National Electricity Market of Singapore: The Road to Liberalisation and Challenges Ahead

Yip Pak Ling
Senior Vice President, Market Operations
Energy Market Company
Agenda

- Singapore’s reform programme
- Introduction to the National Electricity Market of Singapore (NEMS)
- Market structure
- Market features
- What the NEMS has brought to Singapore
- Market performance in 2003
- Developments in 2004
- Challenges Ahead
Singapore’s Reform Process

Impetus for reform

- Electricity market reform is seen as a way of:
  - attracting private investment
  - increasing the efficiency of government assets
  - sending accurate price signals
  - encouraging innovation
  - providing consumer choice

- Electricity market has a significant impact on the competitiveness of a country’s economy
Singapore’s Reform Process

Milestones

1995
- Singapore Power formed, Oct 1995

1998
- Wholesale electricity pool commenced, Apr 1998

1999
- Government review of electricity industry, Sep 1999

2000
- Government decision on further deregulation, Mar 2000

2001
- Energy Market Authority formed, Apr 2001
- Energy Market Company formed, June 2001

2003
- New Electricity Market commenced on 1 Jan 2003

2004
- Introduction of Vesting Contracts & Interruptible Load
Introduction to the NEMS
Participants in the Industry

Senoko Power Ltd
Tuas Power Ltd
Power Seraya Ltd
NEA
SembCorp Power Grid Ltd

Regulator
System Operator
Market Operator (EMC)
Electricity Retailers
- Keppel FELS Energy Supply Pte Ltd
- SembCorp Power Pte Ltd
- Senoko Energy Supply Pte Ltd
- Seraya Energy Pte Ltd
- Tuas Power Supply Pte Ltd

Non-Contestable Customers
Contestable Customers
Introduction to the NEMS
Installed Capacity

MW

<table>
<thead>
<tr>
<th>Facility</th>
<th>CCGT</th>
<th>ST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senoko Power</td>
<td>1,000</td>
<td>1,200</td>
</tr>
<tr>
<td>PowerSeraya</td>
<td>1,000</td>
<td>1,500</td>
</tr>
<tr>
<td>Tuas Power</td>
<td>1,000</td>
<td>1,500</td>
</tr>
<tr>
<td>National Environment Agency</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>SembCorp Cogen</td>
<td>500</td>
<td>500</td>
</tr>
</tbody>
</table>
Introduction to the NEMS
Installed Capacity

The chart illustrates the increase in MW (megawatts) for Installed Capacity, Peak Demand, and Reserve Margin from 1997 to 2003. The Installed Capacity shows a steady increase, while Peak Demand and Reserve Margin exhibit fluctuations with a trend of upward movement.
Market Structure
Market Features

Two Markets

- Wholesale market comprises 2 markets:
  - The ‘real-time market’ or **spot market** for energy, regulation and reserve *and*
  - The ‘procurement market’ for other ancillary services
- Spot market: buyers and sellers trade in energy, reserve and regulation through EMC
- Procurement market: EMC procures by contract (on behalf of the PSO), ancillary services (other than reserve and regulation) required to maintain the secure operation of the power system
## Market Features

### A Comparison

<table>
<thead>
<tr>
<th>Feature</th>
<th>NEMS</th>
<th>PJM</th>
<th>NEMMCO</th>
<th>NZEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locational Pricing</td>
<td>Nodal (3 classes)</td>
<td>Nodal (2 classes)</td>
<td>Zonal (None)</td>
<td>Nodal (2 classes)</td>
</tr>
<tr>
<td>Reserve Trading</td>
<td>✓</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>Regulation Trading</td>
<td>E, Res, Reg</td>
<td>E, Res</td>
<td></td>
<td>E, Res (2 classes)</td>
</tr>
<tr>
<td>Co-optimization</td>
<td>✓</td>
<td>✗</td>
<td>✗</td>
<td></td>
</tr>
<tr>
<td>% Traded</td>
<td>100%</td>
<td>36%</td>
<td>100%</td>
<td>&gt;75%</td>
</tr>
<tr>
<td>Loss Modeling</td>
<td>✓</td>
<td>✗</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Full System Constraint</td>
<td>✓</td>
<td>✗</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Modeling</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Settlement Period</td>
<td>Daily</td>
<td>Daily</td>
<td>Weekly</td>
<td>Monthly</td>
</tr>
</tbody>
</table>
Market Features
Ancillary Service Contracts

- Types of Ancillary Services
  - Reactive support & Voltage control
  - Black start capability
  - Reliability Must Run Service
What the NEMS has brought To Singapore

- Prices respond efficiently to changes in market fundamentals
- Dramatic savings in reserve market
- Structural shift from oil to gas-fired generation
- Evidence of retail competition and price savings
- Choices for consumers
- More innovative products and services
- Demand-side participation
NEMS Performance

Monthly Reserve Costs - NEMS Reserve Cost 2002-2004

- $0
- $500,000
- $1,000,000
- $1,500,000
- $2,000,000
- $2,500,000
- $3,000,000

Average NEM 2002 Reserve Cost
Average NEM 2004 Reserve Cost

Average NEM 2002 Reserve Cost
Average NEM 2004 Reserve Cost
NEMS Performance
NEMS Performance
NEMS Performance
Market Share by Plant Type

(Singapore Electricity Pool - 2002)

- CCGT: 44.00%
- ST: 53.00%
- Others: 3.00%

(National Electricity Market of Singapore - 2004)

- CCGT: 67.10%
- ST: 30.12%
- GT: 2.76%
- Others: 0.02%
Recent Developments

- Introduction of Vesting Contracts
- Introduction of Interruptible Load
Vesting Contracts

- Vesting contracts introduced January 2004
- Market power mitigation method to replace price caps
- VC strike price based on LRMC of most efficient (CCGT) unit
- Introduction led to drop in energy price
Interruptible Load

- Interruptible load is a regime to facilitate demand-side participation in reserve market
- Introduced in January 2004
- Currently 7MW of IL offered into the reserve market
- IL provides a high-quality reserve source as it is not fuel dependent
- Demand-side participation important for a balanced and fair market
Challenges Ahead

- Promote demand side participation
- Increase consumer awareness on electricity market
- Balance trade-off between commercial incentives against system security and reliability of supply of electricity
- Focus on continuous market evolution and further efficiencies
Thank you

For more information, please contact:

pakling.yip@emcsg.com
65-6779 3000
www.emcsg.com