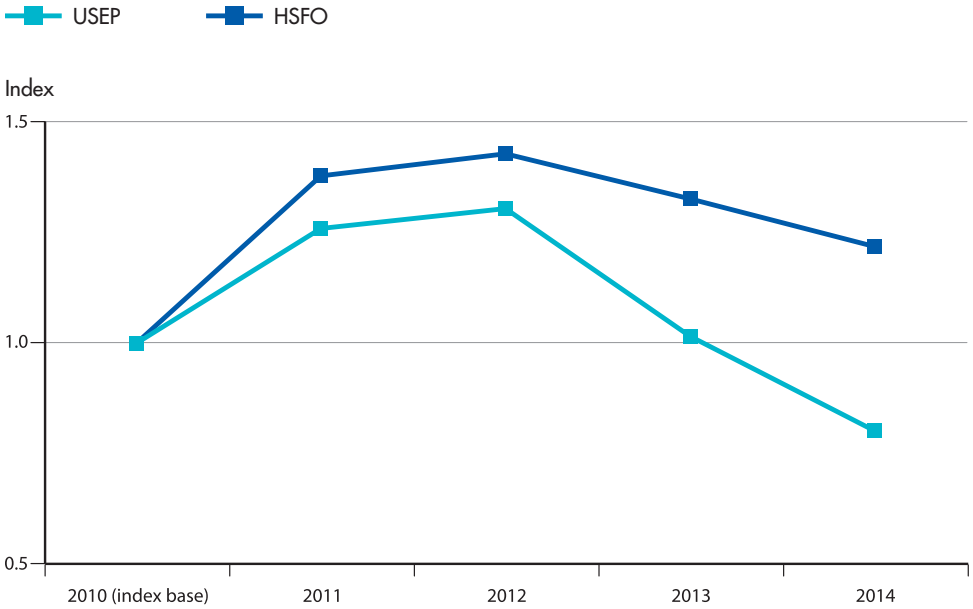
Regulation price saw the largest change among the ancillary services, falling 58.5 percent from 2013 to $33/MWh in 2014. The new regulation requirement which took effect on 1 February 2014 was markedly lower, at 19.4 percent below the volume required in 2013. Regulation supply which was 4.0 percent higher in 2014 further weighed the price down to its lowest since 2008 when it was $31/MWh.

[4] The Balance Vesting Price (BVP) replaced the Vesting Contract Hedge Price (VCHP) from the third quarter of 2013.

Annual Value of Products Traded 2010 – 2014



Annual USEP and Fuel Price (HSFO) Movements 2010 – 2014



Total value of products traded sinks to new five-year low

2014 saw the total annual value of products traded decline again to $7.01 billion, reprising the drop seen in 2013. This was a new five-year low since 2010 when the total value of products traded was around $8 billion.

The supply surge has brought about keener competition in the market, resulting in the USEP ending about 20.8 percent lower than 2013. Forecasted demand's 3.6 percent growth was insufficient to counterbalance the large supply growth, resulting in the lower USEP.

Adding further downward pressure on the annual value of products traded was the contraction in the regulation market, which fell more than $0.5 billion as a result of lower regulation price and quantity.

Overall, the annual value of products traded in 2014 fell by 19.4 percent. Out of this, 18.7 percent can be attributed to the energy market, 0.1 percent to the reserves market and 0.6 percent to the regulation market.

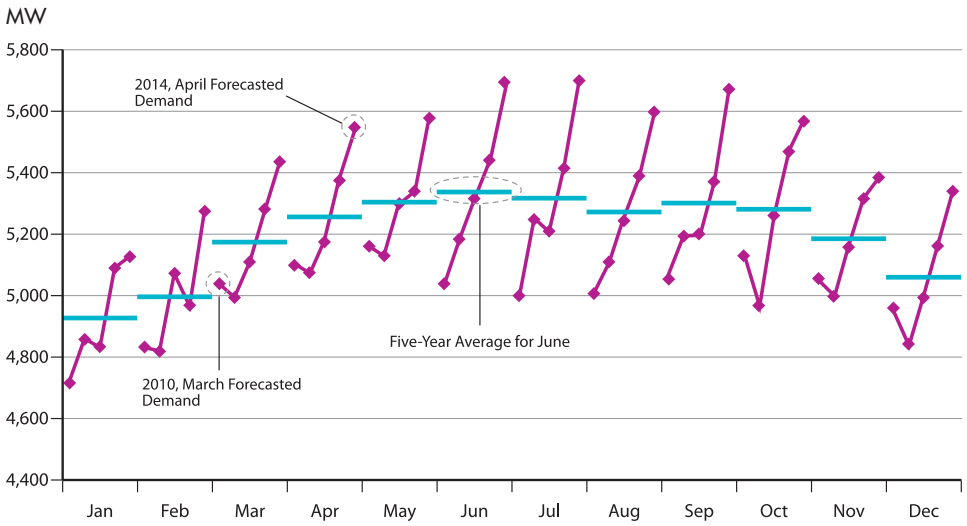
USEP deviates from fuel price[5] as electricity market competition intensifies

2014 saw another 462MW of registered capacity coming on board. All five of the new facilities were in the form of the more efficient CCGT/cogen/trigen generating plants. In comparison, five new facilities totalling 1,618MW were registered in the NEMS in 2013.

The greater competition in the last two years manifested as deviations between the USEP and fuel oil indices. In 2014, the USEP fell 20.8 percent whereas fuel prices came down by 8.1 percent.

[5] The HSFO 180 CST price is used as a proxy for fuel price.

Monthly Forecasted Demand 2010 – 2014



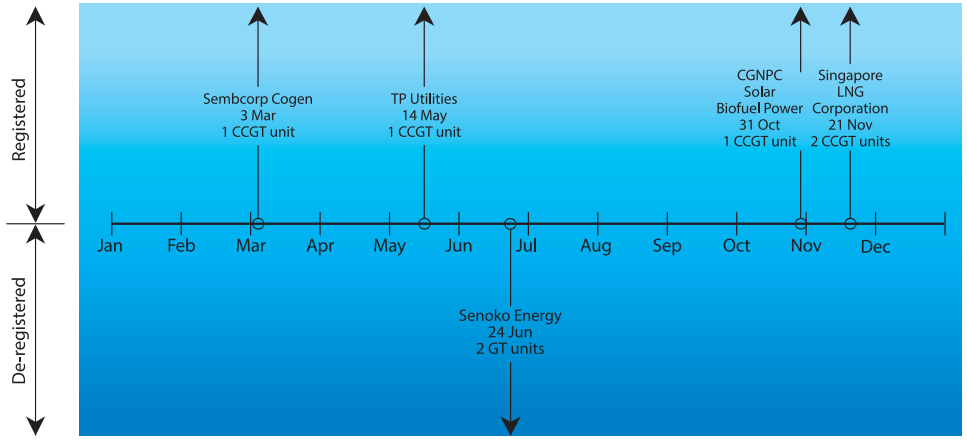
Forecasted demand YOY growth increases in all months

Forecasted demand is the projected electricity consumption in the NEMS. The forecast is provided in real-time by the Power System Operator (PSO) and is a key component in determining the USEP.

Comparing YOY, forecasted demand was stronger across all months in 2014. Excluding February due to the Chinese New Year festival effect, September saw the highest monthly YOY growth rate of 5.6 percent. In 2013, the highest monthly YOY growth rate of 4.0 percent occurred in October (again, January was excluded due to Chinese New Year).

Annually, forecasted demand was 3.6 percent higher in 2014, up from 2.8 percent in 2013.

Generation Facilities Registered and De-registered in 2014



More CCGT generating units commissioned in 2014

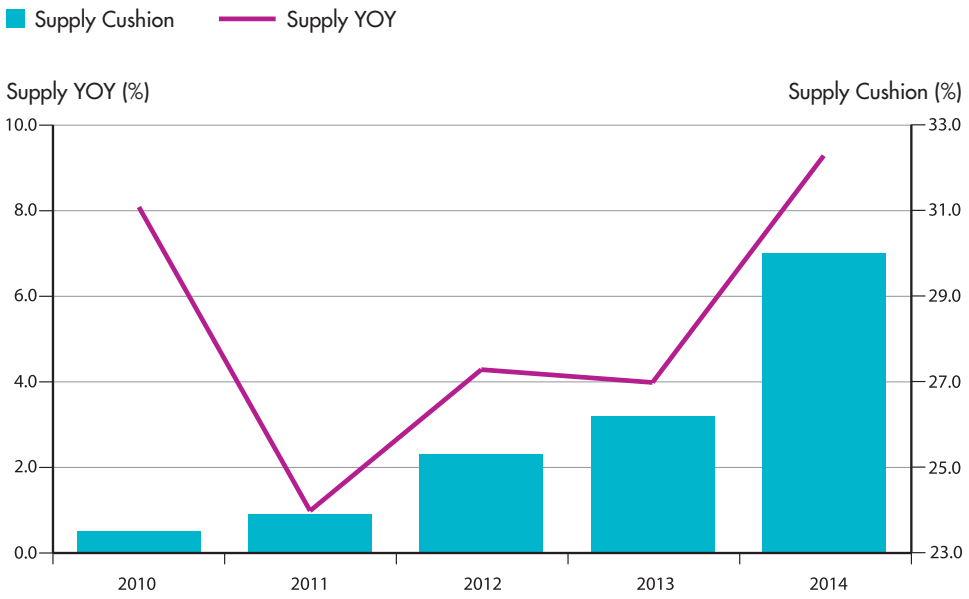
A total of five generating facilities were introduced in 2014. All were CCGT generating facilities with a total capacity of 461.8MW. The new generators brought the total registered capacity to 12,884MW at the end of 2014.

Market Participant	Generation Type	Registered Capacity
Sembcorp Cogen	1 CCGT unit	403.8MW
TP Utilities	1 CCGT unit	32.5MW
CGNPC Solar Biofuel Power	1 CCGT unit	9.9MW
Singapore LNG Corporation	2 CCGT units	15.6MW

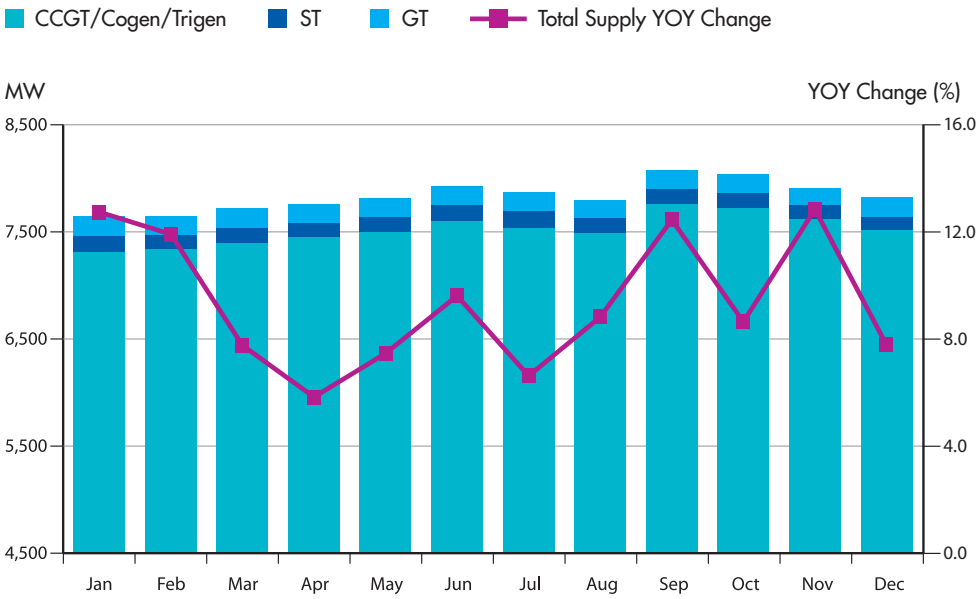
The two GT generating facilities that were de-registered in June were already de-rated to 0MW the year before. Thus they had no impact on registered capacity in 2014.

Of the registered capacity in 2014, 9,892MW or 76.8 percent belonged to the CCGT/cogen/trigen category.

Supply and Supply Cushion Increases Accelerate in 2014



Monthly Supply by Plant Type 2014



Steep rise in supply lifts supply cushion

Supply cushion measures the percentage of total generation supply that is available after matching off forecasted demand. It is calculated by subtracting forecasted demand from total supply, over total supply. If both supply and forecasted demand rise in tandem, the supply cushion would then remain constant.

Given that the growth in supply has surpassed that of forecasted demand over the years, the supply cushion has also risen steadily, averaging a 0.9 percent increase per year from 2011 to 2013. In 2014, however, the increase was dramatically larger than the preceding years – the supply cushion rose 3.8 percent, from 26.2 percent in 2013 to 30.0 percent in 2014. This was the highest level of supply cushion since the market started, and it was the first time that the supply cushion reached the 30-percent mark.

Supply stays above 7,500MW in all months in 2014

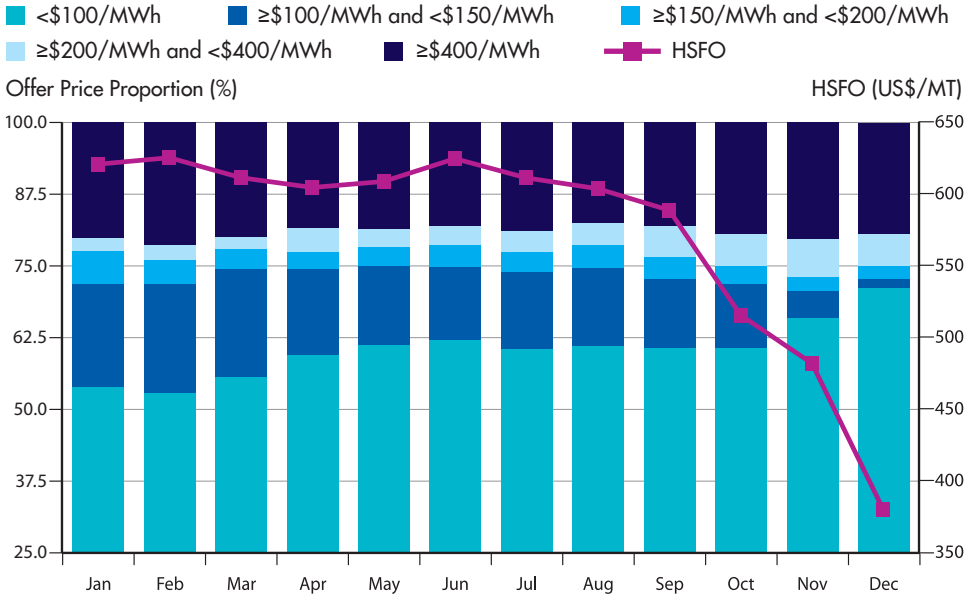
Total supply was significantly higher in 2014, registering a 9.3 percent growth compared to 2013. There was positive YOY supply growth for all months, ranging from 5.8 percent to 12.8 percent.

The shift to a CCGT-dominated market continued to be reflected in the proportion of CCGT supply to total supply – in all months, CCGT supply made up at least 95.0 percent of total supply, with YOY growth ranging from 9.0 percent to 21.9 percent.

ST supply shrank further, with negative YOY growth for all months ranging from as low as -75.2 percent to -47.9 percent. On an annual average, it made up only about 1.7 percent of total supply.

In the months of September and October, total supply registered above the 8,000MW level, a new record in the history of the NEMS.

Monthly Energy Offer Price Proportion and HSFO Price 2014



Supply cost falls on lower fuel price[6] and greater competition

Changes in the energy offer price proportion are affected by the level of competition in generation as well as the upstream cost of electricity generation.

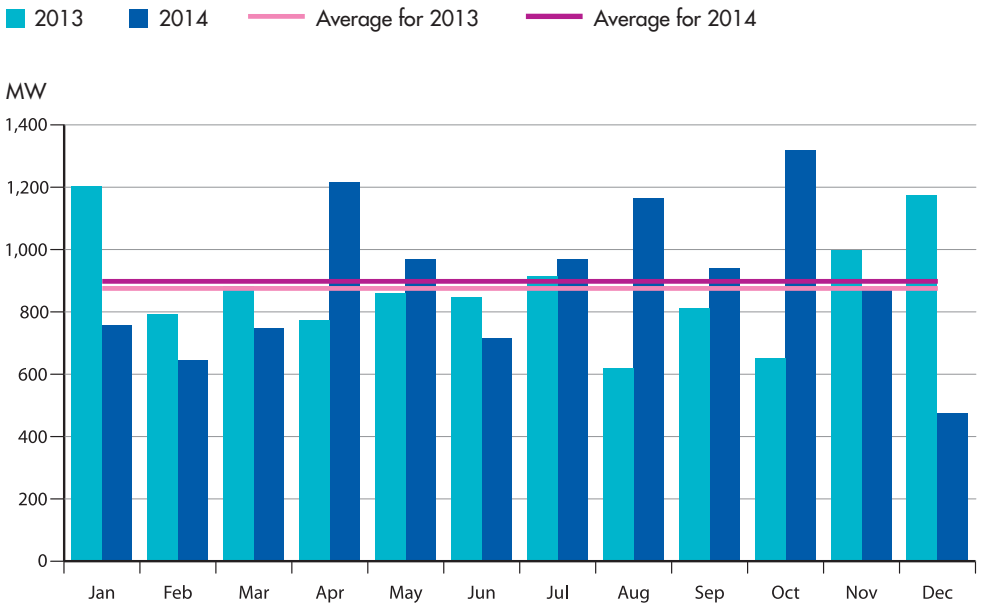
In 2014, the percentage of energy offers priced below $100/MWh averaged 60.4 percent, up from 58.1 percent in 2013. As 2014's total offer quantity was higher, the actual quantity of offers below $100/MWh was around 13.7 percent higher than 2013. This was mainly in line with the increase in generation capacity.

Lower fuel prices tend to enable energy supply to be offered at the lower priced tranches (the proportion of offers below $100/MWh). This relationship was apparent in the months of November and December – when the HSFO price fell below US$500 per metric tonne (MT), the proportion of energy offers priced below $100/MWh rose to 65.9 percent and 71.0 percent respectively. Comparatively, the proportion of energy offers priced below $100/MWh from January to October averaged at a more moderate 58.8 percent.

The new planting of generating facilities since 2013, with a handful fueled by liquefied natural gas (LNG), also aided the supply to shift into the lower price tranches.

[6] Based on HSFO 180 CST price which is used as a proxy for fuel price.

Monthly Generation Maintenance 2013 Versus 2014



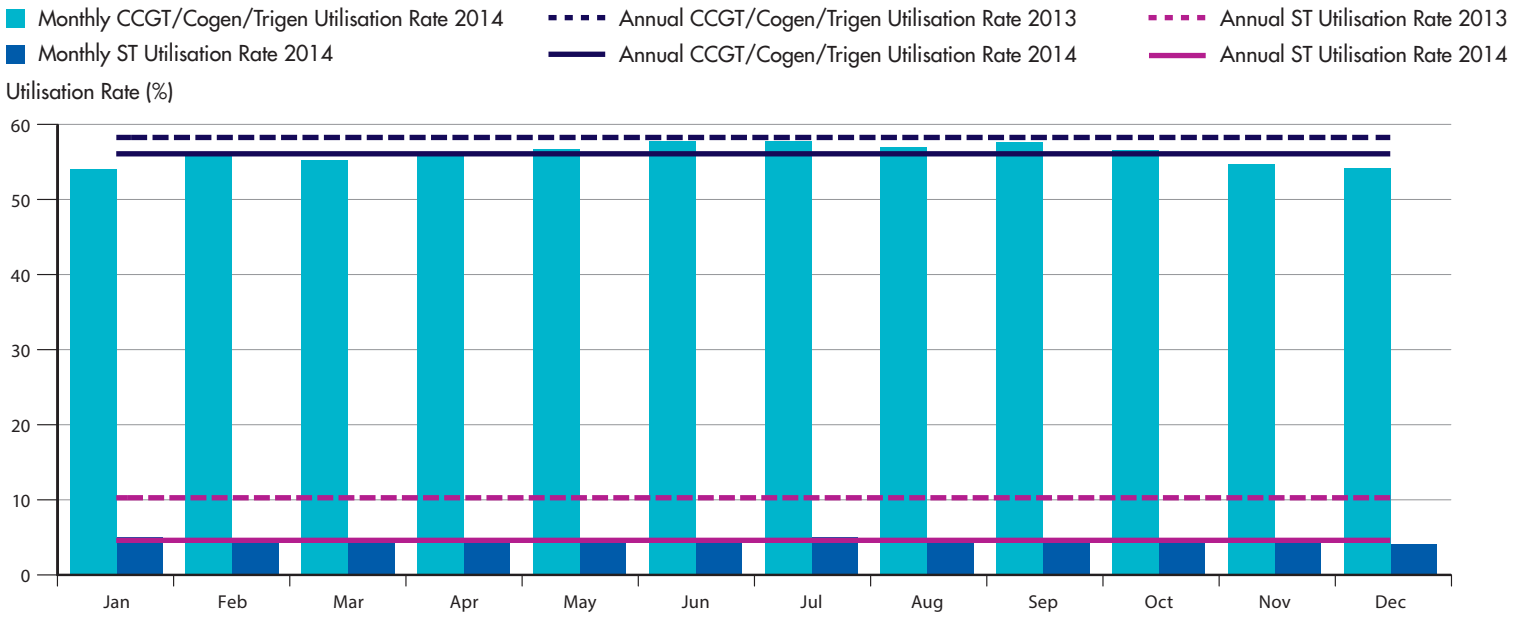
Volatility in monthly generation maintenance increases

Although the annual average generation maintenance levels in 2013 and 2014 were similar, the monthly maintenance profiles were disparate. Whilst 2013 had higher levels of maintenance in the earlier and later parts of the year, 2014 saw higher maintenance levels in the second and third quarters of the year.

The standard deviation of monthly generation maintenance in 2014 was 248MW compared to 179MW in 2013. And while 2013's monthly generation maintenance levels ranged from 619MW to 1,203MW, 2014 saw a wider range of between 475MW and 1,317MW.

The average ratio of generation maintenance to registered capacity decreased to 7.0 percent from 7.5 percent in 2013. This was due to the higher registered capacity while maintenance levels were similar.

Monthly Utilisation Rate by Plant Type 2014



Flatter and lower utilisation rates for CCGT/cogen/trigen and ST plant types in line with strong supply conditions

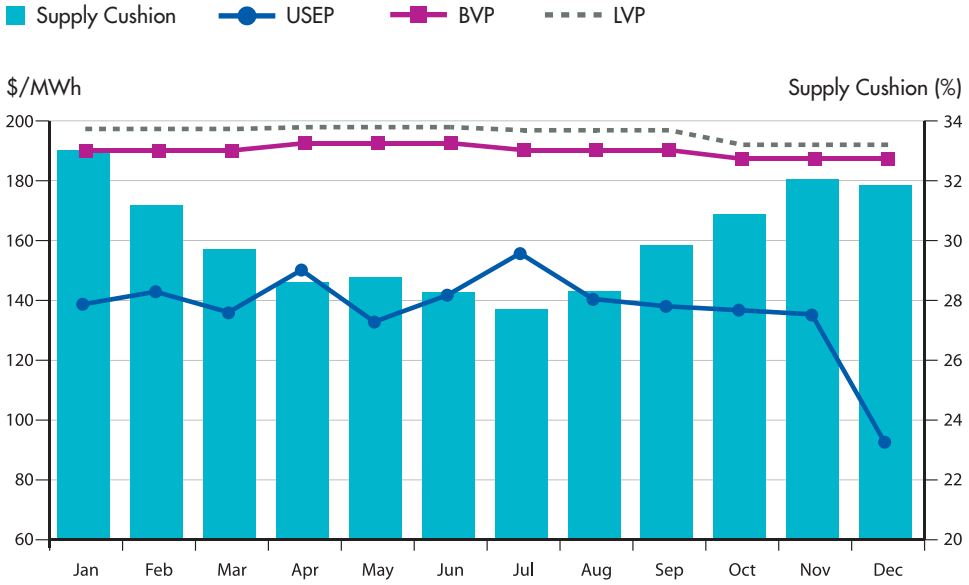
The utilisation rate measures the scheduled energy as a percentage of registered capacity.

For the third consecutive year, the annual CCGT/cogen/trigen utilisation rate fell and averaged 56.2 percent, down from 58.4 percent in 2013. Compared to 2013, the monthly utilisation rate in 2014 was more constant, with a narrower range of between 54.3 percent and 57.9 percent (2013's range was between 53.6 and 63.9 percent). Additionally, while there were three months in 2013 when the CCGT/cogen/trigen utilisation rate went above 60.0 percent, the highest CCGT/cogen/trigen utilisation rate in 2014 was only 57.9 percent, occurring in June.

The annual ST utilisation rate was halved again in 2014. It fell from 20.1 percent in 2012 to 10.2 percent in 2013, and dropped further to 4.5 percent in the current year. This was not unexpected with the entrance of more efficient CCGT/cogen/trigen generating facilities. ST generating facilities are generally more costly to operate, thus less likely to be dispatched.

The drop in utilisation rates underscores the situation of a well-supplied electricity market.

Monthly USEP, BVP, LVP and Supply Cushion 2014



USEP trades well below BVP and LVP benchmarks throughout the year

Starting from the third quarter of 2013, the LNG Vesting Price (LVP) and Balance Vesting Price (BVP) replaced the Vesting Contract Hedge Price (VCHP) as a benchmark against the USEP.

A certain percentage of the total allocated vesting quantity is pegged to LNG, i.e., Total Allocated Vesting Quantity = LNG Vesting Quantity (pegged to LNG) + Balance Vesting Quantity (pegged to piped natural gas). Correspondingly, the LVP is the price for the LNG Vesting Quantity allocated, while BVP is the price for the Balance Vesting Quantity allocated.

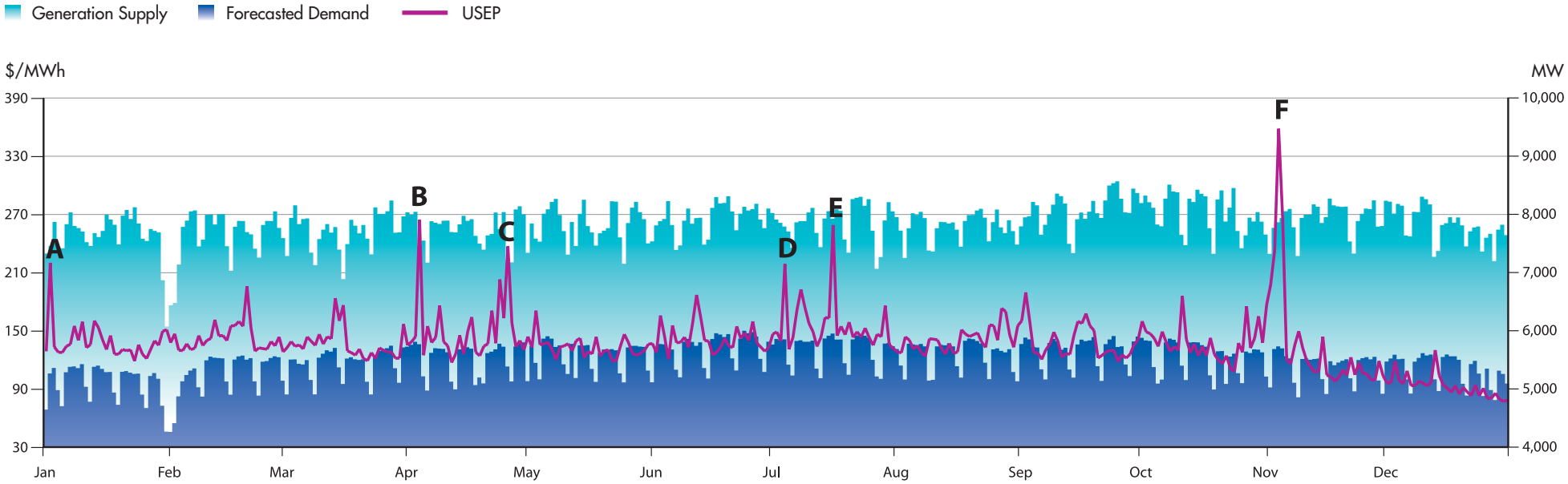
Against the backdrop of a well-supplied market, the monthly average USEP traded between $93/MWh and $156/MWh in 2014. This was significantly lower than 2013, when the range was between $147/MWh and $201/MWh.

The BVP[7] maintained a large buffer that averaged 28.0 percent above the USEP for the year. The closest that the USEP came to reaching the BVP was in July, but even then, it was still a considerable $34.49/MWh or 18.1 percent below the BVP.

The highest monthly average USEP in 2014 was $156/MWh in July, alongside forecasted demand which also peaked at 5,700MW. Correspondingly, the supply cushion was at its lowest point at 27.7 percent. The USEP then started its downward trend in August when it dropped 9.8 percent to $140.46/MWh, before sliding further for another four consecutive months to reach its lowest point of $92.59/MWh in December. The proportions of offers priced below $100/MWh were notably higher in November and December at 65.9 percent and 71.0 percent respectively.

[7] Average of BVP in 2014 was $190.04/MWh; average of LVP in 2014 was $196.02/MWh.

Daily USEP, Forecasted Demand and Generation Supply 2014



The key observations on some of the daily spikes in the USEP in 2014 (higher than $210/MWh) are as follows:

Point A:

On 2 January, the daily USEP averaged $220/MWh. A forced outage of a CCGT facility that occurred in Period 21 lowered supply in the next period by more than 5.0 percent and caused the supply cushion to fall from 23.0 percent to 17.0 percent. The USEP spiked above $700/MWh in Periods 22 and 23. Another forced outage of a generating unit occurred in Period 29, lifting the USEP to the day's peak of $732/MWh with interruptible load (IL) activated for contingency reserve for Periods 29 and 30. In total, there were 14 periods that day when the USEP rose above $300/MWh (Periods 22 to 35). GT was scheduled for these 14 periods.

Point B:

On 4 April, the daily USEP averaged $264/MWh. A CCGT outage in Period 1, along with two other CCGT facilities being on maintenance (total CCGT capacity on maintenance was 733MW or 5.7 percent of total registered capacity), dampened supply availability. Forecasted demand strengthened from Period 16, when it increased by 249MW from Period 15's 5,405MW and climbed at an average of about 80MW per period, until it reached the day's peak of 6,523MW in Period 29. In the same time frame, the supply cushion fell from 25.8 percent in Period 15 to levels below 20.0 percent. Only in Period 37 did the supply cushion climb back above 20.0 percent. There was no IL activation, but GT was scheduled for 15 periods (Periods 19 to 24, and Periods 27 to 35).

Point C:

On 26 April, three CCGT facilities were on maintenance (total CCGT capacity on maintenance was 1,199MW or 9.3 percent of total registered capacity). A CCGT forced outage in Period 30 dragged supply lower. As the supply cushion retreated below 20.0 percent, the USEP rose from $164/MWh in Period 30 to $809/MWh in Period 31. IL was activated for contingency reserve in Period 30 with GT scheduled for 15 periods (Periods 23 and 24, and Periods 31 to 43). There were 8 periods that day when the USEP rose above $300/MWh. The daily average USEP was $237/MWh.

Point D:

On 4 July, two CCGT facilities were on scheduled maintenance, and another CCGT was unable to return from maintenance as scheduled (total CCGT capacity on maintenance was 1,100MW or 8.5 percent of total registered capacity). Separately, the forced outage of another CCGT that occurred in Period 23 propelled the USEP to $556/MWh in Period 24, and the USEP remained above $500/MWh for the next two periods. The supply cushion also fell from 20.6 percent in Period 23 to 18.1 percent in the following period, and it stayed below 20.0 percent until Period 36. IL was activated for contingency reserve in Periods 23 and 24 and GT was scheduled for a total of 15 periods (Period 24, Periods 26 to 36 and Periods 41 to 43). Contingency reserve violation was also recorded in Periods 24 to 31. This violation was due to a newly implemented Stepwise Constraint Violation Penalty (CVP), where the Market Clearing Engine (MCE) would choose to "violate" reserve requirements if the cost of violating them is less than that of scheduling more expensive offers in the market, thereby lowering overall cost to the market. The USEP for the day averaged $218/MWh.

A security constraint limit of 1,450MW applied to four lines between Jurong Pier and the Upper Jurong and Tuas areas reached its limit in Periods 41 to 43.

Point E:

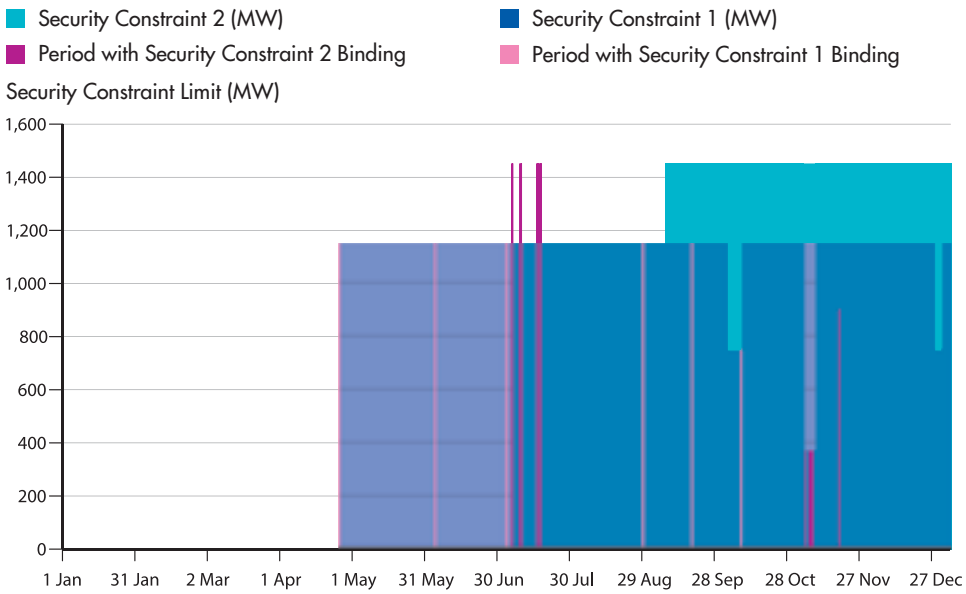
On 16 July, forecasted demand was one of the drivers for the high USEP. Besides hitting the fifth highest daily level in the year, volatility in the forecasted demand (there were 16 periods when forecasted demand rose above 6,500MW – from Period 20 to Period 35) also contributed to the high prices. A CCGT tripping in Period 16 triggered the higher prices, bringing the supply cushion down to 19.6 percent in Period 18 from 24.8 percent in the previous period. IL was activated for contingency reserve in Periods 16 and 17, and GT was scheduled for four periods (Period 19 and Periods 29 to 31). The USEP averaged $258/MWh for the day.

Point F:

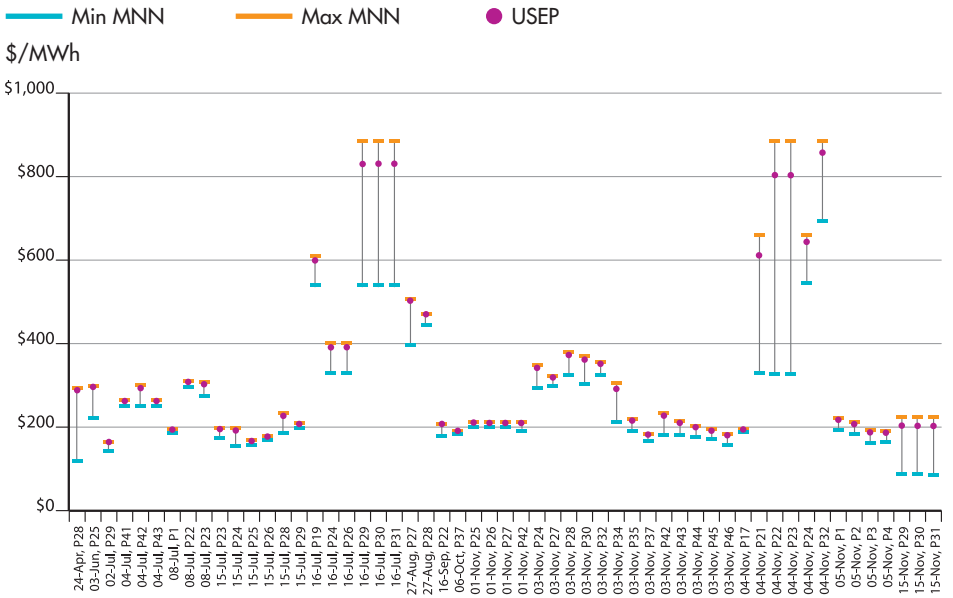
On 4 and 5 November, the average daily prices were at the highest and second highest levels of $358/MWh and $265/MWh respectively. GT was scheduled for 11 periods on 4 November (Periods 24 to 34) and three periods on 5 November (Periods 22 to 24).

Over the two days, there were 21 periods when the USEP rose above $500/MWh, with 14 periods falling on 4 November and seven periods falling on 5 November. The high prices corresponded with the following observations: four CCGT facilities and one steam turbine of another CCGT were on maintenance on both days (total CCGT capacity on maintenance was 765.5MW or 5.9 percent of total registered capacity); security constraint limits were tightened due to the scheduled maintenance work on a constrained transmission line from Period 18 on 1 November to Period 17 on 6 November; on the days when the lower security constraints were imposed, forecasted demand peaked correspondingly, on 4 and 5 November; and finally, offer changes in the affected periods also resulted in the MCE clearing at higher prices.

Security Constraint Limit with Security Constraint Binding



Security Constraint Binding Periods with Minimum and Maximum MNN Prices and USEP



Application of Security Constraints in 2014

In light of the commissioning activities since 2013, the PSO continued to implement security constraints in 2014. This is in line with the view expressed in the EMA policy paper published in 2011 titled *Developments in the Singapore Electricity Transmission Network*[8] – that new generation facilities could lead to excess supply in the network, particularly during the early years of the new plantings. The security constraints were applied to the South-West Block of the transmission grid, which is where most of the new generating facilities in 2013 and 2014 are located.

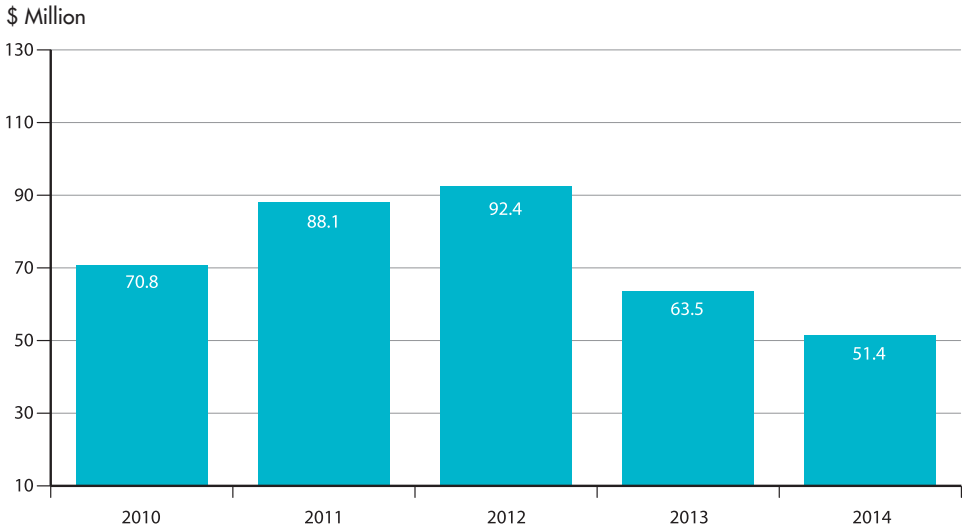
Security constraints were applied from Period 26 on 24 April to Period 48 on 31 December, totalling 12,071 periods or 68.9 percent of the year. This was higher than in 2013 when a security constraint was applied for 55.6 percent of the year. Out of the 12,071 periods in 2014 when the security constraints were in place, security constraint limits were reached (situations known as security constraint binding) for a total of 55 periods, or 0.5 percent of the total periods with the security constraints applied. This was lower than in 2013, when security constraint binding was observed in 131 periods or 1.3 percent of the total periods with the security constraint applied.

The first security constraint which commenced on 24 April consisted of a 1,150MW limit on three lines in the Jurong Island area (Security Constraint 1). On 4 July, another security constraint limit of 1,450MW on four different lines was implemented in the Jurong Pier to Upper Jurong and Tuas areas (Security Constraint 2). Periodically, whenever any of the affected transmission lines were on scheduled maintenance, the PSO modified these two security constraints by tightening the limits or changing the number of lines subject to the constraint, or both. The security constraint limits varied from 300MW on a single line to 1,450MW on four lines.

Typically, the difference between the minimum and maximum Market Network Nodal (MNN) prices is less than $10/MWh, but this widens when the security constraint limit is reached. The charts above show the periods in 2014 when security constraint binding took place, and the associated minimum and maximum MNN and USEP prices. There were several periods across five days (24 April, 16 July, 27 August, 4 November and 15 November) when the differences between the maximum and minimum MNN prices exceeded $100/MWh.

[8] Sourced from EMA website, policy paper #2 published on 5 April 2011.

Annual Reserve Payment 2010 – 2014



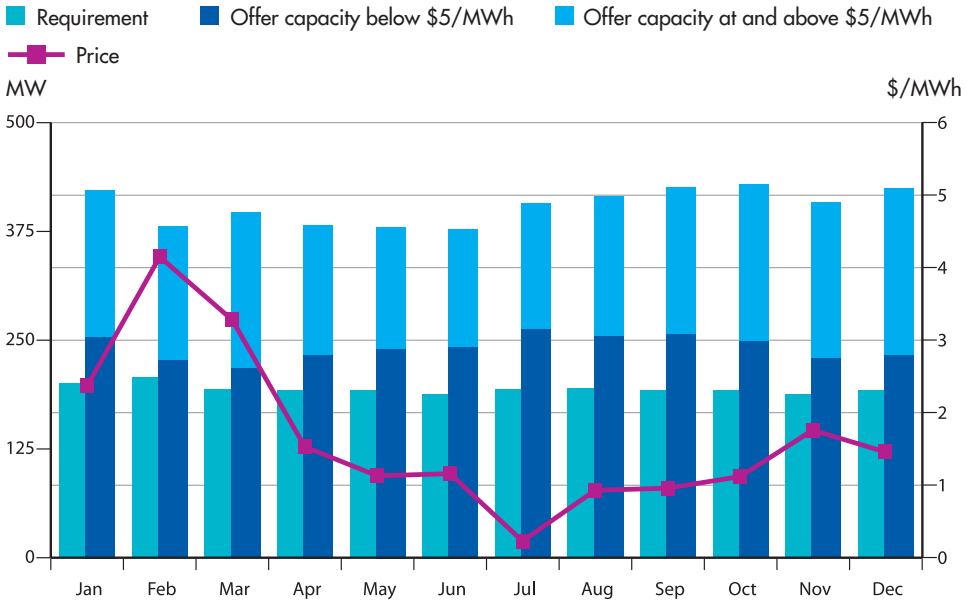
Annual reserve payment drops to lowest level since 2008

Reserves serve as a backup in the electricity market to unexpected outages caused by generators tripping. The amount of reserves required is determined by the amount needed should the largest on-line generator trip. In the NEMS, three reserve products are traded: primary, secondary and contingency reserves. Each reserve has its own price and response time, the latter being 8 seconds for primary reserve, 30 seconds for secondary reserve and 10 minutes for contingency reserve. The generators bear the cost of providing the reserves.

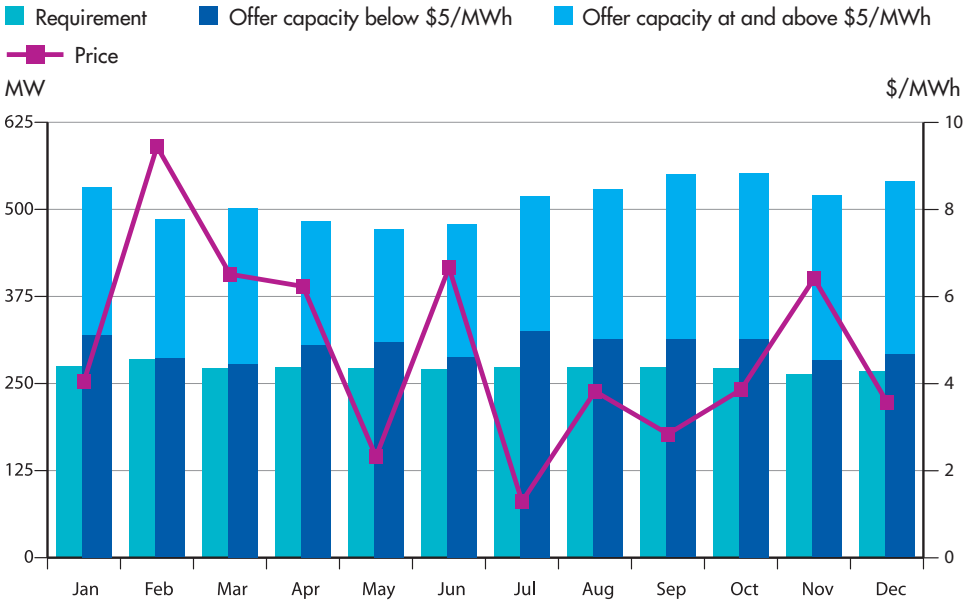
The reserve payment in 2014 was about 19.0 percent lower than 2013, at $51.4 million. This is the lowest level seen since 2008 when the reserve payment totalled $31.6 million. The contingency reserve price drop in the year was greater than the price increases seen in the primary and secondary reserves. In 2014, contingency reserve price fell by $2.93/MWh compared to the year before, while the price increments for primary and secondary reserves were only $0.16/MWh and $1.60/MWh respectively.

The two largest monthly reserve payments took place in January and August at $6.8 million and $6.1 million respectively. These corresponded with the contingency reserve's highest monthly prices which were $10.93/MWh in January and $10.60/MWh in August.

Monthly Primary Reserve Price, Requirement and Supply 2014



Monthly Secondary Reserve Price, Requirement and Supply 2014



Primary reserve price rises as reserve requirements increase and offer availability shrinks

In 2014, the monthly primary reserve price was marginally higher and averaged $1.67/MWh, compared to $1.50/MWh in 2013. The main causes were a higher primary reserve requirement and lower offer availability. The primary reserve requirement was 4.6 percent higher in 2014 than the previous year, while primary reserve offers were 5.1 percent lower. Primary reserve offers in the price tranche below $5/MWh were about 3.1 percent lower in 2014 compared to 2013.

There were no changes to the Risk Adjustment Factor (RAF)[9] in 2014. It was set at 1.0 for all three classes of reserves.

The highest monthly primary reserve price observed was in February when the primary reserve requirement peaked at 208MW. From April onwards, prices were below $2.00/MWh as reserve requirements slipped below 200MW.

2014's increase in primary reserve price was much smaller compared to 2013's rise to $1.50/MWh from $0.46/MWh in 2012.

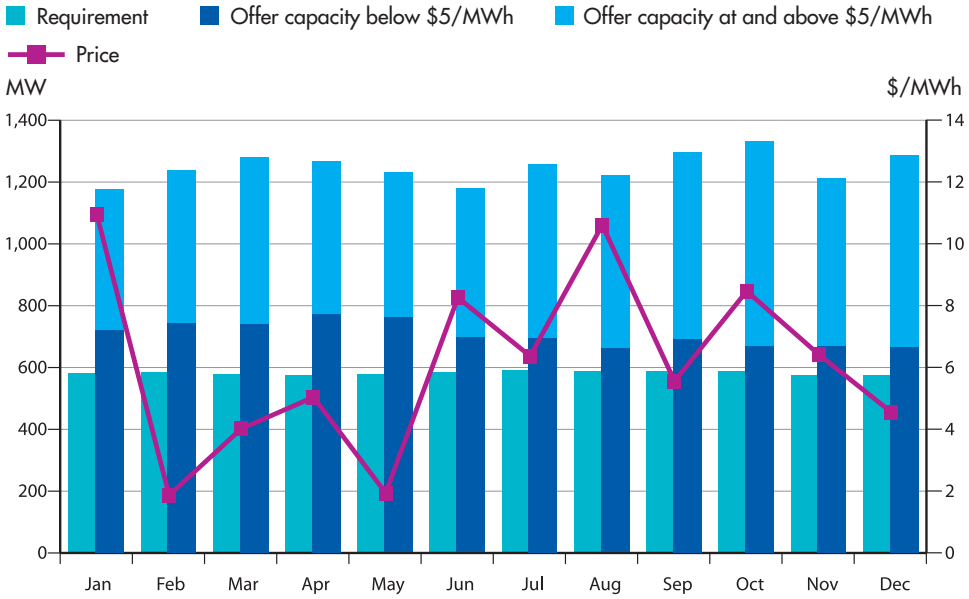
[9] There is a RAF for each class of reserve in the NEMS. The RAF is multiplied by the raw reserve requirement to arrive at the final reserve requirement that is cleared by the market clearing engine (MCE). The PSO may amend the RAF for any reserve class temporarily if it foresees power system conditions that may warrant a higher reserve requirement than usual.

Secondary reserve price mirrors primary reserve price movements

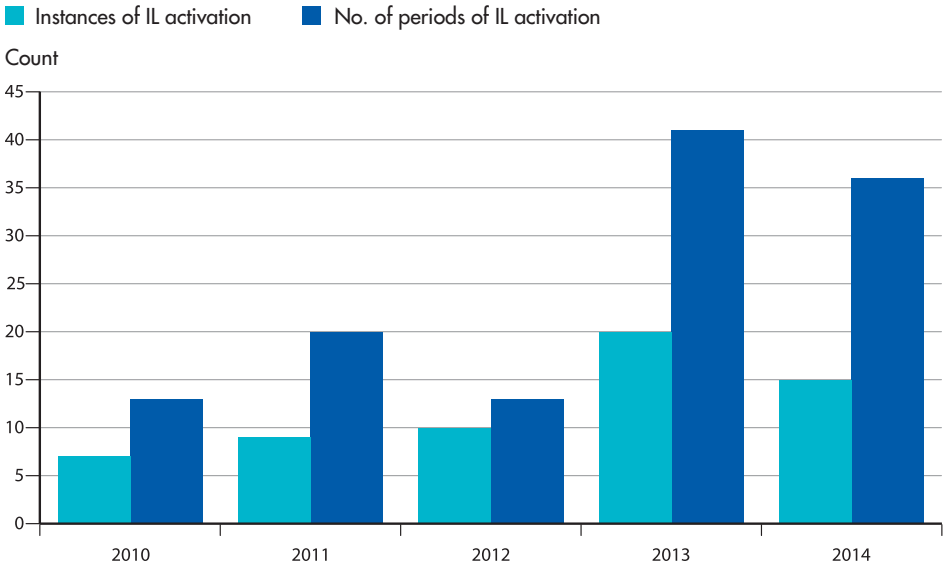
The monthly average secondary reserve price in 2014 of $4.70/MWh was 51.8 percent higher compared to the $3.10/MWh in 2013. Similar to primary reserve, the secondary reserve requirement was higher by 1.3 percent, with the highest requirement seen in February at 285MW. Secondary reserve offers were lower by 5.8 percent, while offers priced below $5/MWh were 4.7 percent lower than in 2013.

The highest monthly secondary reserve price of $9.44/MWh was seen in February, when the secondary reserve requirement was almost at the same level as the amount of secondary reserve offers priced below $5.00/MWh. In all other months, the amount of offers in the price tranche below $5.00/MWh exceeded the reserve requirement.

Monthly Contingency Reserve Price, Requirement and Supply 2014



Annual Interruptible Load (IL) Activations for Contingency Reserve Market 2010 – 2014



Contingency reserve price retreats on lower price volatility and lower reserve requirement

The monthly average contingency reserve requirement was lower by 1.4 percent in 2014 compared to 2013. The monthly contingency reserve requirement was also more stable, ranging between 573MW and 589MW compared to 2013 when it fluctuated between 549MW and 605MW. Although contingency reserve offers in 2014 were 10.5 percent higher overall, there was minimal change in the offers priced below $5.00/MWh, which were 0.5 percent lower than in 2013. The monthly contingency reserve price averaged $6.20/MWh, lower than 2013's average of $9.12/MWh.

Both the highest and lowest monthly contingency reserve prices in 2014 were lower than 2013's respective levels. The highest monthly average price in 2014 was registered in January at $10.93/MWh, while the lowest monthly average price was seen in April at $1.93/MWh.

Instances and number of periods of IL activation decline in 2014

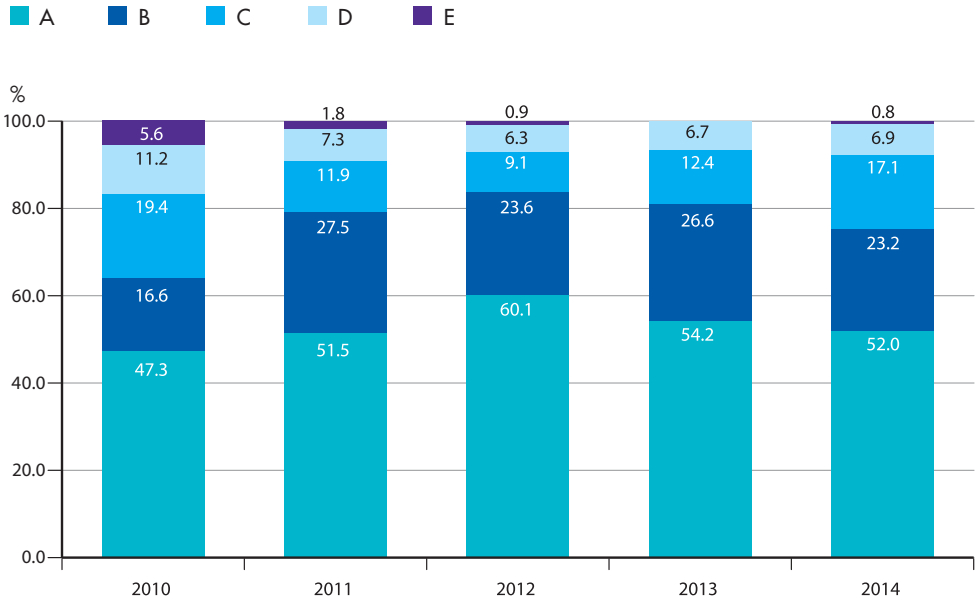
Total IL registered capacity increased in 2014. For primary and secondary reserves, the total IL registered capacity increased from 21MW in 2013 to 23.2MW in 2014 as a result of increased capacity for an existing facility.

For contingency reserve, on top of the increased capacity for the existing facility, a new facility of 2.2MW was also introduced. This raised the total IL registered capacity for contingency reserve to 25.2MW, up from 21MW in 2013.

Like the previous year, IL was not activated for primary and secondary reserves in 2014. The number of IL activations for contingency reserve in 2014 was 15, while the total number of periods when IL was activated was 36. June had the highest concentration of IL activations by number of periods, with 12 of the total 36 periods occurring in the month.

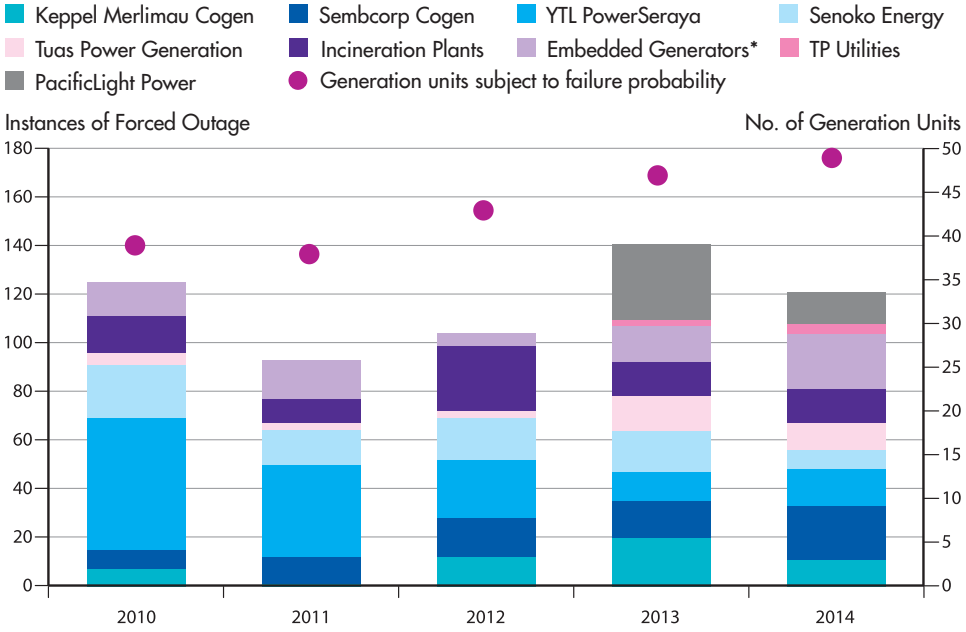
Typically, each IL activation lasted only two periods. The only exception was on 3 June, when IL was activated for 11 periods.

Reserve Provider Group Effectiveness for Primary and Secondary Reserve Classes (Aggregate) 2010 – 2014



Statistics exclude IL providers.
Note: The percentages in this chart may not add up to 100% due to rounding.

Annual Forced Outages by Generation Companies 2010 – 2014



The number of generation units refers to the number of generation units registered in the NEMS which are subject to reserve responsibility share.
*Embedded generators exclude TP Utilities

Reserve provider group effectiveness declines for the second year

Reserve providers in the NEMS are classified into five groups, with Group A reflecting reserve providers with the highest level of responsiveness and Group E reflecting those with the lowest level of responsiveness. A higher level of responsiveness attracts a higher proportion of reserve price.

Ratings for primary and secondary reserve providers fell for the second time since 2012, when the concentration of these reserve providers in Group A was the highest. In 2014, there were 12 changes to the reserve provider group effectiveness ratings, out of which one was an improvement and the rest were downgrades. Of the 11 downgrades, four were moved down by more than one grade (for example, from Group A to Group C). In addition, one reserve provider was categorised in Group E compared to none in 2013.

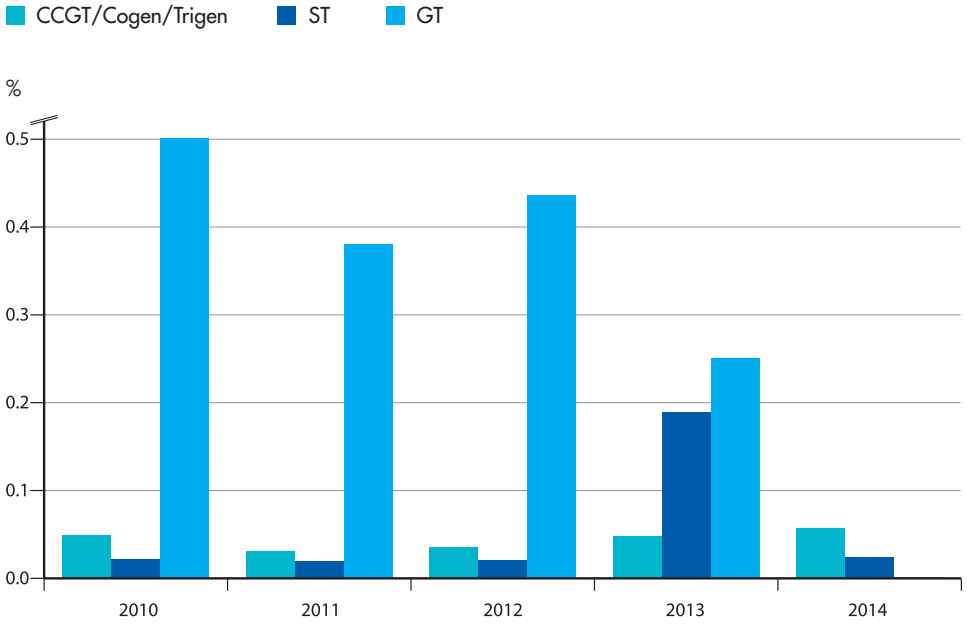
All contingency reserve providers were classified in Group A.

Total forced outages drop in 2014

There were a total of 121 forced outages in 2014. This was a decline from the 141 outages in 2013 which was the second highest number of forced outages since the market started.

Collectively, the number of forced outages from Keppel Merlimau Cogen, Senoko Energy and PacificLight Power in 2014 dropped by 36 compared to the previous year. This contributed to the overall decline in the number of forced outages in 2014.

Average Failure Probability by Year 2010 – 2014



GT failure probability for 2010 was 1.302 percent

Higher CCGT failure probability in Q1 2014 raises average for the year

The average failure probability for a Generation Registered Facility (GRF) is the probability that after being dispatched by the PSO for a settlement interval, the GRF will cease operating, disconnect from the transmission system, or both during that settlement interval, even if no other GRF fails. A generation facility with a lower failure probability will be allocated less reserve cost compared to one with a higher failure probability.

In 2014, the average failure probability for CCGT/cogen/trigen rose to 0.057 percent[10], up from 0.048 percent in 2013. This was due to a high failure probability value in the first quarter (Q1) of 2014 at 0.099 percent.

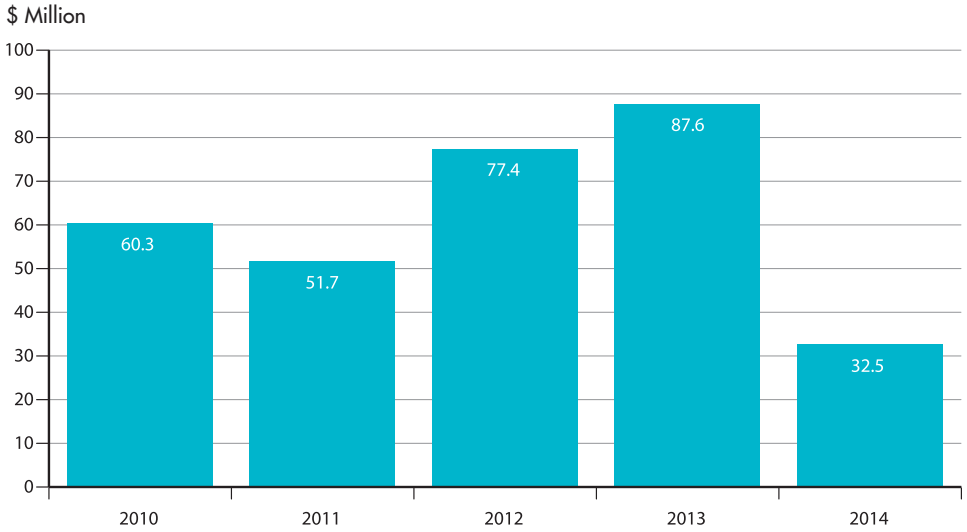
Failure probability values are calculated based on past values[11], so some lag exists. The failure probabilities for the quarters following Q1 2014 were markedly lower as an increasing portion of the forced outage data used in the calculations came from 2014 which had a lower level of forced outages compared to 2013. The CCGT/cogen/trigen failure probability declined to 0.056 percent in Q2 2014, 0.042 percent in Q3 2014, and 0.031 percent in Q4 2014.

The average failure probability for ST declined from 0.189 percent in 2013 to 0.024 percent in 2014, while that of GT dropped from 0.250 percent in 2013 to 0.001 percent (the lowest possible number) in 2014.

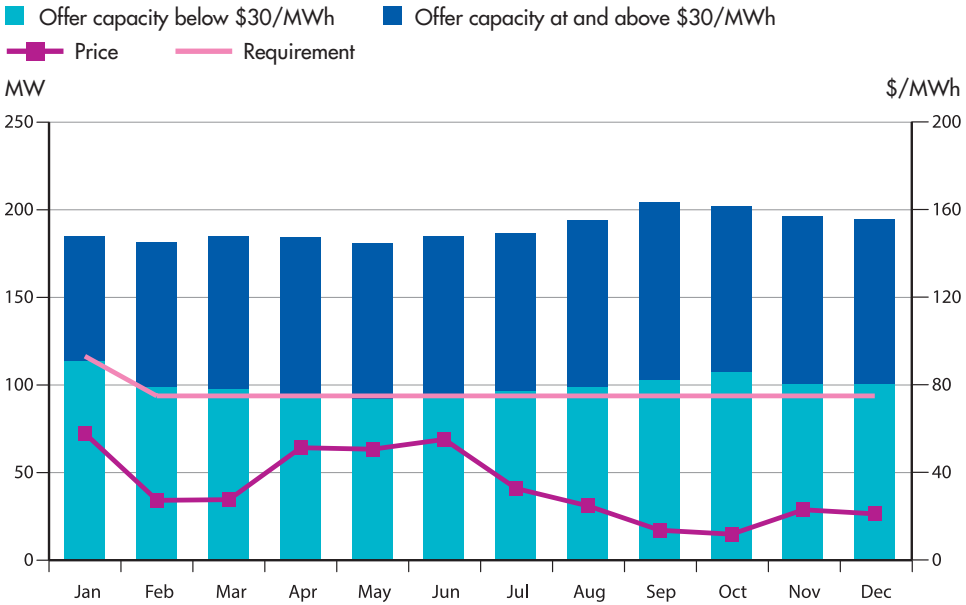
[10] For an average of 10,000 half-hourly periods, CCGT/cogen/trigen incurred 5.7 trips.

[11] Q1 2014 failure probability was calculated using forced outage data between 1 December 2012 and 30 November 2013; Q2 2014 failure probability was calculated using forced outage data between 1 March 2013 and 28 February 2014; Q3 2014 failure probability was calculated using forced outage data between 1 June 2013 and 31 May 2014; Q4 2014 failure probability was calculated using forced outage data between 1 September 2013 and 31 August 2014.

Annual Regulation Payment 2010 – 2014



Monthly Regulation Price, Requirement and Supply



Regulation payment falls along with lower regulation price and requirement

Regulation payment in 2014 stood at $32.5 million, a stark contrast from the $87.6 million in 2013 when regulation payment was at the second highest level since the market started (the highest regulation payment of $108.3 million occurred in 2007). This was the lowest regulation payment seen since 2008 when the amount was $27.5 million.

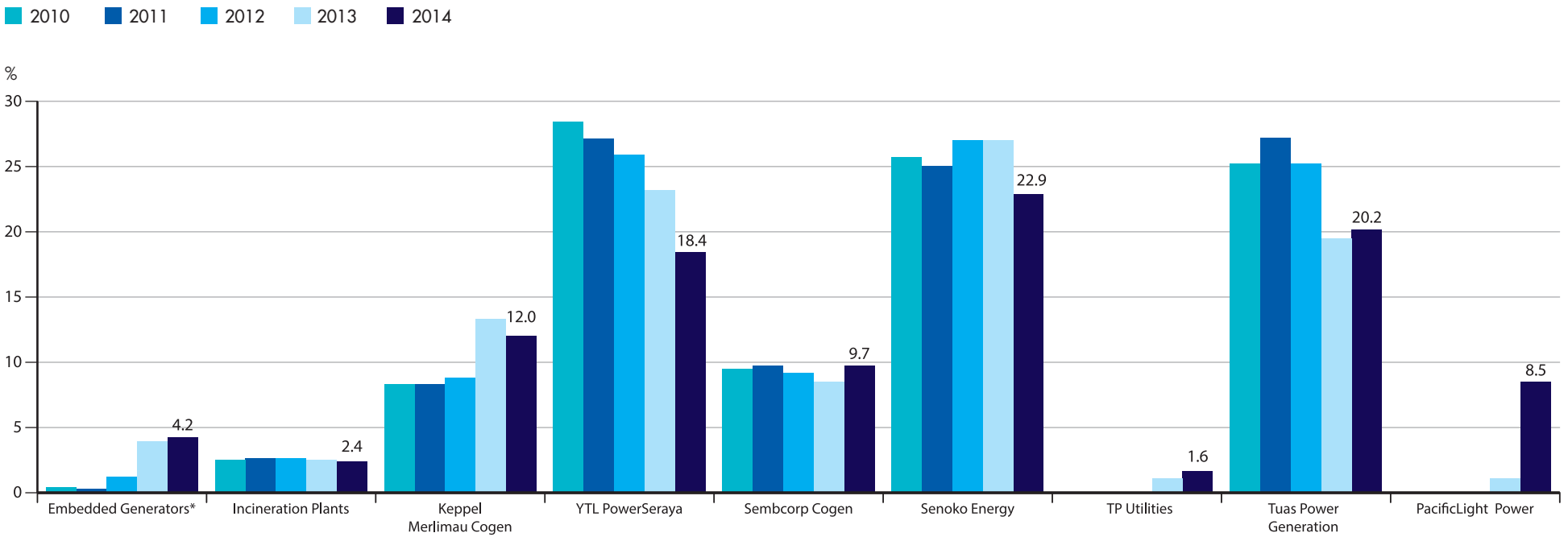
Regulation payment in January was $5.5 million. After the new regulation requirement took effect from 1 February, the average regulation payment from February to December was only $2.5 million.

Regulation price falls on smaller regulation requirement

Regulation price in 2014 plummeted 58.5 percent to an average of $33/MWh, down from $80/MWh the year before. Month-to-month, prices moved within a tight range with the lowest regulation price seen in October at $11.78/MWh, and the highest seen in January at $57.59/MWh.

2014's regulation requirement, which took effect from 1 February, was 19.4 percent lower than the year before. Regulation offers in 2014 were also about 4.0 percent higher than in 2013.

Annual Market Share by Generation Company 2010 – 2014 (Based on Scheduled Generation)



*Embedded generators exclude TP Utilities

More market participants bring about greater competition

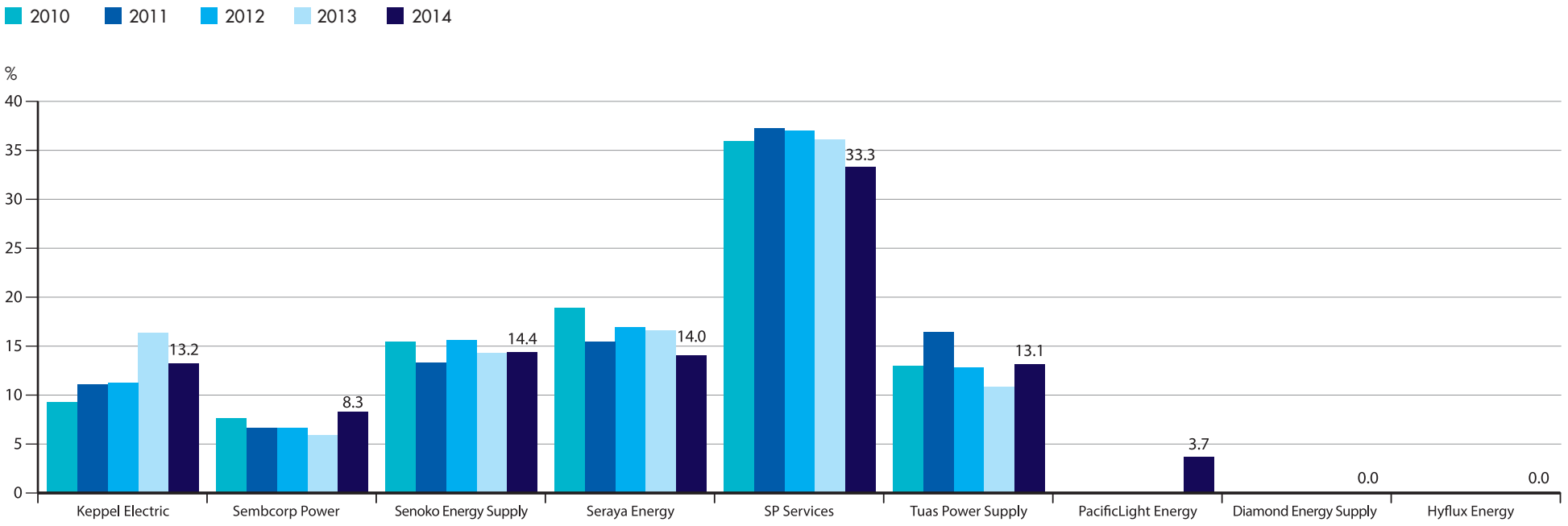
2014 saw shifts in market share that were, to a large degree, an extension of the movements in 2013. The market share of the largest players continued to erode, and that of smaller market participants increased. PacificLight Power, which fielded two generators in June and August 2013, saw its market share rise from 1.1 percent in 2013 to 8.5 percent in 2014. Sembcorp Cogen's third generator, which came online in March 2014, lifted its market share from 8.5 percent in 2013 to 9.7 percent in 2014, after two consecutive years of decline. TP Utilities, which commissioned its second generator in May 2014, saw its market share rise modestly to 1.6 percent from 1.1 percent in 2013.

Of the three largest market participants, YTL PowerSeraya saw its market share slip for the fourth consecutive year, to 18.4 percent. Senoko Energy's market share dropped from 27.0 percent in 2013 to 22.9 percent in 2014.

While Senoko Energy remained the largest generation company by market share, the drop in its market share was significant as it was the first time since the market started when no single generation company had a hold of at least a quarter of the total market share.

Tuas Power Generation gained slightly as its fifth CCGT facility which came online in May 2013 had a stronger presence in 2014. Collectively, the three largest generation companies (Senoko Energy, Tuas Power Generation and YTL PowerSeraya) held a 61.5 percent of the market share, down from 69.7 percent in 2013.

Annual Market Share of Market Support Services Licensee and Retailers 2010 – 2014 (Based on Withdrawal Energy Quantity)



Contestable consumers enjoy a bigger pool of retailers

In 2014, PacificLight Energy garnered 3.7 percent of the retail market, while Sembcorp Power, Tuas Power Supply and Senoko Energy Supply also saw mild increases. The largest drop was seen in Keppel Electric's market share, which fell to 13.2 percent from 16.3 percent in 2013.

Also notable was the drop in the market share of SP Services, to 33.3 percent from 36.1 percent in 2013. In line with the move towards full retail contestability, the Energy Market Authority lowered the threshold to qualify for contestability in 2014 twice: once in April when the threshold was lowered to 8,000kWh from 10,000kWh, and again in October when the threshold was further reduced to 4,000kWh. This would enable more commercial or industrial consumers to choose their retailers.

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 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 2014, EMC issued 20 margin calls, and all were met within the required time frame of two business days.

In 2014, the value of total retail settlement payments (net of bilateral offsets) was $3.47 billion and the value of credit support on 31 December 2014 was $416.6 million.

Contracted Ancillary Services 1 April 2014 to 31 March 2015

Contract Period	Cost of Ancillary Services	Total MW Contracted
01 April 2014 to 31 March 2015	$15,342,803.62	88.848

In addition to the co-optimised reserve and regulation markets, 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, for example, due to a limited number of available suppliers, their prices are regulated.

From 1 April 2014 to 31 March 2015, 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 88.848MW of black-start service at a cost of $15.34 million. The capability was sourced from YTL PowerSeraya, Senoko Energy, Tuas Power Generation and Keppel Merlimau Cogen.

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 Net Fees and PSO Fees Recovered Directly from the NEMS – 1 April 2014 to 31 March 2015

	Total Fees $'000	Fees/MWh* $
EMC Net Fees	24,521	0.2757/0.2700
PSO Net Fees	20,421	0.2277
Total Fees	44,942	0.5034/0.4977

*The full year volume at 89,678MWh is based on the budget for the year approved by the RCP and EMA. EMC's admin fees were reduced from $0.2757/MWh to $0.2700/MWh from 1 November 2014.

Fees Recovered Directly from MPs and Consumers

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

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 black-start ancillary service is contracted by Energy Market Company (EMC) on behalf of the Power System Operator (PSO) on an annual basis.

balance vesting price
This refers to the price for the balance vesting quantity allocated.

balance vesting quantity
With the start of the Liquefied Natural Gas (LNG) Vesting Scheme in the third quarter of 2013, a certain percentage of the total allocated vesting quantity is pegged to LNG. The remaining percentage pegged to piped natural gas is known as balance vesting quantity.

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

contestable consumers
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 (MCE) to ensure that the most inexpensive 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 MCE every half-hour that is the basis for the supply of energy, reserve and regulation in the market.

embedded generators (EG)
Generation units that generate electricity to their onsite load principally for self consumption.

energy
The flow of electricity.

gigawatt (GW)
A measure of electrical power equivalent to one thousand megawatts. Gigawatt hour (GWh) represents the number of gigawatts produced or consumed in an hour.

interruptible load (IL)
A 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.

lng vesting price
This refers to the price for the LNG vesting quantity allocated.

lng vesting quantity
With the start of the LNG Vesting Scheme in the third quarter of 2013, a certain percentage of the total allocated vesting quantity is pegged to LNG. This is known as the LNG vesting quantity.

load
The consumption of electricity.

market clearing engine (MCE)
The linear programme computer application 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 equivalent to one million watts. Megawatt hour (MWh) represents the number of megawatts produced or consumed in an hour.

metered demand
Metered demand is the electricity consumption which is proxied by the withdrawal energy quantity (WEQ).

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 standby 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.

supply cushion
The supply cushion measures the percentage of total supply available after matching off demand.

terawatt (TW)
A measure of electrical power equivalent to one million megawatts. Terawatt hour (TWh) represents the number of terawatts produced or consumed in an hour.

uniform singapore energy price (USEP)
The USEP is the weighted-average of the nodal prices at all off-take nodes.

vesting contract
A vesting contract is a regulatory instrument imposed on some 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. A vesting contract requires these generators to produce a specified quantity of electricity (vesting contract level) at a specified price (vesting contract hedge price).

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 generation technology in the Singapore power system, i.e., the combined-cycle gas turbine (CCGT). EMC's settlement system uses the VCHP to settle the vesting quantity between the MSSL and the generation companies. With the introduction of LNG into the generation mix, the VCHP has been replaced by 'LNG vesting price' and 'balance vesting price' from July 2013.

withdrawal energy quantity (WEQ)
Withdrawal energy quantity (in MWh) refers to the amount of electricity withdrawn by load facilities. It is provided by the MSSL.

wholesale market
The transactions made between generation companies and retail companies.

Generator Licensees	ExxonMobil Asia Pacific	www.exxonmobil.com.sg
	Keppel Merlimau Cogen	www.kepinfra.com
	Keppel Seghers Tuas Waste-To-Energy Plant (in its capacity as Trustee of Tuas DBOO Trust)	www.keppelseghers.com
	National Environment Agency	www.nea.gov.sg
	PacificLight Power	www.pacificlight.com.sg
	Sembcorp Cogen	www.sembcorp.com
	Senoko Energy	www.senokoenergy.com.sg
	Senoko Waste-To-Energy (in its capacity as Trustee of Senoko Trust)	www.kepinfra.com
	Shell Eastern Petroleum	www.shell.com.sg
	TP Utilities	www.tputilities.com.sg
	Tuas Power Generation	www.tuaspower.com.sg
	Tuaspring	www.hyflux.com
	YTL PowerSeraya	www.ytlpowerseraya.com
Retailer Licensees	CPvT Energy Asia	www.cpvtenergy.com
	Diamond Energy Supply	www.diamond-energy.com.sg
	Hyflux Energy	www.hyflux.com
	Keppel Electric	www.keppelelectric.com
	PacificLight Energy	www.pacificlight.com.sg
	Sembcorp Power	www.sembcorp.com
	Senoko Energy Supply	www.senokoenergy.com.sg
	Seraya Energy	www.serayaenergy.com.sg
	Tuas Power Supply	www.tpsupply.com.sg
Wholesale Market Traders	Air Products Singapore	www.airproducts.com.sg
	Banyan Utilities	
	CGNPC Solar-Biofuel Power (Singapore)	www.cgnsedc.com.cn
	CPvT Energy Asia	www.cpvtenergy.com
	Diamond Energy	www.diamond-energy.com.sg
	ECO Special Waste Management	www.eco.com.sg
	Glaxo Wellcome Manufacturing – GlaxoSmithKline Biologicals	www.gsk.com
	Green Power Asia	www.greenpowerasia.com
	MSD International GmbH (Singapore Branch)	www.msd-singapore.com
	Pfizer Asia Pacific	www.pfizer.com.sg
	Singapore LNG Corporation	www.slng.com.sg
	Singapore Oxygen Air Liquide	www.soxal.com
	Sunseap Leasing	www.sunseap-leasing.com
Market Operator	Energy Market Company	www.emcsg.com
Market Support Services Licensee	SP Services	www.spservices.com.sg
Power System Operator	Power System Operator	www.ema.gov.sg
Transmission Licensee	SP PowerAssets	www.sppowerassets.com.sg

Important Notice

This publication is meant only for general information and nothing in it may be construed as advice. Whilst EMC has taken reasonable care in the preparation of this publication, EMC does not warrant its suitability for any purpose. You should always consult your professional advisors before relying on this publication to make any decision.

If you have any specific queries about this publication, you can write to info@emcsg.com.

Energy Market Company Pte Ltd
238A Thomson Road
#11-01 Novena Square Tower A
Singapore 307684
T: +65 6779 3000
F: +65 6779 3030
www.emcsg.com

A member of Singapore Exchange group of companies. Co. Reg. No. 200101336E