

For Information

LEGISLATIVE COUNCIL PANEL ON ECONOMIC DEVELOPMENT

Public Consultation on the Future Development of the Electricity Market

Introduction

This paper informs Members of a 3-month public consultation on the future development of the electricity market that the Administration launched on 31 March 2015. A copy of the consultation document is at **Annex**.

Details

Background

2. The Scheme of Control Agreements (SCAs) entered into between the Government and the two power companies¹ will expire in 2018. As provided in the SCAs, the Government has an option to extend the term of the SCAs for five more years, i.e. till 2023 either (a) on existing terms or (b) on such amended terms as may be mutually agreed by the Government and the power companies before the expiry of the SCAs in 2018. The Government may introduce changes to the electricity supply regulatory framework after the expiry of the SCAs. Before implementing any changes to the electricity supply regulatory framework, the Government will take into account all relevant factors and discuss with the power companies market readiness, potential future changes to the electricity supply regulatory framework, and transition issues before 1 January 2016.

3. The Administration launched a public consultation on 31 March 2015 on the future development of the electricity market, which also sets out our plan to implement the fuel mix for electricity generation in 2020 having regard to the views received in the public consultation conducted in March – June 2014.

¹ The power companies are CLP Power Hong Kong Limited and Castle Peak Power Company Limited, as well as The Hongkong Electric Company Limited.

Our electricity market

4. **Chapter 1** of the consultation document gives a brief background of electricity supply in Hong Kong and highlights its performance against the four energy policy objectives of safety, reliability, affordability and environmental protection, as well as the current regulatory framework.

The review

5. **Chapter 2** sets out the background of the present review. In conducting the review of the future development of the electricity market, we are not only guided by the four energy policy objectives, but have also paid due regard to our goal to introduce competition to the electricity market when the requisite conditions are present. The present review builds on the various reviews and public consultations conducted over the past few years relating to electricity supply, including the mid-term review of the SCAs conducted in 2013, and the public consultation on the future fuel mix for electricity generation launched in 2014.

Readiness to introduce competition in 2018

6. **Chapter 3** sets out our observation of the experiences of Australia, Singapore, the United Kingdom and the United States in introducing competition to the electricity markets. Market liberalisation is a long, complex and evolving process, and delivered mixed outcomes when evaluated against our energy policy objectives. While we should not expect that introducing competition to the market would naturally lead to tariff reduction, it would allow consumers to have more choices. We consider that we should not change our goal to introduce competition to the electricity market.

7. **Chapter 4** gives an analysis of our readiness to introduce competition to the electricity market in Hong Kong in 2018. While a key determining factor is the availability of stable and reliable sources of new supply, there will unlikely be any substantial new source of electricity supply after the expiry of the current term of the SCAs in 2018. However, to pave the way for Hong Kong to introduce competition in the longer term, we plan to conduct the necessary preparatory work, which includes conducting a joint study with the power companies on grid access arrangements by new players, and a study on the detailed arrangements required to enhance the interconnection with the Mainland grid and between the local power grids.

Future regulatory arrangement

8. We have reviewed the regulatory arrangement, and set out in **Chapter 5** our views on the regulatory tool, the price setting mechanism to be adopted, and the features of the future contractual arrangement, including the permitted rate of return, tariff approval process, promotion of information transparency, incentive and penalty scheme to enhance power companies' performance, measures to promote energy saving and renewable energy, etc.

The future fuel mix

9. **Chapter 6** sets out our plan to implement the fuel mix for electricity generation in 2020 having regard to the views received in the public consultation conducted in March – June 2014. We would increase the percentage of natural gas generation to around 50%, and maintain the current interim measure to import 80% of nuclear output from the Daya Bay Nuclear Power Station such that nuclear import would account for around 25% of the total fuel mix. Subject to public views on the tariff implications, we are prepared to develop more renewable energy, and we will also enhance our efforts to promote energy saving. The remaining demand will be met by coal-fired generation. This will help us achieve the environmental targets for 2020.

10. **Chapter 7** provides a summary of the above and sets out the consultation questions to solicit public views. A response form is also provided in the consultation document, together with a report of the fuel mix consultation as the **Annex**.

Public Consultation

11. The public consultation will last for three months until 30 June 2015. The Government keeps an open mind on the various issues, and would engage different stakeholder groups, including the academia, green groups, professional bodies and the business community to solicit their opinions.

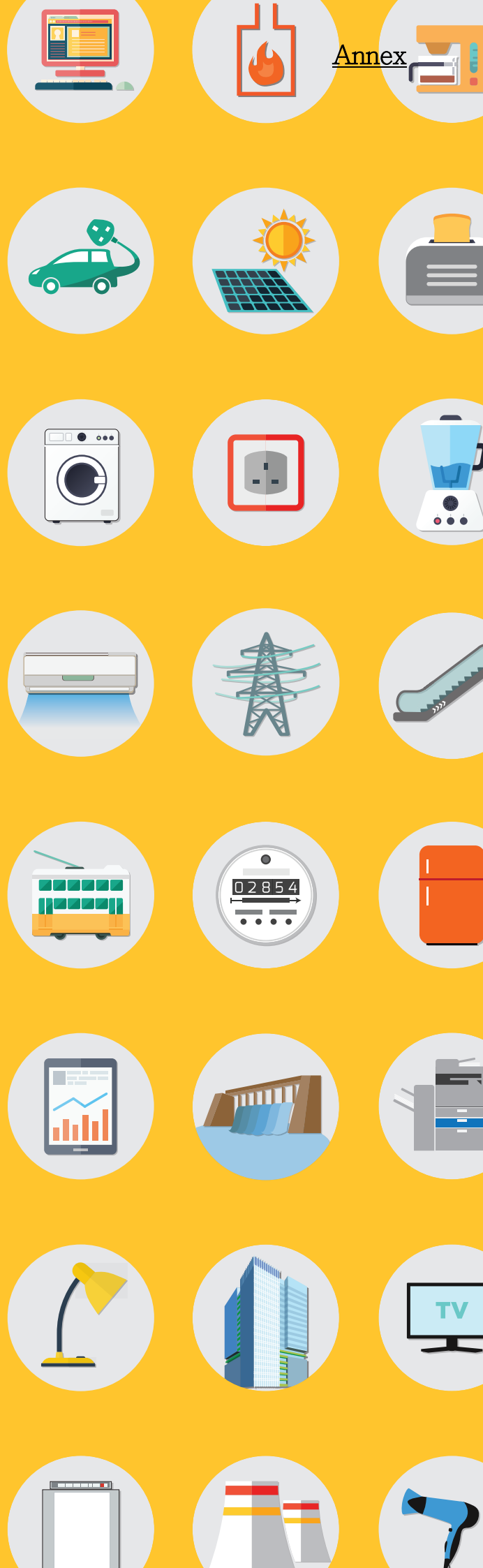
Advice sought

12. Members are invited to note the launch of the public consultation on the future development of the electricity market.

March 2015

Environment Bureau

Public Consultation on the Future Development of the Electricity Market



Content

Foreword	4
Chapter 1 - The Current Electricity Market	5
Policy objectives	
Electricity supply in Hong Kong	
Size of the electricity market	
Performance in achieving the energy policy objectives	
• Safety	
• Reliability	
• Affordability	
• Environmental performance	
Current regulatory framework	
Chapter 2 - Review of the Development of the Electricity Market and Regulatory Framework	15
Background of the review	
• Public views	
• Previous public consultation on future market development	
• Expiry of the Scheme of Control Agreements	
Previous reviews conducted	
• Climate change strategy and action agenda	
• Future fuel mix for electricity generation	
• Mid-term review of the Scheme of Control Agreements in 2013	
Scope of the review	
Chapter 3 - Overseas Experience of Introducing Competition to the Electricity Markets	21
Possible benefits	
Possible modes of competition	
Observations	
• Affordability	
• Reliability	
• Consumer choice	
Desirability of choices	

Chapter 4 - Review of Readiness of Introducing Competition

27

Review of new supply sources

- From the Mainland
- Distributed power generation in Hong Kong
- Competition between the two existing power companies

Preparatory work for introducing new players in longer term

- Grid access
- Enhanced interconnection with the Mainland power grid and between the local power grids
- Segregation of generation and transmission/distribution business of the power companies

Chapter 5 - Future Regulatory Framework

35

Regulatory tool

Regulatory approaches

- Rate of return on assets
- Cap regulation
- Recommended approach for Hong Kong

Improvement to the existing regulatory arrangement

- Duration of the future contractual arrangement
- Permitted rate of return
- Excess generating capacity
- Tariff

Fuel costs

Tariff approval

- Performance improvement
 - Operational efficiency and service quality
 - Emission performance
 - Energy efficiency and renewable energy
- Facilitation to introduce market competition
- Enhanced information transparency

Chapter 6 - Fuel Mix Implementation

45

Major views on the future fuel mix

- Preference over local generation
- Environmental objectives
- Affordability for using more natural gas
- Nuclear power
- Renewable energy
- Demand side management

Way forward

- Measures to take
 - More use of natural gas
 - Nuclear energy
 - Demand side management
 - Existing measures
 - Further promotion of demand side management
- Renewable energy
 - Current position
 - Further promotion of renewable energy

Environmental and cost implications

Lead-up to 2020 and beyond

Chapter 7 - Summary

57

Key points of consultation

Respond to this consultation

Disclaimers

60

Annex - Report on the Public Consultation on Future Fuel Mix for Electricity Generation in Hong Kong

61

Response Form

73

Foreword

We may not notice it, but electricity powers our lives and drives the development of our economy.

While Hong Kong has been enjoying a generally safe, reliable and affordable electricity supply, and there has been continuous improvement in the environmental performance of our electricity generation, we need to consider how to further develop our electricity market and improve our regulatory framework when the current Scheme of Control Agreements (SCAs) expire in 2018. This is no easy task, given the complexity of the wide-range of issues entailed, and the profound impact that any major change could bring to our society.

In conducting this review of the future development of the electricity market, we are not only guided by our four energy policy objectives of safety, reliability, affordability and environmental protection, but have also paid due regard to our goal to introduce competition to the electricity market when the requisite conditions are present. It builds on the various reviews and public consultations conducted over the past few years, including the mid-term review of the SCAs conducted in 2013, and the public consultation on the future fuel mix for electricity generation launched in 2014. We have heeded the public views and feedback received during these exercises, which provide us with important parameters in formulating possible options on the way forward.

In this consultation paper, we have set out our analyses of the market readiness to have new suppliers in 2018 and the preparatory work required to pave the way to introduce competition; proposed some possible options to improve our regulatory arrangement; and laid out our plan to implement the fuel mix for electricity generation in 2020 to meet our demand for electricity and achieve our environmental targets. I hasten to add that these issues are intertwined in that our decision on one will give us more options or limit our choices for another.

Given the paramount importance of electricity to our daily living, any market change needs to be fully deliberated by the community. We keep an open mind on how we should map out our way forward in dealing with the challenges, not just on the supply side but also on the demand side in further promoting energy efficiency. Having regard to the outcome of this consultation, we will commence discussion with the power companies to draw up the regulatory arrangement for the electricity market after the expiry of the current term of SCAs.

Share your views with us!

KS Wong

Secretary for the Environment

March 2015

Chapter 1

The Current Electricity Market



The Current Electricity Market

Policy Objectives

1.1 Electricity underpins our daily activities and drives our economic developments. It is the Government's longstanding policy to ensure that electricity demand of the community is met safely, reliably, efficiently and at reasonable prices, while minimising the environmental impact of electricity generation. The Government is also committed to introducing competition to the electricity market when the requisite market conditions are present.

Electricity Supply in Hong Kong

1.2 All along, electricity in Hong Kong has been provided by two privately-owned power companies, viz. the CLP Power Hong Kong Limited (CLP Power) and Castle Peak Power Company Limited (CAPCO) (referred to collectively as CLP) and The Hongkong Electric Company, Limited (HKE). Both power companies are privately owned and 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 customers and provide customer services within their respective service areas.

1.3 CLP supplies electricity to Kowloon and the New Territories, including the Lantau, Cheung Chau and most of the outlying islands, mainly from the Castle Peak Power Station and Black Point Power Station. HKE supplies electricity to the Hong Kong Island, Ap Lei Chau and Lamma Island from the Lamma Power Station. At the end of 2013, the total installed capacity of the

two power companies was 12 645 MW, and the total number of electricity consumers was about 3 million, with about 80% being served by CLP and about 20% by HKE. In terms of the fuel mix, in 2013, coal-fired generation contributed to around 57% of our fuel mix on sent-out basis, followed by 21% natural gas and 22% nuclear power imported from the Daya Bay Nuclear Power Station (DBNPS).

Size of the Electricity Market

1.4 Electricity consumption in 2013 stood at around 43 billion kWh, with a split of 26% and 74% between residential and non-residential users (Figure 1), and aggregated¹ maximum electricity demand was about 9 100 MW.

1.5 The size of our electricity market is comparable to that of other international cities such as New York City, Greater London and Singapore in terms of consumption, but is smaller than the consumption level of some major cities in the Mainland such as Beijing, Shanghai and Guangzhou. By comparison, it is only about 5% of the areas covered by the China Southern Power Grid (CSG) or 10% of the Guangdong province in terms of total consumption (see Table 1).

1.6 In terms of the growth trend, Hong Kong's electricity end-use increased by 81% between 1990 and 2012, equivalent to a 2.7% increase per annum. During the same period, our real GDP increased by 134%, equivalent to an average of 3.9% per annum, while population increased by 25% (1.45 million), equivalent to an average of 1.0% per annum. The figures show that electricity use-to-GDP ratios have been dropping amidst

our economic development (Figure 2). This was mainly due to the growth in the less energy intensive service sector and decline in the more energy intensive industrial sector, although the increased awareness of energy conservation and energy efficiency also contributed to the drop.

1.7 Figure 3 also shows that as Hong Kong developed towards a service economy when our manufacturing industries started moving to the Mainland, our economy became less energy intensive.

Figure 1:
Breakdown of electricity consumption by residential and non-residential customers in 2013

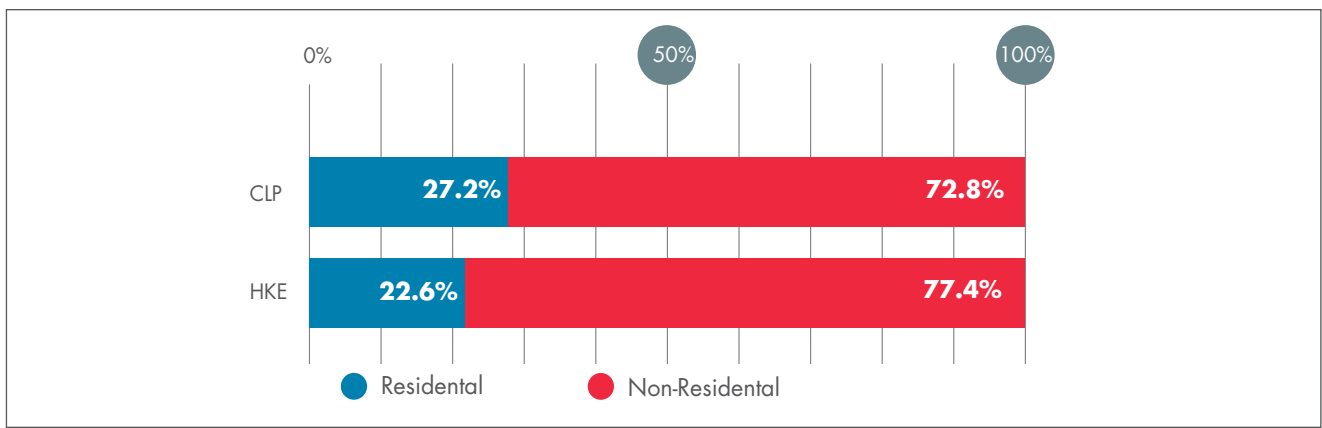


Table 1: Electricity consumption of Hong Kong, Mainland and overseas regions/cities

Regions/Cities	Electricity consumption 2013 (billion kWh)
Area covered by the CSG (Guangdong, Guangxi, Yunnan, Guizhou and Hainan)	894.7
Guangdong Province	483.0
Shanghai ²	115.5
Beijing ²	82.5
Tokyo	73.6
Los Angeles	68.1
Guangzhou ²	67.3
New York City ²	56.9
Singapore	44.9
Hong Kong	42.6
Greater London	40.5

¹ Aggregated maximum electricity demand is the sum of the non-coincident maximum demands of CLP and HKE.

² The consumption figures of the cities are the sales figures of the regional supply companies.

1.8 Looking ahead, it is anticipated that the increase in electricity demand will remain moderate. According to the forecast of the power companies, electricity consumption is expected to grow at about 1-2% annually on average in the coming decade. The growth in the Hong Kong Island supply area is expected to be minimal as major consumption is from the commercial sector the development of which has been stable in recent years. The growth in

electricity consumption will be higher in the other side of the harbour, mainly attributable to population growth, new development areas and new infrastructures to be built.

Performance in Achieving the Energy Policy Objectives

1.9 Our electricity supply has so far been

Figure 2:
Decoupling of electricity use from GDP, 1990-2012

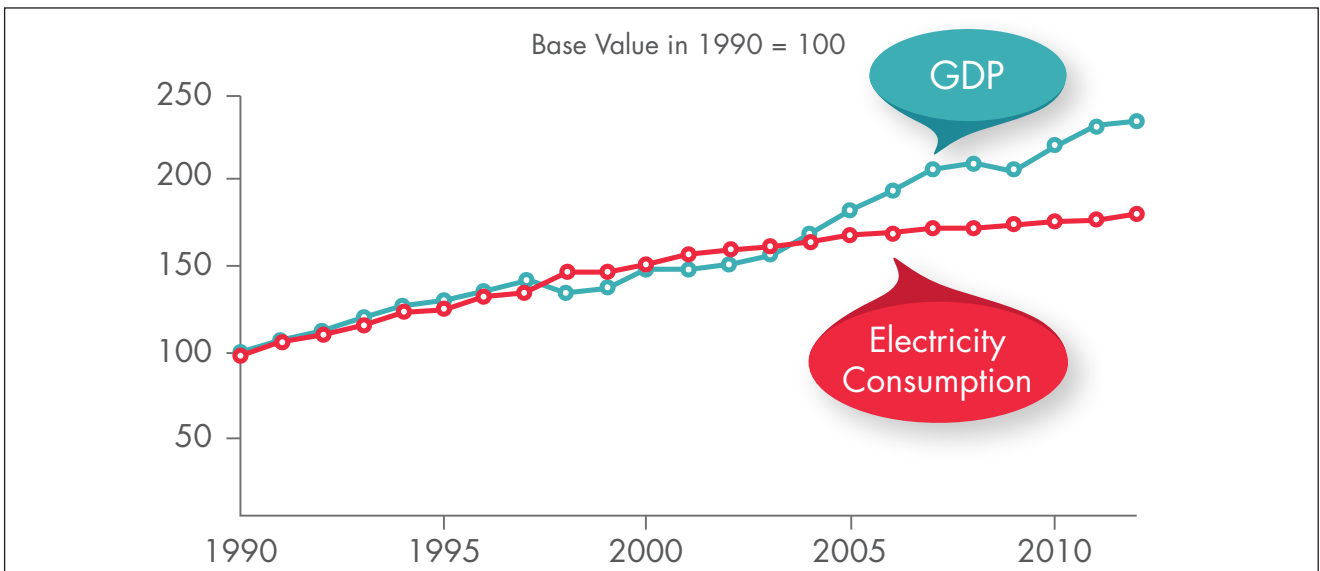
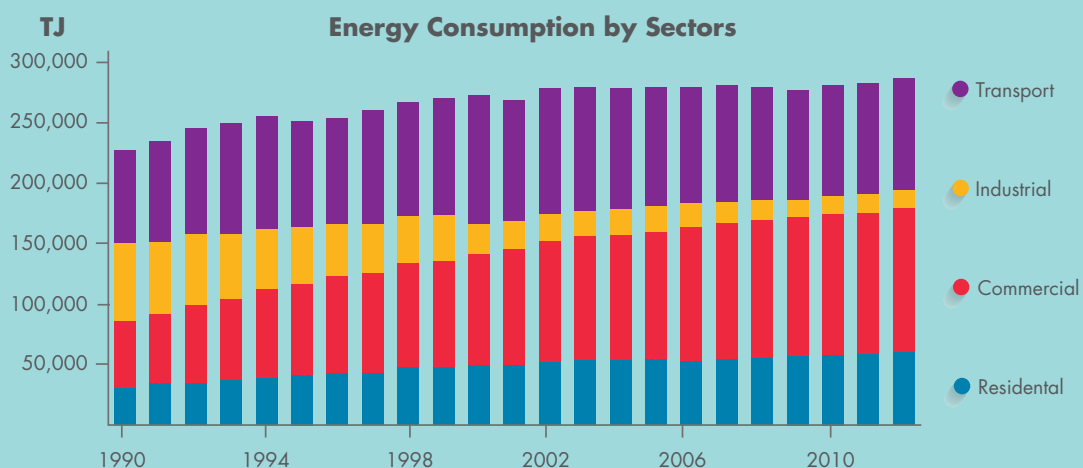


Figure 3:
Energy consumption by sector, 1990-2012 (Source: Hong Kong Energy End-use Data, the Electrical and Mechanical Services Department (EMSD))



able to achieve the four energy policy objectives, which are competing with one another in that the achievement of one objective may come at the expense of another. For instance, maintaining a high degree of reliability calls for more infrastructural investments, which may exert pressure on electricity tariff. The ensuing paragraphs set out the performance of electricity supply in Hong Kong against each of these policy objectives.

Safety

1.10 Ensuring the safety of electricity supply, which is an essential public utility in Hong Kong, is of utmost importance. The two power companies have been maintaining a high safety record in the whole electricity supply chain. Major accident in electricity provision has been rare.

Reliability

1.11 Reliability of power supply is of vital significance to Hong Kong as an international financial and trading centre. A reliable and stable electricity supply is also paramount to ensuring public safety given the high density of skyscrapers with some 62 000 lifts and 8 700 escalators running in them. Over 4.65 million passenger trips are made every day on electrically-powered transport system. As revealed in various surveys and also in the public consultation on future fuel mix for electricity generation that the Government conducted in 2014, the public attaches much importance to reliability of electricity supply.

1.12 Hitherto, Hong Kong has been enjoying a world-class standard of supply reliability. The reliability of Hong Kong stood at 99.9997% in 2013, which means the average unplanned

interruption was less than three minutes a year. This compares well with and in fact surpasses many other large cosmopolitan cities (see Figure 4). There has not been any major blackout for 30 years. The high standard of our electricity supply has also been internationally recognised. For instance, Hong Kong has been ranked number 1 among some 150 economies in respect of electricity supply quality in World Economic Forum's Global Competitiveness Report in 2013-2014.

Affordability

1.13 Our electricity tariff is lower than that of many major cities in the world. As can be seen in Figure 5, our domestic electricity tariff is significantly lower than Singapore, London, New York and Sydney.

1.14 On the overall affordability, households in Hong Kong on average spent less than 2% of their expenditure on electricity supply³. The power companies have also been offering discounts to low consumption domestic consumers and operating several concessionary tariff schemes for the under-privileged households.

1.15 While the consumption level does not necessarily correlate with family income, the majority of low income customers would likely fall within the group of low consumption users, whose electricity tariff burden should have been lessened under the above tariff arrangement. As an illustration, domestic customers consuming less than 100 kWh per month are paying an electricity tariff rate of around 20% to 35% less than the average. Since 2012, low consumption users⁴ have seen no tariff increase for three

³ According to the "2009/10 Household Expenditure Survey and the Rebasing of the Consumer Price Indices" published by the Census & Statistics Department.

⁴ For HKE, "low consumption users" refers to domestic users consuming not more than 150kWh per month, and non-domestic users consuming not more than 500 kWh per month; for CLP, the corresponding figures are 200 kWh and 400 kWh respectively.

Table 2: Average net tariff in Hong Kong from 2009 to 2015

CLP							
	2009	2010	2011	2012	2013	2014	2015
	¢/unit	¢/unit	¢/unit	¢/unit	¢/unit	¢/unit	¢/unit
Basic Tariff	77.4	80.1	80.1	84.2	84.0	88.4	87.2
Fuel Clause Charge	11.8	11.5	14.1	17.8	22.4	22.4	27.0
Rebates	0	0	0	(3.3)	(1.7)	0	0
Average Net Tariff	89.2	91.6	94.2	98.7	104.7	110.8	114.2

HKE							
	2009	2010	2011	2012	2013	2014	2015
	¢/unit	¢/unit	¢/unit	¢/unit	¢/unit	¢/unit	¢/unit
Basic Tariff	94.5	94.5	93.0	93.9	94.4	101.8	102.6
Fuel Clause Charge	25.4	25.4	30.2	37.0	40.2	33.1	32.3
Rebates	0	(0.1)	(0.1)	0	0	0	0
Average Net Tariff	119.9	119.8	123.1	130.9	134.6	134.9	134.9

consecutive years or even slight reduction in some cases.

1.16 The electricity tariff paid by an electricity user comprises two major components: the basic tariff and fuel clause charge. The basic tariff covers operating expenses, standard fuel charges and return to the power companies while the fuel clause charge reflects the changing price of fuels and is borne by consumers and payable to the power companies on a cost-pass-through basis. Table 2 shows the changes of overall tariff and its components in recent years. It can be seen that the overall tariff of Hong Kong has been maintained at a relatively stable level. Since the commencement of the term of the current Scheme of Control Agreements (SCAs) in 2008/09, the average net tariff increase per year was lower than the average annual increase in

composite consumer price index of around 4% over the same period. The increase in basic tariff was even lower at 1-2% a year. The tariff increase in recent years is mainly caused by higher fuel cost as we are using more natural gas to replace coal to improve the environmental performance of power generation.

Environmental performance

1.17 Power generation is a major source of air pollutant emissions. It accounted for 47% of sulphur dioxide (SO₂), 28% of nitrogen oxides (NOx) and 16% of respirable suspended particulates (RSP) in 2012; and nearly 70% of greenhouse gas (GHG) emissions in 2011. As part of our efforts to improve the environment, we have not allowed the power companies to build new coal-fired power plants since 1997. For existing ones, the power companies have

Figure 4:
Supply reliability of Hong Kong and other major cities

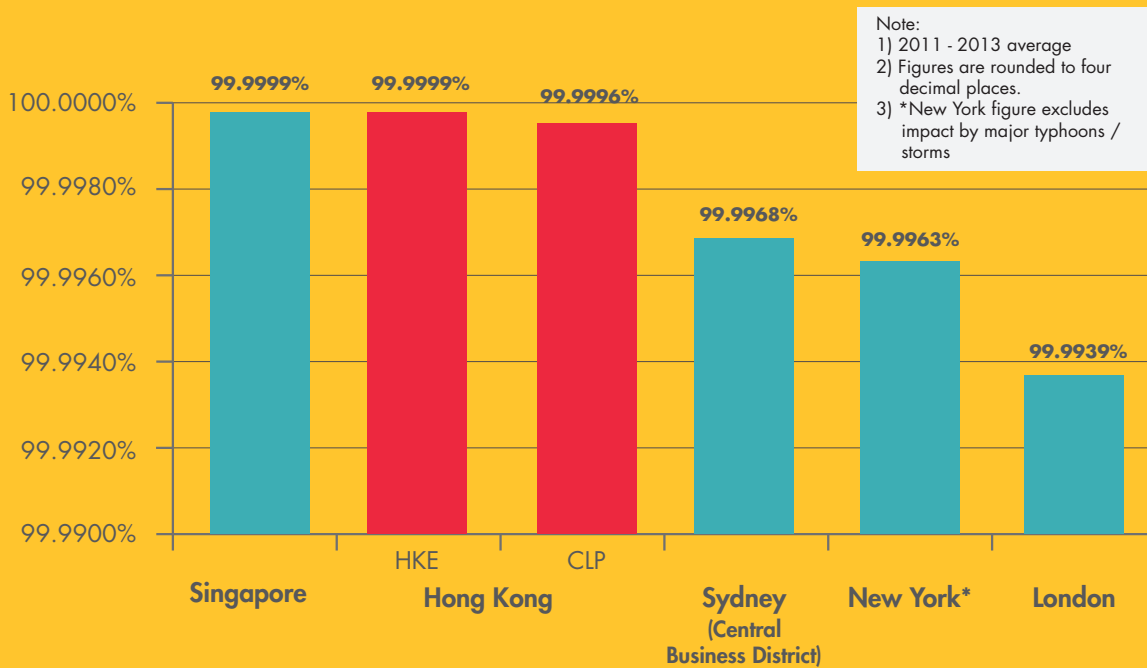
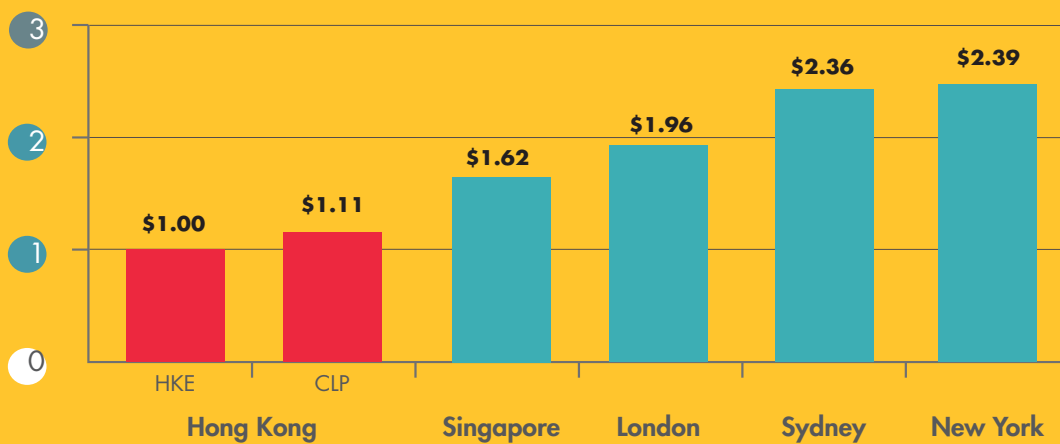


Figure 5:
Electricity tariff of Hong Kong and other major cities



Remarks:

Comparison based on average monthly domestic consumption of 275 kWh⁵.
 For Hong Kong, net tariff for 2015 is adopted.
 For other cities, tariff and exchange rate at November 2014 are adopted.
 The overall average net tariff of CLP and HKE for 2015 is \$1.14 and \$1.35 respectively.

⁵ About 50% of CLP's domestic customers and about 40% of HKE's are consuming at or below 275kWh per month.

added flue gas desulphurisation and NO_x control systems to their major coal-fired generating units. On the legislative side, the Air Pollution Control Ordinance (Cap. 311) (APCO) has tightened the control on power sector through stipulation of emission caps in Technical Memoranda (TM).

1.18 As a result of the above mentioned measures, emissions of SO₂, NO_x and RSP from electricity generation in 2012 dropped by 72%, 43% and 63% respectively as compared to 1997 levels. Looking ahead, the Government has set the emission reduction targets for 2020. Specifically, we target to reduce SO₂ by 35%-75%, NO_x by 20%-30% and RSP by 15%-40% by 2020 when compared to 2010. Table 3 shows the emission reduction targets for major air pollutants.

1.19 Electricity generation is a major contributor of GHG emission, accounting for about 70% of the total carbon emissions in Hong Kong. As our contributions to global efforts in combating climate change, the Government sets a target to reduce Hong Kong's carbon intensity by 50%-60% by 2020 when compared to 2005. To achieve this target and also the air pollutant emissions target mentioned above, we conducted a public consultation on the future fuel mix for electricity generation during March to June 2014. The outcome of the consultation and the way forward are set out in Chapter 6.

Current Regulatory Framework

1.20 Interested investors who meet the relevant reliability, safety and environmental performance requirements can enter Hong

Kong's electricity market. However, given the land requirements for constructing new generating units, it may not be easy for new entrants to find suitable sites for the purpose. Also, due to the relatively small size of the electricity market, and the capital intensive nature of the industry, there have hitherto been only two power companies providing electricity to their respective service areas. In regulating the provision of electricity by these two companies, the Government has been guided by the four energy policy objectives. The APCO and TMs provide the legislative framework for regulating emissions from the power sector; and the Electricity Ordinance (Cap. 406) (EO) and its subsidiary legislation set out the relevant safety requirements in electricity supply and provision.

1.21 The SCAs have been providing a key tool for the Government to regulate the financial affairs of the power companies which are Electricity-Related and to monitor the reliability and environmental performance of the power companies in providing electricity. The SCAs do not give the power companies any exclusive rights to provide electricity in Hong Kong. They are not franchises and do not define a supply area for either of the power companies. Rather, they set out the rights and obligations of the power companies, and the returns for shareholders of the power companies and the arrangements by which the Government monitors the companies' financial affairs so far as they are Electricity-Related. The power companies recognise their obligations to provide sufficient facilities to meet local electricity demand over the term of the SCAs. Their return is also capped at a permitted

rate as a percentage of their fixed assets.

1.22 The first SCA between the Government and CLP Power was signed in 1964, and the one between the Government and HKE and the then Hongkong Electric Holdings Limited in 1979. Features have been added to the SCAs over the years with an aim to improving its operation and to better achieve the energy policy objectives.

1.23 The current SCAs were signed in 2008. As compared with previous SCAs, the duration was shortened from 15 years to ten years, with an option exercisable by the Government to extend for five more years, i.e. till 2023 on existing terms or on such amended terms as may be mutually agreed by the Government and the power companies. Several changes have also been made, which include lowering the annual permitted rate of return (RoR), inclusion of financial incentives to encourage the development of renewable energy (RE) and energy efficiency and conservation, as well as the power companies' performance in

terms of supply reliability, operational efficiency and customer services, exclusion of part of excessive generating units from the power companies' Average Net Fixed Assets (ANFA) for calculating their return, lowering the cap of the Tariff Stabilisation Fund (TSF) to better ameliorate the impact of tariff increase or facilitate tariff reduction, etc.

1.24 The current SCAs provide a framework for the Government to monitor the financial affairs of the power companies through Development Plans (DPs) submitted by the latter and annual Tariff Reviews and Auditing Reviews jointly conducted with them. Under the DP review process, the power companies have to submit their five-year DPs six months before the period covered by the previous DP expires, which should include information about, among others, forecast electricity demand and sales, capital investment, fuel costs, and operating expenditures. With the assistance of an independent energy consultant,

Table 3: Emission reduction targets for major air pollutants

Air Pollutant	2010 Actual Emission Level (tonnes)		2019 Emission Caps for Power Sector (tonnes) [% reduction vs. 2010 actual emission level]	2020 Emission Reduction Targets (% reduction vs. 2010)
	Overall	Power Sector		Overall
Sulphur dioxide (SO ₂)	35 500	17 800	9 220 [48%]	↓35% – 75%
Nitrogen oxides (NO _x)	108 300	27 000	25 480 [6%]	↓20% – 30%
Respirable suspended particulates (RSP)	6 250	1 010	700 [30%]	↓15% – 40%

the Government closely examines the investment proposals in the DPs to avoid investments that are excessive, premature or unnecessary. Following approval by the Executive Council (ExCo), the power companies will make available to the public projected Basic Tariff Rate of each year in the DP period.

1.25 In October every year, a Tariff Review is conducted jointly by the Government and the power companies. With the support of an independent energy consultant, the Government critically reviews the data on electricity demand and sales, fuel cost, operating and capital

expenditure, etc., and their justifications for tariff proposal to ensure that the electricity tariff is maintained at a reasonable level.

1.26 The Government also conducts an Auditing Review jointly with the power companies every year to monitor the power companies' performance in respect of emission, customer service, energy efficiency and RE provision, upon which the power companies' performance incentives are based.



High safety record



Reliability
above 99.999%
less than 3 minutes of
average unplanned
interruption a year



Air pollutants
reduced by 43-72%
in 2012 as compared to
1997



Tariff lower than
many major cities

Chapter 2

Review of the Development of the Electricity Market and Regulatory Framework



Review of the Development of the Electricity Market and Regulatory Framework

2.1 The electricity supply in Hong Kong has been able to achieve the four energy policy objectives of safety, reliability, affordability and environmental protection, as outlined in Chapter 1. Nevertheless, we need to plan ahead for the long-term development of the electricity market in a timely manner, as it takes considerable time to plan, design and construct the necessary infrastructure for electricity provision or introduce any structural changes to the market. At the same time, we need to decide how to pursue our goal of introducing competition to the electricity market.

Background of the Review

Public views

2.2 Electricity supply is currently provided by two privately-owned power companies. Over the years, there have been suggestions that competition should be introduced to the electricity market to allow more suppliers, as well as to allow consumers to have choices. There is also a general belief that promoting competition in the electricity market will help drive down electricity tariff. Some have suggested that distributed power generation in Hong Kong could be further developed to provide new sources of supply.

2.3 On the regulatory framework, there have been criticisms over the present contractual arrangement by SCAs, and the regulatory approach embedded therein, which allows

the power companies to earn an agreed RoR based on their ANFA. While they provide the necessary incentive to ensure continued and adequate investment by the power companies for electricity provision, some reckon that they have encouraged over-investment.

2.4 There has also been quite some criticism that the current permitted RoR of 9.99% (or 11% for investments on RE facilities) is too high; there have been suggestions that the permitted return should be reduced so as to keep down the electricity tariff. Another concern is that the current arrangement which allows the power companies to pass the fuel cost for electricity generation to consumers does not provide sufficient incentive for the power companies to source the cheapest fuel available.

Previous public consultation on future market development

2.5 In 2005-2006, the Government conducted a public consultation on the future development of the electricity market. While it was considered prudent not to predicate the future development of the electricity market on new suppliers from the Mainland, the Government proposed that it would closely monitor the developments in the electricity market in the Mainland so as to identify possible sourcing opportunities in a timely manner. We also said that we would introduce competition to the electricity market when the requisite market conditions were present.

Expiry of the SCAs

2.6 The current SCA with CLP will expire on 30 September 2018, while that with HKE will expire on 31 December 2018. The Government has the option to extend the current SCAs for five more years, i.e. until 2023. The Government may exercise such option by giving the power companies a written notice before 1 January 2016.

2.7 Meanwhile, the Government may introduce changes to the electricity supply regulatory framework after the expiry of the SCAs in 2018. The Government will discuss with the power companies market readiness, potential future changes to the electricity supply regulatory framework, and transition issues before 1 January 2016. The Government will also discuss with the power companies the Stranded Costs implications not less than 36 months before the effective date of any Specified Market Change⁶.

2.8 In recognition of the relatively long period of time for the power companies to recoup investments in the power sector, the SCAs provide that, in the event that the Government does not exercise the option to extend the SCAs as set out in paragraph 2.6 above, the power companies may, through reasonable arrangements determined by the Government after consultation with the power companies, continue to earn from the market the permitted return⁷ up until 2023 on their ANFA based on the current permitted RoR.

Previous Reviews Conducted

2.9 Flowing from the public consultation the Government conducted in 2005-2006 and along the broad direction set for the long-term development of the electricity market when the Government entered into the current SCAs with the power companies, we have conducted several reviews over the past few years on several key aspects relating to the future development of the electricity market and the regulatory framework. These reviews provide important parameters and set the framework for the current review.

Climate change strategy and action agenda

2.10 In 2008, the Environmental Protection Department (EPD) commissioned a consultancy study to assess the impacts of climate change in Hong Kong, as well as to recommend long-term strategies and measures to reduce GHG emissions and adapt to the unavoidable effects of climate change. Based on the findings and recommendations of the study, the Government launched a public consultation in 2010 on its proposed strategy and action agenda to combat climate change. We proposed to adopt a carbon intensity reduction target of 50% to 60% by 2020 when compared with the 2005 level.

2.11 The responses received during the consultation showed that there was broad-based public support for the proposed climate change strategy and action agenda for the coming decade, including the proposed target on carbon intensity reduction by 2020. The

⁶ "Stranded Costs" refers to costs incurred by the relevant power company in relation to investments made or agreements entered into in respect of its activities which directly or indirectly relating to the generation, transmission, distribution, sale of electricity, energy efficiency and conservation, or emissions reduction (i.e., "Electricity-Related" activities), which become stranded (i.e. have not been recovered and cannot in future be recovered in the market) as a result of a change implemented by the Government to the electricity supply market structure causing material impact to the power companies in respect of their Electricity-Related activities (i.e., a "Specified Market Change"). No less than 36 months prior to the effective date of a Specified Market Change, the Government shall institute discussions with the power companies on, inter alia, the mechanism for the recovery from the market any Stranded Costs which cannot be mitigated by the measures to be implemented by the power companies, as reasonably required by the Government.

⁷ This is subject to specified deductions under the SCAs which include, among others, the deduction of interest on the power companies' borrowings for financing their fixed assets; and (if applicable) the deduction of the charge on Tariff Stabilisation Fund.

adoption of this target has an important bearing on the development of the electricity market as it provides a key parameter for the design of the future fuel mix, implementation of which will affect the future mode of electricity supply and the need for infrastructural development.

Future fuel mix for electricity generation

2.12 On the back of the above climate change consultation and following the Fukushima incident in 2011, the Government further reviewed the fuel mix and launched another public consultation in 2014. The outcome of the consultation would help facilitate the timely planning of the necessary infrastructure to meet the future electricity demand when existing coal-fired generating units start to retire from 2017, and achieve the carbon intensity and air pollutant emissions reduction targets set for 2020. Two options were put forward for public consultation. They are (a) to import more electricity through purchase from the Mainland power grid; and (b) to use more natural gas for local generation.

2.13 For the import option, a possible fuel mix ratio would see Hong Kong import electricity from the Mainland to meet about 50% of demand. About 30% would be purchased from the Mainland power grid, while nuclear electricity currently imported from the Mainland would be retained at 20%; the other 50% of electricity demand would be met by local generation. Generation by natural gas would increase to 40%, and coal and RE would account for about 10%. For the local generation option, a possible fuel mix ratio would be to increase the share of natural gas to about 60%; coal and RE would account for about 20%, and import of nuclear electricity from

the Mainland would be maintained at 20%.

2.14 Before proposing the import option, we have commissioned a study which concluded that CSG should have sufficient surplus generation capacity to meet the electricity import requirements for Hong Kong and the import option is technically feasible. We have also studied the grid connection arrangement between our local power grids with the Mainland power grid.

2.15 As we emphasised in that consultation, the future fuel mix for electricity generation will have a significant impact on the mode of electricity supply in Hong Kong and the future development of the electricity market. More specifically, the import option would call for the construction of a new cross-boundary transmission network and enhancing interconnection between the two local power grids. It would hence provide more room to introduce competition to the electricity market at the generation level. On the other hand, more gas units would need to be built under the local generation option. Allowing existing power companies to construct new generating units may add to the potential Stranded Costs that consumers would have to bear, giving rise to more constraints in introducing competition to the electricity market.

2.16 Suffice it to add that availability of new suppliers is a prerequisite to introducing competition to the electricity market in Hong Kong, and importing electricity from the Mainland would open up new sources of supply. The outcome of the public consultation will be a determining factor for the development of the electricity market. The major findings of this

consultation and the way forward are set out in Chapter 6.

Mid-term review of the SCAs in 2013

2.17 The Government conducted a mid-term review of the current SCAs in 2013, half way through the ten-year tenure. Taking into account our experience in operating the SCAs in the first five years, the economic conditions prevailing at the time, as well as the views and suggestions made by the public, experts, academics, green groups and other stakeholders, we put forward to the two power companies various proposals for modifying the SCAs to improve certain terms and conditions of the SCAs, thereby enhancing benefits to consumers. These proposals included reducing the permitted RoR, rationalising fixed assets disposal arrangements, promoting energy efficiency, improving the incentive/penalty scheme, better regulating the TSF balance, enhancing accountability and transparency and rationalising certain accounting arrangements.

2.18 The two power companies accepted some of these proposals. These include establishing an Energy Efficiency Fund to provide subsidies on a matching basis to non-commercial building owners to carry out improvement works to enhance the energy efficiency of their buildings, raising the targets for supply reliability, operational efficiency and customer services,

enhancing transparency of the annual Tariff Review, lowering the cap on the TSF balance from 8% to 5% of its annual total revenues from local sales of electricity to alleviate the impact of tariff increase on customers, etc.

2.19 While the requirement for consent by all the contracting parties to the SCAs limited the room for changes, the mid-term review of the SCAs provided a useful platform for the Government to hear views from the community on possible areas of improvements in the future regulatory regime.

Scope of the Review

2.20 Building on the major reviews and public consultations that the Government has conducted since the coming into force of the current SCAs in 2008, this review has been conducted with due regard to the comments and suggestions that we have received and focus on the following key areas –

(a) the goal to introduce competition – we have examined the major reasons for introducing competition to the electricity markets and reviewed the experience of a number of overseas regimes, and proposed the direction for Hong Kong;

(b) readiness to introduce competition after expiry of the current SCAs in 2018 – we have assessed the readiness of introducing



competition to the electricity market in 2018, and proposed the follow-up work to be taken;

(c) improvements to the regulatory framework – we have studied different regulatory tools and price setting mechanisms (PSM), and suggested some possible areas of improvements in the future regulatory arrangement; and

(d) future fuel mix for electricity generation – we have set out the future fuel mix for electricity generation in 2020 to achieve the environmental targets.

Chapter 3

Overseas Experience of Introducing Competition to the Electricity Markets



Overseas Experience of Introducing Competition to the Electricity Markets

3.1 In conducting the current review, we have looked into the experiences in Australia, Singapore, the United Kingdom (UK), and the United States (US) as we consider how we should pursue our goal of introducing competition to our electricity market.

Possible Benefits

3.2 Since 1980s, competition has been introduced into the electricity markets in some overseas countries. While the objectives behind the liberalisation process varied, it was generally considered that competition could drive down costs and increase efficiency gains through more efficient operation of assets, such as generation plants, and through innovation. This could in turn bring down electricity tariffs. Apparently, market competition could also result in more suppliers and more choices for electricity consumers. In some cases such as Australia, Singapore and the UK, competition was pursued together with privatisation of national assets, as it was considered that market forces rather than government planning should be allowed to drive investment, production and pricing decisions. This could encourage private investment on the one hand, and increase efficiency on the other.

Possible Modes of Competition

3.3 The electricity industry can be generally classified into four segments-

- (a) **Generation** refers to the production of electricity at power plants using primary sources of energy, e.g. coal, natural gas, RE, etc.;
- (b) **Transmission** refers to the bulk transportation of electricity on higher voltage networks from power plants to local areas;
- (c) **Distribution** refers to the transportation of electricity on lower voltage networks to consumers; and
- (d) **Retail** refers to the sale of electricity to consumers, including the customer-end services such as metering and billing.

3.4 Transmission and distribution businesses are generally regarded as natural monopolies as it would not be practical or economical to have more than one set of transmission and distribution network in the same geographical area. These two segments remain largely regulated even in liberalised markets.

3.5 Competition may be introduced at the generation/wholesale level, retail level or both. Broadly speaking, there are three generic models of competition-

(a) Single Wholesale Buyer or Generation Competition

Generation companies, existing and new ones, compete with one another for contracting

electricity supply to a single wholesale or purchasing agency, which procures electricity at the lowest possible cost. Prices in the generation level are not regulated. The purchasing agency provides services in the remaining parts of the supply chain to the final consumers. Consumers do not have a choice of their own suppliers.

(b) Multiple Wholesale Purchasers or Wholesale Competition

Instead of selling to a single purchasing agency, generators compete to sell electricity to distributors or large consumers. These distributors then sell and deliver it to their customers, who do not have a choice of their own suppliers (except those large ones who can directly purchase electricity from the generators).

(c) Retail Competition

This market structure allows all consumers to choose their retailers/suppliers. There would be open access to the transmission and distribution networks.

3.6 In practice, there could be variations to the above generic models to suit local circumstances, stages of development of the electricity market, objectives of liberalisation, etc., and they are usually implemented in stages through a long and evolutionary process. In the UK, the whole supply chain in the electricity industry was completely unbundled into generation, network, and supply sectors, with competition introduced into the wholesale and retail sectors. In Singapore, competition was introduced at the wholesale level and the reform at the retail level is still in progress, while in Australia, wholesale competition was introduced nation-wide and retail competition in some

states. In the US, competition at the wholesale level was introduced by some states but the retail sectors in most states remain largely regulated.

Observations

3.7 Market liberalisation in the countries studied delivered mixed outcomes when evaluated against our energy policy objectives. As it was usually pursued together with other policy goals such as privatisation of state assets or tightened environmental emission requirements, it is not easy to single out or isolate the effect brought about by market liberalisation. Moreover, as liberalisation was a long process, changes brought by other intervening factors, such as fuel price, on the level of tariff, may have masked the effect of market liberalisation on the performance of electricity supply.

Affordability

3.8 In the UK, a reduction in tariff was observed following the introduction of competition as the retail electricity price index fell in real terms by some 23% from 1996 to 2003. While privatisation and divestment of state-owned properties at below-market prices were some other contributing factors, the increase in competition was believed to have increased operational efficiency and helped drive down tariff. However, the wholesale electricity prices subsequently registered an average annual growth rate of 13% between 2003 and 2011, as compared to the annual average CPI rate rise of about 3% in the same period. In Australia, tariffs dropped in the 1990's as a result of efficiency gains from market reform and privatisation, although retail electricity prices increased significantly starting from year 2007/08 due to the escalating network costs and introduction of new environmental policies⁸. In

⁸ Electricity prices in Australia rose nationally by 87% in nominal terms from 2007/08 to 2012/13.

the US, it was reported that in most of the states where competition was introduced, the tariffs were higher, more volatile, and rose faster than those with regulated markets. In Texas, where the market was in a more advanced stage of liberalisation than other states, wholesale prices exhibited no downward trend while the retail prices for residential consumers rose in the initial period after competition was introduced to the retail market. However, as the markets in different states were subject to different levels of market reform, the correlation between the level of liberalisation and tariff impact is not straightforward. In the case of Singapore, competition at the generation level has brought about a change in the use of cheaper fuel type and has helped exert downward pressure on wholesale electricity prices.

3.9 While it is generally accepted that liberalisation led to efficiency gains, it is nevertheless difficult to generalise the impact on tariff in each case, as the tariff level at a particular moment in time is affected by a myriad of factors.

Reliability

3.10 In respect of supply reliability, there have been cases of reduction in generation capacity and lowered level of supply reliability following market liberalisation. The major blackout and energy crisis in California in 2000 is a frequently quoted example, although there were other factors at play that led to the crisis, such as strong demand for power and tight supply, and possible market manipulation. In the UK, although standards were set to ensure supply quality and the average unplanned interruption improved

by 25% between 2002 and 2010, there is no longer any party with responsibility for ensuring long-term security in generation. The market is supposedly left to send the correct price signals. As a result, while the UK had excess generation capacity before the reform, and significant new capacity has been added at the initial stage of the reform, the reserve level has subsequently dropped and there is now concern over the adequacy of supply in the future. Some forecast that the capacity margin may drop to around 2% in 2015-16, and the regulator has to introduce various measures to encourage investment in generation capacity. In Australia and Singapore, it is observed that the reform process did not bring about any negative impact on supply reliability, with that of Singapore staying at a very high level.

Consumer choice

3.11 Liberalised markets provide market contestability for new suppliers and may, enable consumers to have more choices. However, it was noted in a recent report published by the Consumer Council⁹ and some other studies that rebundling or mergers between generators and retailers had taken place in some cases after market liberalisation. Consumers may also respond differently to the availability of choices. In the UK, over 60% of consumers never switched supplier and less than 25% switched more than once. Retail competition in Australia's electricity market is fairly intense with higher consumer switching rates, where small private retailers, mostly new entrants, have been able to obtain some market shares, indicating that they could attract customers with competitive offers. In Texas, where there is a competitive market with

⁹ Hong Kong Consumer Council, Searching for New Direction – A Study of Hong Kong Electricity Market, 2014

many suppliers and tariff plans, some 60% of residential and 70% of non-residential customers switched suppliers by 2014. It is also worth noting that having more choices do not necessarily lead to higher customer satisfaction; it has been reported that customer complaints in the UK and Australia have increased in recent years.

Desirability of Choices

3.12 As noted above, the experiences in other jurisdictions so far show that market liberalisation has delivered mixed outcomes; and evaluation of the actual impact is not straightforward, especially as liberalisation was introduced together with other policy changes. Another key observation is that market liberalisation is a long, complex and evolving process. After years of reform, some jurisdictions have only started to introduce competition at the retail level recently.

3.13 What can be deduced from the above examples is that we should not expect that market liberalisation would naturally lead to a reduction in tariff in Hong Kong as a matter of course. This is especially so as, in our case, there will be no divestment of national assets, which helped drive efficiency gains in the beginning of market

reform in some jurisdictions. Likewise, there is no conclusive evidence to suggest that market liberalisation will help improve the reliability, safety or environmental performance of electricity supply. What is evident in the overseas examples, however, is that introducing competition enabled consumers to have more choices. We consider that this is an important consideration in charting the future course for the development of the electricity market in Hong Kong.

3.14 At present, consumers have no choice of their electricity suppliers in Hong Kong. Arguably, given the nature of electricity as a commodity, there is little scope for product differentiation. However, as shown in some overseas markets, electricity suppliers, in their bids to attract consumers, provided tariff plans based on consumption pattern and time of use. This allows consumers to choose a tariff plan that best suits their own needs. Moreover, consumers may choose their supplier based on the quality of customer service they get, even if tariff plans are similar.

3.15 Another possible area of product diversification is the fuel type used for power generation. Given the natural constraints of Hong Kong in developing RE on a large scale and



that no new coal-fired units has been approved for construction since 1997 for environmental reasons, natural gas will be increasingly used for local generation. Individual consumers cannot choose the fuel used for electricity generation. As the RE resources in Hong Kong are limited in amount and types, even if consumers are prepared to pay for a higher cost, they cannot choose to meet their electricity demand from certain types of RE, say hydro power. Introducing new sources of suppliers could help change this situation. Given that the RE resources are far more abundant in the Mainland, the new sources of supply from the Mainland could provide consumers in Hong Kong with electricity generated from cleaner power sources that would otherwise be unavailable in Hong Kong.

3.16 Meanwhile, there is a view that without any possibility of switching to alternative suppliers, there is an imbalance between the market risks being shouldered by the service providers and their customers. Such market risks include the possible forecast errors and hence investment costs, as well as risks associated in fuel procurement. Introducing competition should in theory help provide the consumers with more negotiating power and shift the imbalance in favour of consumers.

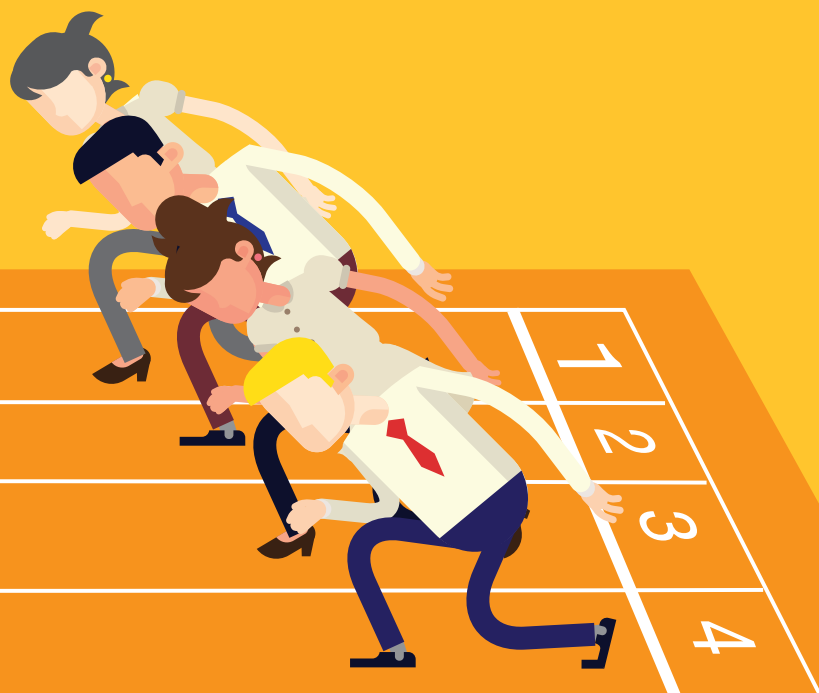
3.17 Having regard to the above, we consider that we should continue to pursue our goal to introduce competition to the electricity market.

Consultation Question

- Q1** How important is choice to you in respect of the supply of electricity?
What objectives do you consider should be achieved through introducing competition to the electricity market?

Chapter 4

Review of Readiness of Introducing Competition



Review of Readiness of Introducing Competition

4.1 This Chapter assesses if we are ready to introduce competition in 2018 when the current SCAs expire, and if not, what preparatory work needs to be undertaken to pave the way to introduce competition in the electricity market when the requisite market conditions are present.

Review of New Supply Sources

From the Mainland

4.2 As explained in Chapter 1, the current electricity market is not closed to new suppliers but there are some practical constraints. A key determining factor of whether and when we can introduce competition to the electricity market is the availability of stable and reliable sources of new supply, and one possible new supply source is from the Mainland. We have been closely monitoring developments in the electricity market in the Mainland so as to identify possible sourcing opportunities.

4.3 The electricity market in the Mainland and in the Pearl River Delta (PRD) area has developed rapidly in recent years both in terms of the growth in the generation and transmission capacities and increase in the level of supply reliability. Following the electricity market reform in the Mainland commenced in 2002, the State Power Corporation was unbundled into two grid companies, namely the State Grid Corporation of China and the China

Southern Power Grid Company Limited, and five generation group companies. Electricity supply to PRD is provided by CSG, which covers the five provinces/region of Guangdong, Guangxi, Yunnan, Guizhou and Hainan. CSG is serving an area of up to one million square kilometres and a population of about 230 million. In tandem with the rapid economic growth in the Mainland, there has been a significant growth in the installed capacity of CSG, which has reached 230 GW, some 18 times that of Hong Kong. The transmission lines total some 189 000 km.

4.4 Non-fossil fuel is taking an increasing portion of the fuel mix of CSG. According to CSG, the share of non-fossil fuel such as hydro and nuclear power in its fuel mix increased from about 30% in 2009 to about 38% in 2013. Looking ahead, it is estimated that from 2020 onwards, non-fossil fuel will make up of more than half of the installed capacity of CSG, with a significant reduction in the share of coal. This is in line with the national policy to increase the use of cleaner energy. In the Energy Development Strategy Action Plan (2014-2020), the State Council set a goal of raising the percentage of clean energy to 15% of the total energy mix by 2020.

4.5 Apart from the increase in generation capacity, the reliability of supply of CSG has also been improving in recent years, as shown in Table 4:

Table 4 : Supply reliability of CSG

Annual average customer minutes loss of CSG's customers (Hour/Customer)	2009	2010	2011	2012	2013
Guangzhou	5.75 (99.934%)	5.29 (99.940%)	1.79 (99.980%)	1.79 (99.980%)	1.47 (99.983%)
Shenzhen	2.80 (99.968%)	1.48 (99.983%)	1.28 (99.985%)	1.12 (99.987%)	0.83 (99.991%)

Note: Figures in brackets are supply reliability expressed in %

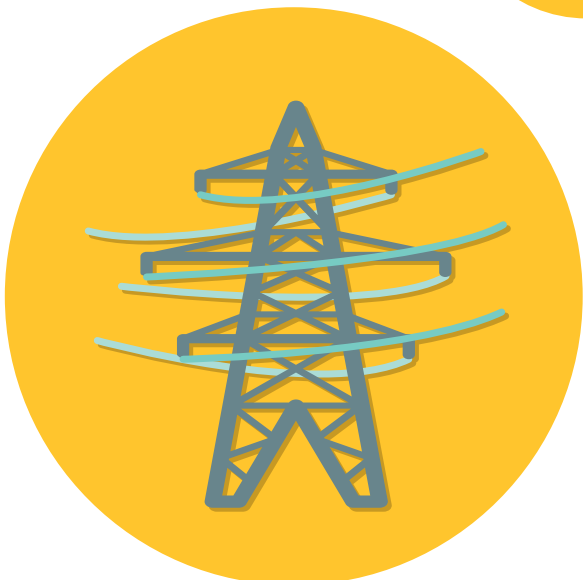
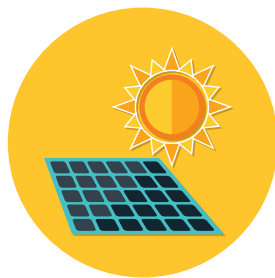
4.6 Having regard to the developments of the Mainland electricity supply, the Government commissioned a consultancy study to assess the feasibility of importing electricity from the CSG, which would open up the sources of electricity to Hong Kong. The study concluded that CSG should have sufficient surplus generation capacity to meet the electricity import requirements for Hong Kong, and it is technically feasible for Hong Kong to import electricity directly from the CSG.

4.7 The CSG's power system is now interconnected with that in Hong Kong through four 400kV lines and seven 132kV lines. The four 400kV lines are to import electricity from DBNPS to Hong Kong and also for power transfer with the Pumped Storage Power Station at Conghua, whereas the seven 132kV lines are to export

electricity to some load centres in Guangdong.

4.8 The study mentioned above concluded that if we are to bring in electricity from CSG, we will need to construct new transmission infrastructure. A possible route of the new power interconnection from Guangdong will be through submarine cable circuits landing on the New Territories East to interconnect with CLP's power system, and from there through submarine cable circuits landing on Hong Kong Island East to interconnect with HKE's power system.

4.9 On the back of the above findings and developments, the Government launched a public consultation on the future fuel mix for electricity generation in March 2014 and promulgated two options. One of the options was to import



electricity from CSG by constructing new cross-boundary infrastructure; the other was to use more natural gas for local generation. More than 86 000 submissions were received during the three-month public consultation. For the reasons set out in detail in Chapter 6 and the Annex, most of the respondents supported local generation by natural gas and expressed reservation about importing electricity from the Mainland at this stage, although some suggested that further studies should be conducted to look into the detailed technical and financial arrangements that should be put in place to allow us to do so.

Distributed power generation in Hong Kong

4.10 In the local context, it is unlikely that there would be a new, sizable electricity supplier as land is in short supply for a new supplier to build generating plants. As an illustration, assuming that a new market player will account for 20% of the total installed capacity in Hong Kong, it will need to build six gas-generating units. An area of about 25 hectares would be required for the purpose. Even if a suitable area can be located, the concern about the potential environmental impact of the new generating units will also likely invite objection from nearby residents.

4.11 However, there may be opportunities for the development of small-scale distributed power generation. For example, in a recent joint project between the Hospital Authority and Towngas, a small-scale generator is being planned for construction in a hospital in Tai Po District that would use landfill gas from the North East New Territories Landfill to generate both heat and electricity for the hospital. Another

example is that a tri-generation system fuelled by biofuel was used to generate electricity and harvest the waste heat for space cooling and dehumidification in the Zero Carbon Building in Kowloon East. While the opportunities for developing such projects are dependent on the availability of fuel sources, and their respective environmental impact would have to be assessed, we welcome their development. We consider that the development of such distributed generation could be further facilitated if improvement to the grid connection arrangement as stipulated in the SCA can be made (see Chapter 6).

4.12 As regards the use of natural gas for distributed generation, it necessitates the conversion of the existing town gas network to carry natural gas to supply fuel for generation. This will involve complex engineering works at the supply side and also necessitate substantial modification or replacement of town gas appliances and fittings by existing consumers. The relevant works are very complicated and will result in major inconvenience to many households.

Competition between the two existing power companies

4.13 There is a suggestion that the existing interconnection¹⁰ between the two existing grids should be strengthened so as to facilitate competition between the two power companies, on the basis that competition between them would allow consumers to choose their own suppliers and narrow the tariff differential between CLP and HKE.

¹⁰ The transmission grids of CLP and HKE have been interconnected since early 1980s. The transmission network of CLP is also connected with the Guangdong power system for transmitting contracted power purchase from DBNPS and power transfer with Pumped Storage Power Station at Conghua to CLP, and for selling CLP's surplus electricity to Guangdong. The existing interconnection is already serving the functions of providing mutual support between the two power grids; reducing the reserve capacity each power company requires; and allowing economy power interchange between the two power companies, such as when the marginal generation cost of one company is substantially lower than the other.

4.14 While we are open to this idea in principle, the benefits to consumers are likely to be perceived rather than real in the short-term for two reasons. Firstly, the current tariff differential between the two power companies is expected to narrow significantly towards the end of the current regulatory period as CLP's tariff is projected to increase in the next few years as it uses more natural gas. Besides, the marginal cost of electricity generation is expected to be similar for the two power companies as both of them will mainly use natural gas to meet the emission cap in future. Secondly, enhancing interconnection between the two power companies would not obviate the need to construct new generating units, but would incur additional substantial upfront investment equivalent to the installation cost of several gas generation units. Our current assessment is that enhancing interconnection at this stage will increase tariff without bringing concrete benefits to the consumers at least in the near term.

4.15 The considerations may be different in the longer-term. If it is decided that electricity from the Mainland should be imported in future to allow consumers to have new suppliers and more choices, the two existing local grids will have to be better connected. It could be more cost effective to consider how to strengthen the interconnection between the two existing grids in that context than to pursue interconnection of the existing grids in isolation. In this regard, as mentioned in the latter part of this Chapter, we plan to conduct a study to look into the detailed arrangements for strengthening the interconnection between the Mainland and Hong Kong, as well as that between the existing grids in

Hong Kong to pave the way for the introduction of competition to the electricity market.

Preparatory Work for Introducing New Players in Longer Term

4.16 While there will not be a substantial new source of supply either from the Mainland or locally in the near term, we would undertake the necessary preparatory work to pave the way for introducing potential new suppliers.

Grid access

4.17 The electricity grid is an interconnected network for delivering electricity from suppliers to consumers. The existing power grids are private properties of the two power companies which have been planned, developed and operated by the companies. The power grid owned by CLP consists of over 13 000 substations and 14 000 km of high-voltage cables and overhead lines, while that of HKE comprises over 3 000 substations and about 4 000 km of cables and overhead lines.

4.18 Owing to the huge costs of upfront investment, it would be highly uneconomical for new entrants to construct a parallel power grid to supply electricity. For this reason, there has been no case of grid duplication in other overseas regimes. This also applies to Hong Kong. Allowing third party access to the existing power grids is a critical enabler for introducing new suppliers. Under the current SCAs, the power companies are already required to offer standardised arrangements for back-up power supply for customers with distributed RE systems in Hong Kong. Grid connection arrangements shall be made between the power companies

and their prospective grid users on reasonable terms and are subject to applicable technical and safety requirements set out in the technical guidelines issued by EMSD. Despite this arrangement, the number of such distributed RE facilities remains small. There are views that the current grid connection arrangements do not provide sufficient incentive for potential RE producers to develop RE facilities and there are concern on the liability that they need to bear. To this end, the Government will discuss with the power companies to look into ways to facilitate better access by distributed RE facilities to the existing power grids (see Chapter 6).

4.19 In the longer run, as and when new electricity supply sources become available and acceptable to the public, we need to ensure that the new players would be allowed to use the power grids at reasonable and fair terms; thereby creating a level playing field for the existing and new market participants. As revealed in overseas experiences, allowing access to existing power grids by third-parties will entail various technical, financial, legal, liability and safety issues. For instance, detailed code of access would have to be drawn up to stipulate the technical standards required of the new players to ensure safety and reliability; the respective roles and responsibilities of the new players and the grid owners would have to be clearly defined; the principles for setting the access fees would have to be drawn up carefully.

4.20 There are two approaches in enabling third-party access to the power grids – mandatory and voluntary. Under the mandatory approach, grid owners are required by legislation to provide grid access to third-party users and the level of

charges for connection and use of the grids are regulated and monitored by a regulator, which can be part of the Government or an independent regulatory body. A resolution mechanism may be put in place to handle possible disputes among various players that may arise. The regulator will monitor compliance by different players with the detailed access code, as well as monitor and approve the development and expansion of the power grids. In some cases, a grid operator may be set up to direct power system operations to ensure system security and supply reliability. While this approach may ensure non-discriminatory access by new suppliers, some may argue this as interference with private business operation and property rights by the Government. It may entail a lengthy legislative process and there may be risks of legal challenges and claims for compensation.

4.21 Under the voluntary approach, grid access is negotiated between the grid owners and the third-party users on an individual case basis. The access agreement, where reached between the grid owners and the third-party users, may cover such key aspects as use of network charges, connection charges, technical and reliability requirements, and liabilities. As compared to the mandatory approach, the voluntary approach would take less time to implement.

4.22 We plan to discuss with the existing grid owners to open up their power grids for access by new players, and to jointly conduct a study with them during the next regulatory period with a view to working out the detailed arrangements for access by new players to the existing power grids preferably on a voluntary basis. The study may cover issues relating to the financial

arrangements (e.g. the principles and formulae for determination of access fees), technical arrangements (e.g. the criteria for connection, development of a detailed access code, system planning and expansion, etc.) and legal and regulatory arrangements (e.g. the demarcation of responsibilities and liabilities of various parties).

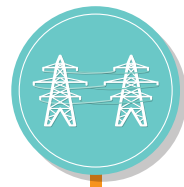
Enhanced interconnection with the Mainland power grid and between the local power grids

4.23 As revealed in the public consultation on fuel mix, there is concern over the reliability of importing electricity from the Mainland at this stage. However, in the longer run, importing electricity from the Mainland would remain a feasible option to introduce new suppliers to the electricity market in Hong Kong. Having regard to the views collected at the fuel mix public consultation, we plan to commission a study with the existing grid owners as well as CSG to look

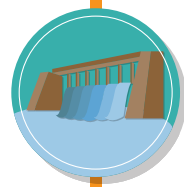
into the detailed arrangements for strengthening the interconnection between the power grids of the Mainland and Hong Kong as well as that between the existing grids in Hong Kong. The study may consider how the interconnection could be enhanced, the planning criteria of the power systems, the design of new interconnection system, possible funding arrangements for the new infrastructure, etc. To ensure reliability, it may also cover the back-up requirement in generation capacity and the decoupling arrangements¹¹ that may need to be put in place to respond to different emergencies.

Segregation of generation and transmission/distribution business of the power companies

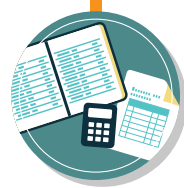
4.24 In order to create a level playing field for all market participants, overseas experience shows that the vertically integrated power companies should be required to segregate



To discuss with power companies and conduct a joint study on the **arrangements for access to the grids by new players**



To conduct a study on **enhancing the interconnection** with the Mainland grid and between the local grids



To pursue with power companies on **publishing the segregated annual cost data** pertaining to their generation, and transmission and distribution systems

¹¹ When a fault occurs in one of the interconnected grids, the grid in normal operation can deploy decoupling arrangement to disconnect from the interconnected grid to avoid being affected.

their generation business from their transmission and distribution business to help avoid any discriminatory access arrangement against the new players. Accounts separation is the usual first step, followed by business separation, which could be in the form of function or corporate segregation.

4.25 The current SCAs have already required the power companies to provide to the Government the segregated annual cost data pertaining to their generation, and transmission and distribution systems. In order to promote transparency and to pave the way for introducing new players, we see a case for the power companies to publish their segregated cost data, bearing in mind the need to protect commercially-sensitive information, disclosure of which may undermine consumers' interest, and we will pursue this proposal with them.

Chapter 5

Future Regulatory Framework



Future Regulatory Framework

5.1 Given the premises that the requisite conditions are not present for us to introduce competition on a sizable scale to the electricity market in 2018, we have reviewed the regulatory regime with a view to identifying areas for improvement and paving the way for introducing new suppliers to the electricity market when the requisite market conditions are present.

Regulatory Tool

5.2 As detailed in Chapter 2, regulation of the financial affairs of the power companies which are Electricity-Related has been exercised through the SCAs. This form of regulation is a relatively simple regulatory regime with comparatively less government involvement in the business decision and operation of the market participants. It entails less administrative burden and governance costs. It also provides a clearly-defined basis for investors to make investments to meet the future demand in a timely manner. As reflected in the performance of electricity supply in Chapter 1, the past decades of experience in adopting the SCA regime shows that the current contractual arrangement has been generally effective in allowing us to meet the energy policy objectives. The major disadvantage of any contractual arrangement is that the terms of the contractual arrangement are subject to negotiation and mutual agreement by the contracting parties.

5.3 An alternative approach of regulation commonly adopted in overseas regimes is through legislation. Under such an arrangement, market participants are required to obtain a licence or franchise for the provision of electricity services. Through the licensing regime, the regulator may

regulate the electricity tariff, set performance standards, monitor the performance and enforce the licensing conditions.

5.4 As the market situation would unlikely have any major change in the near future, and we have been able to achieve the four main energy policy objectives, it appears appropriate to continue with the current contractual arrangement as a regulatory tool. However, if there is indication that this approach fails to allow us to meet the policy objectives in future, in particular the setting of a reasonable level of tariff, or if it fails to allow introduction of measures to pursue our goal of introducing competition to the market, e.g. allowing new suppliers to have access to the existing power grids, we may need to consider the alternative approach of legislative means.

Regulatory Approaches

5.5 Central to any regulatory framework is the mechanism by which tariffs are set and regulated. At present, the two power companies are regulated under a RoR type of regime with a permitted RoR based on the ANFA. There are criticisms suggesting that pegging the permitted return of the power companies with their asset bases would encourage excessive investment. In this regard, we have reviewed the current PSM having regard to overseas experience.

5.6 Broadly speaking, there are four main PSMs for regulating prices and profits of power companies in the regulated sectors of electricity markets. While the RoR regime is a cost-based regulation, the other three approaches, viz. cap regulation, sliding-scale and yardstick benchmarking incorporate incentive-based

factors. The sliding scale¹² is not commonly practised in other regimes and its effectiveness is uncertain. As regards the yardstick benchmarking¹³, as there are only two power companies in Hong Kong, it is not meaningful to use only two companies' data to calculate industry average costs and set them as benchmark. The pros and cons of the other two approaches are set out below.

RoR on assets

5.7 This is the approach presently adopted to regulate the two power companies. Prices are set in such a way that they cover the power companies' costs of production and include a RoR on assets. The primary advantage of RoR regulation is that it incentivises the power companies to invest in providing reliable electricity supply and at the same time set an agreed limit on return. The low level of risk borne by the power companies under this regulatory approach also allows them to access to a lower cost of capital, which in turn could help lower the tariff.

5.8 However, RoR regulation may provide an incentive for over-investment in plants and equipment to inflate the power companies' asset base in order to earn more return. Another possible downside risk of this approach is that it does not incentivise reduction of operating costs, which can be recovered from revenues.

Cap regulation

5.9 Cap regulation establishes a tariff or revenue ceiling and the profitability of the company would depend on how much it can keep down its costs below the cap, which is initially set to cover the operating and capital costs as well as profits allowed. The company may then try to reduce costs in providing electricity, and the difference between the actual costs and the cap will be taken as extra profits. Each year, the cap on the tariff or revenue is adjusted by inflation minus an anticipated efficiency improvement, i.e. RPI (Retail Price Index) - X (anticipated productivity growth).

5.10 Cap regulation is generally considered to be effective in incentivising companies to improve their efficiencies. Through the "X-factor" included in the pricing cap formula, which represents the regulator's estimation of the companies' productivity gains, consumers can benefit from efficiency improvements and cost reductions in the form of lower prices. However, this strong cost-cutting incentive tends to result eventually in degradation of reliability and lower levels of quality of supply. As a company can increase its profit over a regulatory period by decreasing costs, it may reduce expenditure where possible, even at the expense of longer-term quality performance. It is also difficult to set the "X-factor" at the appropriate level to allow companies to earn a reasonable but not excessive level of return.

¹² Under the sliding scale regulation, a price cap is set to incentivise the company to raise profits by lowering costs of production as in cap regulation. However, if the profit of a company rises above a level agreed with the regulator, the price is adjusted downwards so that the extra profit will be shared with consumers. Conversely, if a company's profit falls below an agreed level, the price is adjusted upwards and consumers will have to fund some of the revenue deficiency.

¹³ The main idea of yardstick benchmarking is that the company's profitability is no longer determined only by its own cost performance, but is driven by how well it manages to reduce costs relative to other players in the industry. If a company manages to reduce its costs below the yardstick, it will earn a higher profit; and conversely, companies that lag behind average performance will earn lower profits.

Recommended approach for Hong Kong

5.11 As indicated in the fuel mix public consultation conducted in 2014, reliability of electricity supply is considered by many respondents as highly important. The present RoR approach could help provide the necessary incentives for the power companies to invest in essential electricity supply infrastructure. This will also help us achieve our policy objective to reduce the environmental impact of electricity generation, as RoR can incentivise investment in energy efficiency and conservation. As regards the possibility of over-investment, there are mechanisms in the regulatory regime under the current SCAs to mitigate this risk. For instance, under the DP review mechanism, the power companies are required to submit investment proposals to the Government for review and approval, which are examined with the assistance of an independent energy consultant. In the last DP review exercise, the Government turned down capital projects proposed by the two power companies, which will result in the reserve margin of the power companies dropping to 20 – 30% by around 2018. The test for excess generating capacity in the SCAs also helps reduce the risk of over-investment.

5.12 Given that cap regulation incentivises power companies to cut costs and investment, it runs the downside risk of leading to a reduction in reliability performance. Safety may also suffer as vital checks and maintenance may be made less frequent to save costs. This PSM is also not suitable for the power companies in Hong Kong as a significant portion of their costs is not directly related to local inflation. Linking electricity tariffs to the local inflation indices will result in them not being in line with the actual operating costs.

Improvement to the Existing Regulatory Arrangement

5.13 While there are merits to continue to adopt a fixed asset approach using ANFA as the rate base, with the experience in the past seven years of operation of the current SCAs and the changed economic conditions since their signing, there is a need to improve the existing contractual arrangement. These improvements are necessary to (a) better regulate the performance of the power companies with regard to the four energy policy objectives, (b) strike a better balance between the need to ensure an affordable electricity tariff for consumers and the need to allow power companies to earn a fair and reasonable return on their investment, such that they will invest in the infrastructure required for providing a reliable electricity supply, and (c) facilitate the introduction of competition in future when the requisite conditions are present. With reference to the views and comments that we received from various stakeholders during the mid-term review of the SCA in 2013, we set out some possible areas of improvements and would welcome the public's views.

Duration of future contractual arrangement

5.14 The duration of the current SCAs was shortened from fifteen years in the previous SCAs to ten years, with an option exercisable by the Government to extend the term for five more years after the expiry of the current term of the SCAs. While further shortening the term, say to five or eight years, might provide flexibility for making changes as necessary, this has to be balanced with the need for a relatively stable and certain environment for long-term investment by

power companies as most of the generating units of power companies last for some 30 years or more. We consider it appropriate to maintain the duration of the future contractual arrangement at 10 years, i.e. up until 2028. During such regulatory period, preparatory work as set out in Chapter 4 will be undertaken to pave the way for introducing market competition. To provide us with flexibility and sufficient time to undertake the necessary preparatory work to introduce competition, we also consider it appropriate to retain the option for the Government to extend the terms of the future contractual arrangement for another five years at the same RoR, after reviewing the prevailing market conditions at the time.

Permitted RoR

5.15 The permitted RoR for the power companies was reduced from 13.5% - 15% of the ANFA in the previous SCAs to 9.99% of the ANFA in the current SCAs. This was the outcome of intensive negotiation over the Government's proposed range of 7%-11%, which had been formulated based on an integrated approach taking into account the risk free rate, the cost of equity and the cost of borrowing in a regulated utility market.

5.16 The economic conditions have changed considerably since the signing of the current SCAs in 2008. In particular, the low interest-rate business environment has substantially reduced

the cost of borrowing. There is a clear public aspiration to bring the permitted return down in tandem with the latest economic situation. In conducting the mid-term review in 2013, the Government commissioned a consultancy study to review the methodology, parameters and assumptions used for setting the permitted RoR. In view of the downward trend of the risk-free rate and changes in risk appetites in recent years due to the global economic situation, the consultant suggested that we could consider reducing it to the range of about 6-8%¹⁴. We will commission a further study to update the appropriate permitted RoR, taking into account the prevailing market conditions, for the purpose of negotiation with the power companies.

Excess generating capacity

5.17 Under the existing SCAs, 50% of the net asset value on mechanical and electrical equipment relating to new generating facility found to be excessive upon commissioning to meet the latest electricity demand would be excluded from the power companies' ANFA for calculating the permitted return until the demand catches up with generation capacity. The arrangement is in place to ensure that the power companies will be prudent in forecasting the electricity demand and in assessing the need for generating capacity, avoiding any excessive generating capacity resulted from over-estimation of demand.

¹⁴ The above-mentioned permitted RoR of about 6-8% was derived by adopting an integrated approach as explained in paragraph 5.15.

5.18 While electricity demand forecast error may have occurred due to factors not entirely within the control of the power companies, there may be room to tighten the current mechanism by having the power companies take on a larger share of the financial consequence resulting from error in forecasting demand. This may be achieved by excluding a higher percentage of the net asset value of the mechanical and electrical equipment costs relating to new generating unit that fails the tests mentioned above.

Tariff

Fuel costs

5.19 Currently, fuel cost is borne by consumers, and the basic tariff rates include a standard fuel cost. Through the Fuel Clause Recovery Account (FCA), the differences between the standard fuel cost and actual fuel prices incurred would be returned to or recovered from consumers by means of a rebate or a surcharge each year. Given that the fuel cost is currently borne by consumers, some opine that the power companies do not have any particular incentive to exercise prudence in fuel procurement, and the power companies should be asked to bear part of the fuel cost fluctuation should the actual cost depart significantly from their forecast.

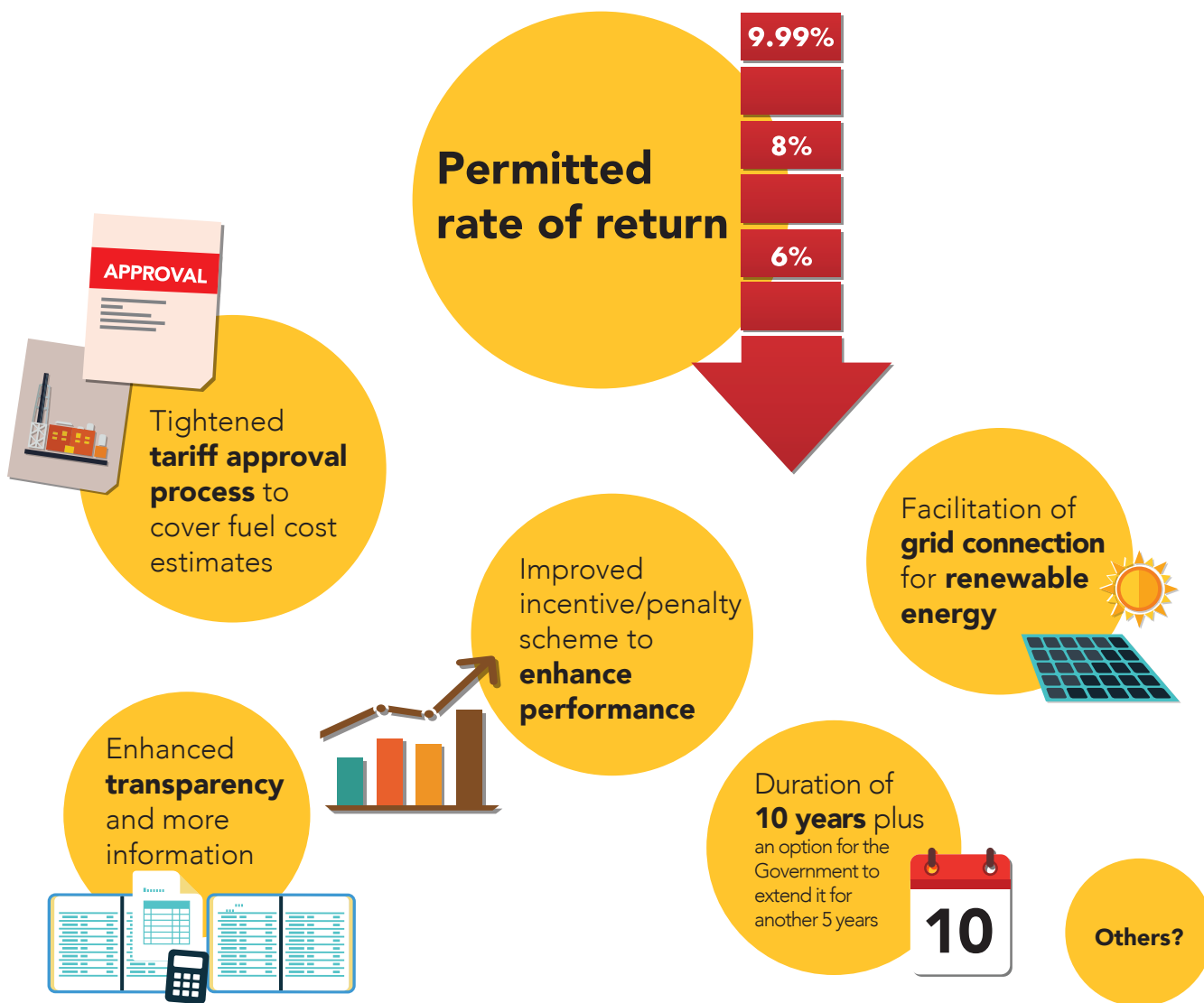
5.20 The Government has been exercising due diligence in monitoring the power companies' fuel procurement. In the annual Auditing Review exercise, we check that the power companies have proper procurement policy and procedures in place. Besides, with the help of an independent consultant, we scrutinise long-term fuel contracts before approving them to ensure that they are in line with international fuel markets trends and practices.

5.21 Regarding the suggestion of having the power companies bear the risk of fuel cost fluctuations, while fuel sourcing and procurement are the responsibilities of the power companies, fuel cost fluctuations are attributable to a myriad of factors, including geopolitics and economic climate that go beyond the control of individual companies. To have the power companies absorb the cost could result in the power companies asking for a higher RoR. It is noted that in regulated markets overseas, it is not uncommon that fuel costs are also passed on to consumers. Separately, there are suggestions that the power companies should enter into fuel hedging contracts to reduce the possible impact to consumers brought by volatile and rising fuel costs. However, it should be noted that hedging cannot mitigate the cost pressure of replacing the lower cost fuel such as coal to a higher cost fuel such as natural gas. It cannot guarantee fuel cost savings either. It may result in significant losses, as experienced by some airlines in 2008 and 2014, and may lead to criticism of speculation. There is also a cost to hedging in setting up future trades, broker fees, etc. Besides, while hedging may remove some volatility risk, it would entail other risks, such as liquidity and counterparty performance risks, which will be borne ultimately by consumers.

5.22 The existing FCA has already provided a mechanism to mitigate the impact of fuel fluctuations on tariffs. That said, we consider the current tariff approval process can be improved to address the concern that the power companies do not exercise due diligence in fuel sourcing and price forecast. This is further described below.

Tariff approval

5.23 Under the current SCAs, the power



companies have to submit DPs, which set out the projected Basic Tariff Rate for each of the five years covered by the DPs, for the approval of ExCo. In the Tariff Review conducted in each of the following years, if the Basic Tariff Rate proposed by the power companies for a year covered by an approved DP does not exceed the projected Basic Tariff Rate approved for that year (Most Recently Approved Rate) by more than 5%, no further approval from ExCo is required for the adjustment. However, if the proposed adjustment of the Basic Tariff Rate for a year covered by an approved DP exceeds the

Most Recently Approved Rate by more than 5%, approval of ExCo is required. It should be noted that approval by ExCo is at the level of Basic Tariff Rate only. The fuel clause charge does not have to be approved by ExCo, and the power companies can make adjustments to their fuel clause charge to reflect the cost of fuels consumed by them for electricity generation.

5.24 As the net tariff that consumers have to pay ultimately comprises both basic tariff and fuel clause charge, there is a case to consider whether the current arrangement should be extended to cover not only Basic Tariff Rate but

also the net tariff. In other words, the projected net tariff and the Basic Tariff Rate in a DP will have to be considered and approved by ExCo. In conducting subsequent Tariff Reviews, the power companies will have to seek the approval of ExCo if either the proposed net tariff or Basic Tariff Rate exceeds the approved one for the year in the DP by a certain margin. This will help strengthen the existing arrangement to ensure that the power companies are prudent in both fuel sourcing as well as fuel price forecasting. This will also enhance the level of scrutiny that the Government can exercise on the ultimate tariff that consumers have to bear.

Performance improvement

5.25 Under the current SCAs, financial incentives are provided to and penalties imposed on the power companies to encourage their performance in respect of supply reliability, operational efficiency, customer services, and emission performance. Financial incentives are also provided to the power companies to

encourage them to promote energy efficiency and conservation and to use RE in electricity generation. As these areas remain important and should be promoted, there may be a case to tighten the regime for raising the power companies' performance in these areas.

Operational efficiency and service quality

5.26 The two power companies are awarded incentives or have to pay penalties for their performance in respect of supply reliability, operational efficiency and customer services. The amount of incentive or penalty payment is calculated by reference to a certain percentage of ANFA of the power companies (Table 5).

5.27 Over the past few years, each of the two power companies has been able to achieve a total of 0.03% of ANFA incentive payments each year for reaching the target level of performance in these aspects. However, there are views suggesting that no incentives should be provided to the power companies for meeting their obligations under the SCAs to provide reliable electricity supply and

Table 5: SCA Incentive/Penalty Scheme

Performance Category	Index	Target	Adjustment
Supply Reliability	Average Service Availability Index (ASAI) ¹⁵	99.995% ≤ ASAI	+0.01%
		99.99% < ASAI < 99.995%	0%
		ASAI ≤ 99.99%	-0.01%
Operational Efficiency	Connection & Supply Performance Index (CSPI) ¹⁶	CSPI = 100%	+0.01%
		99.98% < CSPI < 100%	0%
		CSPI ≤ 99.98%	-0.01%
Customer Services	Appointment Punctuality Index (API) ¹⁷	99.7% ≤ API	+0.01%
		98% < API < 99.7%	0%
		API ≤ 98%	-0.01%

¹⁵ ASAI is an electricity supply reliability indicator, showing the total customer-hours served as a percentage of the total customer-hours demanded.

¹⁶ CSPI is an operational efficiency indicator, showing the percentage of making available the power supply by the power company within the same day of the inspection of installations.

¹⁷ API is a customer services indicator, showing the rate of punctual attendance of installation inspections.

quality service. We keep an open mind and would like to consult the public as to how this mechanism can be improved.

Emission performance

5.28 Before the mid-term review conducted in 2013, the SCAs included an incentive for outperformance or penalty for underperformance in respect of the emission requirement. With the effective operation of the TM under the APCO in emission control, we have proposed and CLP agreed to remove this system during the 2013 Mid-term Review. However, the SCA with HKE still maintains this mechanism in view of HKE's objection against its removal. There may be a case to apply a uniform treatment in future.

Energy efficiency and RE

5.29 There are mechanisms under the SCAs to encourage the two power companies to promote energy efficiency and conservation, and to develop and use more RE. How these aspects would be further improved would be discussed in Chapter 6.

Enhanced information transparency

5.30 We consider that information transparency would help facilitate the effective monitoring of the performance of the power companies. The Government has been pursuing with the power companies on ways to promote information transparency. During the mid-term review of the SCAs in 2013, the two power companies had agreed to our proposal to provide to the public more financial and operation information in conducting the review

of the DPs and annual Tariff Reviews. We have plan to request power companies to release more information to the public in a more structured manner. Meanwhile, we would like to hear public view on the types of information which should be released, bearing in mind the need to protect commercially-sensitive information, disclosure of which may undermine consumers' interest.

Facilitation to introduce market competition

5.31 As we have discussed in Chapter 4, we see a case to undertake the necessary preparatory work to pave the way for introducing potential new suppliers in future. These would include a study on the detailed arrangements for new suppliers to have access to the existing power grids, a study on enhancing interconnection between the Mainland and Hong Kong and that between the existing power grids, and publication of segregated cost data. The future contractual arrangement between the Government and the power companies for the next regulatory period could feature the necessary requirements to facilitate such preparatory work to be undertaken.

5.32 Set out above are some of the possible areas for improvements to the future contractual arrangement between Government and the power companies if this will remain as the regulatory tool. The Government keeps an open mind and would like to hear the views of the public on these improvements and other suggestions to improve the future contractual arrangement.

Consultation Questions

- Q2** To what extent do you think the current contractual arrangement by SCAs has allowed us to achieve the energy policy objectives of safety, reliability, affordability and environmental protection, and what problems do you see with this regulatory approach?
- Q3** What is your view on the following areas in the future contractual arrangement (if any) between the Government and the power companies -
- (a) duration;
 - (b) permitted rate of return;
 - (c) tariff approval mechanism;
 - (d) fuel cost arrangement; and
 - (e) incentive and penalty scheme relating to the performance of the power companies?

What other improvements would you suggest?

Chapter 6

Fuel Mix Implementation



Fuel Mix Implementation

Major Views on the Future Fuel Mix

6.1 Apart from the regulatory regime, another key aspect of the long-term development of the electricity market is the future fuel mix for electricity generation. During March to June 2014, the Government conducted a three-month consultation on two fuel mix options, i.e. to import some 30% of electricity from the Mainland grid to meet our future demand or to use more natural gas for local generation.

Preference over local generation

6.2 We received more than 86 000 submissions during the public consultation. Most of the respondents supported local generation by natural gas and expressed reservation about importing electricity from the Mainland at this stage. Given that it is an untested arrangement and the reliability of supply of CSG, albeit improving, is still lower than that of Hong Kong, many respondents considered that importing electricity from the Mainland grid would not be as reliable as local generation, with some expressing the concern that the Government might not have direct control over the generation and transmission of electricity from the Mainland. While noting Macao has been importing over 90% of its electricity demand from CSG and is enjoying a similar degree of supply reliability as Hong Kong, many questioned whether the supply reliability requirement of the two places could be directly compared.

6.3 There were also some concerns that importing electricity from the Mainland would lower Hong Kong's emissions of carbon and air pollutants at the expense of the Mainland, with

some suggesting that the marginal fuel used to meet the demand from Hong Kong would likely be coal. Some were also concerned that Hong Kong would become a captive buyer in importing electricity from the Mainland and would not have any control over the quality and price of the imported electricity.

6.4 On the other hand, some respondents considered that given the rapid growth of the electricity market in the Mainland, the proximity between Hong Kong and the Mainland, and lack of certain types of clean energy (such as hydro) in Hong Kong, enhancing interconnection between Hong Kong and the Mainland should be pursued in the longer term, which would also help introduce a new source of supply. There was a clear view that if we were to proceed with this arrangement, detailed study should be conducted to look into the technical and financial arrangements to ensure that the high standard of supply reliability would not be compromised and that the price of the imported electricity would be affordable. Having regard to this major view, we have proposed in Chapter 4 that we would conduct a detailed study to look into the detailed technical and financial arrangements that should be put in place to allow importing electricity from the Mainland in a reliable manner at affordable price, while continuing to keep in view the development of the electricity market in the Mainland.

6.5 Apart from this key finding, the public and various stakeholder groups provided many useful feedbacks and comments on the future fuel mix. An analysis of the views received is set out at **Annex**. In this chapter, we will highlight the major findings and set out a package of

measures that will be taken to implement the fuel mix for 2020.

Environmental objectives

6.6 There was a general consensus on the need to improve our environment by reducing the environmental impact of electricity generation. There was no disagreement on the adoption of the two environmental targets in guiding the development of the future fuel mix. These targets are to reduce carbon intensity by 50-60% by 2020 when compared to 2005; and to reduce the emissions of SO₂ by 35%-75%, NO_x by 20%-30% and RSP by 15%-40% by 2020 when compared to 2010.

Affordability for using more natural gas

6.7 While “local generation” was the preferred option by a majority of the respondents, there was a general concern expressed by many respondents and stakeholder groups that the use of natural gas as the predominant fuel would increase the future electricity tariff substantially. It might also increase the susceptibility of the tariff to price volatility of natural gas.

6.8 Along the same vein, there were some views suggesting that we should take a phased and incremental approach in increasing the use of natural gas. This would help preserve the flexibility for us to consider importing electricity from the Mainland as and when we have ascertained the reliability of this alternative.

Nuclear power

6.9 As a possible way to mitigate the tariff implications that may be brought by the increasing use of natural gas, some suggested that we should suitably optimise the use of nuclear

power, which could offer a more economical alternative to natural gas, especially if we could rely on the existing transmission network from DBNPS to import slightly more nuclear power. On the other hand, some advocated that we should head towards a zero-nuclear fuel mix.

RE

6.10 Some respondents commented that the Government should vigorously promote the development and use of RE, although there was a general understanding that given the geographical constraints, RE might not assume a major role in our fuel mix. Some suggested that the Government should come up with a specific RE target, and that a roadmap should be drawn up to set out the specific measures that could be adopted to achieve that target. There were also comments that the access to the power grid should be better facilitated to encourage the generation of distributed RE.

Demand side management (DSM)

6.11 A clear consensus among various stakeholder groups and the general public was that the Government should step up the efforts to promote DSM. While the pace of growth of electricity demand has slowed down in recent years as a result of the enhanced awareness of the importance of energy saving, many held the view that more could be done to encourage community-wide efforts to enhance energy efficiency and conservation. By reducing energy demand, there would be a lesser need for investment in generation capacity, which in turn would help reduce the pressure for electricity tariff increase in the longer run.

Way Forward

Measures to take

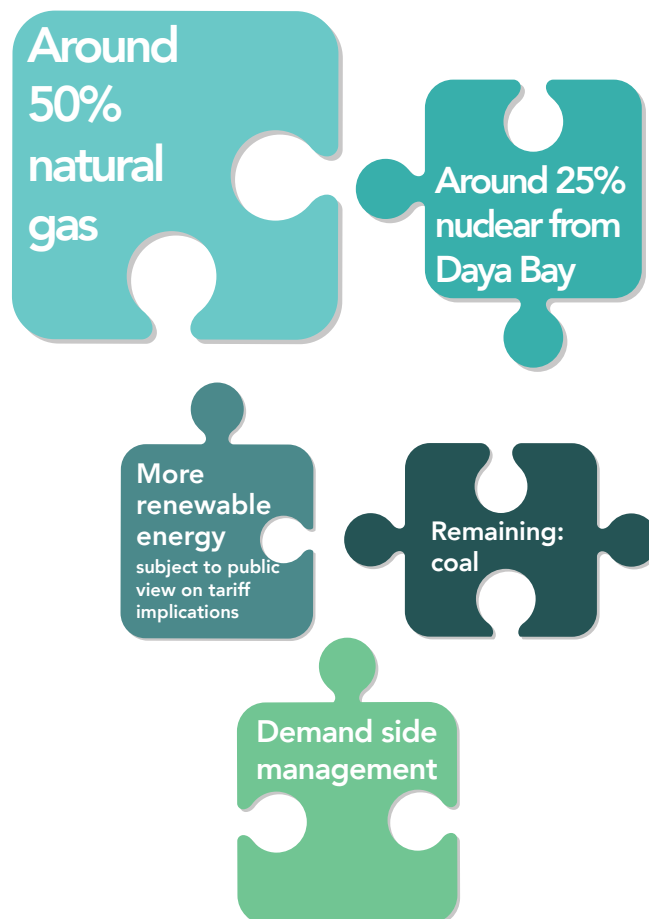
6.12 Having regard to the views and comments received during the public consultation on the future fuel mix, we plan to take the following measures to implement the future fuel mix in order to meet the pledged environmental targets for 2020 -

- (a) to increase the percentage of local gas generation to around 50% of the total fuel mix in 2020, and, subject to a reasonable import price, 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;
- (b) Subject to public views on the tariff implications, to develop more RE, including distributed RE;

- (c) to enhance our efforts to promote energy saving in the community and adopt more DSM measures in order to reduce the overall demand; and
- (d) to meet the remaining demand for electricity by coal-fired generation.

More use of natural gas

6.13 Having regard to the predominant support for the “local generation” option, we would use more natural gas for local generation. However, in order to mitigate the tariff implications that may be brought by a further increase in the use of natural gas, as well as to preserve the flexibility for considering other possible options in the long run, we intend to increase the share of natural gas in the fuel mix from 40% in 2017 to some 50% in 2020, instead of the originally proposed 60% in the consultation document. We envisage that a small number of additional gas units would need



to be built in order to increase the use of natural gas. Such units would in any event be required for meeting the growing electricity demand in early 2020s as the coal-fired generation units gradually retire.

Nuclear energy

6.14 Under the Memorandum of Understanding on energy co-operation signed between the HKSAR Government and the National Energy Administration, energy enterprises of the two sides renewed the agreement on the supply of nuclear electricity from the DBNPS for a further term of 20 years from 2014 up until 2034. Over the past two decades, 70% of the total output of DBNPS is exported to Hong Kong while the remaining 30% is provided to Guangdong province. More recently, as part of the package of measures implemented to mitigate the impact of the likely increase in tariff from 2014-2018, CLP has made interim arrangements for additional import of about 10% of output from DBNPS during the period. As this arrangement would entail no capital investment on new cross-boundary infrastructure, it will help mitigate the tariff impact as we increase the use of cleaner fuel, provided that the cost for the additional increase in nuclear import from DBNPS would be lower than that of local generation by natural gas.

DSM

6.15 There is a clear consensus that more active DSM measures should be pursued to enhance energy efficiency and reduce electricity consumption.

Existing measures

6.16 The Government adopts a four-pronged strategy to promote energy conservation, namely Government taking the lead; improving building energy efficiency; enabling members of the public to make energy efficiency choices to invest in electrical appliances and promoting energy saving practice and lifestyle. As a member of the Asia-Pacific Economic Cooperation, Hong Kong is committed to striving to meet the target of reducing energy intensity by at least 45% by 2035, using 2005 as a base year. The Government has introduced a series of measures to enhance energy efficiency and conservation in the last few years. These include legislation to enhance energy saving in buildings and to introduce energy efficient labeling scheme, conduct energy-cum-carbon audits and energy efficiency enhancement projects for government facilities, public education and publicity programmes and the launching of the first-of-its-kind District Cooling System in Kai Tak Development. The Chief Executive has announced in the Policy Address this year a 5% electricity savings target for government buildings from 2015-16 to 2019-20.

6.17 The power companies also have an important role to play in the promotion of energy efficiency. The current SCAs set out specific energy saving and energy audit targets for the power companies. The power companies can obtain an incentive of 0.01% of ANFA if they meet the annual target of conducting energy audits for their customers (150 cases for CLP and 50 cases for HKE annually). Another 0.01% is provided if the energy saving attributable to the improvement works carried out by customers based on the energy audits conducted by the

power companies meets the target level of 12GWh (for CLP) and 3GWh (for HKE). Over the past five years from 2009 to 2013, the two power companies have completed over 1 000 cases of energy audits and have helped save over 85 GWh of electricity. Following the mid-term review in 2013, the two power companies have agreed to use their performance incentives obtained through energy savings to set up funding schemes to provide subsidies on a matching basis to non-commercial building owners to carry out energy efficiency improvement works, with priority given to single residential blocks.

6.18 In addition, the two power companies have each set up a loan fund (CLP: \$25 million per annum; HKE: \$12.5 million per annum) to provide loans to non-Government customers to implement energy saving initiatives identified in energy audits to promote energy efficiency. They have also set up an education fund (CLP: \$5 million per annum; HKE: \$2.5 million per annum) for energy efficiency and promotion activities.

6.19 Apart from the schemes provided under the SCAs, the power companies have organised a wide range of activities to encourage their customers to save energy, such as promotional campaigns, seminars, conferences, exhibitions and competitions. More recent initiatives include the launch of on-line applications to provide instant access to information on energy efficiency to help customers to estimate electricity consumption and recommend saving plans and tips for customers. Pilot schemes have been launched to encourage energy saving behavior by providing online bi-monthly electricity consumption reports to help customers compare

their electricity consumption with that of similar families in the neighbourhood. To help reduce tariffs and encourage energy saving, the power companies have provided energy rebate and discount to domestic and small and medium enterprises (SME) customers with low levels of electricity consumption. The tariff paid by low consumption consumers is 20% - 35% lower than the average tariff rate.

Further promotion of DSM

6.20 The Government is committed to taking further action to promote energy savings and to reduce the demand for electricity consumption. We are reviewing Hong Kong's energy intensity target and have plan to enhance our efforts to promote energy saving through tightening regulatory tools, enhancing public education and mobilising stakeholders. Details of these measures will be set out in a document on energy saving to be released shortly.

6.21 For the power companies, we would like to seek public view as to how the existing energy savings measures under the SCAs could be improved to further encourage and require the power companies to help promote DSM.

6.22 One possible option is to introduce the Advanced Metering Infrastructure (AMI). AMI can provide more information than conventional meters to enable consumption data collection, automatic meter reading, demand side response, and other advanced applications. If supported by other initiatives such as tariff rebates or discount for using electricity during non-peak hours, AMI can encourage energy saving and help reduce maximum demand for

electricity and defer investment in generation plant. The two power companies have started to study and test the application and technologies of smart meters for general customers. For instance, CLP launched a pilot scheme in 2013 involving around 3 000 residential customers and around 1 400 SMEs. The scheme not only offers customers timely data and energy-saving tips, it also offers new incentives to customers including time of use tariff and a summer saver rebate. The implementation of AMI requires investment in advanced smart grid technology and its territory-wide application will have tariff implications. We will study the outcome of the pilot scheme to assess its effectiveness in managing electricity demand and its cost effectiveness in deciding whether to pursue the initiative and if so the scope of the application.

RE

6.23 As a small city with no indigenous fossil fuel resources, investing in RE could help protect the environment, and give us more energy supply options. However, the physical environment of Hong Kong imposes various constraints on the wide application of RE. The cost of generation, which is notably higher than that of conventional electricity generation, is another major issue of concern.

Current position

(a) Government efforts in RE development

6.24 The Government's current policy is to take the lead to promote the adoption and development of RE facilities for demonstration purpose, subject to their technical feasibility and cost effectiveness, and to encourage

wider adoption of RE in private buildings and organisations. Since 2005, Government departments are required to consider the adoption of RE technologies in all new government buildings and major retrofitting projects in existing buildings. At present, all new schools and educational buildings without air-conditioning are required to have at least 0.5% of their electricity consumption to be provided by RE, where technically feasible, and the Government provided funds to help. On solar power, the Government has been installing photovoltaic (PV) systems in various Government buildings and public facilities. Up to now, over 100 solar PV projects have been completed in Government buildings and public facilities.

6.25 On the education side, to help the public better understand the application of RE technologies, EMSD has published on its website relevant information, guidance notes and guidelines on RE.

(b) Development of RE in the private sector

6.26 To encourage wider adoption of RE in private buildings and organisations, the Government has been providing tax incentives since 2008 on the capital expenditure incurred in relation to installation of RE power systems in private premises over a 5-year period. A more common type of such distributed RE is the installation of PV panels on the roofs of buildings. To facilitate their connection to the grids, the SCAs provide that the power companies shall offer standardised arrangements for back-up supply for customers with distributed RE systems in Hong Kong. Grid connection arrangements shall be made between the power companies and the prospective grid user

on reasonable terms and are subject to the technical and safety requirements stipulated in the prevalent technical guidelines issued by the EMSD. So far, the two power companies have established over 200 connection arrangements with their customers.

(c) RE generated by the power companies

6.27 The power companies are also expected to contribute to the promotion of RE in Hong Kong. In this regard, incentives are provided to the power companies under the SCA in terms of a higher permitted return, i.e. 11%, for their RE infrastructure investments, and a bonus in permitted return depending on the extent to which RE is used in electricity generation. The RE generated by CLP and HKE in 2013 was approximately 40 000 units and 2 million units respectively. Major RE facilities include HKE's solar and wind power systems at Lamma Power Station with a capacity of 1 800 kW, and CLP's renewable generation plant on Town Island with a capacity of up to 200 kW.

Further promotion of RE

6.28 We are open to the suggestion of further promoting RE, subject to the community's acceptance of a higher tariff implication. Some possible options of developing more RE are set out in the following paragraphs.

(a) Development of RE by the public sector

6.29 The Government has plan to make the best use of its waste-management facilities to turn waste into RE. With regard to the various waste-to-energy facilities completed or being planned, including sludge treatment facility, integrated waste management facility, and a number of organic waste treatment facilities, the

RE generated is estimated to be able to meet about 1% of Hong Kong's total electricity demand by the early 2020s.

(b) Promotion of RE in the private sector

(i) *Solar water heating*

6.30 Solar water heater can be installed on the roof of buildings to absorb solar energy and produce hot water. While the system itself does not generate electricity, this form of energy generation could help reduce electricity consumption. There is no need to arrange grid connection and the pay-back period is much shorter than that of using PV panels to generate electricity. To promote the adoption of solar water heating systems, EMSD has published information and guidance notes on the use and installations of such systems at village houses. The Government has also been taking a lead by installing solar water heating systems at Government projects including swimming pools and sports centres.

(ii) *Grid connection*

6.31 As explained in Chapter 4, while the SCAs contain provisions to enable private building owners to connect their distributed RE to the grid of power companies, the number of connection is relatively small as some building owners have concern on the liability they need to bear. To encourage the development of distributed RE, we will discuss with power companies ways to address such concern and facilitate connection.

(iii) *Feed-in tariff*

6.32 One approach adopted in overseas jurisdiction to encourage distributed RE is feed-in tariff scheme, which allows RE producers

to receive payments from power companies for the electricity they generate and export to the grid. This provides incentive for building owners to invest in solar PV panel or other RE generation facilities despite the long pay-back period to recover their upfront installation cost and subsequent maintenance expense. While such scheme would help promote RE, it may be considered by many electricity users as unfair as the cost incurred by power companies in purchasing RE from limited number of building owners will be shared out by all customers. It is noted that consumer electricity prices have risen significantly in Japan and Germany since the establishment of the feed-in tariff.

(iv) *Net metering*

6.33 Net metering is a billing mechanism that credits owners of RE facilities for the electricity they supply to the grid. For example, if a customer owns a PV system, it may generate more electricity than the customer uses during daylight hours. The net metering would allow the PV system owner to export the surplus power to the grid, and the electricity consumption and export are recorded. The customers will be billed for the "net" electricity use. As compared to feed-in tariff, it is a less costly way to general consumers to promote RE.

(c) Promotion of RE by power companies

(i) *RoR on RE investment and tariff implications*

6.34 While that the generation cost of RE is much higher than electricity generated from fossil fuel due to higher investment cost and back-up generation capacity is required to be constructed to meet the demand due to the intermittent nature of RE facilities, the higher RoR for the RE

infrastructure investments and the resulting tariff impact have been posing a major constraint to approve large-scale RE projects proposed by the power companies. In this regard, if the current contractual arrangement is to be continued as proposed in Chapter 5, there is a need to lower the permitted return to mitigate the tariff implication of RE projects so that it may be more acceptable to consumers.

6.35 Meanwhile, the two power companies have been conducting feasibility studies and formulating proposals to develop offshore windfarms. If pursued, these windfarms may meet 1-2% of our total electricity need. Nevertheless, the cost of the windfarms is much higher than that of conventional power plants. While the exact tariff implications will need to be further ascertained when the necessary study data are available, a rough estimate is that it will lead to an increase in tariff by around 3-5% if the current RoR of 11% is applied. Even if we are to reduce the permitted return for the RE facilities below that allowed for generating units using natural gas, the unit generation cost of off-shore windfarms is still likely to be higher than that generated by natural gas, given the need for back-up facilities for RE generation.

(ii) *RE certificate*

6.36 Another possible way to promote RE is to ask power companies to issue RE certificates which provide key information about the electricity delivered to the grid/purchased, e.g. type of RE producing the electricity, location and vintage of the RE generator, associated GHG emission of the RE generation, etc. Electricity with RE certificates will be sold at a premium above the normal tariff level. By purchasing a certificate, the purchaser can

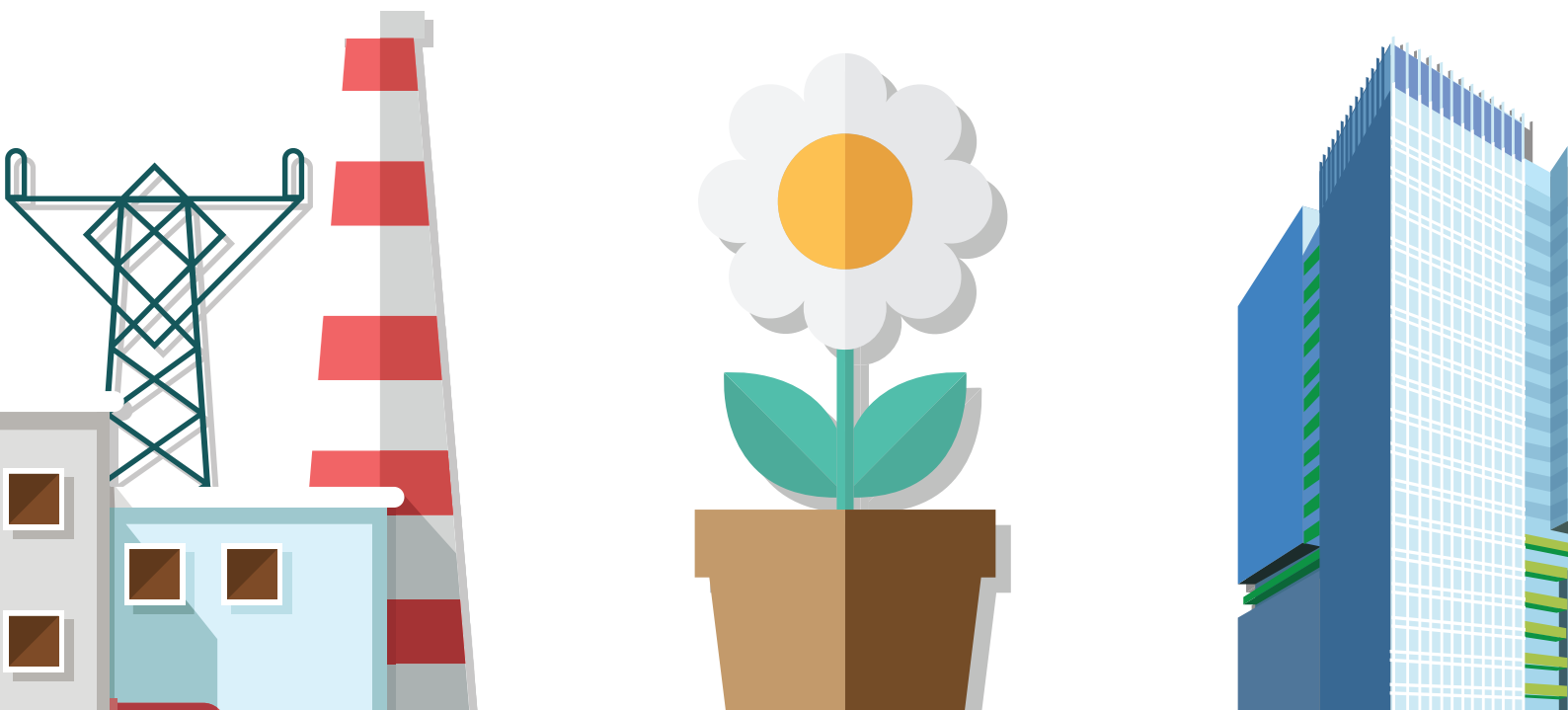
claim that he has consumed electricity generated from clean energy source. With more active promotion by the power companies, individuals, private companies, and organisations may be more prepared to pay more to purchase certificates to help green the environment. The revenue generated from the sale of such certificates can be used to alleviate the overall tariff impact on all consumers brought by large scale RE projects. However, the success of the scheme in Hong Kong would depend on the number of corporations and organisations prepared to participate in the scheme and the price of these certificates.

6.37 In other jurisdictions, there are initiatives to promote the market for RE by incorporating the requirement to purchase RE electricity into the green building rating system. However its success will hinge on the presence of similar rating criteria in the local green building rating system such as BEAM Plus, the support for and adoption of this green building rating system, as well as the availability of RE electricity for sale to the building owners and occupiers.

Environmental and Cost Implications

6.38 Taking the above steps, the local fuel mix by 2020 would be made of around 50% natural gas, around 25% nuclear power and around 25% coal and RE. Based on the projected electricity consumption of about 48 billion kWh in 2020, we expect that we would meet the lower bound of the air pollutant emission reduction and carbon intensity reduction targets.

6.39 In terms of affordability, it is expected that electricity tariff will cost more than present as we are reducing the reliance on less expensive but more polluting coal. For the two fuel mix options put forward in the fuel mix consultation, we previously estimated that the unit electricity import cost (under the “grid purchase” option) and unit gas generation cost (under the “local generation” option) would roughly double the unit generation cost over the five years from 2008-2012. Under the fuel mix proposal for 2020 set out above, we expect that the unit generation cost will be lower than that under the two proposed



options. However, it is premature to make any meaningful assessment of the tariff implications for any particular year. This is because how the increase in unit cost will be reflected in electricity tariff would depend on a host of factors, including the future fuel cost which is significantly affected by international oil price movement, the retirement schedule of existing generation units, the pace of capital investment, the design of new infrastructure, the expiry of cheaper fuel contract, etc. More importantly, electricity tariff in a particular year is also affected by other factors including operation costs, sales volume, as well as movement in the TSF and the FCA.

Lead-up to 2020 and Beyond

6.40 As it would take some four to five years to plan and construct the necessary gas-fired generation units required for implementing the fuel mix for 2020, we would discuss with the power companies the planning and construction of these gas units based on the above fuel mix along with the discussion with them on the future regulatory regime. Once the infrastructure is in place, flexibility should apply to actual deployment of each fuel type in 2020 based on the circumstances prevailing at the time.

6.41 Going beyond 2020, the outcome of the proposed detailed study on the arrangements pertaining to importing electricity from the Mainland grid may have a bearing on the future fuel mix. In the interim, as some of the existing coal-fired generation units have to retire due to their service conditions, they would likely be replaced by natural gas units, while the actual fuel deployment would be considered having regard to the latest projection of fuel prices, environmental performance of each fuel type, as well as the prevailing environmental targets.

Consultation Questions

- Q4** Should Hong Kong further promote RE despite its higher tariff implications; and if so, about how much (in terms of percentage of your electricity bill) are you prepared to pay?

- Q5** What specific requirements would you suggest to be set out in the future contractual arrangement (if any) between the Government and the power companies to encourage the promotion of DSM and RE by the power companies?

Chapter 7

Summary



Summary

7.1 In this consultation document, we have set out the present state of the electricity supply and possible direction that could be set for the future development of the electricity market. While the experiences of overseas markets do not provide any conclusive evidence to show that introducing market competition will necessarily drive down electricity tariff, increase reliability or operational efficiency, it could allow consumers to have more choices.

7.2 We have also reviewed the readiness of Hong Kong to introduce competition to the electricity market after the current SCAs expire in 2018. While it is unlikely to be any new substantial supply sources in 2018, we propose to conduct necessary preparatory work to pave the way for Hong Kong to introduce competition to the electricity market in the longer-term.

7.3 Given the premises that the requisite conditions are not present for us to introduce competition on a sizable scale to the electricity market in 2018, we have reviewed various regulatory tools and approaches that should be adopted in the next regulatory period. Some possible areas for improvement to the future contractual arrangement between the Government and the power companies, if any, have been proposed.

7.4 Electricity supply is an indispensable part of our daily lives. Any changes to the market structure and regulatory framework would have a significant impact and have to be carefully deliberated and considered by the community as a whole. We keep an open mind and look forward to hearing the views from various stakeholders and the public on the various key issues, as we chart the way forward.



Key Points of Consultation

7.5 A summary of the consultation questions is set out below -

- Q1.** How important is choice to you in respect of the supply of electricity? What objectives do you consider should be achieved through introducing competition to the electricity market?
- Q2.** To what extent do you think the current contractual arrangement by SCAs has allowed us to achieve the energy policy objectives of safety, reliability, affordability and environmental protection, and what problems do you see with this regulatory approach?
- Q3.** What is your view on the following areas in the future contractual arrangement (if any) between the Government and the power companies -
- (a) duration;
 - (b) permitted rate of return;
 - (c) tariff approval mechanism;
 - (d) fuel cost arrangement; and
 - (e) incentive and penalty scheme relating to the performance of the power companies?

What other improvements would you suggest?

- Q4.** Should Hong Kong further promote RE despite its higher tariff implications; and if so, about how much (in terms of percentage of your electricity bill) are you prepared to pay?
- Q5.** What specific requirements would you suggest to be set out in the future contractual arrangement (if any) between the Government and the power companies to encourage the promotion of DSM and RE by the power companies?
- Q6.** Do you have any other comments and suggestions?

Respond to this Consultation

7.6 Please send your comments and suggestions to us on or before **30 June 2015** by mail, e-mail or facsimile to the following addresses:

Electricity Reviews Division
Environment Bureau
15/F, East Wing, Central Government Offices
2 Tim Mei Avenue
Tamar, Hong Kong
emr@enb.gov.hk
2147 5834

7.7 For the ease of responding to this Public Consultation, we have set out the consultation questions as summarised in Chapter 7 on a response form.

7.8 If you have any enquiries, please contact us on 3509 8639.

DISCLAIMERS

1. All the views expressed in this consultation paper are for the purpose of discussion and consultation only.
2. Nothing in this consultation paper (i) represents or constitutes any decision made by the Government or any public officer, or (ii) shall give rise to any rights or interests or expectations, or (iii) shall be construed or relied upon by any person or entity against the Government or any public officer.
3. This consultation paper is without prejudice to and shall not fetter or affect any powers or duties of the Government or any public officer under the SCAs (current or future) or under any other contractual arrangement between the Government and the power companies or any legislation or regulation (including the modifications and re-enactments thereof).
4. Without limiting the generality of the foregoing, any future contractual regulatory tool and contractual arrangements between the Government and the power companies referred to in this consultation paper are subject to negotiation with and agreement by the power companies.

Annex

**Report on the Public Consultation
on Future Fuel Mix for Electricity
Generation in Hong Kong**

Report on the Public Consultation on Future Fuel Mix for Electricity Generation in Hong Kong

Purpose

This Annex reports on the feedbacks and comments we received during the public consultation on future fuel mix for electricity generation in Hong Kong conducted from 19 March to 18 June 2014.

Background

2. The “fuel mix” for electricity generation means the mix of energy sources used to generate electricity. 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 2012, coal dominated the overall fuel mix in Hong Kong (53%), followed by nuclear electricity imported from the Daya Bay Nuclear Power Station (DBNPS) in the Mainland (23%), natural gas (22%), and oil and renewable energy (RE) (2%).

3. In order to facilitate timely planning of necessary infrastructure to meet the future electricity demand when existing coal-fired generating units start to retire from 2017, and to achieve the environmental targets we have set for 2020 in respect of reducing carbon intensity and air pollutant emissions, we conducted a review of the future fuel mix for electricity generation, and launched a three-month public consultation.

4. We put forward two fuel mix options for public consultation. The first option was “grid

purchase”, under which importing electricity through purchase from the Mainland power grid (i.e. the China Southern Power Grid) was proposed. The second option was “local generation”, under which use of more natural gas for local generation was proposed. The consultation document set out the analysis of the benefits and drawbacks of these two fuel mix options against the four energy policy objectives and some other key considerations, including implications for the post-2018 electricity market, diversification, flexibility in scaling up future supply and possible impact on local employment.

5. In order to encourage the public and stakeholders to provide their views and comments on this important matter, radio and TV APIs were launched and advertisements placed on newspapers to publicise the public consultation, and a total of 30 discussion forums and meetings were held with various stakeholders to solicit their views. We also consulted the Legislative Council (LegCo) Panel on Economic Development, the Energy Advisory Committee (EnAC) and the Advisory Committee on the Environment (ACE).

6. Having consolidated the opinions received, we set out the key findings in the ensuing paragraphs.

Key Findings of the Public Consultation

Total Number of Responses

7. To facilitate the public to provide their feedbacks, a standard response form was

included in the public consultation document, which asked them to indicate if they support the two options, show their preference over the two options, and provide other comments and suggestions. A copy of the response form is at **Appendix.**

8. We received a total of 86 128 submissions, of which 84 839 were from individuals and 1 289 from groups and organisations. 2 188 submissions are anonymous submissions. Their inclusion would not have any material impact on the outcome of the overall analysis. Meanwhile, we notice that 1 256 and 155 emails of the same content came from two accounts and one submission was attached with 293 signatures, most of which had no personal particulars. These three cases were treated as three submissions only.

9. Among the submissions, 136 were excluded from our analysis as there was internal inconsistency, e.g. indicating both support and objection to the same option, or supporting option 2 and objecting to option 1 in question 1, but preferring option 1 over 2 in question 2. There were a total of 582 late submissions received during the one-month period after the end of the consultation period, which were also excluded from our analysis.

Analysis of the Responses

Support for the two options

Consultation question 1: How do you view each of the two fuel mix options with regard to safety, reliability, cost, environmental performance and other relevant considerations?

10. The first question asked the respondents to indicate if they support or do not support each of the two fuel mix options. If they do not support any of the two options, they are invited to indicate the reasons by ticking the boxes next to the four energy policy objectives of safety, reliability, affordability and environmental performance, or specifying other reasons. A total of 85 651 responses were received, with 84 436 coming from individuals and 1 215 being corporate responses.

Option 1

11. Limited number of respondents supported the “grid purchase” option. On the other hand, the majority of respondents did not support this option. “Reliability” was the most common reason given by respondents in objecting to this option. Most of the respondents who did not support this option included “Reliability” as a reason for not supporting this option, although most of the respondents gave multiple reasons. Many respondents also quoted “Environmental Performance”, “Safety” and “Affordability” as reasons for objection.

12. Limited number of respondents indicated that they had some other reasons objecting to the “grid purchase” option, but most of them did not specify the reasons or merely repeated the four energy policy objectives. Among those who gave a specific reason, most of them were worried that Hong Kong would lose control and regulation of the power sector. Some other more notable reasons were –

(a) *Over dependency on the Mainland* – some respondents considered that as electricity is an essential utility, Hong Kong should strive for self-sufficiency through local generation and avoid over

dependency on the Mainland.

(b) *Displacement effect* – some respondents expressed concerns that importing electricity would lower Hong Kong's own emissions at the expense of the Mainland and neighbouring regions.

(c) *Implications for local employment and career development* – some respondents considered that the "grid purchase" option would reduce the scale of local electricity generation by the two power companies, thereby affecting local employment opportunities and career development of engineers in the electricity supply sector.

Option 2

13. A majority of respondents, for both individual and corporate responses, supported the "local generation" option. Limited number of respondents did not support this option. Among them, the majority cited "Affordability" and half of them cited "Reliability" and "Safety" as reasons for objection. Some respondents mentioned they opposed this option on other grounds but did not specify the reasons.

14. Of all the submissions, most supported either the "grid purchase" option or the "local generation" option. Only a small fraction supported both options, or opposed to both.

Preferred option

Consultation question 2: Which of the two fuel mix options do you prefer? Why?

15. The respondents were asked to indicate their preference over the two fuel mix options, and state the reasons. A total of 84 340 responses to this question were received, with

83 163 coming from individuals and 1 177 being corporate responses.

16. A majority of the respondents preferred "local generation" over "grid purchase". "Reliability" was the most frequently cited reason for their preference with the majority of those who preferred option 2 picking this reason, followed by "Environmental Performance", "Safety" and "Affordability" in that order. Slightly over half preferred "local generation" on the ground of all the four major policy objectives.

17. Some other reasons given for their preference for "local generation" include -

(a) pursuing the "grid purchase" option would have a negative impact on local employment and career development of those in the power sector;

(b) importing electricity would render Hong Kong losing control and regulation of power supply; and

(c) "grid purchase" would cause Hong Kong to be over-reliant on the Mainland.

18. Limited number of respondents preferred the "grid purchase" option, with more than half of them choosing all four energy policy objectives as the reasons. "Affordability" and "Environmental Performance" were slightly more frequently cited than the other policy objectives as the reasons for support. Other reasons given for their preference for "grid purchase" include -

(a) there would be a higher possibility to introduce competition to the local electricity market under the "grid purchase" option; and

(b) importing electricity would help diversify our fuel mix and minimise the reliance on a single

type of fuel.

19. Of those who preferred “local generation”, most of them did not support “grid purchase”, and vice versa. Only a few who preferred “local generation” also supported “grid purchase”. Regarding the small fraction of respondents who supported both options, most of them preferred “local generation”; the same pattern is observed in respect of the small number of respondents who objected to both options.

Other comments

20. Other than showing their support or otherwise for the two fuel mix options and their preference, some 5 400 respondents also provided specific comments and suggestions in the submissions. The major views expressed are set out below –

(a) *Promotion of RE* – there were about 3 000 submissions suggesting that the Government should consider further promoting the use of RE in Hong Kong. While acknowledging the lack of indigenous resources in Hong Kong and the impracticality for RE to assume a higher portion of the fuel mix, they considered that the estimate of 1% of RE by 2020 was too pessimistic.

(b) *Displacement of pollutants* – there were about 1 300 submissions suggesting that the fuel mix of the Mainland power plants was no cleaner than that in Hong Kong. Importing electricity from the Mainland would be tantamount to displacing or exporting the pollutants from local power generation to the Mainland. About half of these respondents held the view that importing electricity from the Mainland would lead to more coal-fired power generation therein.

(c) *Promotion of Integrated Gasification Combined Cycle (IGCC)* – some 1 200 submissions suggested that IGCC be promoted in Hong Kong, which was a technology to gasify coal before its combustion for power generation to enhance efficiency and reduce air pollutant emission.

(d) *Loss of control and regulation* – about 1 000 submissions expressed worries that Hong Kong would lose control and regulation of the electricity imported from the Mainland under the “grid purchase” option, including control of reliability and contingency arrangement, control of the cost of generation in the Mainland, tariff of imported electricity, engineering regulation, control of generation fuel mix, control and certainty on emission performance, etc.

(e) *Promotion of demand side management* – about 600 submissions suggested that demand side management should be further promoted. A slower or even negative growth of electricity consumption would help reduce the need for natural gas for power generation thereby minimising our use of highly-priced fuels.

(f) *Implications for local employment and career development* – some 400 submissions considered that importing electricity from the Mainland would constrain future development of the two local power companies, thereby affecting the employment opportunities of local engineers and other practitioners in the power sector.

(g) *Over reliance on the Mainland/Self-sufficiency* – about 300 submissions suggested that Hong Kong should continue to rely mainly on local electricity generation rather than relying on the Mainland for power import, as we have the capability to be self-sufficient.

(h) *Introducing competition to the market* – some 200 submissions suggested that having more local generation would add constraints to introducing competition to the electricity market. They considered that the Government should consider introducing competition to the electricity market. Enhancing interconnection of the two local power companies through the “grid purchase” option could help achieve that goal.

(i) *Use of nuclear power* – some respondents considered that Hong Kong should gradually phase out the use of nuclear power, while some considered that given the excellent track record of the DBNPS in providing reliable and reasonably priced electricity to Hong Kong, the Government should consider importing additional nuclear power from existing nuclear plants in the Mainland or even from new plants, as a means to mitigate future tariff increase and lower the emission from power generation.

Major Views of Stakeholder Groups

21. Most of the feedbacks presented above were received by means of the standard response form. Some 100 written submissions with elaboration of views and comments from various groups and organisations were also received. In addition, we attended 30 fora and discussion sessions to discuss with various stakeholder groups the fuel mix options and solicit their views. We consulted the LegCo Panel on Economic Development at its meeting on 12 May 2014 to listen to the views of the deputations, and another meeting on 26 May 2014 to discuss with Members. We also consulted the EnAC and the ACE on the fuel mix options. The major views received are set out below.

Power companies

22. The CLP Power (CLP) considered that in planning for the future fuel mix, it is important to preserve the flexibility and optionality. It suggested a phased and flexible approach, which combines both “grid purchase” and “local generation” option. More specifically, CLP reckoned that the “local generation” option would provide more certainty in terms of maintaining electricity supply reliability as well as improving environmental performance; while the “grid purchase” option had the potential to provide more opportunities in the longer term for importing electricity of lower carbon as the Mainland’s reliability continues to improve. It proposed to start early on the planning of the “local generation” option to meet Hong Kong’s electricity needs by building a small number of new local gas units, commence a detailed study for the “grid purchase” option, and review future electricity demand and relative energy costs before determining a firm fuel mix ratio.

23. The Hongkong Electric (HKE) considered that the “local generation” option clearly prevailed over the “grid purchase” option when assessed against the Government’s four energy policy objectives and other major considerations. In terms of reliability, “grid purchase” was untested whereas the “local generation” option could certainly help maintain the high reliability of power supply. In respect of environmental performance, the “grid purchase” option would only transfer the emissions from Hong Kong to the Mainland and the imported electricity from the Mainland would likely be generated from coal. On the other hand, coal generation would be replaced by gas generation under the “local

generation” option, which would help reduce emissions not only in Hong Kong but also in the region. On affordability, HKE opined that the “grid purchase” option would eventually render Hong Kong becoming a captive buyer, losing bargaining power for fair, reasonable and competitive import electricity prices. Regarding gas price for local generation, HKE considered that gas prices had come down from their historical peaks and would likely be stabilised at the present level with room for reduction.

24. As regards other criteria for assessment, HKE opined that “grid purchase” did not assist in diversifying Hong Kong fuel’s mix as the fuel used to generate the imported electricity would likely be coal. “Local generation” was also more flexible in scaling up future supply, while “grid purchase” was a rigid option in adapting to changes in future demand, due to its huge infrastructure development and long lead time for construction. It also reckoned that option 1 would not bring any meaningful competition as it would end up with a single bulk supply from the CSG. Overall, HKE considered that option 2 should be adopted.

LegCo and political parties

25. Majority of the submissions from political parties and LegCo Members commented that there was not enough information for making a considered choice; more information on the two fuel mix options, such as the generation costs and the supply reliability of the Mainland power sector, should be provided. Most did not express clear preference over the two options, while there were a few submissions in support for “local generation”, slightly more than those for “grid purchase”.

26. Most of the submissions acknowledged the importance of supply reliability and doubted if the high level of reliability could be maintained under the “grid purchase” option. On environmental performance, there was a majority view that the “grid purchase” option would displace pollutant emissions to the Mainland. Some criticised that the Government had failed to propose a reduction of the share of nuclear energy in the fuel mix, and the proposed “grid purchase” option would in effect increase the use of nuclear power. Some reckoned that importing electricity from the Mainland would affect the career development of local professionals in the power sector. On the other hand, some suggested using more nuclear power to mitigate pressure on future tariff while preserving supply reliability.

27. Most submissions agreed that the “local generation” option would increase Hong Kong’s reliance on natural gas, the price of which was highly volatile. It also required capital investments on new gas units, which would have tariff implications. There was a suggestion that the power companies should source natural gas globally to reduce reliance on a single source, and the Government should study the feasibility of developing LNG infrastructure to enhance energy security and support diversification of gas sources.

28. Most submissions suggested that the Government should consider actively promoting RE, in particular waste-to-energy, and continue to take the lead in promoting energy efficiency and conservation.

29. Some submissions commented on the future development of electricity market. There were views that the permitted return

should be lowered in the next SCAs and the power companies should be asked to shoulder part of the fuel costs. Some suggested that the Government should proceed with the segregation of generation and transmission businesses and enhancing interconnection between the two power companies in order to open up the electricity market.

Business sector

30. There was a general preference for “local generation” for its well-tested reliability. Concerns were expressed over the “grid purchase” option, and some suggested that the Government should conduct a detailed study on the relevant technical and financial arrangements. Majority of the respondents stressed the importance of maintaining a high level of supply reliability, which was vital to business operations. They noted that Macao was not a good comparison as it might not require the same level of supply reliability. They had doubts on the reliability of the electricity supply from the Mainland, especially when the Government did not have direct control over the generation

and transmission of electricity from the Mainland. On environmental front, some doubted that the “grid purchase” option would likely result in higher emissions in the Mainland as the fuel source of the imported electricity was not specified. The marginal fuel type would likely be coal, and it was unclear if the coal plants in the Mainland would adhere to the same stringent emission control as that in Hong Kong. The possible displacement effect was also mentioned in a number of submissions.

31. On affordability, many submissions noted that there was insufficient information on the cost comparison between the two fuel mix options, as well as the cost of and funding arrangement for the cross-boundary infrastructure. The mechanism for regulating the price of imported electricity was unclear and Hong Kong might become a captive buyer in the long run. Respondents were generally concerned about the likely increase in electricity tariff in future. Some suggested that LNG facilities might be considered to assist the power companies to gain access to international gas sources.



32. A few submissions suggested that given the imported nuclear power from the DBNPS had a proven record of supplying reliable and affordable power to Hong Kong, consideration should be given to increase the share of nuclear power in our future fuel mix. Many respondents suggested that more RE including waste to energy should be adopted.

Professional bodies and think tanks

33. There was a general preference for local generation as it could ensure supply reliability, although some submissions commented that both options had their own drawbacks. Most of the respondents stressed the importance of maintaining a high standard of supply reliability. Some commented that the “grid purchase” option depended on the security of the Mainland transmission network, which would be susceptible to extreme weather events. In case of emergency, it would be difficult for a local backup generating unit to kick-in. Some noted that the experience of Macao might not be directly relevant. Some groups suggested that a detailed study should be conducted to look into the various issues pertaining to the “grid purchase” option, such as the funding arrangement for constructing the necessary cross-boundary transmission line, means to ensure reliability, operational arrangement, etc. A few submissions reckoned that importing electricity from the Mainland would cause Hong Kong to lose its self-reliance.

34. On environmental performance, most respondents considered that the “grid purchase” option merely outsourced electricity generation to the Mainland, while more local generation by gas would be more preferable for emission reduction at source. Majority of the respondents believed that under the “grid purchase” option, Hong Kong would have no control of the cost of generation in the Mainland and might become a captive buyer with no bargaining power on the price of import. They acknowledged that the “local generation” option had the drawback of high gas price, with some suggesting that this might be mitigated by having an LNG terminal in Hong Kong. They also suggested that the “local generation” option could be deployed in incremental steps to preserve flexibility.

35. Some groups were open to the use of nuclear energy and suggested that consideration be given to increase its share in the fuel mix. Quite a number of groups suggested that the Government should step up efforts on promoting RE (including the construction of offshore windfarms and the promotion of distributed electricity generation) and energy efficiency.

36. Some of the respondents held the view that the long-term fuel mix was closely related to the future development of the electricity market and the regulatory framework, and suggested that the Government should lay out its plan for the latter and the implementation details.



Green groups and NGOs

37. Most of the green groups and NGOs did not support either option, with some explicit reservations over the “grid purchase” option. On environmental front, there was a general view that as the fuel mix of the imported electricity from the Mainland was not specified, it was unclear if it would be cleaner than that produced locally. Importing electricity under such mode would mean displacing emissions from Hong Kong to the Mainland. Some went further to suggest that we should import RE from the Mainland or make sure that for every quantum of electricity imported from the Mainland, an equal amount of RE would be generated. A few submissions also expressed concern about the reliability of importing electricity from the Mainland.

38. Most respondents suggested that the Government should be actively promoting the use of RE. Some advocated the setting of a specific RE target, while some suggested that the generation and transmission businesses of the power companies should be separated and access to the grid should be provided to distributed RE to promote its development. Another clear view held by the groups is that energy efficiency and conservation should be more vigorously promoted to reduce energy consumption. A possible measure is to introduce progressive tariffs for non-domestic consumers. Many respondents in this group suggested that we should not increase the use of nuclear energy. Some said that the price setting mechanism under the SCAs should be reviewed.

Response Form

Public Consultation on Future Fuel Mix for Electricity Generation for Hong Kong

Please send this response form to us on or before 18 June 2014 by one of these means:

mail: Environment Bureau, Electricity Reviews Division, 15/F, East Wing,
Central Government Offices, 2 Tim Mei Avenue, Tamar, Hong Kong

e-mail: fuel_mix@enb.gov.hk

fax: 2147 5834

Part 1 (See Notes)

This is a corporate response (representing the views of a group or an organisation) or
 individual response (representing the views of an individual)

by _____
(name of person or organization)

at _____ and _____
(telephone) (e-mail)

Part 2

Fuel Mix Options

FUEL MIX	IMPORT		NATURAL GAS	COAL (& RE)
	NUCLEAR (DBNPS)	GRID PURCHASE		
Existing (2012)	23%	-	22%	55% **
Option 1*	20%	30%	40%	10%
	Total : 50%			
Option 2 *	20%	-	60%	20%

* The above fuel mix ratios aim at providing a basis for planning the necessary infrastructure for electricity supply. Flexibility should apply to actual deployment of each fuel type, having regard to the circumstances happening on the ground.

** Inclusive of a small percentage of oil

Part 3

Specific Questions for Consultation

Q1: How do you view each of the two fuel mix options with regard to safety, reliability, cost, environmental performance and other relevant considerations? (Please indicate your view on EACH of the two options.)

Option	Support	Not Support	Reason for NOT supporting (You can tick more than one box)
1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Safety <input type="checkbox"/> Reliability <input type="checkbox"/> Affordability <input type="checkbox"/> Environmental performance <input type="checkbox"/> Others (please specify): _____ _____
2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Safety <input type="checkbox"/> Reliability <input type="checkbox"/> Affordability <input type="checkbox"/> Environmental performance <input type="checkbox"/> Others (please specify): _____ _____

Q2: Which of the two fuel mix options do you prefer? Why? (Please tick **ONLY ONE** box)

Option 1
 Option 2

Reasons: (You can tick more than one box below)

Safety
 Reliability
 Affordability
 Environmental Performance
 Others Please specify: _____

Part 4

Other Comments and Suggestions

Response Form

Public Consultation on the Future Development of the Electricity Market

Please send this response form to us on or before **30 June 2015** by one of these means:

mail: Electricity Reviews Division, Environment Bureau , 15/F, East Wing,
Central Government Offices, 2 Tim Mei Avenue, Tamar, Hong Kong
e-mail: emr@enb.gov.hk
fax: 2147 5834

Part 1 (See Notes)

This is a corporate response (representing the views of a group or an organisation) or
 individual response (representing the views of an individual)

by _____
(name of person or organisation)

at _____ and _____
(telephone) (e-mail)

Part 2

Consultation Questions

Question 1 How important is choice to you in respect of the supply of electricity? What objectives do you consider should be achieved through introducing competition to the electricity market?

Question 2 To what extent do you think the current contractual arrangement by SCAs has allowed us to achieve the energy policy objectives of safety, reliability, affordability and environmental protection, and what problems do you see with this regulatory approach?

Question 3 What is your view on the following areas in the future contractual arrangement (if any) between the Government and the power companies?

(a) duration

(b) permitted rate of return

(c) tariff approval mechanism

(d) fuel cost arrangement

(e) incentive and penalty scheme relating to the performance of the power companies

What other improvements would you suggest?

Question 4 Should Hong Kong further promote renewable energy despite its higher tariff implications; and if so, about how much (in terms of percentage of your electricity bill) are you prepared to pay?

Question 5 What specific requirements would you suggest to be set out in the future contractual arrangement (if any) between the Government and the power companies to encourage the promotion of demand side management and renewable energy by the power companies?

Question 6 Do you have any other comments and suggestions?

Lined area for providing comments and suggestions.

Notes :

1. It is optional for you to provide your personal information in Part 1 of this response form.
2. The names and views of individuals and organisations which put forth submissions in response to this Consultation Document ("senders") may be published for public viewing after conclusion of the public consultation exercise. The Government may, either in discussion with others (whether privately or publicly), or in any subsequent report, attribute comments submitted in response to this Consultation Document.
3. We will respect the wishes of senders to remain anonymous and / or keep the views confidential in part or in whole. If the senders request anonymity in the submissions, their names will be removed when publishing their views. If the senders request confidentiality of their views, their submissions will not be published.
4. If the senders do not request anonymity or confidentiality in the submissions, it will be assumed that the senders can be named and the views can be published in their entirety.
5. To safeguard senders' data privacy, we will remove senders' relevant data (if provided), such as telephone numbers, email addresses, residential / return addresses, identity card numbers, facsimile numbers and signatures when publishing their submissions.
6. Provision of any personal data in this response form is voluntary. Any personal data provided may be transferred to the relevant Government bureaux and departments for purposes directly related to this consultation exercise. The Government bureaux and departments receiving the data are bound by such purposes in their subsequent use of such data. Any sender providing personal data to us in the submission will have the rights of access and correction with respect to such personal data. Requests for data access and correction should be made in writing to:

Address: **Electricity Reviews Division**
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15/F, East Wing, Central Government Offices
2 Tim Mei Avenue, Tamar, Hong Kong

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