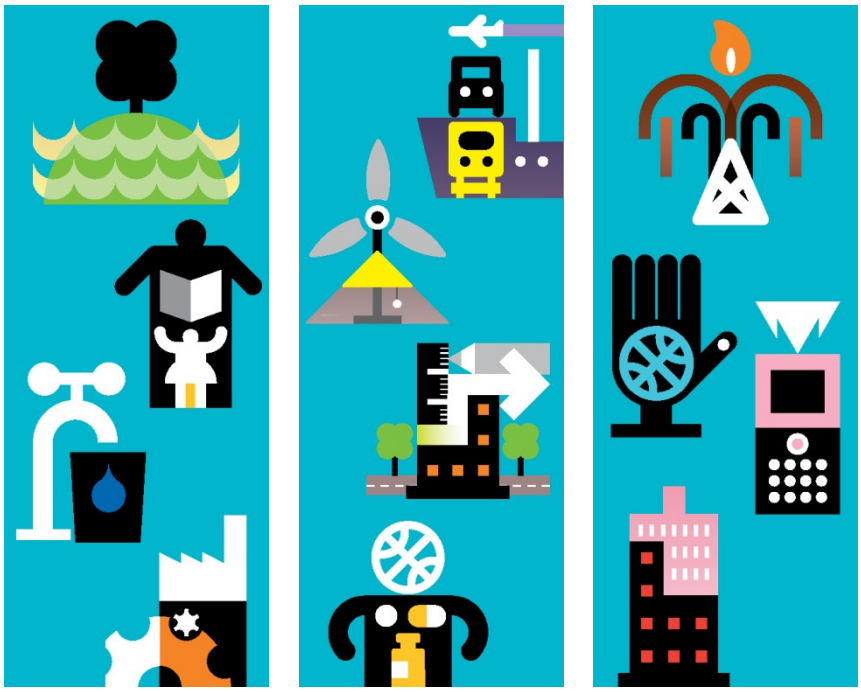

Executive Summary

April 2015

Electrical and Mechanical Services Department

Mott MacDonald

Overview of Electricity Markets in Overseas Jurisdictions

Executive Summary

April 2015

Electrical and Mechanical Services Department

Electrical and Mechanical Services Department
Government of Hong Kong Special Administrative Region

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Executive Summary

Australia

Prior to the liberalisation process, the supply of electricity in Australia was provided by vertically integrated, state-owned utilities meeting customer demands of individual states and territories.

The liberalisation process in Australia started in the mid-1980s in response to emerging concerns about the inefficiency of the state-owned electricity industry; the response, at that time, was to introduce some reforms at state level with the objective of strengthening the management and control arrangements for the electricity industry. Then in the early 1990s, the emerging neo-liberal ideology and globalisation process created an enormous pressure on the Australian electricity industry – and in other state controlled sectors – to undertake more radical reforms. The reform of the electricity industry became an integral part of the main reform program introduced by the Australian government; and as part of it, several agreements were reached between various state governments in Australia to reform their electricity industries. **The main objective of this reform was to increase competition in the industry and provide greater choice for end-use electricity consumers**.

Even though the federal government has taken a large stake in power sector regulation, the electricity market is still regulated through a combination of state and federal legislation. To ensure proper coordination among different governmental levels, the sector is steered by the Council of Australian Governments[1] (COAG) which provides the ground for political agreements between the different stakeholders.

A key part of the reform in the electricity industry came with development of the National Electricity Market (NEM) in 1998, which comprised New South Wales, Victoria, Australian Capital Territory, Queensland and South Australia (and included Tasmania in 2005). The establishment of the NEM was the result of extensive consultation and collaboration between the states and the electricity industry. The reforms also included the unbundling of the vertically integrated state-owned electricity authorities into separate generation, transmission, distribution and retail sales sectors in each State.

The Australian Energy Market Operator (AEMO) is responsible for aggregating and dispatching supply to meet demand in the NEM in the lowest cost manner available. In addition to the electricity market, AEMO runs the gas market in Australia. AEMO was created with the objective of strengthening the national character of energy market governance by drawing together under one operational framework the responsibility for electricity and gas market functions, NEM system operations and national transmission planning.

Retail competition was introduced in 2003 in the states of Victoria, New South Wales, Queensland and South Australia, and regulated at state level. Currently, all states in Australia, (except Victoria, South Australia and New South Wales) apply some form of retail price regulation for electricity supplied under a standard retail contract, applying either a building block approach (bottom-up process) or a benchmark of retail cost index. Australian governments agreed to review the continued use of retail price regulation and to remove it if “effective competition” can be demonstrated. The Australian Energy Market Commission

[1] The COAG is the peak intergovernmental forum in Australia and its members are the Prime Minister, State and Territory Premiers and Chief Ministers and the President of the Australian Local Government Association.

(AEMC) continuously assesses the effectiveness of retail competition in each state; however, state and territory governments make the final decisions on this matter.

Since the implementation of the NEM, wholesale prices have been in the range of 20 to 60 AU$/MWh (at real prices from January 1998). From the analysis performed, it appears that the NEM provides cost reflective prices in electricity markets (gas prices and carbon scheme) and this is consistent with the expected outcome of the reform process undertaken by the country. At retail level, the trend in prices shows a significant increase over the past five years with network costs being the key price driver, followed by the introduction of green policies (carbon price and renewable energy promotion) – both of them regulated activities.

In terms of operational efficiency, considering that competition provides, in theory, strong incentives to operational efficiency across market participants and the fact that the NEM is reaching good level of competition at the wholesale and retail markets, means that operational efficiency should have improved.

Currently, the retail sector in the NEM remains fairly competitive; three retailers – AGL Energy, Origin Energy and Energy Australia – jointly supplied 77% of small electricity customers in southern and eastern Australia in 2012–13. The existence of a contestable market provided small private retailers (mostly new entrants) the possibility of gaining market share during 2012-2013. This is in line with the objective of the power sector reform in providing customer choice. However, the retail competition has not led to increased customer satisfaction and their complaints have been increasing.

In terms of system reliability, it is observed that the liberalisation process did not have an impact on the overall reliability of the system.

From our review, there appears to be a general consensus in Australia across federal and state governments that while a good level of competition has been achieved, this should be further pursued and improved; this is particularly important for gentailers[2], as they have the possibility of exercising market power. It has also been agreed that the liberalisation process needs to be carefully considered and barriers removed as long as there is an agreement on the benefits for the society in pursuing further market development.

At wholesale level, the NEM shows good level of competition and, while adjustments are required to mitigate market power of some market players (mainly fine tuning, from improvements in the transmission grid for bottleneck prevention to regulatory changes for ensuring barriers are not raised in market competition), we can conclude the objective of the reform process has been achieved. At retail level, we can reach to the same conclusion in Victoria, South Australia and New South Wales, and to a reasonable extent in Queensland and Australian Capital Territory. Tasmania is still lagging to achieve a competitive environment at retail level but it is important to highlight that Tasmania was the last state to join the NEM therefore, it lags on below the learning curve compared the rest of the states.

Despite the initial unbundling of generation, transmission, distribution and retail activities, the NEM is currently observing a process of vertical integration between generation and retail activities. This could be

[2] Gentailers are power companies that have both generation and retail business

seen as a contradiction within the market design: unbundling was implemented to promote competition, but the market rules have allowed generators and retailers to re-bundle. While there is a natural economic incentive for this (allowing generators and retailers to hedge risks), the process can easily lead to a raising in barriers for competition, allowing the gentailers to exercise market power and prevent new entrants into the market. In fact, the regulator has noted a number of cases in which market power has been exercised, though this has not been observed on a continuous basis. The different government bodies (regulators and competition authorities) will need to maintain a strict monitoring on gentailers activities to prevent these companies exercising market power.

Singapore

Prior to 1995, the Public Utilities Board (PUB) owned and managed power generation, distribution and retailing. This structure served Singapore adequately for three decades.

In 1995, the government of Singapore introduced the first reform of the electricity industry when it corporatized the electricity undertakings of the PUB. **The main objective of the reform was to gradually introduce competition in electricity generation and retail so that Singapore would have an electricity market that allows market forces rather than central planning to drive investment, production and pricing decisions**.[3]

Consistent with the government policy, the liberalisation process was gradually introduced. A key milestone took place in 2003 when the National Electricity Market of Singapore (NEMS) was formed under a new legal and regulatory framework by the Energy Market Authority (EMA) and the Energy Market Company Pte Ltd (EMC). The NEMS handles the purchase and sale of electricity, serving as a trading platform for electricity.

In 2004, the EMA imposed "vesting contracts" (special financial contracts)[4] on the three largest generators (Senoko Energy, PowerSeraya and Tuas Power Generation) as a condition of their electricity licences. The vesting contracts were designed to reduce the market power of the large players with pricing provisions intended to reflect the economics of new generation plant. The vesting contract level allocated to each generator diminishes as the market power of that generator is reduced. Vesting contracts are still in place, although EMA has recently determined to lower the vesting contract level from the current 40% of the total demand to 30% for first-half 2015 and 25% for second-half 2015 and 20% for 2016[5].

In addition, EMA has been gradually introducing further contestability to the retail market by reducing the eligibility threshold of non-residential users. However, household customers are still non-contestable and remain on the regulated tariff.

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[3] EMA (2010) - Introduction to the National Electricity Market of Singapore.

[4] With the vesting contracts, generation companies are committed to selling a specified amount of electricity (viz the vesting contract level) at a specified price (viz the vesting contract price). This removes the incentives for generation companies to exercise their market power by withholding capacity to push up spot prices in the wholesale market. [Source: https://www.ema.gov.sg/Licensees_Electricity_Vesting_Contracts.aspx]

[5] Source: EMA (2014). Review of the Vesting Contract Level for the Period 1 January 2015 to 31 December 2016 – Final Determination Paper.

EMA is also promoting the introduction of a Demand Response Programme (DRP) to enhance competition in the wholesale electricity market. The DRP will allow customers with flexible electricity demand to voluntarily reduce their demand, in exchange for a reduction in the electricity prices as a result of their actions.

Also, EMA together with the Singapore Exchange (SGX) was preparing to launch the first electricity derivative (future) market in Asia by the end of 2014. This market was finally launched on 1 April 2015 and the product to be traded is the Uniform Singapore Energy Price[6] (USEP) Quarterly Base Load Electricity Futures. The objective of the electricity futures market is to provide market participants with a tool to manage their risk exposures and prevent the need of vertical integration between generators and retailers. Potential new participants to the electricity market can also use the futures market to back fixed price contracts for consumers with an appetite for low risk electricity price contracts.

Changes in the generation mix (replacing more expensive oil with comparatively more economical natural gas) driven by market competition, combined with stable LNG prices in the region, have helped to exert downward pressure on wholesale electricity prices in Singapore; thus, enabling contestable consumers to purchase more competitive retail packages. Therefore, the government strategy of developing wholesale competition together with further reliance on natural gas as a source to maintain industrial competitiveness appears to be paying off.

Electricity tariffs for non-contestable consumers are regulated by the EMA and are updated quarterly to reflect changes in the cost of power generation. Considering that regulated prices follow the trends in wholesale prices, non-contestable consumers have also benefitted from competition. In addition, they have also benefited from lower grid charges (in both nominal and real terms) for which we can consider the government has made reasonable efforts to promote efficiency in regulated activities.

Considering that competition, in theory, provides strong incentives for operational efficiency across market participants, the fact that the NEMS is reaching good level of competition at the wholesale and retail markets means that operational efficiency should have improved.

The introduction of contestability at retail level has brought significant changes to the market shares of retailers companies over the last decade; while the retail market is served by six retailers as in 2003, their market share has changed quite substantially (at least in terms of electricity sales). Despite the lack of information to develop a more detailed analysis, this trend in customer choices appears to show that market forces are driving customers decisions, in line with the objectives of the government for the liberalisation of the power sector.

Finally, in terms of system reliability, the fact that Singapore was able to improve reliability levels in its grid leads us to infer that the development of competition and efficiency at retail and wholesale markets has not affected the reliability of the grid.

The reform process in Singapore is in the process of moving towards full retail market liberalisation (EMA has recently taken decisive steps in the retail market to reduce the eligibility threshold level allowing retail

[6] The USEP is the weighted-average of the nodal prices at all off-take nodes as calculated by the Energy Market Company.

companies to access an increasing amount of customers); and, the government is working on introducing further tools in an effort to increase competitive behaviour of market participants.

The reform program introduced by the government is largely achieving its objective, as the market reforms have introduced enough incentives for market participants to invest in more efficient forms of power generation (increasing the share of natural gas combined-cycle gas turbine (CCGT) and replacing expensive diesel / oil generation). This change in the generation profile affected prices at wholesale and retail levels providing end customers a share on the improvements in efficiency.

Retail competition has changed the market share of retail companies which would imply that customers are benefitting from better commercial offers (either in terms of cheaper energy and/or better services). However, the contestable market is an area in which EMA needs to improve monitoring activities (or at least to make more transparent the monitoring results) in order to understand whether customers have enough information to maximise the benefits of retail competition. It should be noted that full contestability to all retail customers has not yet completed and vesting contracts are still in place, reflecting the possible risk in the market reform.

A key issue in the Singapore electricity sector is the lack of public available information over the contestable market. Currently, EMA does not provide analysis, information or monitoring activities on commercial offers of retailers for contestable consumers; there are also no price comparison tools for customers as observed in other countries. Additionally, while there appears to be a certain level of vertically integration between generators and retails, we were not able to find out any analysis or monitoring of the potential threat of this activity on new entrants and market competition.

United Kingdom

Prior to the reform, all power generation plus the transmission grid in England and Wales were run by the Central Electricity Generating Board (CEGB). Distribution and supply were integrated activities undertaken by 12 regional Electricity Supply Boards who had monopoly status and provided a supply to all consumers in their own geographical areas. All utilities were publicly owned and run.

The approach to electricity sector reform in the UK, albeit broadly consistent, was undertaken slightly differently in Scotland, Northern Ireland and in England and Wales, reflecting the pre-existing industry structure (and the strength of regional lobbies). The overall approach was driven by the Conservative Government which was pursuing an agenda of widespread privatisation and reform throughout all utility sectors. **One of the main philosophical drivers was the belief that competition between privately-owned, profit-driven organisations would drive down costs and increase the efficiency of the utility sectors, as well as relieving some pressure on the State treasury.**

The Electricity Act 1989, primary legislation which applied to the whole of Great Britain (Scotland, England and Wales), restructured the industry, provided for its privatisation, introduced wholesale and retail competition and established a new independent regulatory body to oversee the industry throughout GB. The Act clearly defined the separate roles of policy maker, regulator and service providers.

Under the Act, the CEGB in England and Wales was broken up. The thermal generation assets were split into two generation companies, PowerGen and National Power, which were corporatised and floated. The nuclear assets were vested in a new public company, Nuclear Electric, which together with the Scottish nuclear assets was floated as British Energy several years later. The 12 regional Electricity Supply Boards were also corporatised and privatised as Regional Electricity Companies (RECs).

In 1990, the Electricity Pool was established, which provided a compulsory spot market for wholesale electricity and set a half hourly market price which paid all generators the marginal price, thereby low cost generation made potentially excessive profits. In 2001, the Pool was abolished and replaced by a wholesale market in which generators and suppliers were free to strike bilateral contracts for physical delivery of wholesale electricity. It was thought that bilateral contracts would be struck closer to cost rather than marginal price, reducing the excessive profit for low cost generation.

Retail competition was introduced gradually, with largest customers (consuming >1MW) being eligible for competitive supply first and the consumption limit on eligibility being reduced in stages. From 1990 consumers over 1MW had access to competitive supply; in 1994, consumers over 100kW and between 1998 and 2000 all retail consumers became eligible.

With over 60% of the customers having never switched supplier, there are widespread concerns that the retail market is uncompetitive, and the Office of Gas and Electricity Markets (Ofgem), the sectors regulator, has referred the sector to the Competition in Markets Authority (CMA) for an investigation, following Ofgem's 2014 'State of the Market Assessment' report. The CMA will investigate which areas of the market are not functioning and will report on findings over the course of 2015.

In 2013 the government introduced the Energy Act 2013, which implements major changes under the Electricity Market Reform (EMR) programme. The main aspects of the reform are the Contracts for Difference (CfD) and the Capacity Market, which effectively turns the government into a central energy and capacity procurer, with the energy market playing a much reduced role. The CfD, which gives a close to fixed price of energy for low carbon generators, is being implemented to spur investment in renewable and nuclear capacity in order to achieve renewable and carbon emissions reduction targets. The capacity market will pay existing and new firm generation capacity and demand side response in order to ensure medium and long term capacity adequacy.

In the initial form of the liberalised wholesale market, only three generating companies existed. The concentration of generating assets in a small number of companies suppressed competition. As of May 2014 the Big 6 companies together own just over half the current installed generating capacity, with the remaining capacity own by independents and other international companies, a significant amount of which is renewable capacity. The retail market has seen much less significant changes than the wholesale market. There have been no major shifts in market shares between companies, but there has been a small but significant gain of market share by smaller suppliers since January 2013.

Electricity prices, in both the wholesale and retail markets, have increased since the early 2000's. These increases are attributable to gas price increases and the introduction of carbon pricing and green policies. It is likely that electricity prices would have increased without liberalisation as the underlying generation costs have increased.

As the wholesale market is considered to be competitive, we would expect that there would be strong incentives to improve the operational efficiency of the market. However, Ofgem reported in 2014[7] that competition in the retail market is weak due to market segmentation and possible tacit co-ordination between incumbent suppliers. Therefore, we cannot guarantee that operational efficiency at the retail market is maximised.

United States

California

At the beginning of the 1990's, California was in the middle of a major state-wide recession, with high unemployment rates and companies being pushed away to other states due to high electricity prices. In 1995, because of expensive investments in nuclear power and high-priced contracts for power, California consumers paid the highest rates in the western continental United States (the average rate of about 99 USD/MWh)[8]. **The state's governor believed that a new market system would lower prices by encouraging competition among existing and new wholesale and retail suppliers and by reducing regulation**.[9]

The reforms required the utilities to become transmission and distribution companies, divesting themselves of generators, with the divested generators only able to sell power to a state-managed power exchange. The grid would be operated by an Independent System Operator (ISO). The distribution companies retained retail responsibilities but retail competition was part of the reform process as well. Under the reform arrangements, the supply-side of the market was largely deregulated while the retail market was strongly regulated during the transitional stages of the reforms by the California Public Utilities Commission (CPUC) putting in place controls on retail prices.

In 2000/2001, there was a sustained period of high and volatile electricity prices at wholesale level that was not reflected on retail tariffs due to caps on tariffs. As a consequence, a major utility (Pacific Gas and Electric) went bankrupt and rolling blackouts resulted. Multiple factors contributed to the system failures, including a drought that reduced the level of hydroelectric power available to serve customers, unexpected outages at nuclear power plants, high natural gas prices, and strong demand for power. A further factor was California's heavy reliance on short-term markets which made it vulnerable to market manipulation.

As a consequence of the crisis, further reforms in the Californian power market were put on hold. Transitional arrangements were implemented with the Department of Water Resources (DWR) signing several Power Purchase Agreements (PPAs) to procure electricity for the utilities. In 2003, the utilities resumed some procurement of power for their customers and the DWR reduced the cost of the long-term contracts through renegotiation. Further to this, market developments in California over the past years were aimed to improve the deployment of renewable energy sources, which is an indirect way of introducing competition at wholesale and retail levels without changing the current market structure.

[7] March 2014 report, 'State of the Market Assessment', Ofgem - https://www.ofgem.gov.uk/ofgem-publications/86804/assessmentdocumentpublished.pdf accessed 21/01/2015

[8] Weare, Christopher (2003). The California electricity crisis: causes and policy options

[9] World Bank (2001) - The California Experience with Power Sector Reform Lessons for Developing Countries.

Considering that wholesale prices were at a low level during the first years of the pool market in California, excluding the crisis period – between mid-2000 to mid-2001 – the effects of the reform had virtually no impact in lowering electricity price. At retail level, the objectives of the reform were not met and retail consumers have not yet observed a general decrease in prices.

The fact that about one third of total generation (i.e. utility owned generation) is not participating in the market but follows a regulatory review process and that there is no retail competition, implies that the effects of the reform process had a limited impact in the overall enhancement of operational efficiency.

The analysis of the power system reliability performance indicators provides no evidence to consider that the liberalisation process produced a structural break on reliability of electricity supply to customers. However, during the 2000/2001 crises, the electricity system did experience rolling blackouts due to tight supply, strong demand, market manipulation, etc.

California has been operating a hybrid combination of regulated / non-regulated market for 16 years; while the wholesale electricity market behaves competitively, the retail market continues to be fully regulated under direct control of CPUC and we have found no indications at the time of preparing this report that the Government has plans to introduce further competition at retail level.

Based on this, the preliminary condition required to foster competition at retail level would be to reach a political consensus in California that promoting retail competition would be beneficial for the society. Nonetheless, we were not able to find any indication that California has the political will (or that it is being currently analysed) to foster further liberalisation measures than the ones already implemented.

PJM

PJM Interconnection, founded in 1927, administers competitive wholesale markets across 13 states and the District of Columbia. PJM is the Regional Transmission Operator (RTO) and is regulated by the Federal Energy Regulatory Commission (FERC). FERC (Order 2000) established goals and principles for RTO market design. Among these goals are: eliminating discriminatory access to competitively priced electricity, encouraging new suppliers' entry into the market, promoting efficient and reliable operations, and fostering economically efficient investment in generation and transmission facilities.

PJM introduced an energy spot market in 1998 and daily and monthly capacity markets in 1999. It implemented a day-ahead energy market[10] in 2000 and a revised capacity market[11] in 2007. There are also a synchronized reserve market and a day-ahead scheduling reserve market. The 2007 capacity market is based on PJM's Reliability Pricing Model (RPM) which provides long-term price signals, consistent with the PJM's Regional Transmission Expansion Planning process, for supply-side capacity resources and demand-side capacity obligations.

[10] Day-ahead markets allow participants to trade energy and revise their position the day before operation. Introducing a day-ahead market gives participants opportunities to trade based on more relevant demand and availability information, allowing for more efficient market outcomes.

[11] Capacity markets provide payment to firm capacity, and is used as a mechanism to ensure supply security.

PJM, as a very mature market, has a wide range of instruments to provide competitive incentives to market participants; in this sense, there are no (to our knowledge) current plans to introduce further markets or instruments to further promote competition in PJM. Nonetheless, the dynamic nature of power markets and specifically in the PJM area – where the size of the market is enlarging – require constant fine-tuning of the markets in order to ensure they continue to provide competitive outcomes in the future. In this sense, even though PJM has reached its intended results, small regulatory improvements across the different markets can keep improving market outcomes, achieving greater cost effective services to its consumers.

Implementing those changes in market regulation requires work and coordination among PJM Board, stakeholders and the FERC. PJM operates on an independent basis, and has introduced small changes in market rules and regulation in order to enhance competitive results. The conditions that allow PJM to operate in competitive basis are:

- The existence of FERC as regulatory body;
- The existence of PJM acting as Independent System Operator (operate the assets but do not exercise ownership on them);
- Unbundled market participants;
- Low regional congestion problems (even though local congestion problem exists and may create room to provide incentive for exercising market power by some market participants);
- Continuous monitoring process, tests and procedures that allows mitigating the exercise of market power by stakeholders; and
- The availability of proper amount of information to ensure market transparency

Texas

Prior to reforms which came in to force at the retail level in 2002, the electric industry in Texas consisted of a mixture of investor-owned utilities, generation and transmission cooperatives, distribution cooperatives, river authorities, and municipally owned utilities. Generating plants owned by non-utilities produced approximately 10% of the consumption.

Liberalisation of the electricity market came into force in 2002 with industrial and political support for reforms. In its scope of competition report in 1999, the Public Utility Commission of Texas (PUCT) recognised that regulated utilities were overearning due to declining costs for utilities and stable prices. Plans to de-regulate the sector were announced in 1999 with the expressed intention of bringing down the costs of electricity for consumers.

A key component of the Texas deregulation system was the setting up of a Regional Transmission Operator (a role assigned to the State agency called the Electric Reliability Council of Texas (ERCOT)) to ensure open access to the transmission system. ERCOT also administers the competitive wholesale (day-ahead and real-time) market, ancillary service market and the retail market.

Wholesale electricity prices in the ERCOT are driven by gas price and local climate conditions. Increasingly, wind availability will become a significant driver of electricity price as wind capacity continues to increase. While wholesale prices increased (in real terms) in the period between 2002 and 2008, they decreased subsequently and the prices in 2013 are about the same level of those observed at market

liberalisation in 2002. While prices have not decreased from 2002 – following the objectives of the liberalisation process – they reflect marginal generation costs and follow the trend of natural gas prices.

A similar trend could be observed in retail prices. While the retail electricity price increases show de-regulation of the retail market did not meet the stated intentions of reducing the electricity price, it appears to be clear that prices reflect the market conditions affecting the power sector.

Considering that competition, in theory, provides strong incentives for operational efficiency across market participants and that the information analysed shows that both wholesale and retail markets in ERCOT performed competitively, then the operational efficiency should have improved in both markets.

Market liberalisation has increased customer choices in Texas and customers have been actively searching for better commercial opportunities. More recently, switching rates started to decline and, according to the information analysed, this may be caused by retail markets reaching high maturity levels.

In terms of system reliability, the analysis of power system performance provides no evidence to consider that the liberalisation process produced a structural break on reliability of electricity supply to customers. However, there is concern currently about the long term generation supply adequacy as power prices are not high enough to spur investment in new generation. A number of reforms, such as the Operating Reserve Demand Curve (ORDC), which artificially increases electricity prices when operating reserves drop, and easing of electricity price caps, are currently being implemented.

Texas is one of the most active regions of those reviewed in this study in terms of introducing further tools to promote market development. ERCOT and PUCT have followed the guidelines for market development provided years ago which shows that there is political willingness in the State to pursue effective development of competition in the power sector.

The degree of vertical integration between generators and retailers in the Texan market is unclear as the market monitoring activities appear to consider only specific sections of the market (i.e. retail and generation) and do not consider the market as a whole. Such vertical integration can lead to a reduction in market liquidity and competition (in retail and/or generation) where vertically integrated utilities with market power have the possibility of raising economic barriers to the entry.

Lessons for Hong Kong

Introducing competition in the electricity markets in the jurisdictions under the study had mixed outcomes, with some of them not meeting their intended objectives at the time of liberalisation.

Where markets have reached a reasonable level of competition, we observed that market prices follow the fundamentals of power sector. However, this does not necessarily mean that competition will decrease electricity prices *per se* for end customers as there are many factors affecting the final price of electricity (including the market structure before the liberalisation). In fact, electricity tariffs in the jurisdictions under study have mostly been on the rising trend, due to, e.g. the rising fuel prices and network costs, costs driven by green measures, etc.

A general consensus among the society has been a key ingredient for the introduction of liberalisation reforms on the countries under analysis. It provided the institutions with the necessary mandate and power to introduce the required changes in the existent structures. In Hong Kong, the government has been studying the possibility of introducing competition in the power market trying to determine the extent of benefits and implications from liberalisation processes across the world. However, the special characteristics of Hong Kong and its power sector require that the decision process must be carefully evaluated and the public's aspirations duly considered before introducing any type of reform.

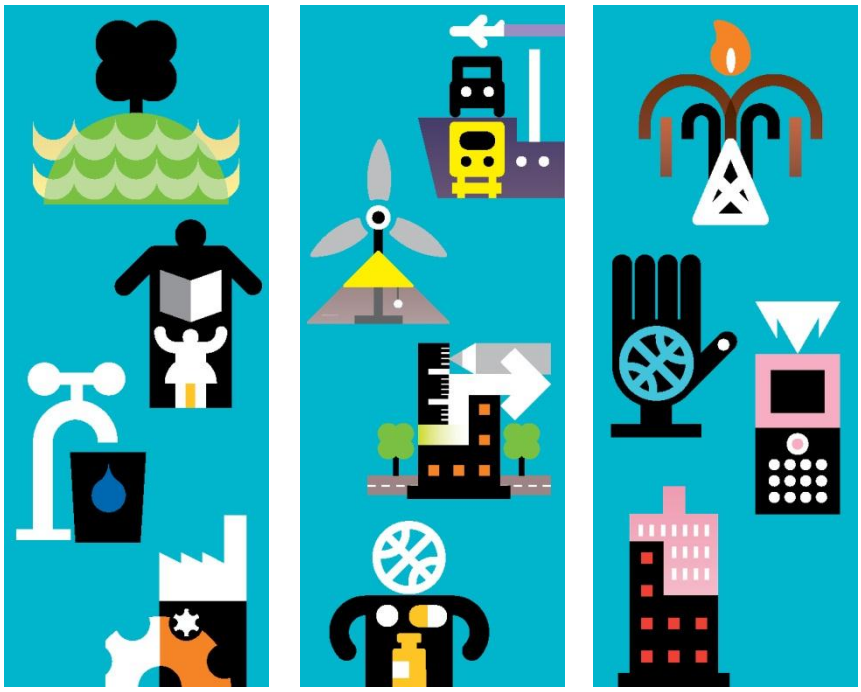
To develop a power market requires the existence of a "critical mass" of companies to ensure enough liquidity in the market; certainly, this cannot be guaranteed with only CLP and HEC participating in the market. One potential alternative would be to allow Mainland China companies to act as market participants in the wholesale market; however, this will require cooperation and coordination at government level between Mainland China and the Hong Kong Special Administrative Region. A detailed study should be conducted to ascertain that such arrangement would not bring unacceptable negative impact to the overall electricity supply reliability in Hong Kong.

The Singapore case presents many similarities to the case in Hong Kong, in terms of geographical space limitations, high reliability requirements to the system, vertically integrated utility prior to the reform. However, in Singapore, the utility was state owned before unbundling and liberalisation process, whereas in Hong Kong the two utilities are privately owned. Any reforms to introduce a competitive market would need to respect these companies' rights given by law.

As in the case of the early reforms in the UK, market power would need to be considered in Hong Kong due to the existence of just two utilities. Regulators would need to consider requirements to unbundle existing utilities in order to develop a competitive wholesale market; such unbundling should have to be made in accordance with the law in Hong Kong and in respect of the private property of the existing utilities.

PJM has developed a successful competitive wholesale market because of a number of conditions that have been satisfied. So far, Hong Kong has the Environment Bureau with regulatory and monitoring power on the two electricity supply companies operating in Hong Kong under the Scheme of Control Agreements. All the rest of the conditions appear not to be currently available; those of particular importance are:

- The inexistence of third party access to the grid (including all secondary regulation);
- The fact that only two market participants exists today (which would require forcing the unbundling of these companies to promote competition);
- Limited interconnection capacity between Hong Kong and Mainland China (if this is required to boost competition at wholesale level and if Mainland China is considered an appropriate source of supply); and
  The issue of enough interconnection capacity between the two existing systems as one of the preconditions for market development, in order to ensure price signals are not distorted by congestion issues.



行政摘要

2015 年 4 月

Mott MacDonald

海外司法管轄區電力市場概況

行政摘要

2015 年 4 月

香港特別行政區政府
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行政摘要

澳洲

在改革過程之前，澳洲由國有垂直整合的電力公司提供電力，以滿足各省份及地區客戶的用電需求。

澳洲的改革過程始於 1980 年代中期，以應對公眾對國有電力行業效率低的問題的關注；當時的應對工作是在省層面引入改革，目的是加強電力行業的管理及管控制度。然後在 1990 年代初期，新興的新自由主義意識形態及全球化進程促使澳洲電力行業 – 以及其他國有行業 – 進行更大的改革。電力行業的改革成爲澳洲政府推行的主要改革計劃中重要的一環；其中，不同省政府對於電力行業改革達成了多項協議。**改革的主要目的是提升電力行業的競爭，並為最終電力消費者提供更多選擇。**

儘管聯邦政府在規管電力行業已有很大程度的參與，但電力市場仍然受到一眾省及聯邦的法律所規管。為確保各級政府的協調，該行業由澳大利亞政府理事會[1]督導，為不同持份者提供平台，以便達成政治協議。

電力行業改革的一個重要部分是在 1998 年發展的國家電力市場（NEM）。NEM 涵蓋了新南威爾士省、維多利亞省、澳大利亞首都領地、昆士蘭省及南澳大利亞省（及在 2005 年加入的塔斯曼尼亞省）。NEM 的建立是各省份與電力行業廣泛磋商及合作的成果。改革還包括將每個省份的國有垂直整合的供電部門分拆成爲獨立的發電、輸電、配電及零售行業。

澳洲能源市場營運商 （AEMO）負責整合及調度供應，以最低成本滿足 NEM 的需求。除電力市場外，AEMO 也營運澳洲的天然氣市場。成立 AEMO 的目的是將電力及天然氣市場功能、NEM 系統營運及國家輸電規劃的責任，整合在同一營運框架內，以加強國家在管控能源市場的角色。

維多利亞省、新南威爾士省、昆士蘭省和南澳大利亞省於 2003 年引入零售競爭，在省政府層面受規管。目前，澳洲所有省份（維多利亞省、南澳大利亞省及新南威爾士省除外）均採用砌模塊的方法（自下而上的過程）或以零售價格指數為基準，對在標準零售合同下的電力零售價格採取某種形式的規管。澳洲政府同意檢討繼續採用零售價格規管的安排，並當證實已達致 “有效競爭” 時將其廢除。澳洲能源市場委員會（AEMC）會持續為每個省份零售競爭的有效性作出評估。然而，省政府及地區政府會就該事宜做出最終的決定。

自 NEM 實施起，電力批發價格維持在 20 至 60 澳元/兆瓦時的範圍內（自 1998 年 1 月起的實際價格）。分析顯示，NEM 如實反映了電力市場的價格（天然氣價格與碳計劃），並與該國進行改革進程的預期結果一致。在零售層面，過去五年的趨勢顯示價格顯著上升，而網絡收費是推動價格變化的主要原因，其次是引入環保政策（碳價格及可再生能源的推廣）– 兩者均是受規管的項目。

就營運效率而言，引入競爭理論上會為整個市場的參與者，在提升營運效率方面提供巨大誘因，而事實上 NEM 在批發和零售市場達到了良好競爭的水平，意味著營運效率應該已經有所提升。

目前，NEM 的零售業保持相當大的競爭；三家零售商 – AGL 能源 (AGL Energy)、原產能源 (Origin Energy) 及澳洲能源 (Energy Australia) – 在 2012 至 2013 年期間一共為澳洲南部及東部的小型電力用戶提供了 77% 的電力。競爭市場的存在，使小型私人零售商 (主要是新的市場參與者) 有機會於 2012 至 2013 年期間爭取

[1] 澳大利亞政府理事會是澳大利亞的政府之間高峰論壇，成員包括首相，州長，首席部長和澳大利亞地方政府協會主席。

到市場份額。這與為客戶提供選擇的電力行業改革目標一致。然而，零售業的競爭並沒有帶來客戶滿意度的提升，而客戶投訴一直有所上升。

對於系統可靠性而言，觀察發現開放市場的過程並沒有對系統的整體可靠性帶來影響。

我們認為，聯邦政府與省政府似乎都一致認爲儘管競爭已經達到良好水平，但仍然需要進一步推行有關工作及提升競爭，尤其重要的是「發電零售商」[2]，因爲他們可能會行使市場勢力。此外，我們一直認同，如果能就進一步推進電力市場發展可為社會帶來益處的意見達致共識，便須就開放市場的過程作審慎考慮，並要消除相關障礙。

在批發層面，NEM 顯示出良好的競爭水平，然而需要進行調整以削減某些市場參與者的市場勢力（主要是微調，從改善輸電網絡以避免瓶頸，到監管的改革，以確保不會對市場競爭產生障礙），這樣我們可以得出結論 – 改革的目標已經達到。在零售層面，對於維多利亞省、南澳大利亞省及新南威爾士省而言，我們可以得出同樣的結論，而對於昆士蘭省和澳大利亞首都領地而言，在一定程度上也適用。在實現零售層面競爭方面，塔斯曼尼亞省仍然落後，但是需要強調的是塔斯曼尼亞省是最後一個加入 NEM 的，在學習曲綫上落後於其他省份。

儘管在初始階段時已分拆了發電、輸電、配電和零售活動， 目前可以見到 NEM 的發電及零售活動在重新整合的過程中。這可以看作是市場設計中的矛盾：實施分拆是爲了促進競爭，但是市場規則允許發電商與零售商重新整合。雖然當中存在自然的經濟誘因（允許發電商與零售商對沖風險），此過程會輕易導致競爭壁壘提高，讓發電零售商可以行使市場勢力，防止新的參與者進入市場。事實上，監管機構已經注意到一些行使市場勢力的個案，不過並沒有發現持續的情況。不同的政府機構（監管機構及競爭管理機構）需保持對發電零售商活動進行嚴格監察，以防止這些公司行使市場勢力。

新加坡

在 1995 年之前，公用事業局（PUB）擁有並管理發電、配電及零售業務。這電力市場結構在新加坡已運作了三十年。

於 1995 年，新加坡政府進行了電力行業的第一次改革，將 PUB 的電力事業企業化。**改革的主要目標是逐步引入發電和零售層面的競爭，使新加坡形成一個電力市場，讓市場的力量而非中央規劃來促進投資、生產及定價決策。**[3]

開放市場的進程是逐漸引入的，與政府的政策一致。於 2003 年，在新的法律及監管框架下，由能源市場管理局（EMA）和能源市場私人有限公司（EMC）成立的新加坡國家電力市場（NEMS），成爲一個重要的里程碑。NEMS 作爲電力的交易平臺處理電力的買賣。

[2] 發電零售商是同時擁有發電和零售業務的電力公司

[3] EMA（2010）- 新加坡國家電力市場的介紹

於 2004 年，EMA 為三大發電公司（聖諾哥能源 (Senoko Energy)、西拉雅能源 (PowerSeraya) 和大士發電 (Tuas Power Generation)）強加了“既定合同”（財政專項合同）[4] 作爲其電力牌照的條款。既定合同是為了減少大型市場參與者的市場勢力，並通過定價條款反映新發電廠的經濟狀況。當發電商的市場勢力減少時，分配給每個發電商的既定合同份額比例也隨之減少。儘管既定合同仍然存在，EMA 最近已決定將既定合同的水平，由目前佔總需求的 40%，在 2015 年上半年降低至 30%，在 2015 年下半年降低至 25%，及在 2016 年降低至 20%[5]。

此外，通過降低非家庭用戶的自選電力供應合資格門檻，EMA 在零售市場進一步逐漸引入競爭。然而，家庭用戶仍然是非自選電力供應用戶，所以其電費仍然受監管。

EMA 還促進引入需求響應計劃（DRP），以加強在電力批發市場的競爭。DRP 允許有靈活電力需求的用戶，自願減少他們的電力需求，以換取降低電費。

此外，EMA 與新加坡交易所（SGX）籌備於 2014 年底推出亞洲第一個電力衍生產品（期貨）市場。該市場最終於 2015 年 4 月 1 日啟動，交易的產品是新加坡能源均價[6]（USEP）季度基本負載電力期貨。電力期貨市場的目的是為市場參與者提供一個管理其承受風險的工具，及免除了發電商與零售供電商之間有重新整合的需要。潛在的電力市場新參與者也可利用期貨市場來支持固定價格合同，以顧及偏好低風險電價合同的消費者。

由市場競爭驅動的發電燃料組合的變化（以較爲經濟的天然氣取代更爲昂貴的燃油），加上該地區的天然氣價格穩定，有助對新加坡的電力批發價格施加下行壓力；從而使自選電力供應用戶可購買更具競爭力的電力零售組合。因此，政府發展電力批發市場競爭的策略，及進一步依賴天然氣作為發電燃料，以保持工業競爭力的做法似乎已得到了回報。

非自選電力供應用戶的電費由 EMA 監管，且每季度更新，以反映發電成本的變化。考慮到受監管的價格跟隨批發價的趨勢，非自選電力供應用戶亦已從競爭中獲益。此外，他們也會受惠於較低的電網收費（名義及實際上），爲此我們認為政府已作出了很大的努力，在監管工作中促進效率。

考慮到競爭，在理論上可為整個市場參與者在提升營運效率方面提供巨大誘因，而事實上 NEMS 在電力批發和零售市場達到了良好競爭的水平，意味著營運效率應該已經有所提升。

過去十年，在零售層面上引入競爭，為電力零售商的市場佔有率帶來了明顯的變化；零售市場於 2003 年有六個電力零售商，自此其市場佔有率有很大的改變〔至少在電力銷售上〕。儘管缺乏資料作更詳細的分析，客戶選擇電力零售商的趨勢顯示市場力量正驅使客戶作出抉擇，這與政府開放電力行業的目標一致。

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[4]有了既定合同，發電公司會致力在指定的價格（即既定合同的定價）賣出特定的電力（即既定合同水平）。這消除了發電公司通過扣起發電容量以推高批發市場的現貨價格來行使他們的市場勢力之誘因。來源:：
https://www.ema.gov.sg/Licensees_Electricity_Vesting_Contracts.aspx

[5]來源： EMA（2014 年）檢討由 2015 年 1 月 1 日至 2016 年 12 月 31 日的既定合同水平- 最終裁定報告。

[6] USEP 是能源市場公司計算的所有承購節點加權平均節點價格。

最後，對於系統可靠性而言，新加坡能改善其電網可靠性的事實使我們推斷，在零售和批發電力市場推動競爭和效率改善並沒有影響電網的可靠性。

新加坡的改革過程正步向全面開放電力零售市場〔EMA 最近在電力零售市場採取了果斷的步驟，以降低合資格的門檻，容許零售供電商可爭取日益增加的客戶〕；而政府正著手推行更多措施以提高市場參與者的競爭。

政府提出的改革計劃很大程度已達到其目標，因為市場改革已提供足夠誘因給市場參與者，投資更高效能的發電方式（增加天然氣聯合循環渦輪發電機組（CCGT）的比例和取代昂貴的柴油/燃油發電）。這種發電模式的改變影響批發和零售層面的價格，使終端客戶可分享發電效率改善的成果。

零售競爭改變了零售商的市場佔有率，即代表客戶可受惠於更好的商業服務計劃（廉價的能源及/或更佳的服務）。然而，EMA 需要改善競爭市場的監察工作（或至少要令監察結果更加透明化），以了解客戶是否有足夠資訊，讓零售競爭帶來最大的好處。要注意的是讓所有零售客戶可選擇零售供電商的開放過程仍未完成，而既定合同仍然存在，反映了市場改革的潛在風險。

新加坡電力行業的主要問題是缺乏有關競爭市場的公開資料。現時，EMA 並不提供有關零售供電商為爭取自選電力供應用戶的商業服務計劃之分析、資訊或監察工作；也沒有像其他國家為客戶提供價格比較的工具。此外，雖然發電商和零售供電商之間似乎有一定程度的重新整合，我們未能找到就這些活動對新市場參與者和市場競爭構成潛在威脅的任何分析或監察工作。

英國

在改革前，所有在英格蘭和威爾士的發電廠和輸電網都是由中央發電局（CEGB）營運的。而配電及供電的整合服務則由 12 個地區供電局負責，他們壟斷了市場，為各自地區的所有顧客提供電力。所有電力公司均是國家擁有及營運的。

雖然英國在電力行業的改革方法大致上一致，但蘇格蘭、北愛爾蘭、英格蘭和威爾士所採取的方法亦有少許差異，反映了原先存在的行業結構（和地區民眾的力量）。整個改革受當時保守黨政府在推行廣泛地私有化及改革所有公用事業的計劃所推動。**推動改革的其中一個主要理念是相信私營和利潤驅動型的機構之間的競爭會降低成本、提高公用事業的效率和紓緩國家財政部的壓力。**

1989 年的〝電力法〞(Electricity Act 1989) 是一項適用於整個大不列顛（蘇格蘭、英格蘭和威爾士）的主要法例，重組了整個電力行業 、規定了行業的私有化、引入了批發和零售的競爭及建立了一個全新的獨立監管機構負責監管整個大不列顛的電力行業。此法例明確訂明政策制定者、監管者和服務提供者各自的角色。

在此法例下，在英格蘭和威爾士的 CEGB 被分拆。熱能發電資產分拆為兩間發電公司 – “PowerGen” 和 “National Power”，並將其企業化及上市。核電資產則注入到一間新的上市公司– “Nuclear Electric”，而連同蘇格蘭的核電資產，在數年後上市成為 British Energy。12 個地區供電局也被企業化和私有化成為區域電力公司（RECs）。

共用電力庫於 1990 年成立，提供了一個強制性的電力批發現貨市場，以訂立一個半小時的市場價格，以支付發電商的邊際價格，但卻讓低成本的發電設施可能賺取過多的利潤。 共用電力庫於 2001 年被取消，並由發電商和供電商可就批發電力的實際交付自由達成雙邊合同的批發市場所取代。雙邊合同所定的電價被認為會較接近成本，而非邊際價格，因而減少了低成本發電設施可獲得過多的利潤。

電力零售市場是逐漸引入競爭的，大用電客戶（用電需求>1 兆瓦）首先有資格選擇具競爭力的電力供應，而合資格的用電門檻是分階段下調的。自 1990 年起，用電超過 1 兆瓦的客戶可選擇具競爭力的供應；於 1994 年，是用電超過 100 千瓦的客戶，而由 1998 年至 2000 年之間，是所有的零售客戶均合資格。

鑑於有超過六成的用電客戶從未轉換供電商，可見普遍市民對零售市場缺乏競爭存有疑慮。故此電力行業的監管機構，天然氣和電力市場辦公室（Ofgem）在編寫了 Ofgem 2014 年〝市場狀況評估〞報告後，已轉介市場競爭管理局（CMA）對電力行業進行調查。CMA 將調查電力市場的哪一個部分運作不佳，並將在 2015 年報告調查的結果。

政府於 2013 年推出 〝能源法 2013〞 (Energy Act 2013)，在電力市場改革（EMR）計劃下推行多項主要的變革，而其中主要的改革是差價合約（CfD）和發電容量市場。這些改革實際上將政府轉變成為一個中央電能及發電容量的採購者，令電能市場所扮演的角色的重要性大大減低。正在實行的差價合約為低碳發電商提供一個接近固定的能源價格，以帶動在可再生能源和核能發電容量的投資，以達到可再生能源和減碳排放的目標。為確保中長期發電容量充足，當地推行了發電容量市場，向擁有實質發電容量的現有及新發電商付款，以及推行需求側響應計劃。

在開放批發市場初期，只有三間發電公司存在。發電資源集中在少數公司中，抑制了競爭。截至 2014 年 5 月，6 大公司合共擁有剛剛超過一半的現有裝機發電容量，而剩下的容量則由獨立公司和其他國際公司擁有，當中很大數量是可再生能源發電容量。相比批發市場，零售市場沒有顯著變化，而供電公司之間的市場佔有率亦沒有明顯變化。不過，自 2013 年 1 月起，較小型的供電商所佔的市場份額一直有些微的增加，而其市場佔有率的增加亦十分顯著。

自 2000 年代初開始，批發和零售市場的電力價格不斷上升。電價上升是由於天然氣的價格上升以及引入碳定價和綠色政策所致。隨著發電成本的增加，即使沒有開放市場，電力價格亦很可能會上升。

由於批發市場被視為具競爭力，我們預期會有足夠的誘因改善市場的營運效率。然而，Ofgem 在 2014 年的報告[7]指出零售市場競爭疲弱，原因是市場分割和現存供電商之間可能合謀，有默契地進行協調。因此，我們未能保證零售市場的營運效率可達至最高水平。

美國

加利福尼亞州

[7] 來源: Ofgem 2014 年 3 月的報告《市場狀況評估》 –（於 2015 年 1 月 21 日查閱）

https://www.ofgem.gov.uk/ofgem-publications/86804/assessmentdocumentpublished.pdf

在 20 世紀 90 年代初，美國加州處於全州經濟衰退期及高失業率，而由於高電價，公司被迫離開轉到其他州份。於 1995 年，由於在核電方面的昂貴投資及高價的電力合同，加州的消費者都要支付在美國西部大陸最高昂的電費（平均約為 99 美元/兆瓦時）[8]。該州的州長認為，一個通過鼓勵現有及新的批發和零售供電商之間競爭的新市場體系，以及減少監管，可將電價降低[9]。

這些改革要求電力公司強行售讓他們的發電設施，成為輸電及配電公司，而所售讓的發電公司只可賣電給州管理的電力交易所。電網則由一個獨立的系統運行機構（ISO）營運。配電公司保留零售的責任，但引入零售競爭也是改革進程的一部分。根據改革的安排，市場的供應側已大部份開放，而零售市場在改革過渡階段仍受加州公共事業委員會（CPUC）嚴格的規管，使零售電價受到監管。

於 2000/2001 年，有一段時期批發電價持續高企及波動，但由於電費上限管制，零售電價並無反映這些情況，結果引致一個主要電力公司（太平洋天然氣和電氣公司）破產及導致拉閘限電的輪流停電。多項因素促使了系統的失效，包括乾旱導致水力發電減少了向用戶的供應、核電廠意外停運、天然氣價格高企及電力需求龐大。另一個因素是加州嚴重依賴短期市場，使它容易受到市場操控的影響。

危機帶來的後果是加州將電力市場進一步的改革擱置。所實施的過渡安排是由水資源部（DWR）簽訂若干電力購買協議（PPAs），為電力公司採購電力。於 2003 年，電力公司為其客戶恢復了一些電力採購，而 DWR 亦通過重新談判減少了長期合同的費用。另外，加州在過去幾年的市場發展，目標是提高可再生能源的調度，這是在不改變目前電力市場結構下間接引入批發和零售層面競爭的做法。

撇除 2000 年中期至 2001 年中期的危機時期，加州電力庫市場首數年的批發價處於一個低水平，反映改革對降低電價幾乎沒有影響。在零售層面，改革並沒有達到目標，零售消費者還未見到價格普遍回落。

事實上佔大約三分之一總發電容量的電力公司沒有參與市場，而是遵照監管的審查過程，並且沒有於零售層面進行競爭，意味著改革進程對提高整體營運效率的影響有限。

電力系統可靠性表現指標的分析並沒有提供證據顯示開放市場的進程對供電可靠性造成結構性破壞。然而，在 2000/2001 年的能源危機期間，由於供應緊張、需求龐大及市場操控等，電力系統曾經歷了拉閘限電的輪流停電。

加州營運一個受監管與及一個放寬規管而開放的混合電力市場有 16 年之久；雖然批發電力市場存在競爭，但零售市場繼續在 CPUC 直接的管控下受到全面的規管。在編寫本報告的時候，我們沒有發現任何跡象顯示政府有計劃在零售層面引入進一步的競爭。

在此基礎上，在零售層面促進競爭的前提條件是加州各界須就推動零售競爭為社會帶來好處的意見上達成政治共識。然而，我們無法找到任何跡象顯示（或者說，就目前的分析而言）加州有政治意願促進較現有措施更進一步的市場開放措施。

[8] 克里斯托弗（2003），加州電力危機：原因和政策選擇

[9] 世界銀行（2001） - 美國加州電力行業改革的經驗對發展中國家的借鑒。

PJM

PJM 聯網於 1927 年成立，負責管理 13 個州和哥倫比亞特區的競爭批發市場。PJM 是區域性輸電營運商（RTO），由美國聯邦能源監管委員會（FERC）所監管。FERC（指令 2000）就 RTO 市場的設計，定立目標和原則。這些目標包括：消除可選擇具競爭力定價的電力的不合理限制 、鼓勵新的供電商進入市場、促進高效益及可靠的營運，以及促進在發電和輸電設施方面具經濟效益的投資。

PJM 於 1998 年推出能源現貨市場， 並於 1999 年推出日計及月計的發電容量市場。它在 2000 年實施了提前一天計的能源市場[10] ，並在 2007 年實行修訂發電容量市場[11]。而且也有一個同步備用發電容量市場及提前一天計劃調度的備用發電市場。 2007 年的發電容量市場是基於 PJM 的可靠性定價模型（RPM），它提供長期的價格信號，與 PJM 的區域輸電擴展規劃過程一致，為供應方的發電容量資源及需求方的容量需求覆行責任。

PJM 作為一個非常成熟的市場，有一系列的工具，鼓勵市場參與者進行競爭。據我們所知，PJM 目前沒有計劃引進更多的市場或工具以進一步推動區內的競爭。然而，電力市場的動態性質，尤其是市場規模正在擴大的 PJM 區是需要不斷對市場作出微調的，以確保他們將來可繼續提供有競爭力的結果。即使 PJM 已達到預期的效果，在不同市場的小規模改進仍可以繼續優化市場結果，為其消費者提供更具成本效益的服務。

實現這些市場規管的變化，是需要 PJM 董事會、股東以及聯邦能源監管委員會之間的合作和協調。 PJM 是在獨立自主的基礎上營運的，而為了提高競爭的效果，已經為市場規則和規例引入了一些小改進。允許 PJM 在競爭的基礎上營運的條件包括：

- FERC 作為監管機構；
- PJM 作為獨立系統營運商（營運資產，但沒有擁有權）；
- 分拆市場參與者；
- 輕微的區域性電網擠塞問題（即使局部電網擠塞的問題存在，也可能為一些市場參與者製造空間以至提供誘因促使其行使市場勢力）；
- 持續監察的過程，測試和程序，以減少持份者運用市場勢力; 及
- 適量資訊的流通性，以確保市場透明度

德克薩斯州

在 2002 年零售層面的改革開始之前，德克薩斯州 (德州) 電力行業夾雜著投資者擁有的電力公司、發電和輸電合作社、配電合作社、河道主管部門和市政府擁有的電力公司。由非電力公司擁有的發電廠所生產的電力大約佔用電量一成。

[10] 提前一天計的市場允許參與者進行能源交易，並可在交易日的前一天為他們的買賣報價作出修訂。引入提前一天計的市場讓參與者可以在具備更多有關電力需求及發電機組可用性的相關信息的基礎上進行交易，從而得到更有效的市場結果。

[11] 發電容量市場向有實質發電容量的市場參與者付款，而這是確保供電穩定的一個機制。

在工業及政治支持改革下，開放的電力市場於 2002 年開始運作。德州公用事業委員會（PUCT）在 1999 年的競爭報告中認為，受監管的電力公司由於成本下降及物價穩定，賺取著過高的利潤，而定意為降低消費者用電開支的開放市場放寬規管的計劃於 1999 年公布。

德州開放市場放寬規管系統的一個重要組成部分是設立區域性輸電營運商，這是被稱為德州電力可靠性委員會（ERCOT）的國家機構所承擔的角色，以確保輸電系統得以開放，容許接駁使用。ERCOT 也管理競爭批發市場（提前一天計及實時市場），以及輔助服務市場和零售市場。

ERCOT 的電力批發價格受天然氣價格和當地的氣候情況影響。隨著風力發電容量不斷提高，風能的可用性將成為一個影響電價的重要因素。雖然批發價格 （實質值）在 2002 年和 2008 年期間有所上升，但隨後回落，而 2013 年的價格與 2002 年開放市場時觀察到的水平相差不多，儘管價格自 2002 年以来並沒達到開放市場進程的目標有所下降，但卻反映了邊際發電成本及跟隨了天然氣價格的走勢。

類似的趨勢可以在零售價格中觀察得到。雖然電力零售價格上漲顯示開放零售市場及放寬規管並沒有達到降低電價的目的，但似乎清楚顯示價格反映了影響電力行業的市場狀況。

考慮到競爭可以為整個市場的參與者在提升營運效率方面提供巨大誘因，而資料分析顯示，ERCOT 的批發和零售市場均具競爭性，因此這兩個市場的營運效率都應該已經得以改善。

在德州，客戶一直積極尋找更好的商業機會，而開放的市場增加了客戶的選擇。根據分析的資料，最近客戶轉換供電商的比率開始下降，這可能是由於零售市場已達到較高的成熟程度。

在系統可靠性方面，電力系統表現的分析並沒有提供證據顯示開放市場對供電可靠性造成結構性的破壞。不過，有人對長遠發電供應是否充足表示憂慮， 因為目前電力的價格沒有高到足以鼓勵新的投資。多項改革正在實施，例如營運發電備用容量需求曲線（ORDC），在發電備用容量下降時會人為地提高電價，與及放寬電力價格上限。

在這項研究中，德州是在引入進一步促進市場發展工具最活躍的地區之一。 ERCOT 和 PUCT 遵循了多年前的市場發展指引，這表明該州有政治意願在電力行業有效地推行競爭。

在德州的市場，發電和零售商之間的垂直整合程度並不明確，因為市場監察活動似乎只考慮市場特定的部分（如零售和發電），没有將市場作為一個整體考慮。當具備市場勢力的垂直整合電力公司可能增加進入市場的經濟障礙時，這種垂直整合可能會削弱市場的流動性和競爭（在零售和/或發電層面）。

香港可借鑒之處

在所研究的司法管轄區的電力市場，引入競爭有不同的結果，其中一些地區未能達到在開放市場時所定的預期目標。

在那些競爭達到一個合理水平的市場，我們觀察到市場價格符合電力行業的基本因素。不過，這並不一定意味著競爭本身一定會為最終客戶降低電價，因為影響電力最終價格的因素很多（包括開放前的市場結構）。

事實上，在所研究的司法管轄區的電價，大多一直在上升趨勢中，原因例如是上升的燃油價格和網絡的收費，由環保措施推高的成本等。

在所分析的國家，社會能達致普遍共識，一直是引進開放市場改革的一個關鍵因素。它為監管機構提供了必要的授權和權力，在現有的市場結構引入所需的改變。在香港，政府一直有研究為電力市場引入競爭的可能性，試圖確定世界各地開放市場進程的益處和影響有多大。然而，鑑於香港及其電力行業的特質，在決定引入任何類型的改革之前，必須作出仔細的評估及適當考慮公眾的訴求。

發展一個電力市場需要公司“臨界質量”的存在，以確保市場有足夠的流動性；當然，若只有中電和港燈參與市場，就不能作出這保證。一個可能的替代方案是，容許中國內地的公司成為批發市場的參與者；然而，這需要中國內地和香港特區在政府層面的合作與協調。另外也需要進行詳細研究，以確定這樣的安排不會對香港整體的電力供應可靠性帶來不可接受的負面影響。

改革前的新加坡與現今的香港有許多相似之處，比如地域空間的限制、系統可靠性要求高及垂直整合的電力公司。不過，在新加坡，電力公司在分拆及開放市場之前是國有資產，而在香港兩家電力公司都是私人擁有的。引入競爭市場的任何改革，都必需尊重法律賦予這些公司的權益。

由於香港只有兩家電力公司存在，正如英國早期的改革，必需考慮市場勢力的問題。監管機構需要考慮分拆現有電力公司，以發展一個具有競爭力的批發市場；進行這種分拆時，應該按照香港的法律及須尊重現有電力公司的私有財產。

由於已具備了多項條件，PJM 已發展為一個成功具競爭力的批發市場。到目前為止，香港環境局根據 《管制計劃協議》有權監管及監察在香港營運的兩家電力公司。目前香港還未具備其他條件；其中尤為重要的包括：

- 仍未開放電網容許第三方使用（包括所有配套規例）；
- 事實上目前只有兩個市場參與者存在（所以需要迫使這些公司分拆業務以促進競爭）；
- 香港和中國內地之間的聯網容量有限（若這是在批發層面提高競爭所需要的，以及若中國內地被視為是合適的供應源）;及
- 兩個現有電力系統需要有足夠的聯網容量作為發展電力市場的前提條件，以確保價格訊號不被電網擠塞的問題扭曲。