Singapore energy market

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Contents

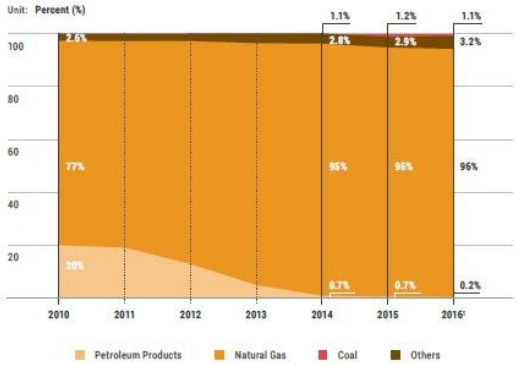
Introduction – recent developments in the Singapore energy industry

With the merchant power market celebrating its first decade of operations and the gas market liberalisation recently completed, Singapore is now looking to finalise its long term energy market strategy. This note serves as an update on some of the recent developments in the Singapore Energy Industry as it enters a crucial phase of development. The attached schedules also present a summary of the functions of the liberalised Singapore Electricity and Gas Markets.

POWER MARKET UPDATE

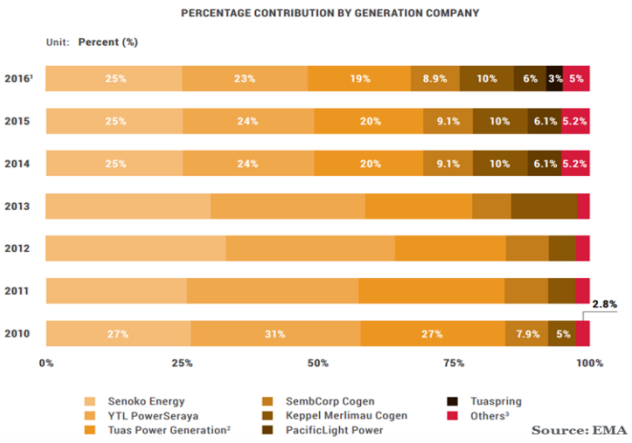
The Singapore power market has witnessed, over the last few years, both expansion and consolidation as it looks forward to the coming years of energy market development. From a consolidation perspective, almost all of the large incumbent power generators have undergone repowering exercises and moved almost exclusively towards CCGT plants for power generation as they reposition themselves in a more competitive wholesale market for power generation. Today, about 95% of Singapore's electricity is fuelled by natural gas.

FUEL MIX FOR ELECTRICITY GENERATION



Expansion of the power generation sector has mainly come from new market entrants like PacificLight Power (formerly known as GMR Energy) who brought 800MW of gas fired units online in early 2014. PacificLight Power is not alone though in the contest for space in the generation segment of the market. Hyflux (through Tuaspring Pte Ltd) joined in the market for power generation as part of the second Tuas Desalination project with a 411MW onsite CCGT plant, and a 120MW waste to energy plant with Mitsubishi Heavy Industries is expected to be completed in 2019.

The expansion of smaller and new market entrants led to a decline in the generation capacity market share of the three largest local power generators – Senoko Energy, YTL PowerSeraya and Tuas Power – sliding from 84% in 2010 to 67% in the first quarter of 2016.



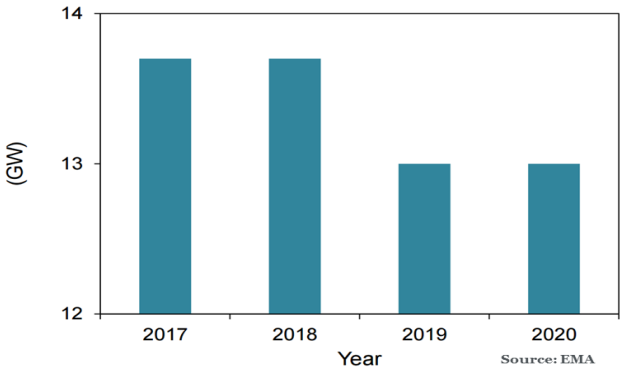
Introduction – Recent developments in the Singapore energy industry (cont'd)

Singapore also continues to encourage energy efficiency as it moves towards a greener future. The most direct manifestations of this include the continued steady growth of the National Environment Agency's waste to energy plants and the likely increase in the number of rooftop solar projects to reduce their carbon footprints.

This is supported by the recent decision announced in Budget 2017 to impose carbon tax, the Energy Conservation Act 2012 which aims to mandate good energy management practices for large energy users[1] and an energy efficiency fund in Singapore to grow businesses that focus on energy efficiency supported by the Economic Development Board ("**EDB**").

All this means that there will continue to be overcapacity in the generation market for the foreseeable future and, at least in theory, the consumers should benefit from this competition[2].

PROJECTED TOTAL ELECTRICITY SUPPLY (CAPACITY)



*Based on the projected licensed capacity as of the end of the calendar year

[1] The Energy Conservation Act 2012 was amended this year to include stronger measurement and reporting requirements for greenhouse gas emissions, regular energy efficiency opportunity assessments and minimum energy performance standards for common industrial systems to further encourage energy efficiency.

[2] As of now, full retail contestability has still not been achieved so household and small consumers retain the Market Support Services Licensee as their default power retailer. The Government however aims to fully liberalise the electricity market in the second half of 2018.

Introduction – Recent developments in the Singapore energy industry (cont'd)

Increased competition in the generation industry however almost immediately translates into a battle for the cheapest fuel source for power generation. For a large part of the foreseeable past, this has been piped natural gas from Indonesia and Malaysia. This dominance (which not only fuels power generation but also major industries in the petrochemicals, electronics and biomedical sectors) has been deliberately challenged in Singapore in the recent past by the importance the Singapore government places in diversification of fuel sources and by the global fall in LNG prices (particularly long-term prices). It is Singapore's long-term strategy for fuel mix diversification for power generation and industry that will dominate this discussion in the coming months.

LNG AND ITS IMPACT ON THE SINGAPORE GAS MARKET

Singapore's current gas import is a mixture of piped natural gas imported through four pipelines from South Sumatra and West Natuna gas fields in Indonesia and the gas imports from Malaysia, together with LNG via the LNG terminal.

Significant focus has been placed by the Singapore government in reducing the reliance on these piped natural gas imports and increasing gas imports from other sources. This led to the Singapore government moving ahead with the development of its first LNG import and regasification terminal[3] and the appointment of Shell Gas Marketing Pte Ltd ("**SGM**") (formerly known as BG Asia Pacific Pte Limited) as Singapore's first LNG aggregator.

At the time this decision was made, piped natural gas into Singapore was significantly less expensive than the comparable LNG price but the decision to proceed was nonetheless made on strategic grounds and ignoring the immediate economics of the decision. Singapore had to create an 'artificial' demand for LNG in order to wean the market off its reliance on piped natural gas. This 'artificial' market was created by simultaneously requiring power generators to accept LNG as part of their fuel portfolio as well as imposing a moratorium on future piped natural gas imports.

In hindsight, the strategy appears to have been prescient. With new sources of gas flooding the global market (both traditional gas fields in Australia (which is set to overtake Qatar as the largest LNG exporter by the end of the decade) and East Africa and shale gas in North America), LNG prices are set to fall in the medium to long term in spite of strong demand from China and Japan. At the same time, the West Natuna and South Sumatra gas fields in Indonesia appear to be depleting at a higher rate than originally envisaged and this, coupled with pressure on the Indonesia government to reserve more of its precious resources for domestic consumption, would likely mean a far less reliable future for piped natural gas imports.

This has led to SGM's 3 Mtpa franchise for aggregating LNG for Singapore having a strong uptake. As SGM's supply approaches the 3 Mtpa mark, The EMA departed from the sole importer framework and awarded Pavilion Gas Pte Ltd and Shell Eastern Trading (Pte) Ltd, following a competitive RFP process, exclusive licences for the next tranche of LNG import to supply up to 1 Mtpa of LNG or for 3 years, whichever is earlier. The second tranche of supply is expected to start in the second half of 2017.

[3] Singapore is now considering a second LNG terminal to be situated in the east of Singapore.

Introduction – Recent developments in the Singapore energy industry (cont'd)

Following the appointment as LNG importer, Pavilion Energy, parent company of Pavilion Gas Pte Ltd, has recently taken big steps by inking a memorandum of understanding with Indonesia's Pertamina to collaborate on, amongst others, small-scale LNG projects within the region. Pavilion Energy is also collaborating with ExxonMobil to improve the safety and operational standards for LNG bunkering in Singapore and developing downstream projects solutions.

In an effort to meet the increasing demand for smaller scale shorter-term contracts, Singapore is considering to allow spot LNG imports of up to 10% of total gas imports in the second half of 2017.

With the LNG terminal able to support 7 LNG storage tanks and up to 15Mtpa of LNG demand, the Singapore government is also open to seeing the LNG terminal being used as a trans-shipment and trading hub. Indeed, the LNG terminal is looking to commission a nitrogen blending facility later this year to accommodate supplies with varying LNG specifications.

Further, the expected 2018 completion of the fourth storage tank at the LNG terminal will increase the spare storage capacity by 260,000 cubic meters, inviting proposals to use the spare capacity which is in excess of the domestic needs. As of today, a number of international LNG trading companies (such as Shell, GDF Suez, ConocoPhillips and BP) have set up LNG trading offices in Singapore and they will be looking to tap the strong regional growth of spot and short-term LNG contracts. There should be no doubt though that the government sees the LNG terminal's first priority as that of helping to ensure security of fuel supply for Singapore.

The decisions on the LNG import strategy made in the recent months are seen as measures taken to tackle the wider question on the long term fuel mix strategy and the on-going question of how LNG imports will affect the import of piped natural gas.

Given the long term investments and decisions required with respect to new piped natural gas import contracts, the EMA is aware that it will not be able to make sharp changes in direction once its long term policy and strategy have been settled. Amongst other things, the EMA will have to make challenging decisions on issues such as LNG imports into the nearby Malaysian LNG import terminals. Where regasified LNG is piped into Singapore from these terminals, they will likely be considered to be piped natural gas and thus subject to EMA's current moratorium.

The extent to which the moratorium may be lifted for such future imports (and thus a potential direct challenge to the business of the Singapore LNG terminal) will be a difficult decision that the EMA will have to make in terms of striking a balance between market forces and price competitiveness and security of supply.

Introduction – Recent developments in the Singapore energy industry

SINGAPORE ENERGY MARKET INVESTMENTS IN THE NEAR FUTURE

The business of the Singapore LNG terminal is, of course, of significant interest to the EMA and the Singapore government as a whole.

The initial intention was for the LNG terminal to be a self-sustaining business model to be run independent of government subsidy (but albeit subject to regulation by the EMA). The decision for the EMA to take over terminal development reflected the urgency and importance with which the government saw the terminal as a cornerstone of its energy strategy.

That said, it remains the intention of the government to, at an appropriate juncture, divest the ownership of the LNG terminal to the private sector (perhaps similar to the way in which the previous Temasek owned generating companies were divested in 2008) – a decision that will no doubt attract significant market interest.

It should also be noted that the EMA is presently exploring the development of a domestic secondary gas trading market (which we expect will support the LNG framework) as well as an update to the Gas Network Code.

The Singapore Exchange and the EMC have also worked together to jointly develop the SGX LNG Index Group ("**SliNG**") as an Asian LNG spot index. The later part of 2017 will likely see the launch of SliNG spot pricing indices for the Dubai, Kuwait and Indian LNG markets

In summary, the Singapore energy market is best described as a 'managed privatised' market. Singapore is adamant not to fall into the cycle of underinvestment and high energy prices that befalls many other privatised energy markets around the world but yet wants to take full advantage of deregulated market practices.

The strategy appears to have worked so far but its continued success will depend on the ability of the EMA and the Singapore government as a whole to balance the supply and demand pressures of the merchant market with the strategic priorities of the city state.

Schedule 1 - Summary of Singapore electricity market deregulation and wholesale market operations[4]

HISTORICAL BACKGROUND

The electricity and piped gas industries in Singapore have traditionally been vertically integrated and government-owned. The Public Utilities Board ("**PUB**") was formed in May 1963 to undertake the supply of water, electricity and piped gas to the population of Singapore.

In 1995, the Government began to implement a number of changes to deregulate the electricity industry. On 1 October 1995, the PUB transferred its electricity and gas activities to Temasek Holdings. Within Temasek Holdings, Singapore Power was created as the holding company for several other new companies including the generation companies, PowerSenoko (now known as Senoko Power) and PowerSeraya; the transmission company, PowerGrid; and SP Services Ltd, the electricity supply and utilities support services company.

A further generator, Tuas Power, was set up as an independent company directly under Temasek Holdings.

THE NATIONAL ELECTRICITY MARKET OF SINGAPORE ("NEMS")

On 1 April 2001, the Government established a body corporate, the EMA, under the Ministry of Trade and Industry ("**MTI**"), to regulate, among others, the electricity industry. In that same year, PowerGrid transferred its system operator function to the Power System Operator ("**PSO**"), and the market operator function and pooling and settlement responsibilities to the Energy Market Company Pte Ltd ("**EMC**"), which was formed as a subsidiary of the EMA to operate the Singapore Electricity Pool ("**SEP**") and subsequently the wholesale electricity market in the NEMS.

The NEMS consists of a wholesale electricity market and a retail electricity market. The wholesale market consists of two markets: the "real-time" (or the "**spot market**") for energy, reserve and regulation; and the "procurement market" for other ancillary services. The sale of energy, reserve and regulation are done through price/offer quantities submitted by generation companies every half hour.

In addition, as part of the government's policy of separating ownership of electricity generation assets from ownership of the Transmission and Distribution Systems, Singapore Power divested its ownership interests in Senoko Power and PowerSeraya to Temasek Holdings. Temasek Holdings subsequently divested Tuas Power, Senoko Power and PowerSeraya to private sector investors.

4 EMA – Introduction to the National electricity Market of Singapore (version 6) – October 2010.

Schedule 1 – Summary of Singapore electricity market deregulation and wholesale market operations (cont'd)

REGULATORY FRAMEWORK

Electricity Act

The Electricity Act is the principal legislation governing the electricity industry and the NEMS. The principal rights and obligations of the participants in the wholesale and retail electricity markets are set out in the Singapore Electricity Market Rules (the "**Market Rules**"), the electricity licences and in the codes of practice (the "**Codes of Practice**") issued by the EMA.

The Singapore Wholesale Market Rules

The Market Rules are effectively contracts between each market participant and the EMC under section 49 of the Electricity Act. This ensures that market participants have the option to take legal action against the EMC for damages sustained as a result of the non-observance of the Market Rules by the EMC and vice versa. The Market Rules also contain dispute resolution procedures.

The objectives of the Market Rules are:

- to establish and govern efficient, competitive and reliable markets for the wholesale selling and buying of electricity and ancillary services in Singapore;
- to provide market participants and the Market Support Services Licensee (the "**MSSL**")[5] with non-discriminatory access to the transmission system; and
- to facilitate competition in the generation of electricity.

Electricity Licenses

Under the Electricity Act, an entity may not engage in certain electricity-related activities unless it has been issued with an electricity licence by the EMA (or it has been exempted from holding one). The electricity-related activities that require an electricity licence are:

- operation of any wholesale electricity market;
- generation of electricity;
- transmission of electricity;
- provision of market support services (such as meter reading and meter data management);
- retail of electricity;
- trading in the wholesale electricity market; and
- importing or exporting electricity.

[5] It should be noted that although the MSSL is obtaining supply from the wholesale market, it is not technically a market participant. However, the Market Rules provide for MSSL to be treated, for the most part, similarly to the manner in which market participants are treated. Thus, a MSSL is subject to most of the same obligations as market participants are under the Market Rules.

Schedule 1 – Summary of Singapore electricity market deregulation and wholesale market operations (cont'd)

Codes of Practice

The electricity licences require that licensees comply with relevant Codes of Practice and other standards of performance that govern their activities. The Codes of Practice contain detailed rules that govern the electricity licensees in conducting their activities. The Codes of Practice developed to date include:

The Transmission Code

The Transmission Code is binding on the Transmission Licensee, which is SP PowerAssets. It sets out the minimum conditions that SP PowerAssets must meet in carrying out its obligations as owner of the Transmission System and to facilitate non-discriminatory access to the Transmission System.

Regulated Supply Service Code

The Regulated Supply Service Code is binding on MSSLs, which is currently SP Services only. It sets out the minimum conditions that a MSSL must meet in carrying out its obligations to procure the supply of electricity and provide market support services to non-contestable consumers under section 21 of the Electricity Act.

Market Support Services Code

The Market Support Services Code (the "**MSS Code**") is binding on MSSLs. It sets out the minimum conditions that a MSSL must meet in carrying out its obligations to provide market support services to Retail Electricity Licensees ("**RELs**") and contestable consumers, and facilitate their access to the wholesale electricity market.

Metering Code

The Metering Code is binding on the Transmission Licensee, generation licensees and MSSLs, and sets out the minimum conditions that a metering equipment service provider must meet in carrying out its obligations to install and maintain meters. It also sets out the roles and obligations of the meter reader and meter data manager.

Codes of Practice for RELs

The Codes of Practice for RELs sets out the minimum standards of behaviour that a REL must observe in retailing to consumers.

Market Agreements and Contracts

Most market participants in the NEMS are required to enter into a number of agreements and contracts. These are generally a consequence of their respective licence conditions, the Market Rules and Codes of Practice. The table in page 9 sets out the various market agreements and contracts in the NEMS.

Schedule 1 - Summary of Singapore electricity market deregulation and wholesale market operations (cont'd)

Agreements	Contact Parties	Purpose
Operating Agreement	PSO and SP PowerAssets	The Operating Agreement gives the PSO the authority to direct the operations of the Transmission System subject to certain limitations on the manner and extent of those operations.
MSSL – EMC Agreement	EMC and MSSLs	This agreement establishes a contractual relationship between the EMC and the MSSL and provides that the Market Rules will have the effect of contract as between the EMC and the MSSL in so far as it applies to them.
MSSL – Market Participant Agreement	MSSL, generation licensees and direct marketing participants ("**DMP**")	This agreement provides for meter reading services for wholesale settlement. The generation licensees pay directly for the services with fees set by the MSSL.
PSO – Market Participant Agreement	PSO, generation licensees, RELs and DMP	This agreement establishes a contractual relationship between the PSO and the market participant and provides that the Market Rules will have the effect of contract as between the PSO and the market participant in so far as it applies to them.
MSSL Agreement	MSSL and RELs	This agreement is a service agreement between the MSSL as provider and the RELs as procurer in relation to the various customer support services as defined in the MSS Code.
Connection Agreement	SP PowerAssets, generation licensees, party wanting DMP and electricity consumers	This agreement gives effect to the obligations that must exist between SP PowerAssets and the party wanting connection services.
Retailer Use of System Agreement	SP PowerAssets and RELs	This agreement is for the collection of Use of System charges ("**UoS Charges**"), that is, the transmission and distribution tariffs, when a REL opts for consolidated billing, that is, when a REL assumes the payment responsibility of its customers for the transmission charges.
Agency Agreement	MSSL and SP PowerAssets	This agreement is an agency agreement for the provision of UoS Charges collection services for SP PowerAssets
Ancillary Services Agreement	EMC on behalf of the PSO and the generation licensees	This agreement is a contract between the EMC and a market participant (usually a generation licensees) supplying ancillary services.

Schedule 1 – Summary of Singapore electricity market deregulation and wholesale market operations (cont'd)

ELECTRICITY INDUSTRY STRUCTURE

The EMA

The EMA was established in April 2001 pursuant to the EMA Act as an independent regulator overseeing the electricity and gas industries in Singapore. Under section 3 of the EMA Act, the EMA is charged with the general administration of the EMA Act, and its functions and duties include:

- to perform the interests of consumers with regard to prices, reliability and quality of services;
- to perform the functions of economic and technical regulator;
- to ensure that electricity licensees provide an efficient service;
- to ensure security of supply of electricity to consumers and to arrange for the secure operation of the transmission system;
- to protect the public from dangers arising from electricity-related activities;
- to create an economic and regulatory framework for the electricity sector that promotes competitive, fair and efficient market conduct and prevents the misuse of monopoly or market power; and
- to advise the Government on matters relating to the electricity system.

In fulfilling these functions, the EMA has at its disposal a number of regulatory tools and powers. These include the authority to issue, suspend, revoke or modify an electricity licence; the power to issue and modify codes of practice and other standards of performance; the power to issue directions to electricity licensees; the power to fine electricity licensees; and the authority to investigate and sanction anti-competitive conduct.

The EMC

The EMC is licensed to operate the wholesale electricity market in the NEMS. The EMC's functions are to:

- operate and administer the wholesale electricity market in the NEMS;
- prepare schedules for generation facilities, loads (that is, the withdrawal of electricity from the Transmission System) and the Transmission System;
- settle accounts of market participants;
- facilitate the planning and augmentation of the Transmission System;
- provide information and other services to facilitate decisions for investment and the use of resources in the electricity industry; and
- exercise and perform the functions, powers and duties assigned to the EMC under the EMA Act, its electricity licence, the Market Rules and applicable Codes of Practice.

The EMC is a wholly-owned subsidiary of Asian Gateway Investments Pte Ltd, whose parent company is the Singapore Exchange.

Schedule 1 – Summary of Singapore electricity market deregulation and wholesale market operations (cont'd)

PSO

The role of the PSO (a division of EMA) is to ensure the security of supply of electricity to consumers and to arrange for the secure operation of the electricity system.

The functions of the PSO include:

- maintaining the reliability of the electricity system;
- forecasting and reporting on conditions on the Transmission System; and
- coordinating the outages of generation facilities.
- providing Transmission System status and load forecasting to the EMC for the purposes of market clearing;
- coordinating the actions of the EMC and market participants during emergencies; and
- dispatching generation facilities.

Market Participant

A Market Participant in the NEMS is defined as a person (that is, an entity or organisation, as well as people) that:

- has an electricity licence issued by the EMA; and
- has been registered with the EMC as a market participant.

The wholesale electricity market is a mandatory market in the sense that any person who wishes to convey electricity over the Transmission System must be registered as a market participant with the EMC. Market participants may be:

- the Transmission Licensee;
- generation licensees;
- RELs;
- persons, other than the generation licensees and RELs, who have been licensed to trade in the wholesale electricity market; and
- any department of the Government that generates electricity before 1 April 2001.

An MSSL is not a market participant.

In the NEMS, it is mandatory for all generation facilities above to be licensed by the EMA. It is also mandatory for generation facilities above 10MW to be registered for dispatch by the PSO. Mandatory registration ensures that all generation facilities of any significant size are subject to the Market Rules.

Schedule 1 – Summary of Singapore electricity market deregulation and wholesale market operations (cont'd)

Transmission Licensee

SP PowerAssets is currently the sole Transmission Licensee in Singapore, and has appointed SP PowerGrid (which holds the transmission agent licence) as its agent to carry out management and operation of its transmission business.

The responsibilities of SP PowerAssets and of the persons whose facilities are connected to the Transmission System are set out in the Transmission Code and the connection agreements. The Market Rules also contain specific provisions for SP PowerAssets and the PSO's obligations in respect of the reliability and security of the Transmission System.

The transmission network transports electricity at high voltage from generators to the low voltage distribution network (or, in a small number of cases, directly to large industrial consumers).

SP PowerAssets, being the monopoly provider of transmission services, is not permitted to compete in the energy market, whether as a generator, retailer or trader (either directly or indirectly by ownership of companies engaged in such activities), because opportunities exist for it to afford a preference to its competitive activities or its competitive affiliates.

Market Support Services Licensee

SP Services is currently the sole MSSL and provides market support services to the majority of electricity consumers in Singapore. SP Services charges regulated fees, as approved by the EMA, for market support services provided.

RELs

The retail electricity market does not come under the jurisdiction of the Market Rules and the EMC. It is created and regulated under the EMA Act, the electricity licenses and the Codes of Practice issued by the EMA.

RELs may be market participants who purchase electricity directly from the wholesale electricity market or purchase through the MSSL. Since the RELs are permitted to trade in electricity and are not subject to the same degree of regulation as the MSSL, they may offer contestable consumers contracts different from those available from the MSSL.

RELs can bundle energy and other charges into a single invoice, charge a price other than the Uniform Singapore Energy Price (the "**USEP**")[6] for energy, and offer additional services to consumers.

Consumers

Consumers are classified as either contestable or non-contestable, depending on their electricity usage. Contestable consumers are entitled to purchase electricity from a REL, or directly from the wholesale electricity market, or indirectly through MSSLs. Non-contestable consumers are supplied by MSSLs.

Currently, consumers with a monthly usage of 10,000kWh and above are contestable. The EMA continues to study when full contestability of all retail consumers will be allowed.

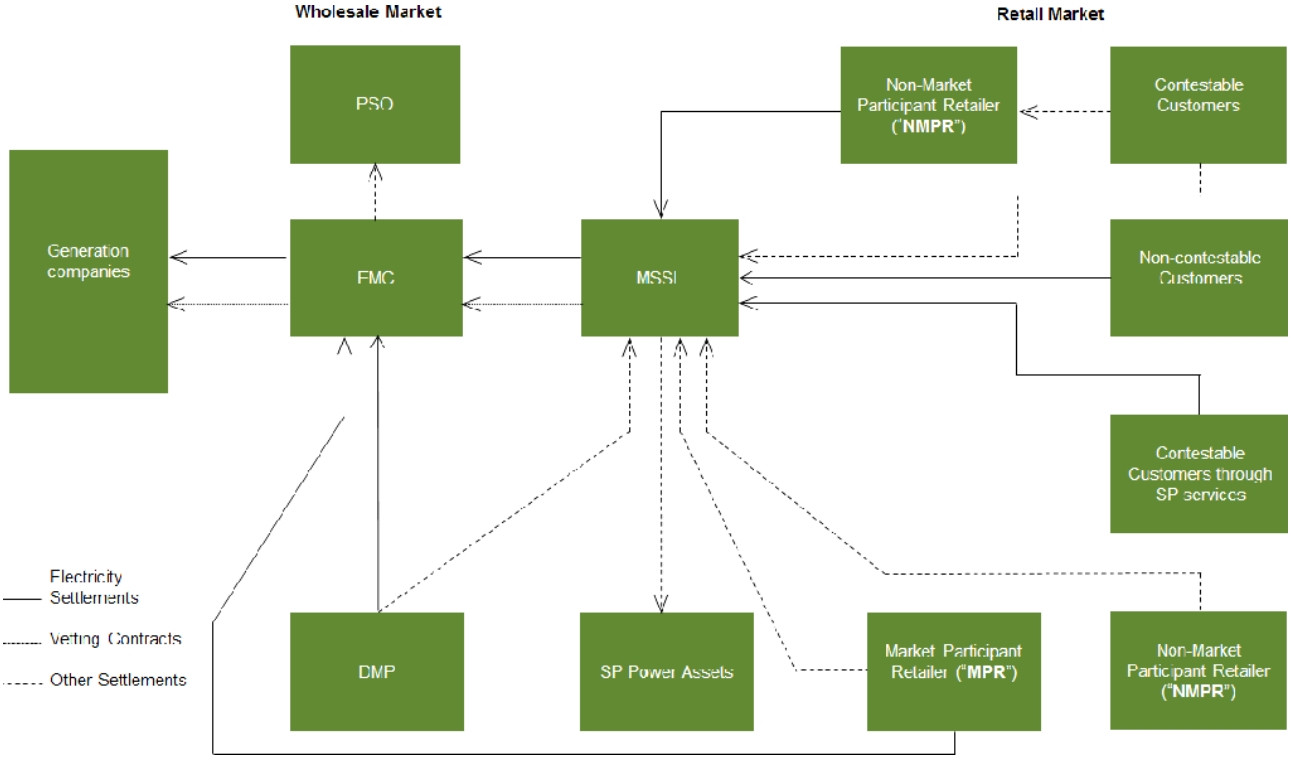
Relationships between the Market Participants

The figure on page 13 shows the financial flows between the Market Participants in the NEMS.

[6] Please refer to page 18 for further discussions on the USEP.

Schedule 1 - Summary of Singapore electricity market deregulation and wholesale market operations (cont'd)

Financial Flows between the Market Participants in the NEMS



Competition

An important role for the EMA is the monitoring of market behaviour to guard against the concentration of market power, abuse of dominance and exercise of anticompetitive behaviours such as collusion and capacity withdrawal to drive up prices. The EMA is also empowered to prohibit anti-competitive practices including restrictions on mergers and acquisitions (that is, there will be cross ownership limitations).

Significantly, the anti-competition provisions in the Electricity Act have retrospective effect. Where the EMA finds that a person has acted in an anti-competitive manner, the EMA can give a direction for the cessation of such conduct and impose a financial penalty on the person.

The electricity industry is excluded from the Competition Act 2004 as the EMA will continue to regulate anti-competitive practices and other competition issues in the electricity industry.

OVERVIEW OF WHOLESALE MARKET OPERATIONS[7]

In the NEMS, the real-time dispatch of electricity (scheduling generators to supply energy, reserve and regulation) is determined by the operation of a wholesale spot market run every half-hour. Generators offer their capacity (specifying price/quantity pairs) to the market and the PSO provides a prediction of the expected load along with any system constraints for that half-hour. The market then determines the least-cost dispatch quantities and the corresponding market clearing prices based on the offers made by generators.

The wholesale electricity market consists of two markets:

- the spot market for energy, reserve and regulation; and
- the procurement market for other ancillary services.

7 EMA – Introduction to the National Electricity Market of Singapore (version 6) – October 2010.

Schedule 1 - Summary of Singapore electricity market deregulation and wholesale market operations (cont'd)

Every half-hour, the Market Clearing Engine ("**MCE**"), a linear programming computer model, determines the spot market outcomes for:

- the dispatch quantity produced by each generation facility;
- the reserve and regulation capacity required to be maintained by each generation facility; and
- the corresponding wholesale spot market prices for energy, reserve and regulation.

Quantities and prices are based on price/quantity offers made by the generators and load forecasts prepared by the EMC based on demand forecast information received from the PSO.

RESERVE AND REGULATION

Reserve is unused capacity that has to be made available to the electricity system quickly to correct any imbalance and maintain reliable supply in case of an unexpected outage of a scheduled generation facility. This capacity must be able to be in production within a short timeframe, depending on the arrangement. There are three reserve classes: primary reserve (eight seconds' response), secondary reserve (30 seconds' response) and contingency reserve (10 minutes' response).

Regulation, or "load-following", is a normal operational requirement to cover second-to-second variations in load away from estimated load.

DISPATCH SCHEDULING

Dispatch scheduling is the process of matching the generation capacity needed to meet forecast demand. It is at the heart of running an electricity system. To enable the MCE to generate the dispatch schedule, the PSO and the generation facilities' dispatch coordinators need to know in advance when each generation facility will be operating and how much output is expected from each. The dispatch schedule comes from the MCE.

The PSO instructs the generation facilities to conform to the dispatch schedule. Any deviations from the estimated load and corresponding schedule are handled by the PSO using ancillary services.

THE MARKET CLEARING ENGINE

Every half-hour, the MCE is run to determine the dispatch schedule and the associated energy market prices for the upcoming dispatch period. The MCE also determines which generation facility is on reserve and regulation duty along with the market prices for reserve and regulation.

The objective of the MCE is to find a set of dispatch instructions that minimises the cost of supplying load at all nodes (injection or exit points) of the Transmission System, as well as meeting the reserve and regulation requirements for electricity. There is no overall cheaper dispatch available, in terms of the offers that have been made to the market, by providing energy, reserve and regulation from different sources, or in different quantities from the same sources. This is the minimum cost market dispatch.

The supply of energy, reserve and regulation is specified by means of offers that contain price/quantity tranches indicating the quantity of energy, reserve or regulation that each dispatchable generation facility is willing to supply at the corresponding energy, reserve or regulation prices.

With the dispatch based on estimates of the demand for the coming dispatch period, the market prices are similarly the prices set according to those estimates. This form of price setting, called ex ante pricing (pricing before the event), gives the market participants certainty about market prices even if dispatch quantities differ from those scheduled[8].

[8] For all but plants providing regulation, energy actually injected should not differ greatly from scheduled energy, under normal circumstances.

Schedule 1 - Summary of Singapore electricity market deregulation and wholesale market operations (cont'd)

The MCE does not produce a single market energy price because of the effects of losses and congestion on the transmission system. Different energy prices apply to different nodes on the transmission system.

THE OFFER PROCESS

Energy, Reserve and Regulation Offers

Generators make offers to supply energy, reserve, and regulation for each of their units in each half-hourly dispatch period in which they want to operate. They are similarly permitted to offer interruptible load to supply reserve. Offers can vary for each half-hour, and are assumed to stand, unless modified, from the time they are made through to dispatch. The market does not distinguish between offers used for the market outlook, pre-dispatch and real-time processes. It simply uses the most recent offer made for each half-hour.

Key features of the generator offer process are:

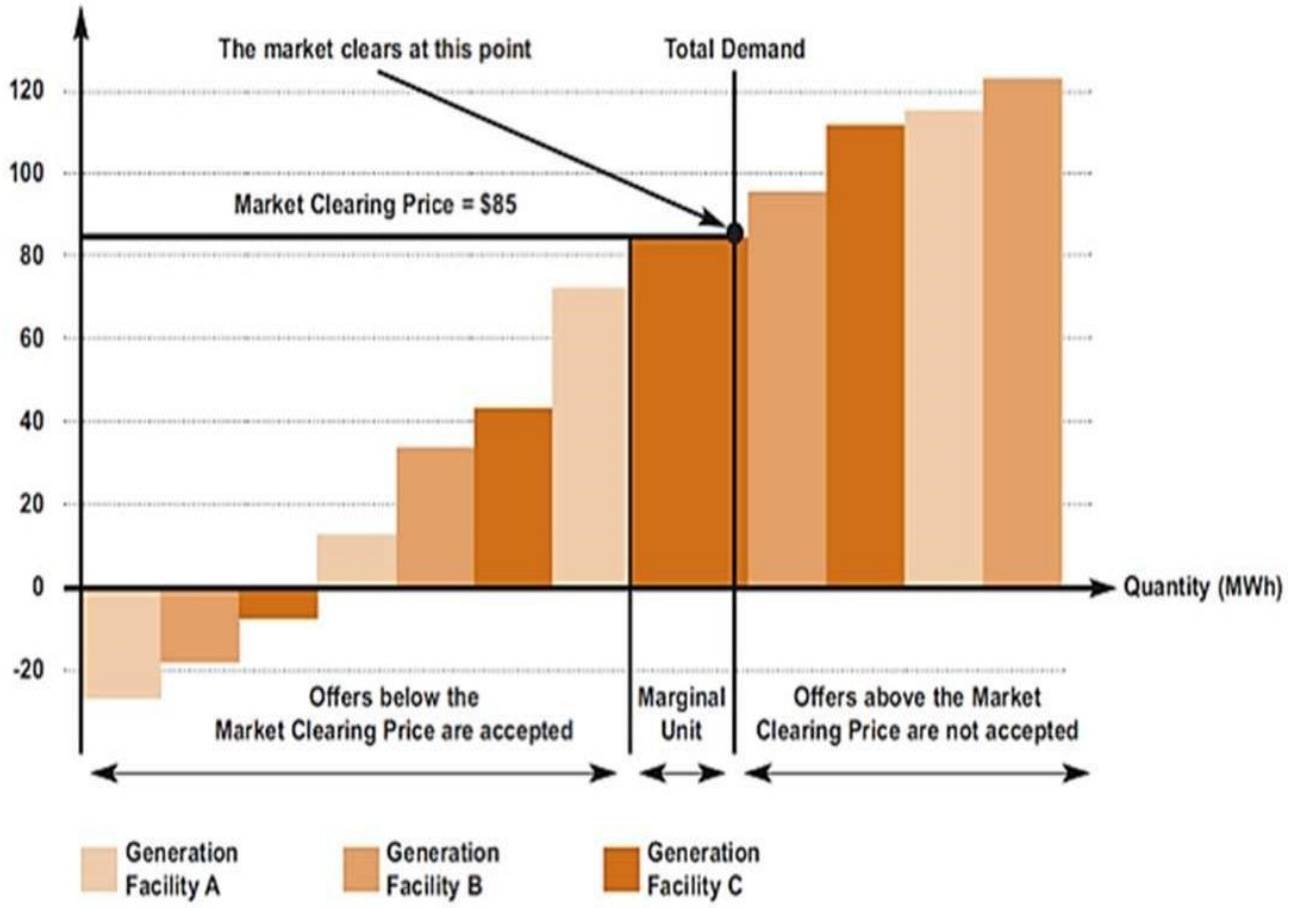
- standing offers are required. Generators are required to make standing offers into the market. The standing offers form a pattern for a week. The use of standing offers is particularly valuable for smaller generators, since it eases the administrative burden of participating in the market;
- continuous adjustment of offers. Market participants are allowed to continually adjust their offers up to gate closure[9];
- up to 10 price/energy quantity bands. Generators may make energy offers consisting of up to 10 price/quantity bands (tranches) for each facility for each half-hour;
- up to five price/reserve and regulation quantity bands. Generators and interruptible load may make reserve offers (of different classes) and generators may make regulation offers if they are registered to do so;
- combined offers. Energy, reserve and regulation are all offered simultaneously, and are co-optimised by the market clearing model. The model respects the trade-offs between the commodities so that a facility will not be scheduled to produce more energy, reserve and regulation than it can simultaneously manage; and
- offers at a node. Energy offers for each generation facility are made at the node where that facility is located.

9 Although offers modified within the last hour may be subject to scrutiny from the market surveillance panel.

Schedule 1 - Summary of Singapore electricity market deregulation and wholesale market operations (cont'd)

Market Clearing Process in the Spot Market

Prices in S$ per megawatt hour ("**MWh**")



Schedule 1 - Summary

MARKET CLEARING PROCESS

The figure on page 16 shows a simplified example of the market clearing process in the spot market.

In this example, there are three generators (A, B and C) whose offers consist of four price/quantity tranches each. The tranches are arranged in ascending price order. The market-clearing price is found at the point where total demand from consumers is met by the offer tranches. In this example, the third tranche from Company C sets the market-clearing price with its offer price of S$85/MWh. The total demand is a forecast of the load for that period.

Offers below the Market Clearing Price are accepted and those generation facilities are dispatched, in full, to the offers. Offers above the Market Clearing Price are not accepted, and so the generation capacity represented by those offers is not taken at all. At the margin, the offer that sets the price is usually only partially dispatched. The generation facility at the margin is called the marginal unit (the "**Marginal Unit**").

UNIT COMMITMENT

The NEMS is a self-commitment market. This means that unit commitment is the responsibility of each generation company, and no start-up or shutdown payments are made (generation companies are expected to factor these payments in to their offering strategy). This fact is important because some generation units require a significant period of time to warm up before they can produce electricity and hence need to be committed some time in advance. The PSO needs to know and account for the ability of the generation unit to ramp up or down. This information is part of the standing capability data required from each generation unit.

PRICES AND CHARGES

Energy Price

In common with many modern electricity markets, the NEMS uses a form of energy pricing referred to as nodal pricing, meaning that prices at each node in the network will be influenced by the physical properties and constraints of the transmission system. This results in the price of energy differing at different physical locations on the network.

The MCE automatically produces a different price at each node on the network. Dispatchable generators are paid the nodal price at their point of injection.

Reserve and Regulation Price

Reserve is generation capacity that is required in case of an unexpected outage of scheduled plant. Because generating units may fail without warning, some reserve capacity has to be made available to the system to correct any imbalance quickly and maintain reliable supply. Reserve is a significant factor in the Singapore system since some generating units (600MW thermal units, for example) are large relative to the total load.

A generator would wish to receive payment for the reserve and regulation it provides because it forgoes the opportunity of being dispatched fully, by being partially available for PSO to call on it for reserve and regulation, as and when required.

Schedule 1 - Summary of Singapore electricity market deregulation and wholesale market operations (cont'd)

Reserve in Singapore can be provided by generation facilities and load[10]. For a facility to provide reserve as quickly as in eight seconds or even in 30 seconds, it needs to be already spinning and synchronised. In most instances, that requires the unit also to be supplying energy, with reserve capability coming from its ability to ramp up its scheduled output very quickly. Since not all plants have this technical capability, a plant has to be certified as meeting the requirements for registration to provide reserve before it can be offered in the reserve market.

There are also different reserve provider groups for each class of reserve. These groups represent the reliability of different reserve sources in providing reserve, and their effectiveness in curtailing falls in system frequency.

Since a facility's capacity may be available for both energy and reserve/regulation, the MCE must consider the optimal trade-off between the offers for reserve, regulation and energy.

In solving the markets for each class of reserve and regulation, the MCE simultaneously finds the lowest cost solution (in terms of the offers made) that trades off between these products for the various facilities. Within the MCE, optimisation of the supply of energy must account for the minimum running level of facilities that provide reserve. The overall optimal solution may result in a unit being run "out of merit" for energy so that the unit is available for reserve[11].

Offers for reserve from a generator can only be made in association with a corresponding offer for energy.

Part of the standing capability date for the plant is a function relating its reserve capability to its energy capability. This relationship is entered into the MCE.

The cost of regulation is recovered from consumers and generation facilities. The cost is allocated on a S$ per MW basis across all MW of consumption in a dispatch period plus the first 10MW of electricity dispatched by each generation facility in that dispatch period.

USEP

While the generation facilities are paid their nodal price, buyers from the wholesale electricity market pay a uniform overall average price so that no customers are disadvantaged by location. The USEP is calculated from the weighted average of the nodal prices at all of the exit nodes on the Transmission System. The nodal energy price at each node is weighted by the energy withdrawn from that node.

VESTING CONTRACTS

In the transition to the NEMS, the EMA had concerns with the degree of market power that will exist in the wholesale electricity market. The EMA has addressed these concerns using Vesting Contracts without interfering with the structure of the wholesale electricity market. Vesting Contracts are contracts for differences ("**CfDs**") vested on the large incumbent electricity generation companies, for a transitional period.

In Singapore, the Vesting Contracts take the following form:

– generators will be required to enter into Vesting Contracts with the MSSL, who is the counterparty to all of the Vesting Contracts. The MSSL will then distribute debits and credits associated with the contracts to consumers, both contestable and non-contestable;

[10] An Interruptible Load scheme was introduced into the Singapore market in 2004.

[11] Since often a facility must be running in order to be available for reserve, it may be dispatched for energy even though its energy offer is higher than that of the marginal plant for energy. This is acceptable because there is no cheaper energy and reserve solution for the system as a whole. The reserve price received by such a plant will compensate it for the shortfall between its energy offer price and the energy spot price.

Schedule 1 - Summary of Singapore electricity market deregulation and wholesale market operations (cont'd)

– Vesting Contracts have a contract price (or strike price) set at about the economic or long-run marginal cost (LRMC) of a new entry generator (i.e. the electricity price that a new investor in base-load capacity would require in order to cover its fixed and variable costs at a reasonable return to shareholders over the life of the plant). The same strike price applies to all generators;

– the contract quantity will be set to keep the market power of large generators at an acceptable level. During peak load times, the contract quantity will be a larger proportion of total load, while in off-peak times it will be a smaller proportion. The average contract quantity will reduce over time as new capacity is built to mitigate the market power of incumbents; and

– the contract quantities for each generator are based on the generation capacity for each company.

Vesting Contracts are settled by the EMC in the wholesale electricity market and by the MSSL in the retail electricity market. The figure below illustrates the settlement process for Vesting Contracts.

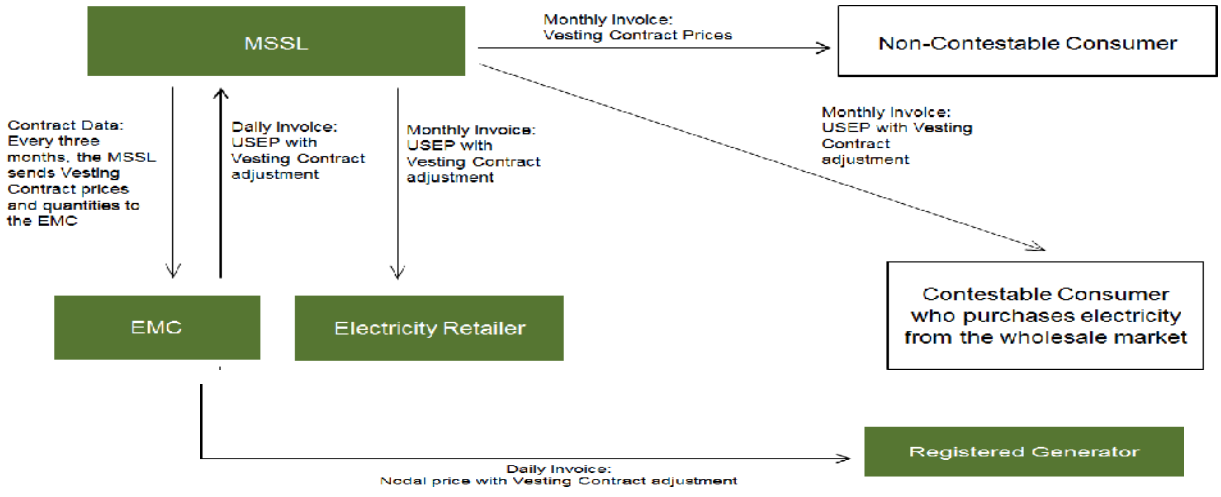
BILATERAL CONTRACTS

The wholesale market in Singapore is not designed to eliminate or be immune to price volatility; rather, it is important to the market that prices move freely. As a result, the design also recognises the need to allow participants to manage price risk.

The generation and electricity retail companies can enter into bilateral contracts, at their discretion, to reduce price fluctuations. These contracts are purely financial arrangements, the most common of which are CfDs.

Under such an arrangement, the contracting parties agree to a strike price for a given volume of energy. They continue to buy and sell on the spot market but settle between themselves any financial difference between the spot and CfD strike price. When the strike price is higher than the spot price, the electricity retail companies make a payment to the electricity generation companies for the difference, and vice versa.

Bilateral contracts create price certainty for the parties and limit their exposure to potential volatility in the spot market. Bilateral contracts are outside the wholesale electricity market and are not taken into account in the physical dispatch process, and are not in any way regulated by the Market Rules. However, the facility exists for the parties to the bilateral contracts to settle their contracts through the EMC's settlement system.



Schedule 2 - Summary of Singapore gas market deregulation and the Gas Network Code

HISTORICAL BACKGROUND

The Singapore Government first announced its intention to liberalise the gas market in March 2000.

The key concerns driving the Government's liberalisation plans related to opening up competition and establishing greater security of supply.

In turn, gas market reform would support the parallel liberalisation of Singapore's electricity market.

Since the initial announcement in 2000 and the implementation of an appropriate regulatory framework, the gas market in Singapore has evolved to a great degree, with new sources of natural gas coming on stream and new entrants emerging in the market.

The Gas Act (Cap, 116A, 2002 rev.ed. as amended) (the "**Gas Act**") was passed in 2001 and most of its provisions have come into force. Modelled on legislation from other liberalised gas markets, the Gas Act seeks to establish, among other things:

- a separate and independent gas transporter in Singapore;
- a single integrated Gas Network Code to govern the relationship between the transporter and other market participants;
- regulated open access to the integrated network, with contractually defined and tradable capacity rights within the transmission network; and
- a licensing regime for the gas transporter, importers, shippers, retailers and LNG terminal operators.

Schedule 2 - Summary of Singapore gas market deregulation and the Gas Network Code

CURRENT KEY GAS MARKET PLAYERS

The EMA

Formed on 1 April 2001, the EMA is a statutory board under the MTI that regulates the electricity and gas industries and markets in Singapore.

Gas Transporter

As described below, in liberalised gas markets, the Gas Transporter is the monopoly owner of the on-shore transportation network consisting of the pipelines between the onshore receiving facility and the relevant offtake valve. PowerGas Limited ("**PowerGas**") is the licensed gas transporter in Singapore.

Gas Importer

Importers own off-shore pipelines and procure natural gas from sources offshore on behalf of end-users by entering into Gas Supply Agreements ("**GSAs**") with gas suppliers upstream.

Singapore's Gas Importers include Gas Supply Pte Ltd ("**GSPL**"), SembCorp Gas Pte Ltd ("**SembGas**"), Senoko Energy Pte Ltd, and Keppel Gas Pte Ltd ("**Keppel**").

LNG Aggregator

The LNG Aggregator's role is to:

- aggregate gas demand from all potential users, excluding those end users which are procuring PNG under long-term EUAs;
- procure LNG from suppliers on behalf of the end-users; and
- enable and facilitate appropriate trading mechanisms for LNG to be arbitraged against PNG and vice versa.

The LNG Aggregator also requires a Gas Importer (LNG) licence.

SGM was selected as Singapore's first LNG Aggregator, while Pavilion Gas Pte Ltd and Shell Eastern Trading (Pte) Ltd have been awarded exclusive licences for the next tranche of LNG import, which is expected to start in the second half of 2017.

Shippers

Shippers, consisting of either Importers or end-users such as generating companies, enter into on-shore transportation agreements with the gas transporter to ship gas from a receiving facility to an end-user or retailer at a point on the transportation network. Under the Gas Network Code, Shippers include Direct Access Customers ("**DACs**') as defined under the Gas Act.

Schedule 2 - Summary of Singapore gas market deregulation and the Gas Network Code (cont'd)

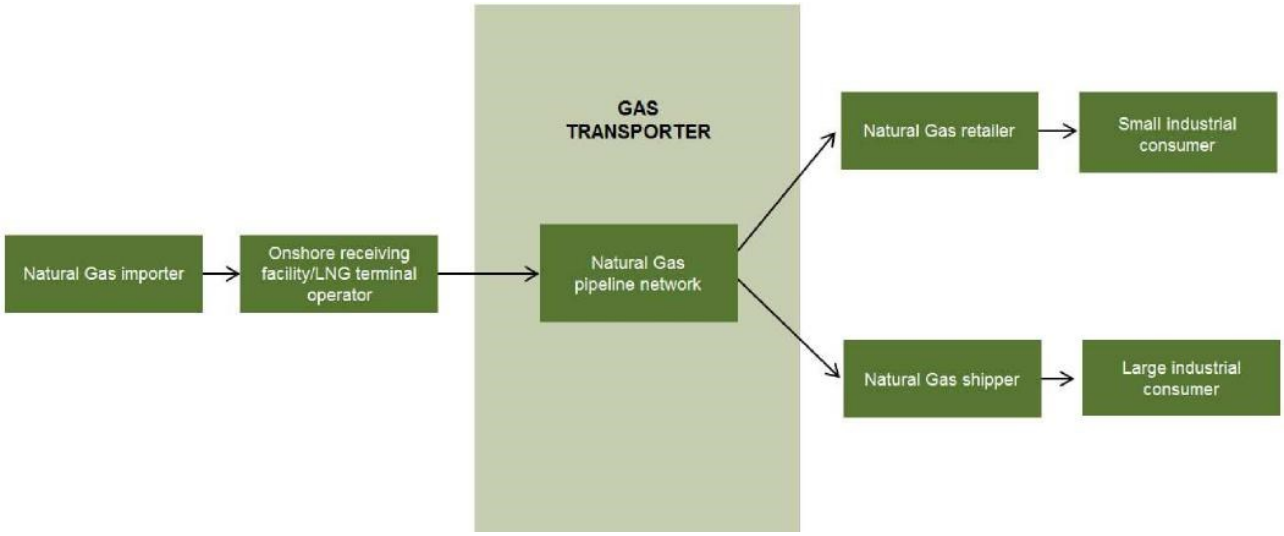
Retailers

Retailers purchase gas from Shippers and sell it on to end users. Retailers will hold a Gas Retailer's licence that will allow them to retail gas to Retail Customers and arrange the transport of gas with the Transporter. They are prohibited from being in the business of gas transportation and will be bound by the Gas Network Code.

Gencos and other End Users

The Singapore Gencos, powered largely by combined cycle gas turbines, are the primary end-users for imported natural gas.

End users enter into End User Agreements ("**EUAs**") with Shippers or Retailers to purchase and consume the natural gas in the system. For example, Senoko Gas Supply Pte Ltd assumes the role as Shipper under the Gas Network Code while also constituting end users themselves. GSPL and SembGas, assume the role of Shippers for the purposes of the EUAs between the parties. End users can also be DACs who contract directly with the Transporter for Capacity Rights. DACs are bound by the Gas Network Code.



THE EXISTING REGULATORY FRAMEWORK: THE GAS ACT

The Gas Act was passed in 2001 to create the competitive market framework for the gas industry as well as to make provision for the safety, technical and economic regulation of the transportation and retail of gas. The figure above is an illustration of the structure of the gas market.

Licensing of Gas Market Players

The EMA's regulation of the gas market players described above shall rely on the licensing provisions of the Gas Act. The impending Section 6(1) provides for the following specific licences.

Transporter Licence

In addition to granting the right to PowerGas to own and operate its gas transportation business, the Transporter Licence (issued under Section 6(1)(a) of the Gas Act), shall set out, inter alia:

- the methodology by which the Transporter is entitled to levy charges;
- the basis for economic regulation;
- the standards/codes to which the Transporter is required to follow and comply; and
- the parameters for safety and security.

Schedule 2 - Summary of Singapore gas market deregulation and the Gas network Code (cont'd)

The rights and obligations set out in the Transporter Licence will be supplemented by the provisions of the Gas Network Code, which will govern the commercial and legal relationship between PowerGas and the Shippers.

Shipper Licence

The Gas Act originally only identified gas transportation and retail as licensable activities, It was subsequently determined that Shippers under the Gas Network Code should also be licensed (Shipper licenses are issued pursuant to Section 6(i)(c) of the Gas Act).

It was felt that relying solely upon the contractual rights of the Transporter under the Gas Network Code vis-à-vis Shippers did not provide sufficient controls in the event a Shipper was behaving unscrupulously.

By making the shipping of gas a licensable activity overseen by the EMA, greater comfort would be given to the industry as a whole that dominant shippers could not unfairly influence the market.

Therefore, as well as being contractually bound to the terms of the Gas Network Code, it will be a licensing requirement that Shippers comply with the Gas Network Code.

Retailer Licence

Retailers (under Section 6(1)(d) of the Gas Act) are licensed for the purposes of protecting consumers. In this regard the licence:

- addresses the basis upon which Retailers may levy charges upon their customers;
- includes price control provisions until retail competition evolves;
- identifies standards of performance to which Retailers are subject;
- specifies the duties to be followed by Retailers upon receiving requests from consumers for gas supply; and
- sets out parameters for safety and security regarding supply of gas to consumers' premises.

*Onshore-Receiving Facility Operator's ("**ORF**") Licence*

Following the 29 June 2004 'black-out' in Singapore, the Energy System Review Committee ("**ESRC**") produced a report (the "**ESRC Report**"), which identified problems associated with the operation of the ORF as causing the black-out, it was recognised that, given the critical role played by ORFs in the Singapore energy supply chain, facilities of this nature should be regulated.

The ESRC specifically recommended "a reliability, outcome-based licensing system for ORF operators in Singapore".

The objective being that poor reliability should be penalised while good reliability should be rewarded. Licensing of ORFs (which incidentally are the same as Upstream Facility Operators under the Gas Network Code) is now covered under Section 6(i)(e) of the Gas Act. The ORF licence addresses operational and safety issues.

Schedule 2 - Summary of Singapore gas market deregulation and the Gas network Code (cont'd)

LNG Terminal Operator Licence

As stated above, Section 6 of the Gas Act as originally drafted has been amended to specifically identify the role of managing or operating the LNG Terminal as a licensable activity (under Section 6(1)(f) of the Gas Act), and its rights and obligations in that capacity are set out therein.

Gas Importation Licence

As part of the fuel policy promoting the use of LNG being implemented, importers of natural gas or LNG need to be licensed so as to enable the EMA to manage any future importation of PNG. SGM, Pavilion Gas Pte Ltd and Shell Eastern Trading (Pte) Ltd, as the LNG Aggregators will need an importation licence under Section 6(1)(h) of the Gas Act.

Accompanying Codes/Regulations

Metering Code

The Metering Code addresses the obligations of Meter Owners to maintain, calibrate and install their meters, the procedures for the provision of meter readings, the specifications to be met for different types of meter and also addresses issues associated with the production, storage, collection, transmission and verification of metering data.

Schedule 2 - Summary of Singapore gas market deregulation and the Gas Network Code (cont'd)

Retailer Code of Conduct

The Retailer Code of Conduct supplements the Retailer Licence and sets forth in detail the minimum standards of performance in accordance with which a Retailer is required to conduct its retail activities. More specifically the code focuses on:

- the manner in which a Retailer may market/advertise its business;
- the manner in which the Retailer must present its invoices to a customer;
- the procedures to be followed to address customer complaints;
- the terms and conditions to be included in a consumer contract; and
- the basis upon which a Retailer may discontinue supply of gas to a customer.

Gas Supply Code

The Gas Supply Code addresses issues of safety in the supply of gas with regard to connections to the system, turn-on, discontinuance, disconnection and alteration of the physical apparatus downstream of the gas meter or gas service isolation valve. More specifically the Code focuses on:

- the obligations of the gas transporter to maintain minimum gas pressure at the premises of retail customers the basis upon, and manner in which an application may be made for the connection of a gas installation to a gas main;
- the basis upon, and manner in which gas may be admitted into the gas appliance;
- the procedures and processes to be put in place by the transporter to respond and attend to gas escapes; and
- the procedures and processes to be followed by the transporter prior to the interruption of the gas supply to a consumer's premises public safety issues in constructing, maintaining, monitoring, inspecting and testing gas pipelines.

Gas Regulations

The Gas Regulations are passed pursuant to the Gas Act and provide the legislative basis upon which relevant persons (other than licensees) are required to comply with applicable codes of practice. The Gas Regulations address the relevant persons responsibility for maintenance and connection along the gas supply chain from a gas main to a gas service pipe, gas meter and gas installation.

The most important of the accompanying codes and regulations for the gas market is the Gas Network Code itself, which will be described in detail below.

SUMMARY OF THE GAS NETWORK CODE

The following list identifies the main features of the Gas Network Code.

Capacity Rights

What are Capacity Rights?

The Transportation System is a pipeline system comprising all gas pipelines, gas plant and gas equipment used for the purposes of the conveyance of gas. The Transportation System comprises the Transmission Network (at which gas pipelines convey gas at a minimum pressure of 18 Bar) and the Distribution Networks (any part of the Transportation System which is not part of the Transmission Network).

Shippers reserve capacity in the Transmission Network between an injection point and an offtake point. Capacity Rights are expressed in mmBtu/Balancing Period (that is one hour) and entitle the Shipper to convey that quantity of gas through the Transmission Network in a Balancing Period.

Schedule 2 - Summary of Singapore gas market deregulation and the Gas Network Code (cont'd)

How can a Shipper obtain a Capacity Right?

Shippers can apply for Capacity Rights directly to the Transporter or can obtain Capacity Rights by trading directly with another Shipper.

A Shipper's Registered Capacity Rights are those expressed in a Capacity Certificate granted by the Transporter to a Shipper. A Shipper's Available Capacity Rights are its Registered Capacity Rights plus or minus any Transferred Capacity Rights depending upon whether it is a Transferee or Transferor or Shipper.

How are Capacity Rights determined and made available to Shippers?

The capacity within the Transmission Network is assessed by the Transporter using assumption modelling based upon pressures/flows/offtake requirements.

It should be noted that the Transporter is required to issue an Open Season Invitation under which all Shippers will be invited to submit applications for new Firm Capacity Rights and/or offers to surrender existing Registered Firm Capacity Rights or part thereof under the following circumstances:

- If an individual applicant's demand for capacity within a pipeline exceeds that pipeline's capability, and the Shipper (not accepting his allocated capacity) requests the Transporter to issue an Open Season Invitation;
- If demand from multiple applicants for capacity within a pipeline exceeds that pipeline's capability and a Shipper (not accepting his allocated capacity) requests the Transporter to issue an Open Season Invitation; and
- If no request to issue an Open Season Invitation is made in a consecutive period of 24 months.

What charges are payable for Capacity Rights?

Capacity Charges are levied to the Registered Shipper in respect of its Capacity Rights on a monthly basis (irrespective of whether or not that Shipper may have traded some of its capacity rights). The level of Capacity Charges can be elicited from a Capacity Statement which is published by the Transporter annually and reflect a distant related pricing methodology. The transporter's allowed rate of returns on its assets in any year is regulated by the EMA pursuant to the gas transportation licence.

Penalty regimes/discipline

Shippers are entitled to convey more gas through the Transmission Network between the system points if they apply for Authorised Capacity Overruns and their application is accepted by the Transporter. In those circumstances a Shipper will pay an enhanced Capacity Charge equal to 1.25 times of the normal charge. If a Shipper fails to apply for an Authorised Capacity Overrun or its request is rejected, but nonetheless flows more gas through the Transmission Network than it is entitled, it will be liable to pay an Unauthorised Overrun Charge set at two times the normal charge.

In the event the Transporter fails to deliver gas to a Shipper at an offtake point in compliance with a nomination/scheduled quantity which accords to a Shipper's Available Capacity Rights the Transporter shall, subject to numerous exemptions, be liable to make payments to the affected Shipper.

Schedule 2 - Summary of Singapore gas market deregulation and the Gas Network Code (cont'd)

Gas quantities

Nominations

For every Balancing Period a Shipper wishing to convey gas through the Transmission Network is required to nominate the quantity of gas it wishes to inject, and offtake, at each point within the Transmission Network. Nominations are made on a seven day rolling basis and can be changed in respect of a single Balancing Period at any point in time up to one hour prior to Gate Closure. Gate Closure is one hour prior to the commencement of a Balancing Period.

A Shipper's Nomination has to be balanced (that is the difference between the amount nominated for injection and the aggregate amount nominated for offtake at all the Eligible Offtake Points divided by the Network Shrinkage Factor is no greater than a quantity of gas equal to 0.001 mmBtu).

In the event a nomination is in acceptable form and is within a Shipper's Available Capacity Rights plus its Authorised Overrun Amount, it will be scheduled by the Transporter within its Initial Operating Schedule.

Within 30 minutes of Gate Closure, the Transporter will issue a Final Operating Schedule. The Scheduled Quantities specified in the Final Operating Schedule are used for various purposes within the Gas Network Code:

- establishing the parameters for the Transporter's liability regime in the event it fails to deliver gas;
- establishing the parameters for Failure to Notify Charges and Nomination Divergence Charges; and
- in assessing a Shipper's Injection and Offtake Quantity pursuant to the default allocation formula.

Schedule 2 - Summary of Singapore gas market deregulation and the Gas Network Code (cont'd)

Metering

In accordance with the metering obligations under the Metering Code, it is possible to assess the metered quantities of gas injected into, and offtaken from, the Transmission Network for every Balancing Period.

The metered quantities/profiled quantities are then utilised in the Gas Network Code for the purposes of Initial Settlement to assess each Shipper's Injection and Offtake Quantities for a Balancing Period.

Once meter readings which have been based on profiled readings are obtained for the Transmission Network Offtake Points and meter readings have been provided in respect of the Distribution Network Offtake Points (which enables the Transporter to re-calculate a Shipper's Aggregate Transmission/Distribution Quantity) each Shipper's Injection and Offtake Quantities for a Balancing Period in a particular month will be recalculated for the Final Settlement process.

Usage Charges and other charges

A Shipper's Offtake Quantity is used to calculate its Usage Charges on the Transmission Network and any Unauthorised Overrun Charges. In addition, in the event a Shipper's Offtake Quantity at a Transmission Network Offtake Point with Balancing Period Read Meter differs from its scheduled quantity by a pre-determined percentage the Shipper will be liable for Nomination Divergence Charges. The Nomination Divergence Charge Rates may be reviewed and revised by EMA from time to time. If the Shipper reasonably anticipates this difference but fails to inform the Transporter, it will also be liable for Failure to Notify Charges.

Commodity Variances

Where a Shipper's Injection Quantity does not equal the Shipper Offtake Quantity and the Aggregate Shipper Transmission/Distribution Quantity (subject to the Network Shrinkage Factor) in a Balancing Period a Shipper will be imbalanced. Such Commodity Variances can be caused by pressure fluctuations or by one Shipper "taking" gas which is deemed to have been injected into the Transmission Network at a different point by another Shipper.

Where a Shipper's Injection Quantity is greater than its Shipper Offtake Quantity (that is it has injected more gas into the system than it has offtaken) that Shipper will have a positive Commodity Variances. By contrast where a Shipper's Injection Quantity is less than its Shipper Offtake Quantity (that is it has offtaken more gas into the system than it has injected) that Shipper will have a negative Commodity Variances.

A Shipper with a positive imbalance in any Balancing Period can bi-laterally trade its Commodity Variances with another Shipper who has a negative Commodity Variances in the same Balancing Period.

Allocation

In order to allow for open competition and as more Shippers enter the gas market, it is possible that more than one Shipper will inject gas at a single Transmission Network Injection Point.

The Metered Injection Quantity at a Transmission Network Injection Point needs to be allocated amongst each of those Shippers to determine each Shipper's Injection Quantity.

The Shippers may enter into an allocation agreement whereby an appointed allocation agent (which can be a Shipper) will, upon being provided with the Metered Injection Quantity for a particular Balancing Period, allocate that quantity amongst the injecting shippers pursuant to the terms of the allocation agreement and inform the Transporter accordingly.

Schedule 2 - Summary of Singapore gas market deregulation and the Gas Network Code (cont'd)

Alternatively, if there is no allocation agreement in effect at a Transmission Network Injection Point where there is more than one injecting shipper or if, during a Balancing Period, the allocated amounts provided by the allocation agent do not accord with the Metered Injection Quantity, the LNG Terminal Operator (in the case of regasified LNG) or the Transporter (in the case of other gas forms) shall, itself, determine each Shipper's Injection Quantity utilising a default allocation mechanism.

The terms of the default allocation mechanism are reflected in the Gas Network Code and are based upon a combination of factors including the attribution of a shipper's offtake quantity to each injection point and the amount of a shipper's nomination (for the purposes of assessing whether a shipper is deemed to have "contributed" to an "excess" or "shortfall" position).

Similarly, where there is more than one Shipper at a Transmission Network Offtake Point, the Shipper Offtake Quantity is determined either by an appointed allocation agent or in accordance with a default allocation formula based entirely on pro-rating the Metered Offtake Quantity amongst the Shippers in accordance with their nominations.

It should be noted that the quantity of gas taken off the Transmission Network from a Transmission/Distribution Point (that is a point where gas passes from the Transmission Network to a Distribution Network at a pressure reduction station) is not allocated amongst the Shippers pursuant to an allocation agreement or a default mechanism.

Instead the quantity metered at such point is allocated, at Initial Settlement, amongst the Shippers based upon a Shipper's profile of customers obtaining gas from that point to determine a Shipper's Transmission/Distribution Quantity.

Following receipt of the actual meter readings from those customers, a Shipper's Transmission/Distribution Quantity in each Balancing Period is re-calculated using a combination of profiling and attribution for the purposes of Final Settlement.

Risks and liabilities

In addition to addressing the mechanics and operating procedures by which gas is intended to be conveyed through the Transportation System, the Gas Network Code also deals expressly with the rights and obligations owed by the Transporter to Shippers and vice versa and the consequences for failing to comply with the provisions established within the Gas Network Code.

Schedule 2 - Summary of Singapore gas market deregulation and the Gas Network Code (cont'd)

The following list identifies those provisions which are most critical to the risk/liability regime.

Gas specification

The Gas Network Code includes a list of gas specification parameters for the quality of gas which may be injected into the Transmission Network. This includes items such as the ranges of calorific value and the Wobbe Index and the maximum permitted allowances for Carbon Dioxide, particulates and various elements (known as the "**Gas Entry Conditions**").

Penalty regime

The pre-defined penalties to which the Shippers are subject, as specified in the Gas Network Code and include the Unauthorised Capacity Overrun Charges, Failure to Notify Charges and Nomination Divergence Charges.

The pre-defined penalties to which the Transporter is subject, as specified in the Gas Network Code and include compensation for Transporter Injection Imbalances. Conversely, there may be Transporter Rebate Payments where the Transporter Injection Imbalance Error is kept within certain limits.

Scheduled Maintenance

The Transporter is entitled to carry out Scheduled Maintenance on the Transmission Network in accordance with its Annual Maintenance Programme. The programme is prepared and published annually. The Transporter must use endeavours to secure that the estimated reduction in the availability of a Shipper's Capacity Rights as a result of Scheduled Maintenance is minimised.

During Scheduled Maintenance the Transporter is exempt from the liability regime to deliver gas to offtake points to the extent disrupted by the Scheduled Maintenance.

Scheduled Maintenance will not, however, effect the payment of Capacity Charges by the Shippers to the Transporter.

Schedule 2 - Summary of Singapore gas market deregulation and the Gas Network Code (cont'd)

System Stress

In circumstances where the operating state of the Transportation System is unsafe (for instance, because of a significant fall in pressure) the Transporter has the ability to declare a System Stress. During the period of System Stress certain provisions in the Gas Network Code will be suspended and the Transporter and the Shippers will need to comply with the System Stress Operating Procedures. For instance, the Transporter can require Shippers to inject and offtake gas from the Transportation System in accordance with its instructions (albeit that the compliance by the Shipper with the instructions is subject to its reasonable endeavours). The Nomination Divergence Charges, Failure to Notify Charges and Overrun Charges will not be payable during System Stress.

After giving a System Stress Notice, the Transporter shall keep Shippers reasonably informed and where reasonably practicable, inform Shippers of the expected Code Re-start Time. Following return to normal operation, the Transporter is then required to appoint an independent appropriately qualified person to investigate the cause of the System Stress and to make, where possible, recommendations for the avoidance of a similar situation arising in the future. Unless the cause of the System Stress is due to the Transporter's negligence or wilful misconduct, the costs incurred during System Stress are allocated to the party causing the System Stress or are smeared across all the Shippers in circumstances where no person is deemed to have caused the System Stress.

Force majeure

As one would expect, force majeure relieves the affected party from performing its obligations under the Gas Network Code. In the context of the Gas Network Code it is acknowledged that essentially the Transporter is obliged to convey gas and the Shippers are obliged to pay Capacity Charges. As such Shippers are only relieved from their obligations to pay Capacity Charges to the extent a force majeure event impacts upon the Transporter's ability to convey gas in accordance with Shippers' Capacity Rights.

The important point to note is that an event which impacts upon a Shipper's ability to take gas (for example an explosion at a power station) will not be construed as a force majeure event under the Gas Network Code.

The event does not affect such Shipper's obligation to pay Capacity Charges. Capacity Charges will, therefore, continue to be payable by that Shipper irrespective of the fact that it is not in a position to receive gas and is making no nominations.

Where a force majeure event under the Gas Network Code lasts for more than 30 consecutive months either party may terminate its Transportation Framework Contract.

Limitations/caps on liability

Aside from the specific remedies identified in the Gas Network Code such as Nomination Divergence Charges, Failure to Notify Charges etc., the Gas Network Code specifically addresses the manner in which other claims may be made against the Transporter by a Shipper or against a Shipper(s) by the Transporter.

In this respect no party shall be liable to any other party for loss or damage, except to the extent that such loss or damage is reasonably foreseeable and arises directly out of any material breach of contract, wilful misconduct by or any negligent act or omission of the Party in the execution of its duties. Claims for indirect, consequential losses, and loss of profits are precluded as well.

The damage will not encompass claims for consequential losses. The liability of the Transporter to any one Shipper is limited to a maximum of S$500,000 per event.

Schedule 2 - Summary of Singapore gas market deregulation and the Gas Network Code (cont'd)

The liability of the Transporter to all Shippers is limited to S$5 million.

These limits do not apply to a party's liability for death or personal injury resulting from that party's material breach of contract, wilful misconduct or negligence.

Credit Regime

Two distinct credit regimes apply to the Shippers under the Gas Network Code. The first applies to their liability to the Transporter for the payment of Transportation Charges (that is Capacity Charges, Usage Charges and Distribution Charges). The second applies to their liability to the Transporter for the payment of Balancing Charges (that is Commodity Variance Charges and Metering Performance Charges).

The credit regime applicable to the Transportation Charges requires a Shipper to remit to the Transporter security (in the form of cash deposits and/or banker's guarantee) in an amount equal to three times its Average Monthly Transportation Code Indebtedness.

The credit regime applicable to the Balancing Charges requires a Shipper to remit to the Transporter security (in the form of cash deposits and/or banker's guarantee) in an amount equal to its Balancing Credit Limit (which is currently set at a value equal to two months of a Shipper's Available Firm Capacity Rights multiplied by the Administered Negative Imbalance Price).

The credit regime applicable to the Balancing Charges is vitally important to each of the Shippers because, ultimately, through the Balancing Neutrality mechanism they each are taking credit risk on each other's ability to settle Balancing Charges.

In other words, in the event the Transporter is required to enforce the security granted in its favour as a result of a Shipper failing to pay its invoice for Commodity Variance Charges and the security is insufficient, the Transporter will look to all the other Shippers for its under-recovery through the Commodity Variance neutrality mechanism.

Shipper Termination

The ultimate sanction (and clearly the last resort) available to the Transporter is to terminate its transportation framework contract with a Shipper in default. A Shipper Default is expressly defined in the Gas Network Code and obviously includes failure to make payment.

In a situation where a Shipper is terminated, all its Registered Capacity Rights (other than where a Transferee Shipper of those Capacity Rights has elected to become the Registered Shipper thereof) revert to the Transporter. Under those circumstances the amount of spare capacity on the system will clearly increase. Another Shipper may "take-up" that capacity, but if that does not occur it is possible that, where the Transporter is permitted to obtain a regulated rate of return on its assets on an annual basis, all other Shipper's costs will be increased accordingly to enable the return to be made on the same asset base with fewer Shippers.

Dispute resolution

The Gas Network Code establishes an expert resolution forum for technical disputes and resolution by arbitration in accordance with the SIAC Rules for all other disputes.

Further information

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