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STRATEGIC ENERGY PROCUREMENT: EFFECTIVE ENERGY MANAGEMENT IN MULTI-TENANTED PREMISES

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ABSTRACT

This paper is the valuable result of a joint effort amongst Tuas Power Supply Pte Ltd, one of the leading retailers in the new electricity market, Singapore Turf Club and Quality Power Management Pte Ltd (QPM), a service provider in the power and energy sectors. It highlights the importance reasons for implementing Strategic Energy Procurement (SEP) as an effective means of energy management in a rapidly de-regulating electricity market. The Singapore Turf Club underlines the usefulness and effectiveness of SEP in creating savings.

Keywords
Strategic Energy Procurement, New Electricity Market, energy retailers, multi-tenanted, de-regulation

1 INTRODUCTION

Liberalisation of the Singapore electricity market is finally taking shape. For over 30 years, the Singapore electricity industry had been vertically integrated and government owned. In 1995, despite being one of the smallest markets in terms of demand size, Singapore became the first country in Asia to kick-off de-regulation of the electricity market. The nation is now into the final phase of implementing the New Electricity Market or NEM.

Under the NEM, electricity will be traded between generator companies and retailers through a “real time” wholesale electricity market, a computer-based wholesale auction market set up and administered by the market operator – Energy market Company (EMC).

Generator companies submit bids to the wholesale electricity market to sell electricity for each of their generator sets. Retailers procure electricity from the wholesale electricity marker to serve end consumers.

The wholesale market is subject to spot prices which can be volatile. A liberalized electricity market creates healthier competition among electricity suppliers allowing market forces to dictate pricing.

Consumers that have been declared contestable can procure energy independently from licensed electricity retailers. The process of achieving contestability and procuring energy from licensed retailer is simply termed Strategic Energy Procurement or SEP.

SEP is a systematic, cost-effective and efficient method of energy procurement. It is rapidly gaining popularity among clients in the commercial and industrial sectors where energy consumption constitutes a significant amount of their operating expenditure. When applied correctly and with good management commitment, it is a highly efficient tool in turning a cost-centre into a revenue-generating centre.

2 NEW ELECTRICITY MARKET (NEM)

As early as 1 October 1995, Singapore began the reform of its electricity and piped-gas industries by separating the regulator from the operational entity. Singapore Power was established to undertake the electricity and piped-gas operations of the Public Utilities Board (PUB).

PUB was re-constituted as the regulator for the newly reformed electricity and piped-gas markets. Singapore Electricity Pool started
operating on 1 April 1998 as the wholesale market for electricity.

This vertically integrated monopoly held by Singapore Power (SP) created an unlevelled playing field as SP was both market operator and power system operator through its subsidiary SP Services Ltd (formerly known as Power Supply Ltd) as PowerGrid Ltd respectively. In 2000, the government decides to fully open the electricity market. In April 2001, SP divested its two generation companies and confined its undertaking to the electricity and gas grids. Energy Market Authority (EMA) was formed on 1 April 2001 to take over the regulatory functions of PUB whilst functioning as the power system operator for the electricity and piped-gas markets.

![Diagram of Singapore electricity industry structure](image1.png)

**Figure 1 : Singapore electricity industry structure**

Source : EMA 2002

SP Services Ltd, a subsidiary of Singapore Power Ltd, will continue to supply to non-contestable consumers. However, it will transform into the Market Support Services Licensee (MSSL) providing market support services such as consumer registration, meter reading, billing and bill collection. MSSL will also be the retailer of last resort.

The Energy Market Company (EMC) will be the market operator of the wholesale electricity market. On 24 June 2002, the EMA commenced the eight-week trial for a new software to manage dynamic energy trading. The software comprise two distinct areas – energy market clearing engine and market settlement system (managed by the Energy Market Company or EMC) and the electronic business transaction and retail settlement managed by SP Services Ltd.

Currently, the licensed retailers in Singapore are: Tuas Power Supply Pte Ltd, SembCorp Power Pte Ltd, Keppel Electric Pte Ltd, Senoko Energy Supply Pte Ltd, Tratebel Asia Pte Ltd, Marubeni Petroleum and Seraya Energy Pte Ltd.

**Managing price risk**

To manage price risk in the NEM, power generating companies employ a variety of tools to hedge against price volatility. Short or long-term financial hedge contracts can reduce exposure to volatile spot prices. These contracts may be based upon agreed price for a defined quantity of electricity (or reserve) at specific times. The most common types of bilateral financial contracts for a power generating company are:

*Contracts for Differences (CfDs)*

CfDs are bilateral contracts between power generating companies and retailers entered at the discretion of the participants based on agreement to a CfD hedge strike price and the volume of energy covered.

*Vesting contracts*

Vesting contracts are a form of CfD vested on the incumbent power generating companies by EMA for a specified transitional period. The objectives of vesting contracts are to limit the potential

![Bilateral financial contracts](image2.png)

**Figure 2 : Singapore wholesale electricity market**

Source : EMA 2002

![Market share by installed capacity](image3.png)

**Figure 3 : Market share by installed capacity**

For Singapore System in Year 2001

- Total installed: 8,100MW
- Peak demand: 5,000MW
- Demand: 33,000 GWh
- 1st quarter 2002 transactions: 7,220 GWh
- Total generation capacity: 8,144 MW
- Maximum Demand: 4,888 MW
misuse of market power by the larger power generating companies and reduce price volatility. When spot price exceeds contracts price, the Market Support Service Licensees (MSSL) pays the generators the difference and vice versa when spot prices fall below contract price.

**Divestment strategy**

The next stage of de-regulation is the 100 percent divestment of the three generation companies owned by Temasek Holdings – Tuas Power, Power Seraya and Senoko Power.

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![Current ownership structure](image)

**Figure 4 : Current ownership structure**

**3 CURRENT ELECTRICITY MARKET**

According to statistics released by the Energy Market Authority (EMA), electricity sales for the first quarter 2002 was 7,220 GWh which is 2.4% higher than the same quarter last year. This increase was due to a 4.6% rise in domestic sales. Non-domestic customers increased by a further 1.9%. Currently, non-domestic customers comprise 80% of the total sales.

**4 CONSUMER CHOICES IN THE NEM**

Singapore officially announced liberalization of the electricity market on 1 January 2003. In the NEM, as contestable consumer can procure electricity in one of the following ways:
- From the wholesale spot market directly as a wholesale market participant
- From the wholesale spot market through Market Support Services Company
- From a licensed electricity retailer through an agreed electricity purchase contract

**5 NEM MILESTONES**

EMA has implemented a phased approach in liberalizing the electricity retail market. There are over 200 contestable consumers with a contracted capacity of 2MW and above. Further liberalization of the retail market is expected after May 2003 for another 6,000 consumers with an annual energy consumption of at least 240,000 kWh. This will be followed by a further 5,000 consumers subsequently. Retail contestability will progressively cascade to the remaining 1 million consumers including households in 2004.

**Table 1 : Time table for the retail competition**

**6 MASTER AND SUB-METERS**

Most commercial buildings in Singapore are multi-tenanted premises. Electricity consumption is measured using master and sub-metering. Electricity consumption for the whole premise is measured by Time-of-Day (TOD) interval meter (master meter) in half hourly intervals.

**7 DYNAMICS OF CONTESTABILITY IN MULTI-TENANTED PREMISES**

Contestability in commercial and industrial property owners can be attained through two key criteria: a contracted capacity in excess of 2 mega watts (MW) and if multi-tenanted, all tenants agree en-bloc to allow the owner to procure energy on their behalf.

The appointed retailer will also lease the tenants’ meter from PowerGrid Ltd on behalf of the landlords. However, the private retailer is not allowed to enter into supply agreements directly with the tenants as they are not contestable until Phase 3 when the marker is fully liberalized. All terms and conditions for the en bloc purchase of electricity shall be constructed as commercial contractual obligations between the landlord and tenants.

SEP covers many fields encompassing administrative, financial engineering, legal and contractual interpretation and documentation, project management and facilitation. The pre-sale period often involves much market education and awareness of the new electricity market. SEP consultants work closely with property owners and facility managers. They have to be technosavvy and help the client navigate through a minefield of legal jargon, interpret legal issues correctly and evaluate proposals from retailers onto a common benchmark. The most daunting task is to educate consumers to look beyond the tariff structure and evaluate the value-added offerings.

They would also need to review the recovery strategies in the event of power failure, appreciate the legal implication of the service level agreement between landlord and tenants, and landlord with retailer, contractual liabilities, pricing model and the financial risk arising from the entry position of spot prices.
Clients appreciate the tangible savings generated through the savings analysis and modeling exercise. However, the financial exercise has to be intricately balanced with the right dose of technical competence.

The ability to work closely with the landlord’s Licensed Electrical Worker (LEW) forms a critical part of SEP. The role of the LEW in the NEM has been further expanded to conducting compliance checks and installation turn-on.

**SEP Methodology**

To expedite complex SEP projects, a systematic approach termed the QPM 3-step methodology was developed. The process involves the following:

- Tenant collective agreement for an en bloc procurement of electricity
- Application to EMA for contestability statutes
- Preparation of tender specifications
- Calling for energy tender
- Tender evaluation and recommendation
- Finalisation of contract documentation
- Management of switchover to new retailer
- Post-implementation monitoring and reporting

The entire exercise of getting contestability for the landlord can be between 21 days to two months depending on the pro-activity of the tenants. Thereafter, the SEP consultant has to follow through with EMA for an official approval before he can proceed with the energy tender.

**Application of SEP**

In May 2022, QPM furnished SEP services to Allgreen Properties Limited for Great World City, a commercial development with a mix of retail and office space occupying over 400,000 square feet of shopping space. The 18-storey complex comprises 140 retail outlets, 46 office units, 304 service apartments and the Tiara Condominium. There are more than 1,000 car park lots to meet shoppers’ needs. From initial modeling of various savings scenario, it was determined that indicative savings of between 5 to 10% of the total energy cost per month could potentially be achieved through switching to a new energy supplier. The savings was modeled on the landlord’s existing charges comprising reactive power, contracted and uncontracted capacity and internal losses. In the modeling exercise, a reduced tariff to tenants was factored in.

### Cost component of electricity

**Customer specific cost**

Customer specific cost includes the cost of reserving customer specific capacity (contracted capacity) and costs which cannot be shared with other customers. System costs refer to costs which can be shared amongst customers based on usage (kWh) and system built primarily to cater for peak usage.

**System costs**

Among the customer specific cost - contracted capacity is rather unique to Singapore. Contracted capacity charge is the cost recovery of deducing capacity to meet the customer’s declared capacity requirements. The rationale for this cost is that assets have to be sunk to create the capacity demanded by the customer. For new supply, the customer’s contracted capacity is fixed for five years. Upwards revision is allowed but not downwards. When the customers exceed the contracted demand, he will be liable for a penalty which is approximately 1.5 times the contracted capacity rate for the extra demand which the retailer has to cater for.

System cost charges include peak and off-peak period charge and effective power charge. Peak period charge recovers the shared network cost and is applicable between the peak period from 7.00 AM to 11.00 PM. Conversely, the off-peak period charge is applicable from 11.00 PM to 7.00 AM. Reactive power is intrinsically a pricing signal to customers to maintain a high power factor in their electrical distribution system. A high power factor indicates higher efficiency.

### Types of value-added services

Retailers can offer as part of their package - meter reading services, billing management system, bill collection on behalf of the landlord, debt management, automatic meter reading (AMR) systems, customer service call centers, load profiling of main incoming feeds, energy audit, energy management services, licensing and servicing of electrical installations, pre-conditioning monitoring and testing of electrical installations, power quality monitoring (on-line, snap shot) and electromagnetic interference monitoring and diagnostics, systems integration and IT applications.

<table>
<thead>
<tr>
<th>Table 2 : Cost components of Grid Charges</th>
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<td>Source : QPM 2002</td>
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### 8 DERIVATIVES OF SEP

Competition had spawned the need for quality, value-added services and level of service as the differentiating factors. In the near future, energy retailers are likely to differentiate themselves by offering innovative packages like:

a. Energy billing management system  
b. Power quality monitoring and analysis  
c. Systems integration and IT application services  
d. Automatic meter reading (AMR) system  
e. Maintenance and technical support services

### Energy billing and management system

The benefits of an in-house billing system includes better management, efficient deployment of resources, integration of energy billing into monthly rental and no vendor lock-in. A comprehensive billing system should include customizable client-specified formats system to generate energy billing together with the monthly rental invoices. In the near future, billing will be web-enabled and made accessible on a 24 X 7 basic.
**Figure 5**: QPM 3-step methodology  
Source: QPM 2002

### Power Quality (PQ) monitoring and analysis
Prime-movers like QPM have been pioneering IT applications and internet-enabled energy meters and software to support real-time energy monitoring of power generation and distribution.

### System integration and IT application services
With more and more internet-based applications being built, there will be a need to either outsource the systems integration portion of the services or to develop and maintain an in-house IT team.

### Automatic meter reading (AMR) systems
Recently, Automated Meter Reading (AMR) interfaces are gaining public interest as an alternative means of meter reading management. Such considerations spring from the need to reduce labour-intensive activities by utilizing higher value-add and short-term Return on Investment (ROI) systems that help increase efficiency and accuracy of services.

### Maintenance and technical support
These services will increase exponentially with the increasing use of more sophisticated software and hardware in the power quality, AMR and billing management system. A new class of service providers will emerge to serve the needs of this market providing technical support, help desk and customer services.

### ENERGY MANAGEMENT STRATEGIES

9. **Strategic Energy Conservation Techniques**
Strategic energy conservation reduces the amount of energy consumed by commercial building owner through reducing lighting loads or installing better efficient air-conditioning equipment. See Figure 6a.

9. **Peak Shaving Strategy**
Peak shaving strategy reduces the building’s maximum demand requirement during the peak periods hence reducing the Use of System cost such as the Contracted Capacity, Uncontracted Capacity and the Network Utilisation charges. It involves direct control of the building’s non-critical equipment which can be load shed during peak periods. Another approach (Figure 6b) would be to utilize self-generation facility to product electricity for self-consumption during peak periods at a lower cost to the peak price of each day.

9. **Load Shifting Strategy**
Load shifting strategy involves shifting of the operation load in the peak periods to the off peak periods or by installing thermal energy storage system for the air-conditioning system, and operating this during the off peak period.

![Diagram](attachment:image.png)

**Figure 6**: Energy management strategies  
Source: Tuas Power Supply Pte Ltd  
(adapted from Hose, J.F. “Demand side planning; a practical perspective”, IEEE Power Engineering Society)

Load shifting also reduces the building’s maximum demand and hence reduces the Contracted Capacity and Network Utilisation cost.

### 10 CONCLUSION
Through implementation of various projects, SEP has proven to be a cost effective means to reduce operating energy expenditure. Inadvertently, bulk purchasing of electricity for group properties is being practiced whereby the property group, on behalf of its tenants negotiates directly with licensed retailers to procure energy at substantially lower rates. However, there is a need to create awareness of SEP services to property owners and building operators before the market fully liberalises in 2004.
Case study: Experience of Singapore Turf Club in Electricity Purchasing

When Singapore Turf Club migrated from Bukit Timah in mid-1999 to the new racecourse at Kranji, its electricity cost doubled. This was further increased when night racing was introduced. In an effort to reduce cost, management set as directive to reduce the electricity cost by at least 10%.


Around mid 2001, the Club solicited quotations from the five listed retailers. From this exercise, it was clear that neither the consumers nor retailers could be specific on the type of retail package best suited for the needs of the consumer.

Trial run

For the first retail contract, the Club embarked on a six-month duration based on fixed 24-hour tariff that was not subject to fuel price index variation. Notice of termination of supply contract with Power Supply Ltd (PSL) was served at end August 2001. The Club exercised its contestable statute on 1st October 2001 with SembCorp Power, opting for an all-hours fixed tariff for a six-month period. Initially, the electricity bill for October 2001 was about 2% lower compared to Power Supply Ltd.

On September 11, disaster struck at the World Trade Centre, New York. This set off a string of global event plunging the oil index to a historical low. Recession set in and the electricity tariff took a massive plunge as it was pegged closely to the oil price index. PSL revised its tariff down by 3.3% on 1st November 2001 thereby effectively eliminating the 2% saving.

The Club bargained for a lower tariff. Fortunately, the retailer reduced the tariff and offered various schemes (some with 20% savings) on the condition that the supply contract be extended. The six months contract was allowed to lapse and a new tender was called. On 1st Jan 2002, PSL unexpectedly reduced their tariff further by 9% for peak and 29% for off-peak. The adjustment meant that buying power from the retailer (based on previous secured supply contract) was more expensive, various conditions were incorporated into the tender specification:

a. As long as PSL remains a retailer for contestable customers, the successful Tenderer shall match PSL’s high-tension tariff if PSL tariff becomes lower than that proposed by the Tenderer, and;

b. In the event that PSL revises their tariff upwards within the contractual period, the tenderer shall revise his tariff to match PSL’s or their proposed tariffs whichever is lower.

This tender involved seven licensed retailers including Seraya Energy and Marubeni International Petroleum. Out of these, five retailers responded.

Analysis and Comparison

All the retailers submitted different rates for peak and off-peak period. To determine the most competitive package, the Club developed its own analysis tools using time and load weighted averages.

Time weighted average (TWA):

\[ TWA = \frac{1}{2} \times X \text{ peak rate/kWh} + \frac{1}{2} \times X \text{ off-peak rate/kWh} \]

Load weighted average (LWA):

\[ LWA = \text{peak LR} \times X \text{ peak rate/kWh} + \text{off-peak LR} \times X \text{ off-peak rate/kWh} \]

Saving achieved

The SEP exercise yielded savings of about 15% per month since July 2002. The secured tariff was based on an oil index of about US$120/MT, i.e. monthly average price for 180cst HSFO (high sulphur fuel oil). This was close to historical low. However, with the impending tension of war in the Middle East region, the current oil index of about US$170/MT is expected to increase further and thus the published electricity tariffs will increase in tandem.

Fortunately, with the good tariffs secured, The Club is able to reap substantial energy savings for financial year 2002/03 ending 31 March 2003. Coupled with good in-house energy management strategies, the monthly electricity bill was reduced by 25% compared against budget and about 15% if procured from PSL.

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ABOUT THE COMPANIES
Quality Power Management Pte Ltd
Quality Power Management Pte Ltd (QPM) is a leading service-provider offering multi-disciplinary solutions to the power and energy sectors. A pioneer in power quality monitoring, energy management and strategic energy procurement, its domain expertise spans the building, construction and facilities management sectors.

Tuas Power Supply Pte Ltd
Tuas Power is the first electricity generator to emerge and compete with incumbents in the Singapore electricity market. Establishes since 1995 as a wholly owned subsidiary of Temasek Holdings, it manages a balanced portfolio of highly efficient combined cycle plants and flexible conventional steam sets. With its current capacity of 1,935 MV, Tuas Power’s total generation capacity will increased to 2,670 MW with the addition of two more combined cycle plants in late 2005 or early 2006. Its retail subsidiary, Tuas Power Supply Pte Ltd, is a trusted energy solutions provider which is currently among the leading electricity provider for contestable customers who have switched from the traditional supplier to an independent retailer.

Singapore Turf Club
Singapore Turf Club operates horse racing and gaming business in Singapore. In addition to the world class horse racing facilities at Singapore Racecourse in Kranji, there are 70 branches located around Singapore to better serve its customers. Details of the club can be found at: www.turclub.com.sg