



## 1. Introduction

1.1 In 2014, Hong Kong consumed around 44 billion kilowatt hours ("kWh") of electricity with a split of 27% and 73% between residential and non-residential users. All along, electricity in Hong Kong has been provided by Hongkong Electric Company Limited and CLP Power Hong Kong Limited. Both privately-owned power companies are vertically integrated in that they own and operate their respective electricity supply chains, including generation plants, transmission and distribution networks. They supply electricity directly to about three million consumers in Hong Kong and provide customer services within their respective service areas.

1.2 Hong Kong does not have any indigenous resources for electricity generation and has been meeting its electricity demand through importing fuel for local electricity generation or importing electricity from the Mainland. In 2013, coal-fired generation dominated the overall fuel mix in Hong Kong (57%), followed by nuclear electricity imported from the Daya Bay Nuclear Power Station ("DBNPS") (22%) and natural gas (21%).

1.3 The two power companies have entered voluntarily with the Government into mutual agreements — the Scheme of Control Agreements — concerning their financial affairs. The current Scheme of Control Agreements will expire in 2018. At end-March 2015, the Government launched a three-month public consultation on the future development of the local electricity market. In the consultation document, the Government states that the requisite conditions are not present for Hong Kong to introduce competition on a sizable scale to the electricity market in 2018. To pave the way for Hong Kong to introduce competition in the longer term, the Government plans to conduct the necessary preparatory work which includes conducting a joint study with the two power companies on grid access arrangements by new players.

1.4 On the future fuel mix of electricity, the Government proposes in the consultation document to increase the percentage of natural gas generation to around 50% of the total fuel mix in 2020, and to maintain the current interim measure to import 80% of the nuclear output from DBNPS, such that nuclear import would account for around 25% of the total fuel mix in 2020.

1.5 The Panel on Economic Development will hold a meeting on 27 May 2015 to discuss the afore-mentioned consultation document. To facilitate Members' deliberations, this information note outlines the development of electricity markets in Singapore, the United Kingdom ("UK"), and Florida of the United States ("US") with special reference to their regulatory framework and market operation. A table of comparison of the electricity markets of these three places and Hong Kong is provided in the [Appendix](#).

## **2. Electricity markets in selected places**

2.1 Traditionally, electricity sectors predominantly developed and operated within regulated frameworks in which vertically integrated power companies handled most or all activities – from generation to transmission to distribution. Since the mid-1980s, there has been a wave of regulatory restructuring to unbundle generation from transmission and distribution. After years of deregulation, many developed economies have introduced some degree of liberalization to their electricity markets, and some have free entry to generation while allowing all electricity consumers to choose where they buy their power.

### Singapore

2.2 Singapore is the first place in Asia to liberalize its electricity market, which had traditionally been vertically integrated and government-owned until 1995. In 1995, the Singapore government corporatized the electricity and gas undertakings of the Public Utilities Board ("PUB"), which had been responsible for the supply of electricity, piped gas and water for the entire population of Singapore since 1963. PUB was reconstituted on 1 October 1995 to continue to supply water and take on the new role of regulating the electricity and piped gas industries in Singapore.

2.3 Singapore's utility market reform also went with the transfer of the electricity and gas undertakings of PUB to Temasek Holdings, the investment arm of the Singapore government. Within Temasek Holdings, Singapore Power was created as the holding company for several other new companies including two generation companies, a transmission and distribution company, and an electricity supply company<sup>1</sup>.

2.4 The second phase of reform was implemented in April 1998 when the Singapore Electricity Pool commenced operation to facilitate trading of electricity under a competitive wholesale market. In September 1999, a comprehensive review of the electricity market was undertaken, and it was subsequently decided that it should be further deregulated. In April 2001, the Energy Market Authority (EMA) was created to replace PUB as the new regulator for the electricity and piped gas industries. A new company, the Energy Market Company (EMC), was formed as an EMA subsidiary to operate the Singapore Electricity Pool. To further enhance competition and market efficiency, a new electricity wholesale market – the National Electricity Market – was opened on 1 January 2003 to replace the Singapore Electricity Pool.

### *Regulatory framework*

2.5 Singapore's electricity industry is governed by the *Electricity Act* which prescribes the role of EMA as the industry regulator. All participants in the electricity market are required to be licensed by EMA, which is responsible for drawing up and enforcing the licensing conditions.<sup>2</sup> EMA sets out performance standards and other operating codes to be followed by the licencees and other industry operators. Under the *Electricity Act*, EMA is empowered to issue directions to a licensee, investigate any potential breaches of the licensing conditions, suspend or revoke licences, and fine a licensee.

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<sup>1</sup> As at end-2008, Temasek Holdings had divested all its power generation assets except its ownership of the power grids through Singapore Power.

<sup>2</sup> Licence issued to generators normally lasts for 30 years, retailers 10 years and transmission network owners unspecified period.

## *Operation of the electricity market*

2.6 In Singapore, all power generators with a capacity of 10 MW or more are mandatorily required to be licenced by EMA<sup>3</sup>. Singapore's licensed power generation companies had a combined generation capacity of 12 521 MW as at June 2014. The six main electricity generation companies accounted for 95% or 11 934 MW of the total, with the remaining accounted for by waste-to-energy plants and autoproducers<sup>4</sup>.

2.7 In Singapore, electricity is traded at the National Electricity Market operated by EMC. The market, through matching supply and demand, determines the prices at which generators are paid. Both the electricity retailers and eligible consumers can buy electricity from the market at the Uniform Singapore Energy Price calculated from averaging the prices paid to generators.

2.8 Electricity is delivered to the end users via the transmission and distribution network owned by SP PowerAssets, a subsidiary of Singapore Power. Day-to-day operation of dispatching power is carried out by SP PowerGrid, another subsidiary established by Singapore Power for the management of the transmission network and the operation of the distribution network. Under the *Electricity Act*, SP PowerAssets is prohibited from participating in retail activities or owning a retailer (as well as participating in or owning generation). This arrangement is to ensure that retailers can compete on an equal footing using the same network<sup>5</sup>.

2.9 Since 2001, the retail electricity market in Singapore has been liberalized in phases to promote the efficient supply of competitively priced electricity. Today, about 75% of total electricity demand in Singapore has been opened up for competition. At present, non-residential consumers with an average monthly electricity consumption of 4 000 kWh of electricity or more can choose to become contestable customers<sup>6</sup>. Instead of buying electricity at the regulated tariff from SP Services<sup>7</sup>, contestable consumers can

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<sup>3</sup> Generators below 10 MW at a single location are generally exempted from being licensed as a generator and they are licenced as a wholesaler.

<sup>4</sup> An autoproducer is an industrial establishment which, in addition to its main activity, generates electricity and/or heat, wholly or partly for their own use.

<sup>5</sup> Generator planning to connect to the transmission network has to apply to the transmission licensee and seek approval from the EMA which also sets the connection fee.

<sup>6</sup> Eligibility threshold will be lowered to 2 000 kWh per month in July 2015.

<sup>7</sup> SP Services is a subsidiary of Singapore Power which provides metering and billing services to the electricity market.

choose to buy electricity from electricity retailers under customized price plans or from the wholesale electricity market at prices that fluctuates every half-hour.

2.10 Various degrees of price regulation still exist at wholesale, transmission, and retail markets. At wholesale level, there is a cap on the Uniform Singapore Energy Price. The three biggest power generation companies are also required by EMA to sell a specified amount of electricity at specified price to prevent abuse of their market positions. Meanwhile, the transmission system in Singapore is a natural monopoly and SP PowerAssets is thus subject to price regulation. At retail level, non-contestable consumers (e.g. residential customers and small business customers) are only allowed to purchase electricity from SP Services at regulated tariffs which are reviewed by EMA every quarter.

### The United Kingdom

2.11 The UK is a pioneer country in the European Union to liberalize the electricity market. Its liberalization experience started with the adoption of the *Electricity Act* in 1989. Prior to the liberalization, the UK's electricity market had been under public ownership since 1947 when the Labour government nationalized more than 57 public and private bodies involved in the generation and distribution of electricity<sup>8</sup>. For example, the state-owned Central Electricity Generating Board (CEGB) had monopoly rights over power generation and transmission in England and Wales<sup>9</sup>. It sold electricity to 12 area boards that were in charge of distribution and supply of electricity to the end consumers.

2.12 The adoption of the *Electricity Act* in 1989 abolished the statutory rights of CEGB on generation and opened the market to private generators. The power stations owned by CEGB were transferred to three generating companies – PowerGen, National Power and Nuclear Electric – which were subsequently privatized in the 1990s. For the 12 area boards, they were privatized and became licensed Regional Electricity Companies ("RECs"). These RECs jointly owned the National Grid Company, a new company established to take control of the transmission system of CEGB. The National Grid Company was eventually listed on the London Stock Exchange in 1995.

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<sup>8</sup> See Heddenhausen (2007).

<sup>9</sup> Scotland had two vertically integrated power companies that exercised regional monopolies, while Northern Ireland had one vertically integrated power company.

2.13 The statutory obligation to supply electricity was transferred from CEGB to RECs, which were then privatized in December 1990. Each REC, now referred to as distribution network operator (DNO), is responsible for a regional distribution services area. There are currently 14 DNOs in the UK, which are owned by six different groups. Under the *Utilities Act 2000*, these DNOs are prevented from supplying electricity; this is done by a separate electricity supply company chosen by the consumer.

2.14 Another innovation in the UK's electricity market reform was the establishment of the Electricity Pool in 1990 requiring all generators (public and private) to sell their electricity in a wholesale market. Generators announced how much they were willing to supply at each possible price in the following day. Then demand was estimated and market prices ensued from equating demand and supply. However, there was no provision for the involvement of buyers in price setting process. In March 2001, a new model was introduced, the one of bilateral contracts which allows generators and buyers to trade directly.

### *Regulatory framework*

2.15 The Gas and Electricity Market Authority regulates the electricity and gas markets in the UK, pursuant to the powers granted under the *Gas Act 1986*, *Electricity Act 1989*, *Competition Act 1998*, *Utilities Act 2000* and other statutes. The Authority has established the Office of Gas and Electricity Markets ("Ofgem") as its executive arm to perform day-to-day regulatory duties.

2.16 On the regulation of the UK's electricity industry, Ofgem's role is to protect and advance the interests of consumers by promoting competition where possible, and through regulation only where necessary. Ofgem issues licences to companies to carry out activities in the electricity and gas sectors, sets the levels of return which the monopoly networks companies can make, and decides on changes to market rules. Ofgem has powers to revoke and enforce licences, which include imposing financial penalties on licence holders who contravene licence obligations and specified statutory obligations. Ofgem may also propose any licence modifications that it considers necessary to meet its objectives.

## *Operation of the electricity market*

2.17 There are four main licensable activities in the UK's electricity market: generation, transmission, distribution and supply. On power generation, all power generators aiming to supply any premises have to be licenced unless they meet the legal requirements for exemption, such as those with an output less than 10 MW. The UK's power generation companies had a combined licensed generation capacity of 85 GW at end-2013.

2.18 In the UK, supply-demand balance of electricity is primarily done by suppliers, generators, traders and customers trading in the competitive wholesale electricity market. Trading can take place bilaterally or on exchanges, and contracts for electricity can be struck over timescales ranging from several years ahead to on-the-day trading activities. Electricity can also be imported or exported through interconnection. Currently, there are electricity interconnections between the UK and its neighbouring countries like France and the Netherlands.

2.19 Full competition was introduced into the UK's electricity retail market in 1999. Since then, domestic and non-domestic consumers have been able to choose their electricity supplier. Electricity suppliers purchase electricity from the wholesale market or indirectly from generators and arrange for it to be delivered to the end consumers. They are also responsible for setting the prices that consumers pay for the electricity that they use, as well as metering the consumption and billing.

## Florida of the United States

2.20 In the US, the electricity market structure differs among states. A total of 16 states such as New York and Texas have liberalized their markets, such as allowing consumers retail choices. Another seven states like California took some steps towards liberalization but some of them have eventually suspended or terminated the process. The remaining ones, mostly the central and south-eastern states, such as Florida, have yet to liberalize their markets which are still dominated by vertically integrated companies.

## *Regulatory framework*

2.21 The Florida Public Service Commission ("PSC") is a state body established under the Florida statutes with the mission to safeguard Florida's consumers receiving some of their essential services – electricity, natural gas, telephone, water and wastewater – in a safe, affordable, and reliable manner. In so doing, PSC exercises regulatory authority over utilities in one or more of the following three key areas: rate base/economic regulation, competitive market oversight, and monitoring of safety, reliability, and service issues. Its decisions are subject to direct appeal to either the district courts of appeal or to the Florida Supreme Court.

2.22 On the regulation of electricity companies, PSC has regulatory authority over:

- (a) investor-owned electric companies on all aspects of operations, including rates and safety;
- (b) municipally-owned electric utilities<sup>10</sup> with respect to safety, rate structure, territorial boundaries, bulk power supply, operations, and planning; and
- (c) rural electric co-operatives<sup>11</sup> with respect to safety, rate structure, territorial boundaries, bulk power supply, operations, and planning.

## *Operation of the electricity market*

2.23 There were 57 power utilities in Florida at end-December 2014, comprising five investor-owned electric companies, 34 municipally-owned electric companies, 18 rural electric co-operatives. The investor-owned companies dominate electricity supply in Florida, accounting for about 74% or approximately 39 GW of the total installed capacity in 2013. They all operate

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<sup>10</sup> Municipally-owned utilities are publicly-owned utilities designed to provide electricity to consumers within local government jurisdictions.

<sup>11</sup> Rural electric co-operatives are small rural electric utilities owned by the people they serve. They came into place on 21 May 1936, when the *Rural Electrification Act* was signed into law. At that time, the cost of providing service in the non-urban areas of Florida was prohibitive, and the investor-owned utilities refused to extend their lines into non-urban areas until there was enough development to make a profit. The *Act* empowered local farmers, residents and businesses to join together to create their own electric utilities.

as vertically integrated companies which generate, transmit and distribute electricity to their customers and handle related services like customer service, billing and others.

2.24 In Florida, not all electric utilities generate all the electricity they sell to their retail customers. Many smaller municipally-owned electric companies, rural electric co-operatives, and smaller investor-owned electric companies may purchase all or part of their customers' generation requirements from other utilities. They also purchase the transmission services necessary to deliver their purchased power from the power plants where the electricity is generated to the end users.

2.25 The other element of Florida's wholesale market is the interchange market. In the interchange market, utilities which would otherwise own and operate all their own generation units may find it economical to purchase capacity and electricity from generating units owned by other utilities. Purchases in the interchange market can take place on an hour-by-hour basis, on a short-term basis up to a year, or on a long-term basis for many years.

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Table – Electricity markets of Hong Kong, Singapore, the United Kingdom and the United States

	Hong Kong	Singapore	The United Kingdom	The United States (Florida)
<b>Market structure</b>	<ul style="list-style-type: none"> <li>Vertically integrated.</li> </ul>	<ul style="list-style-type: none"> <li>Partially liberalized.</li> </ul>	<ul style="list-style-type: none"> <li>Fully liberalized.</li> </ul>	<ul style="list-style-type: none"> <li>Vertically integrated.</li> </ul>
<b>Regulatory regime</b>	<ul style="list-style-type: none"> <li>Bilateral agreement.</li> </ul>	<ul style="list-style-type: none"> <li>Dedicated regulatory body with statutory powers.</li> </ul>	<ul style="list-style-type: none"> <li>Dedicated regulatory body with statutory powers.</li> </ul>	<ul style="list-style-type: none"> <li>Dedicated regulatory body with statutory powers.</li> </ul>
<b>Agreement or licensing period</b>	<ul style="list-style-type: none"> <li>10 years, optional 5 years extension.</li> </ul>	<ul style="list-style-type: none"> <li>Generation licence lasts 30 years; retail licence lasts 10 years; transmission licence period is not specified and termination is based upon a 25-year notice by the regulator.</li> </ul>	<ul style="list-style-type: none"> <li>Licence can last until it is revoked, and can continue until determined by a 25-year written notice by the regulator.</li> </ul>	<ul style="list-style-type: none"> <li>N/A.</li> </ul>
<b>Profit control</b>	<ul style="list-style-type: none"> <li>Permitted rate of return tied to asset.</li> </ul>	<ul style="list-style-type: none"> <li>No such control except the monopoly networks.</li> </ul>	<ul style="list-style-type: none"> <li>No such control except the monopoly networks.</li> </ul>	<ul style="list-style-type: none"> <li>Rate of return based on equity.</li> </ul>
<b>Transmission network ownership</b>	<ul style="list-style-type: none"> <li>Privately owned by each of the two power companies.</li> </ul>	<ul style="list-style-type: none"> <li>Indirectly owned by Singapore government.</li> </ul>	<ul style="list-style-type: none"> <li>Privately owned by three operators including the listed National Grid.</li> </ul>	<ul style="list-style-type: none"> <li>Privately owned.</li> </ul>

Table – Electricity markets of Hong Kong, Singapore, the United Kingdom and the United States (cont'd)

	Hong Kong	Singapore	The United Kingdom	The United States (Florida)
<b>Installed capacity</b>	• 12 625 MW (2014).	• 12 521 MW (2014).	• 85 000 MW (2013).	• 52 402 MW (2013).
<b>Fuel mix<sup>(1)</sup></b>	<ul style="list-style-type: none"> <li>• Gas: 21%;</li> <li>• Coal: 57%; and</li> <li>• Nuclear: 22%.</li> </ul>	<ul style="list-style-type: none"> <li>• Gas: 95.6%;</li> <li>• Biomass/coal: 4%; and</li> <li>• Oil: 0.3%<sup>(2)</sup>.</li> </ul>	<ul style="list-style-type: none"> <li>• Gas: 30%;</li> <li>• Coal: 29%;</li> <li>• Nuclear: 19%; and</li> <li>• Renewable/others: 22%.</li> </ul>	<ul style="list-style-type: none"> <li>• Gas: 59.6%;</li> <li>• Coal/oil: 21.8%;</li> <li>• Nuclear: 11.3%; and</li> <li>• Renewable/others: 7.3%.</li> </ul>
<b>User groups<sup>(3)</sup></b>	<ul style="list-style-type: none"> <li>• Household 27%;</li> <li>• Commercial 66%; and</li> <li>• Industrial 7%.</li> </ul>	<ul style="list-style-type: none"> <li>• Household 15%;</li> <li>• Commercial 37%;</li> <li>• Industrial 42%; and</li> <li>• Transport/others 6%.</li> </ul>	<ul style="list-style-type: none"> <li>• Household 35%; and</li> <li>• Commercial and Industrial 65%.</li> </ul>	<ul style="list-style-type: none"> <li>• Household 52%; and</li> <li>• Commercial and Industrial 48%.</li> </ul>
<b>Price setting</b>	• Set by the two firms but subject to government scrutiny.	• Household tariff set by regulatory body and reviewed every quarter.	• Electricity retailers can freely to set the price after price regulation was removed in 2002.	• Tariff level and adjustments approved by the state regulatory body.
<b>Interconnection and power import</b>	• Limited local and cross border interconnection.	• Limited interconnection with Malaysia.	• Interconnection with Ireland, North Ireland, France and the Netherlands.	• Interchange between utilities and interstate import.

Notes: (1) The figures of Hong Kong and Florida are 2013 figures. Singapore's are 2014 figures and the UK's are provisional figures for 2014.

(2) Figures may not add up to 100% due to rounding.

(3) All figures except Florida's are 2014 figures. The Florida's are based on 2013 figures whereas the UK's are provisional figures for 2014.

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