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Panel on Economic Development
Meeting on 15 December 2015

Updated background brief on
annual tariff reviews with the two power companies

Purpose

This paper sets out the background of the Government's annual tariff reviews with the two power companies and summarizes Members' major concerns on related issues raised at previous discussions of the Panel on Economic Development ("the Panel").

Regulation of electricity supply in Hong Kong

2. Electricity supply in Hong Kong is regulated through the Scheme of Control Agreements ("SCAs") signed between the Government and individual power companies, namely, The Hongkong Electric Company Ltd. ("HEC")¹ which supplies electricity to customers on the Hong Kong Island, Ap Lei Chau and Lamma Island; and CLP Power Hong Kong Ltd. and Castle Peak Power Company Ltd.² (referred to collectively as "CLP" hereafter) which jointly supply electricity to customers in Kowloon and the New Territories including Lantau, Cheung Chau and some outlying islands. The two SCAs set out the rights and obligations of the power companies and provide a framework for the Government to monitor the power companies' financial affairs and technical performance.

¹ HEC is a subsidiary of Power Assets Holdings Limited.

² CLP Power Hong Kong Ltd. is a subsidiary of the CLP Holdings Limited. Castle Peak Power Company Ltd. ("CAPCO") is a joint venture electricity generating company established between CLP Power (40%) and ExxonMobil Energy Limited (60%). CLP Power has reached agreement with China Southern Power Grid International (HK) Co., Limited to each acquire half of the 60% interest in CAPCO held by ExxonMobil.

3. The Government entered into SCAs with the power companies on 7 January 2008 for a term of 10 years³. The Administration has completed its mid-term review of the existing SCAs and briefed members of the outcome of the review on 25 November 2013 with details in LC Paper No. CB(1)344/13-14(06).

4. The Administration launched a three-month public consultation on 31 March 2015 to solicit public's views on the future development of the electricity market ("the 2015 Consultation"). Details on the key findings including competition, regulatory arrangement, key features of a future contractual arrangement in respect of duration, permitted rate of return ("RoR"), fuel cost arrangement and tariff approval mechanism, incentive and penalty scheme, promotion of renewable energy, promotion of demand side management are set out in LC Paper No. CB(4)217/15-16(03).

2014-2018 Development Plans of the power companies

5. The Government approved the 2014-2018 Development Plans of CLP and HEC on 10 December 2013. The Development Plans outline the capital projects to be implemented by the power companies, the increase in average Basic Tariff Rate to be effective from 1 January 2014, and the projected levels of Basic Tariff Rates during the five years.

6. Capital projects that are reported in the Development Plans cover –
- (a) power generation systems, such as construction or refurbishment of power plants;
 - (b) transmission and distribution systems, including the construction of new substations, additional circuits, improvement and reinforcement of existing system; and
 - (c) customer and corporate services development, which includes information system development, metering system development, energy and distribution management systems development, motor vehicles and building renovation.

³ There is an option to be exercised by the Government before 1 January 2016 to extend the SCAs for five more years, i.e. until 2023.

HEC's Development Plan

7. HEC's Development Plan covers the period from 1 January 2014 to 31 December 2018 ("HEC DP Period") and has the following features:

- (a) capital projects for a total estimated capital expenditure ("CAPEX") of \$13 billion which would be incurred during the HEC DP Period. This CAPEX includes \$3 billion, approved on a provisional basis, for construction of a new gas-fired power plant unit; and
- (b) the average Basic Tariff Rate would increase by 7.1 cents/kWh, or 7.5% to 101.8 cents/kWh with effect from 1 January 2014.

CLP's Development Plan

8. CLP's Development Plan covers the period from 1 January 2014 to 30 September 2018 ("CLP DP Period") and has the following features –

- (a) capital projects for a total estimated CAPEX of \$34.1 billion would be incurred during the CLP DP Period. These include upgrading the efficiency of three units of Combined-Cycle Gas Turbine at Black Point Power Station, and extending the useful lives of its generating plants at Castle Peak A, Castle Peak B, Black Point Power Station and Penny's Bay Power Station for five years;
- (b) the average Basic Tariff Rate would increase by 4.2 cents/kWh or 5.0%, to 88.4 cents/kWh with effect from 1 January 2014; and
- (c) the projected levels of Basic Tariff Rate for the CLP DP Period would increase on average by 1.8% per annum.

The tariff adjustment mechanism

9. Electricity tariff is made up of two parts, namely, the Basic Tariff and the Fuel Clause Charge ("FCC"). To ensure that tariff adjustment is reasonable, the Administration would play a gate-keeping role to control cost relating to the Basic Tariff by way of ensuring that any necessary developments and service improvements of the power companies would proceed within the scope of their five-year development plans approved by the Government, and by vetting in the context of the annual tariff review

individual expenditure items, including capital investment, of the two companies to screen out items that are excessive, premature or unnecessary.

10. As for FCC, the Administration would urge the two power companies to, as far as practicable, use the Fuel Clause Recovery Account⁴ and the Tariff Stabilization Fund ("TSF")⁵ as buffers to mitigate the cost impact of any switch from old fuel contracts to new contracts, and any significant fuel price fluctuations in the international market. It would also examine whether any special income of the two companies can be used to offset cost increase.

Tariff adjustments since 2008

11. The Government conducts tariff reviews with the two power companies annually and the average net tariffs charged by HEC and CLP since 2008 are set out below –

Year	HEC (cents/kWh)	CLP (cents/kWh)
2008	127.4	91.1 ^a
2009	119.9 (-5.9%)	88.4 ^b (-3%)/89.2 ^b
2010	119.9 (no change)	91.5 (+2.6%)
2011	123.3 (+2.8%)	94.1 (+2.8%)
2012	131.1 (+6.3%)	98.7 (+4.9%)
2013	134.9 (+2.9%)	104.5 (+5.9%)
2014	134.9 (no change)	110.8 (+3.9%) ^c
2015	134.9 (no change) ^d	114.2(+3.1%)

- Note:
- ^a from January to September 2008
 - ^b from October 2008 to December 2009 during which the Rate Reduction Reserve rebate of 0.8 cents/kWh ceased from 6 May 2009 with the depletion of the Rate Reduction Reserve.
 - ^c CLP's Average Net Tariff Rate ("ANTR") of 2013 shown above has factored in the special rebate of 2.1 cents/kWh as a result of Rent and Rates refund, which has ceased since mid October 2013. Without the rebate, CLP's ANTR of that year was 106.6 cents/kWh. When compared with this rate, the increase of ANTR in 2014 would be 3.9%.
 - ^d ANTR of 2015 remained 134.9 cents/kWh because the increase of 0.8 cents/kWh in the average Basic Tariff Rate over that of 2014 has been offset by the same amount of reduction in FCC.

⁴ The Fuel Clause Recovery Account is operated on a rolling basis. It is an account maintained by the two power companies through which the difference between the standard fuel cost (as reflected in the Basic Tariff) and the actual fuel cost is captured and passed on to consumers by way of rebates or charges.

⁵ A TSF was maintained for the retention of net revenue in excess of the agreed return for the power companies. The cap on TSF balance was reduced to 8% of annual local sales from 12.5% under the previous SCAs and as a result of the 2013 SCA mid-term review, the cap has been further reduced to 5%. The purpose of TSF is to accumulate the excess of net revenues of the power companies over the permitted return, so as to provide funding, where necessary, to ameliorate the impacts of tariff increases on consumers.

Views previously expressed by the Panel

12. Electricity tariff has all along been a matter of contention and members of the Panel have expressed views and concerns over a range of issues at the annual briefings on tariff reviews prior to 2015, including the following –

- (a) disappointment at decisions of HEC and CLP to raise tariff despite the companies' substantial earnings;
- (b) HEC's customers were paying tariff at a much higher rate than those of CLP;
- (c) suggestion of setting up a tariff determination mechanism;
- (d) introduction of electricity suppliers from the Mainland to enhance competition and lower the tariff;
- (e) implementation of increased interconnection between the two power companies to minimize investment on new generating units;
- (f) the Government should enhance monitoring of the power companies' investment on generation facilities, treatment of excessive generating capacity, and sales of surplus electricity to the Mainland;
- (g) the Government should enhance transparency by urging the two power companies to disclose financial information related to the tariff reviews;
- (h) separation of power generation and transmission to facilitate market entry;
- (i) the power companies should exercise greater versatility in handling the coal procurement contracts in the interests of customers;
- (j) the Government should monitor the timing of the adjustment of fuel clause charges made by the power companies;

- (k) the need to strike a balance between commitment to environmental protection and cost control;
- (l) the power companies should use the reserve in TSF to offset the fuel cost increase, or opt not to achieve a maximum RoR;
- (m) the power companies should provide incentives to encourage energy saving initiatives by customers, for example, by setting "hard targets" on electricity consumption; and
- (n) CLP should source cheaper gas supplies or import less costly alternatives such as nuclear energy, liquefied natural gas ("LNG") or shale gas to reduce the pressure on tariff increase.

Concerns about the tariff reviews for 2015

13. At the Panel meetings held on 16 December 2014 and 2 February 2015, members deliberated on matters related to tariff adjustments of the two power companies in 2015. The major issues of common concern were elaborated in ensuing paragraphs.

Issues of common concern

Fuel cost and fuel mix

14. Members were concerned that despite the sharp drop of international oil prices in 2014, it was still foreseen that the rate of increase of CLP's tariff would rise in future years as the company was facing pressure in fuel cost because of the higher price for the gas supplied via the Mainland's Second West-East Natural Gas Pipeline ("WEPII"). They enquired if CLP could find any ways to take benefit from the drop of international fuel prices and review the contracted price of WEPII or source other gas supply, and whether CLP might have over-estimated the rate of increase of the fuel cost.

15. CLP advised that it mainly used natural gas and coal the price of which had dropped in tandem with international fuel prices. However, the company had to use almost a double of natural gas in order to meet the tighter emission caps imposed by the Government by 2015. CLP explained that such move had driven up the total fuel cost by 50% thus the benefit brought by the drop of coal price would be offset by the increased consumption of natural gas. Nonetheless, CLP undertook to closely monitor the international fuel prices and identify cheaper sources of fuel, for example, constructing an LNG floating storage and re-gasification unit.

16. Given the volatility of fuel prices, members enquired if it was feasible to adopt a more flexible approach in fuel mix deployment to alleviate tariff pressure on the general public, and if the Administration and the two power companies would consider increasing the use of nuclear power, which was considered more economical and stable in supply, in electricity generation.

17. The Administration advised that the proposed fuel mix ratio aimed at providing a basis for planning the necessary infrastructure for electricity supply. Fine-tuning should apply depending on circumstances. CLP remarked that it was open to explore the option of using more nuclear power in the long run, subject to Government policy, the decision on fuel mix and technical feasibility. Nevertheless, due to technical constraints, 80% of the electricity output of Daya Bay Nuclear Power Station was the maximum average amount of nuclear power which could be imported in a year for the time being. HEC expressed reservation in importing nuclear power from the Mainland due to technical and economic considerations.

18. Members were concerned if the power companies had compared the fuel prices from different sources and assessed whether the resultant tariff would be affordable to the general public. While CLP said it had always endeavoured to look for cheaper fuels that would meet the emission standards, HEC said it had been working hard to find new source of gas supply to face the global challenge on fuel cost fluctuation. It added that the fuel costs might be very different depending on the timing of signing the contract.

Liberalization of the electricity market in Hong Kong

19. Members were concerned about Government's actions and views in encouraging competition in Hong Kong's electricity market. Issues on segregation of electricity generation from the power grid, providing access to power grids and liberalization of the electricity market were discussed. The Administration advised that it maintained an open mind to the segregation of electricity generation from the power grid.

Administration's gate-keeping role

20. Given the annual permitted RoR of the power companies, i.e. 9.99% on the average net fixed assets, was related to their investments on capital projects, there was a view that the Administration should play an important gate-keeping role to screen out unnecessary expenditure items. Members expressed concerns that the high reserve margin would increase investments on generation facilities and push up the tariff, and asked if HEC would defer the plan to construct a new gas-fired unit in view of the worsening economic

environment. In response, the Administration advised that it had exercised due care in reviewing the capital projects proposed by the power companies in their five-year development plans. In fact, some of the capital projects in HEC's 2014-2018 Development Plan were not accepted by the Government, i.e. it had only approved the proposed L10 to replenish the generation capacity and bring down the reserve margin to about 20% to 30% but not the proposed gas-fired unit L11.

21. Concerns about CLP's over-estimation of fuel costs in past projections were expressed. Noting that the relevant estimations had been reviewed by the Government jointly with the energy consultant it engaged, a member was worried that the Administration could not perform its gate-keeping role properly and failed to take into account the significant drop of international oil price, leaving the customers unprotected. While the Administration remarked that international fuel prices were highly volatile, CLP advised that its projections on fuel prices were always made in a prudent manner.

Tariff Stabilization Fund

22. Members raised concern about the balance of the TSF accounts of the two power companies, and doubted if the increase of operating expenses of CLP was due to improper cost control noting that CLP's TSF balance was used to offset the significant increase in the company's operating expenses. It was concerned that if such increase would be passed on to customers when monies in TSF were fully exhausted.

23. Emphasizing that it always strived to control the operating expenses and keep them at a low level, CLP reiterated that its tariff increase in 2015 was due to the use of about a double of natural gas from WEPII to meet the significantly tighter emission caps.

Other issues

24. A member expressed concern that households living in cubicles and subdivided flats without independent electricity meters could not benefit from the frozen tariff and enquired whether the power companies would devise measures to help these people. In response, HEC said that it was willing to look into ways to help these households, and would take into consideration the safety concern on the usage of electricity in premises which might not meet the Administration's safety standard.

Council questions

25. At the Council meetings on 17 October 2012, 23 January, 19 June, 23 October, 27 November, 11 December 2013, 9 April and 11 June 2014, 3 and 24 June 2015, Dr Hon Kenneth CHAN, Hon TANG Ka-piu, Hon CHAN Hak-kan, Hon Cyd HO, Hon Kenneth LEUNG and Hon James TIEN raised questions about the electricity market covering, among others, measures to reduce electricity tariff, subsidies of the Government, the use of solar energy, opening of the power grid, the future fuel mix in electricity generation, the impacts on basic tariffs of lowering the permitted profit rate and Government's policy on introducing competition to the electricity market.

Latest developments

26. CLP announced in July 2015 that all CLP customers would receive a special fuel rebate of 8 cents per unit based on their electricity consumption between January and June 2015 subsequent to a drop in fuel prices in recent months. The total amount of rebate would approximately be \$1.2 billion.

27. The Administration briefed the Panel on the views received during the 2015 Consultation at the meeting on 23 November 2015. In response to concern about increased interconnection between the two power companies raised at the meeting, a list of Administration's papers on the subject issued for previous meetings of the Panel is prepared for members' reference at **Appendix I**.

28. The Administration and the two power companies will brief the Panel on the tariff reviews for 2016 at the meeting on 15 December 2015.

References

29. A list of the relevant papers which are available on the LegCo Website (<http://www.legco.gov.hk>) is at **Appendix II**.

Panel on Economic Development
Administration's papers related to interconnection between the two power companies

	Meeting Date	Title of Paper	Details
1.	10 Dec 2002	<p>"(I) Post 2008 Regulatory Regime for the Electricity Supply Sector (II) Technical Study on Increasing Interconnection between the Two Power Companies" (LC Paper No. CB(1)478/02-03(04)) issued by Economic Development and Labour Bureau</p>	<p><u>Paragraphs 10 to 16</u></p> <p>"(II) TECHNICAL STUDY ON INCREASING INTERCONNECTION BETWEEN THE TWO POWER COMPANIES</p> <p>INTRODUCTION</p> <p>10. A consultancy study completed in 1999 concluded that, prima facie, there could be overall economic benefits to be gained if additional interconnection was installed between CLP Power and HEC.</p> <p>Subsequently, EMSD commissioned Consultants to undertake a technical feasibility study to identify issues involved in increasing interconnection between the two power companies.</p> <p>THE STUDY</p> <p>Scope</p> <p>11. Briefly, the main purpose of the Study is to determine the preferred size of new interconnection and undertake a technical assessment by analyzing the power transfer capacity achievable for different sizes of interconnection, having regard to any constraints in the existing transmission system and the projected power flow in the transmission network.</p> <p>12. An overall assessment of the impact of increased interconnection on the power system, (such as changes in load flow pattern and system stability); essential enhancement of the power system; and implications for generation and transmission planning criteria are included. Possible locations for a technically feasible cable route corridor between suitable connection points of CLP Power, in Kowloon, and HEC, in Hong Kong, are also examined together with an estimated time-frame for the project.</p>

			<p>Progress</p> <p>13. To date, the Consultants have prepared a final draft report and EMSD is completing a detailed evaluation of the technical content. An essential task is to verify data provided by the two power companies upon which the Consultants based their engineering assumptions and projections. It is anticipated that this process should be concluded early next year when technical findings should be finalized.</p> <p>WAY FORWARD</p> <p>14. The Study examines the technical feasibility of increasing interconnection and the interface between existing supply systems operated by the two power companies. However, increasing interconnection has wider implications, other than technical issues, which must also be addressed before taking forward any proposal.</p> <p>15. Moreover, the power systems are the private property of the two power companies, increased interconnection could therefore only be introduced with the agreement of the companies. Furthermore, legal arrangements for funding interconnection and possible tariff implications will require careful analysis. Similarly the question of liability, in the event of interruption to interconnected supplies in future, will also need to be addressed.</p> <p>16. In summary, increased interconnection between the two power companies entail a number of complex issues which need to be addressed."</p>
2.	28 Jul 2003	<p><u>"Technical Study on Increasing Power Interconnection in Hong Kong: Consultancy Findings" (LC Paper No. CB(1)2253/02-03(01)) issued by Electrical and Mechanical Services Department</u></p>	<p>Please refer to Annex I for LC Paper No. CB(1)2253/02-03(01).</p>
3.	28 Feb 2005	<p><u>"Future Development of the Electricity Market in Hong Kong Stage I Consultation" (LC Paper No. CB(1)829/04-05(01)) issued</u></p>	<p>Please refer to Annex II for extract of LC Paper No. CB(1)829/04-05(01).</p>

		by Economic Development and Labour Bureau	
4.	27 Jun 2005	"Future Development of the Electricity Market in Hong Kong: Views received during the Stage I Public Consultation" (LC Paper No. CB(1)1855/04-05(05)) issued by Economic Development and Labour Bureau	<p><u>Paragraph 6</u></p> <p>"D. Increased Interconnection</p> <p>Most of the views received did not support increased interconnection, out of concerns that it might affect supply reliability and increase tariffs.</p> <p>Others opined that increased interconnection would enable more efficient use of the power companies' resources, increase market competition and facilitate customer choice of suppliers."</p>
5.	30 Dec 2005	"Future Development of the Electricity Market in Hong Kong (Stage II Consultation)" (LC Paper No. CB(1)626/05-06(01)) issued by Economic Development and Labour Bureau	<p><u>Paragraph 6(d)</u></p> <p>"... (vi) requesting the two power companies to jointly take forward and plan for increased interconnection at an "optimum" level, to reap the benefits of reserve capacity sharing and coordinated generation planning, and to provide flexibility to take forward emission reduction projects which necessitate temporary outage of certain generation facilities ..."</p>
6.	29 May 2006	"Future Development of the Electricity Market in Hong Kong: Views received during the Stage II Public Consultation" (LC Paper No. CB(1)1567/05-06(01)) issued by Economic Development and Labour Bureau	<p><u>Paragraph 5</u></p> <p><u>"C. Increased Interconnection</u></p> <ul style="list-style-type: none"> ■ Not many individual citizens and companies have offered comments on the subject and their views are quite divided. Some support Government's proposal of increased interconnection while others have reservations or do not support increased interconnection out of concern of the impact on supply reliability and tariff increase. ■ While a number of political groups indicate support for increased interconnection between the two power companies, views of the other stakeholder groups which have offered comments on the subject are divided.

			<ul style="list-style-type: none"> One of the power companies is of the view that there is no economic benefit in increased interconnection." 						
7.	30 Jun 2006	"Future Development of the Electricity Market in Hong Kong Arrangements to Cater for New Supply Sources" (LC Paper No. CB(1)1856/05-06(03)) issued by Economic Development and Labour Bureau	<p><u>Paragraph 9</u></p> <p>"... Government will pursue enhancing the interconnection between the two incumbent power companies, including requiring them to plan for increased interconnection, taking into account the results of the detailed engineering assessments of their existing interconnector."</p>						
8.	7 Jan 2008	"New Scheme of Control Agreements With the Two Power Companies" (LC Paper No. CB(1)546/07-08(01)) issued by Environment Bureau	<p><u>Annex</u></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;"><u>Existing SCA Arrangements</u></th> <th style="text-align: center;"><u>Terms Agreed with CLP and HEC</u></th> </tr> </thead> <tbody> <tr> <td colspan="2" style="text-align: center;">7. Interconnection</td> </tr> <tr> <td style="vertical-align: top;"> <ul style="list-style-type: none"> no provision requesting power companies on interconnection </td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> power companies be required to cooperate with Government and render all reasonable assistance, etc. in taking forward a study to be carried out by Government on increased interconnection at an optimum level planning criteria and reliability standards for the interconnected grid will also be reviewed and harmonised </td> </tr> </tbody> </table>	<u>Existing SCA Arrangements</u>	<u>Terms Agreed with CLP and HEC</u>	7. Interconnection		<ul style="list-style-type: none"> no provision requesting power companies on interconnection 	<ul style="list-style-type: none"> power companies be required to cooperate with Government and render all reasonable assistance, etc. in taking forward a study to be carried out by Government on increased interconnection at an optimum level planning criteria and reliability standards for the interconnected grid will also be reviewed and harmonised
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9.	27 May 2015	"Public Consultation on the Future Development of the Electricity Market" (LC Paper No. CB(4)727/14-15(01)) issued by Environment Bureau	<p><u>Annex</u></p> <p><i>"Competition between the two existing power companies</i></p> <p>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</p>						

			<p>the basis that competition between them would allow consumers to choose their own suppliers and narrow the tariff differential between CLP and HKE.</p> <p>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 shortterm 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.</p> <p>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.</p> <p>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."</p>
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For discussion
on 28 July 2003

LEGISLATIVE COUNCIL PANEL ON ECONOMIC SERVICES

TECHNICAL STUDY ON INCREASING POWER INTERCONNECTION IN HONG KONG : CONSULTANCY FINDINGS

INTRODUCTION

This paper outlines the main findings of the technical feasibility study on increasing interconnection between the two power companies commissioned by the Electrical and Mechanical Services Department (EMSD).

BACKGROUND

2. An earlier consultancy study completed in 1999 concluded that, prima facie, there could be overall economic benefits if additional interconnection was installed between CLP Power Hong Kong Ltd. (CLPP) and Hongkong Electric Company Ltd. (HEC). To pursue further the subject, EMSD commissioned a Consultant, Mott Connell Ltd., to undertake a technical feasibility study to identify the issues involved in having additional interconnection between the two power companies.

3. The scope of the Technical study is as follows:

- (a) Assessment of the preferred size and configuration of a proposed new interconnection;
- (b) Study the feasibility and engineering aspects of the route for a proposed new interconnection;
- (c) Study the capability of the two power systems in accommodating a proposed additional interconnection, and their need for reinforcement;

- (d) Study some proposed planning criteria for the expansion of generation capacity, taking into account a proposed new interconnection; and
- (e) Study some proposed planning criteria for expansion of the transmission systems, taking into account a proposed new interconnection.

Items (a) and (c) are closely interrelated and form the main part of the Technical Study.

4. A copy of Technical Study Report is lodged with the Legislative Council Secretariat for reference by Members. To facilitate Members' consideration of the matter, a copy of the Executive Summary is attached at the **Annex** to this paper.

MAIN FINDINGS

Preferred Size of a proposed new interconnection, a feasible route and its related engineering aspect, project timing and cost estimate

5. In considering the preferred size of a proposed new interconnection, the Consultant has taken into account a number of interrelated factors such as the optimum connection point of the proposed new interconnector with each of the two power systems, the power flow and system constraints of the two existing power systems, the future load growth of the two power systems etc. The main findings are as follows:

- (i) two new interconnectors (500MW/275kV) connecting the Yau Ma Tei Substation in the CLPP network and a new Wan Chai Substation in the HEC network, as identified in the previous study, was a correct choice if there were no adjustment to any of the network reinforcement, projected to be necessary in the Technical Study, for meeting natural load growth of the two respective systems;
- (ii) taking a study period up to 2020, it is anticipated that there would be an increase in power transfer between the power systems, in particular if higher levels of generation coordination are implemented, or the electricity supply market becomes more open. The Consultant recommended that the two new

interconnectors should be rated at 700MW and operated at 400kV, with a new 400kV/275kV transformer building to be built on an identified site in Wan Chai, to take advantage of increased transfer capability that could be made possible by certain rescheduling and adjustment of the projected network reinforcements;

- (iii) the route of the proposed new interconnectors is recommended to be from Yau Ma Tei Substation, through the West Kowloon Reclamation, then across the Harbour under the seabed, and landing in the Central-Wan Chai reclamation area. They will then go into the new transformer building and along the Harbour Road to the new Wan Chai Substation in the designated location. The Consultant has consulted the relevant departments, and based on their feedback, concluded that the engineering issues raised by the interested parties would be solvable;
- (iv) the Consultant estimated that the overall time scale of the project is around 60 months, with 12 months on project planning, 24 months on design and tender, and 24 months on site work;
- (v) the earliest commencement date for the site work could be tied in with the Central-Wan Chai Reclamation project; and
- (vi) the overall cost estimate at 2002 price level for the two recommended 700MW interconnectors together with the associated transformers and switchgears would be around \$1.6b.

Capabilities of the power systems in accommodating a proposed additional interconnection and the need for reinforcement

6. Using the recommendation of two 700MW new interconnectors and those network reinforcements required to cater for natural load growth as a base case, the Consultant has developed four further options to test which one would be the best to suit the situations in 2010, 2015 and 2020. The findings are:

- (i) the recommended option is to use the two new 700MW/ 400kV interconnectors, keeping the three existing interconnectors open circuited and only to be used as emergency standby, and advancing a number of reinforcements in the CLPP network and

the HEC network. The resultant configuration would enable the greatest degree of bilateral transfer of power in the most cost-effective manner between HEC and CLPP over the period up to 2020; and

- (ii) the net increase in cost over the base case for advancing the network reinforcements works at 2002 price level would be around \$0.5b.

Planning criteria for expansion of generation capacity, taking into account a proposed new interconnection

7. With regard to the study on the planning criteria for expansion of generation capacity under the current situation and under the situation with the proposed new interconnector, the Consultant has made the following observations:

- (i) the current primary planning criteria for generation planning of the two power companies have already taken into account the emergency support provided by the existing interconnector. There is already a limited degree of coordinated planning between the two power companies. The secondary criteria of the two power companies are still based on their individual operational contingencies whilst taking into account the sharing of spinning reserve made possible by the existing interconnector;
- (ii) taking into account the support of the interconnector between CLPP and HEC, and also taking into account the additional support to CLPP through its existing interconnections with the power system in South China, the Consultant concluded that, according to their respective primary planning criteria, the loss of load probability in both the CLPP network and the HEC network is on par with international best practice;
- (iii) with increased interconnection and more coordinated planning, the different planning criteria of the two power companies could be harmonized, resulting in some benefits arising from increased sharing of reserves; and

- (iv) joint planning and joint dispatch would technically give greater benefits than coordinated planning. However, this would involve changes in the current structure of the electricity supply sector.

Planning criteria for expansion of the transmission systems, taking into account a proposed new interconnection.

8. With regard to the study on the planning criteria of the transmission systems in the two power companies, the Consultant made the following observations:

- (i) the present transmission planning criteria adopted by the two power companies are only adequate for the present level of interconnection via the three existing interconnectors;
- (ii) with the proposed increase in interconnection, the criteria for transmission planning need to be reviewed, harmonized, and over time changed to encourage the two power companies to plan their transmission network with improved coordination; and
- (iii) if different power systems are strongly interconnected, but not in common ownership nor in common operation, it would be necessary for some rules and regulations such as a Grid Code to be established.

9. In the course of managing the Technical study, EMSD held eleven steering group meetings to give guidance to the Consultant and monitor their progress. A number of working group meetings were also conducted throughout the Technical Study to examine details of particular areas and the findings. The Consultant's approach, assumptions, and interim assessment results were thoroughly examined to ensure that all technical issues were properly addressed.

USE OF THIS TECHNICAL STUDY

10. The Technical Study proposes a technically feasible size and route for increasing interconnection between the two power companies with estimated costs and other relevant engineering issues.

11. As was intended, the Technical Study examined only one of the many inter-related issues involved in considering increasing interconnection of the power systems in Hong Kong. Increasing interconnection has implications which go beyond the technical aspects, these include legal, business, investment, financial, liability and regulatory issues, which must also be addressed as a whole. There is also a need to monitor closely the rapidly changing situation in the Mainland power sector and to update the findings of the Technical Study as they relate to the Guangdong electricity market in the light of more recent developments.

12. We have briefed the Energy Advisory Committee on the Technical Study findings. The Committee noted the findings of the Technical Study and agreed that this is one of the building blocks in the post-2008 electricity market review. The Committee agreed that findings of this Technical Study and other relevant issues mentioned above should be considered in their totality, and noted the need to continue to monitor development in the Mainland power sector.

13. Given the complexity and the range of issues involved, the Government will consider the findings of the Technical Study together with other related issues in the post-2008 electricity market review. We will consult all relevant stakeholders on the way forward with regard to this market review.

ADVICE SOUGHT

14. Members are invited to give their views on the findings of the Technical Study.

Electrical and Mechanical Services Department
July 2003

Agreement No. CE44/2000
Investigation Study of
Increasing Power Interconnections in Hong Kong
Executive Summary of Final Report

1. Overview

1.1 Background and Objective of the Study

1.1.1 In February 2001, Mott Connell Limited (MCL) was appointed by EMSD to carry out an investigation study of increasing power interconnections in Hong Kong (the Study). The Study followed from an earlier feasibility analysis which considered that increased interconnection capacity was technically feasible, although there might be some logistical and timing constraints which needed to be studied further. The objective of this Study was to examine the technical aspects of the interconnector operating as part of the overall CLP Power/HEC's transmission system. A feasible route for the new interconnector¹ was also provided with due consideration of the likely physical planning and construction issues. An overall cost estimate and a probable project time frame were also evaluated. Furthermore the most effective planning mode was recommended.

1.2 Study Methodology and Approach

1.2.1 The various strands of the study were interrelated, and so they were carried out in parallel as the work progressed. The key tool used to assess the electrical impact of the proposed new interconnector was a model of the power system of Hong Kong that had to be constructed based on information supplied by the power companies. This, together with information gathered on the future generation and loads expected on the Hong Kong and Southern China systems was used to arrive at the optimum rating of the interconnector and to assess what reinforcements on the Hong Kong system were likely to be necessary to best accommodate it. The preferred route for the interconnector was identified to enable potential physical planning considerations to be highlighted and to allow costing to be carried out.

1.2.2 Following this, the transmission and generation planning assessment was carried out, drawing from the consultant's experience throughout the world. This assessment covered both the existing planning and possible future planning scenarios with the new interconnector in place.

2. Increasing Power Interconnection

2.1 The Hong Kong Power Market

2.1.1 The electricity supply and demand situation was studied to test the extent to which there was likely to be a need for increased interconnection in Hong Kong in the future. This study was conducted based on projected load growths, and available and planned generation capacity in the HEC's and CLP Power's supply areas. It led to the conclusions that new sources of power above that already envisaged by the power companies would be required to supply Hong Kong soon after 2010, but this could possibly be deferred if an adequately sized interconnector was installed with enhanced coordination of generation planning and utilisation between the two power companies. Furthermore, if suitable arrangements were made to utilise the possibility of spare capacity available in Guangdong in the longer term and the improving transmission network therein, there could be additional moderating effect on the need to install new generating units within Hong Kong. This would depend on the power supply and demand situation in Guangdong and on suitable trading and regulatory arrangements required to enable this to take place.

¹ Interconnector is a transmission line or cable or a set of transmission lines or cables between two power utilities.

2.2 The Existing and the Proposed Systems and Interconnectors

- 2.2.1 Following a review of the existing systems, including the existing interconnection arrangement and its usage, the study then provides a detailed assessment of what the new interconnector rating should be and what reinforcement in the two transmission systems would be required to utilise the new interconnector. These two issues are heavily interdependent since reinforcement of the transmission systems would be required to utilise the new interconnector and with the addition of standard sized transmission circuits as reinforcement, it might be possible to use an interconnector with higher rating.
- 2.2.2 A software model was constructed of the interconnected HEC/CLP Power system and was used to look at how the interconnector and the other main elements of the transmission systems might perform in 2010, 2015 and 2020. The two power companies have, of course, plans in place to reinforce each of the two systems towards 2010 as their respective loads grow. But to provide a baseline for comparison up to 2020, the reinforcements required to cater solely for load growth beyond then had to be projected by extrapolating the forecast data included by HEC and CLP Power in their plans. This baseline was then used as a comparison to gauge the impact of the new interconnector.
- 2.2.3 The analysis, using the above-mentioned model, showed that operating both the existing 132 kV interconnector and the proposed new interconnector together would adversely affect the transfer capability of the new interconnector. This is due to the configuration of the two networks, as the power is not shared between the two sets of interconnectors in proportion to their ratings. Also, by examining how much each power system could deliver to the other through the new interconnector, the model was used to reveal where the transmission systems would have to be reinforced, ahead of the schedule for the baseline system development, to remove constraints on the transfer of power across the new interconnector. The financial impact of this advanced/rescheduled reinforcement was then estimated. Additionally, other aspects related to the network performance as a result of the implementation of the new interconnector were assessed and it is predicted that a more stable power system will result with the establishment of the new interconnector.
- 2.2.4 An iterative procedure was used to arrive at the most appropriate rating of the interconnection combined with the most appropriate level of additional reinforcement that the two systems would need from 2010 to 2020. Various electrical configurations were examined and a plausible one emerged from the studies.
- 2.2.5 To take advantage of the new interconnector and allow bilateral trading between HEC and CLP Power (and possibly with Guangdong) there are a number of reinforcements, particularly on the HEC system, that have to be advanced from the time that they would be required if there were no new interconnector. The modelling also highlighted that the optimum way of eliminating the problem of unbalanced power flow sharing between the old and the proposed new interconnectors is to disconnect the existing interconnector, which can be kept for emergency purposes. In any case, the existing interconnectors may be reaching the end of service life by around 2011 although condition monitoring tests will indicate if extended service life is feasible.

2.3 The Optimum Rating of the Proposed New Interconnection

- 2.3.1 To cater for an increase in power transfers between the two companies and given the current transmission constraints on this transfer (even when the system reinforcements are taken into account), an interconnector capable of supporting at least a 700MW firm capacity is recommended. The choice of size and number of circuits has taken into consideration the economy of scale of cable size and the possible requirement of adding another circuit along the proposed route in the future. Thus two interconnector circuits each of 700MW rating are recommended to allow for the possible outage of one. Although 700MW is the 'firm' capacity, during severe unexpected generation outages on either side short term power transfers of between 700MW and 1400MW would be possible and indeed desirable. Future expansion would be possible by the addition of a third 700MW circuit, giving a total 'firm' capacity of 1400MW.

2.3.2 Based on the possibility of increased transfer capability being available from reinforced CLP Power and HEC networks, it is apparent that higher rated circuits should be considered. To achieve a higher rating per cable circuit, while still maintaining a practicable cable size, requires the use of 400kV cables. The recommended configuration of the new interconnector is therefore two 400kV cable connections between the 400kV CLP Power Substation at Yau Ma Tei to HEC's proposed new 275kV substation at New Wan Chai. The 400kV/275kV transformers required to connect the two systems have to be sited on the Hong Kong Island side of the harbour with the use of 400kV submarine cables. The use of higher rated submarine cables would increase the transfer capacity of the interconnection between CLP Power and HEC. A possible site between the cable landing and the New Wan Chai substation has been proposed. Once the new interconnector is operational, the existing 132kV interconnectors should not be used except under emergency or backup conditions.

2.4 The Route for the Cross Harbour Interconnector

2.4.1 The plausible electrical configuration mentioned in 2.2.4 above requires that the submarine cable crossing the harbour for the new interconnector should operate at 400kV and the voltage be transformed down to 275kV on the Hong Kong Island side. On the Hong Kong side, the HEC system currently does not have any 275kV substation at the eastern part of Hong Kong Island, which makes it difficult to accommodate the new interconnector from Kowloon without substantial network reinforcement and re-engineering of the HEC system. The alternative connection point on the western side is also problematic due to longer route length. In order to keep network reinforcement requirements to a minimum level and to achieve greater flexibility in future system capability enhancement, HEC's 275kV New Wan Chai substation and CLP Power's 400kV Yau Ma Tei substation are considered the most plausible and preferred connection points for the new interconnector. To accommodate the new transformers, space has to be found on the Hong Kong Island side of the harbour for the transformer equipment. The study of the route for the new interconnector from the selected connecting points in Kowloon to Hong Kong Island showed that there were no major issues that would prevent such an installation, provided that land is made available for accommodation of the transformer installation in an appropriate area, on Hong Kong Island.

2.4.2 Both the land cable routes to the connection points in the CLP Power and HEC systems, on each side and the submarine cable crossing itself would be by conventional installation techniques, largely following existing highway routes in line with common practice in Hong Kong and elsewhere throughout the world. Appropriate planning and environmental procedures would need to be followed. This is particularly so for the sea crossing since the seabed in the harbour would be disturbed during cable installation. There are no major foreseeable problems associated with the cross-harbour installation works.

2.5 Costs and Timescales

2.5.1 The estimated cost to supply and install the proposed interconnector is around HK\$1.6 billion² at 2002 prices. The estimated cost³ of rescheduling the necessary reinforcements in the HEC and CLP Power systems to accommodate the interconnector is around HK\$0.5 billion. The overall estimated cost is around \$2.1 billion over the case with no increase in interconnection. From initiation to completion of the interconnector, including the required planning procedures, it is estimated that some 5 years would be required. Even if the planning procedures could be accelerated the reclaimed land in Wanchai that is required for the connection point into the HEC system will not be available before 2006/7. Therefore, the earliest possible completion of the new interconnector would be around 2008 taking into account a construction period of 2 years upon possession of site.

² Land cost is excluded. In any event, the land premium will be assessed on the basis of industrial use and would unlikely be substantial in the overall context.

³ This is the time value of money in advancing the reinforcement works that will be required in the HEC and CLP Power systems in any event in order to maintain security as load demand grows during future years.

3. Review of Power System Planning Criteria

3.1 Assessment Approach

3.1.1 The review of the planning criteria that are currently used and also those that could be used following the installation of the proposed new interconnector were carried out in two parts. Firstly the present and future generation planning criteria and practices were assessed. Secondly the present and future transmission planning criteria and practices were assessed. Following this the possibility and indeed desirability of coordinating generation and transmission planning was reviewed. Three planning modes were considered, namely 'Individual' planning, 'Co-ordinated' planning and 'Joint' planning. There is in fact a continuum between Individual and Joint planning depending on the extent of the co-ordination. Findings of the review and the consequent recommendations are described below.

3.2 Existing Power System Planning Criteria

3.2.1 The existing generation planning can be described as largely individual, although some level of co-ordination does take place between CLP Power and HEC in that generation that is kept ready for immediate use by one company (in case a generating set fails) is shared with the other company (through their shared spinning reserve agreement). This is good practice and means that the total amount of generation that has to be kept in this state of readiness is reduced, hence operating costs are reduced.

3.2.2 The way in which the level of co-ordination could be improved at present would be for the power companies to co-ordinate more with all the interconnected parties on the generation planning function. There is already some trading of power between CLP Power and Guangdong in addition to the current contract to take a portion of the output of Daya Bay nuclear power plant in Guangdong (which CLP Holdings in fact partly own through the Hong Kong Nuclear Investment Company Limited). Through closer co-ordinating of generation planning, further cost savings could be realised while ensuring that the planning margins are adequate for the interconnected systems, and bearing in mind the present limited interconnection between HEC and CLP Power. Differences in reliability criteria between the two would however limit the level of co-ordination to some extent.

3.2.3 The study reviewed the current primary generation planning criterion (i.e. Loss of Load Probability, LOLP) and assessed that the criteria adopted by the power companies are within the range of those adopted by developed countries around the world. The study also revealed that there is an inconsistency in the secondary criterion. In addition, the capacity reserve requirement offers scope for savings with co-ordinated or joint planning after the new interconnector is placed in service. For example, joint planning could provide the most effective means to reduce the overall generation capacity margin requirement.

3.2.4 When assessing the transmission system planning that is currently adopted by the power companies, it was found that the criteria used by HEC and CLP Power were broadly similar and reasonable.

3.2.5 The existing reliability of the transmission system is currently what would be expected from a system in a fully developed economy. There is presently little co-ordination of transmission planning between HEC and CLP Power. This is to be expected given the existing conditions of independence within their own region of supply and the current level of weak interconnection.

3.3 Future Power System Planning Criteria

3.3.1 In future, with the new interconnector in place, the degree of co-ordination could be improved and the costs to the two companies reduced. Methods of achieving this are proposed in the report, utilising essentially a common method of assessing system reliability between the two companies, and to some extent with the Guangdong system too. Additionally it is proposed to use joint planning to achieve further savings. Both HEC and CLP Power would benefit in terms of the reduced costs accruing from deferred capital expenditure on generating plant addition.

- 3.3.2 After the proposed new interconnector is installed and is in operation, the aim should be to maximise the benefits that are then obtainable. Thus generation and transmission will have to be planned and operated in such a way that the best use is made of the cheapest power sources, taking into account the limitations of the transmission network. Various ways of achieving this are discussed. They all essentially mean that the co-ordination between the interconnected parties has to be increased significantly and in addition there would have to be some form of regulation applied in the form of a Hong Kong 'grid code' which the two power companies will have to observe. (A 'grid code' is a set of rules that governs the co-ordination between the parties). Besides, the concept of appointing an independent Power Network Manager to facilitate the implementation of Grid Code and, the planning and management of the overall transmission network is introduced.
- 3.3.3 While the existing generation planning criteria of the two power companies appear to be adequate and within the range of those adopted by developed countries, there is room for enhancement such as criteria harmonization within Hong Kong SAR. It is desirable to establish a multi-area LOLP model to re-evaluate the LOLP criterion with an objective to assess the appropriate level of a harmonized criterion for use before and after the commissioning of the new interconnection. The reliability of the network would be maintained by the use of standard planning techniques and also an Asset Risk Management strategy. In addition, the secondary criterion can be reviewed and revised if necessary for a consistent secondary criterion of the two power companies,
- 3.3.4 A review of the transmission planning criteria indicated that the basic criteria currently adopted by the power companies, namely being able to meet maximum demand under a transmission contingency condition, are essentially the same. CLP Power, however, adopts additional criteria to avoid out of merit generation and restrictions on its generation output. It is recommended that the two utilities adopt a harmonised set of transmission planning criteria so as to enhance flexibility in the utilization of the overall generation resources within Hong Kong.

4. Summary of Findings

- New interconnection comprising two 400kV cables rated at 700 MW each is recommended to enhance the interconnection transfer capability between CLP Power and HEC.
- The interconnection points should be CLP Power's Yau Ma Tei substation and HEC's proposed New Wanchai substation. Given the constraint of the reclaimed land in Wanchai, completion of the new interconnector before 2008 is precluded.
- The proposed route for the new interconnection is achievable with existing technology and will, with the appropriate precautions, be environmentally acceptable.
- The overall cost of the interconnection is estimated at around HK\$2.1 billion over the case with no increase in interconnection at 2002 prices. It includes the cost to supply and install the proposed interconnector of around HK\$1.6 billion, and the additional cost of rescheduling the necessary system reinforcement of around HK\$0.5 billion.
- The new interconnector will enable enhanced sharing of reserve capacity and it will also improve Hong Kong's ability to exchange power with Guangdong in future.
- Some improvements in the way that the HEC and CLP Power systems are planned and regulated are proposed to make best use of the new interconnector's potential to improve the cost effectiveness of the electricity supplies to Hong Kong.

(d) there would be provision for a regulatory review period that typically ranges from three to five years, whereby any elements in the pricing or revenue formula might be adjusted.

3.27 The pros and cons of this approach include:

<i>Pros</i>	<i>Cons</i>
<ul style="list-style-type: none"> • Should bring tariff more in line with the economic situation. • Would provide drivers for efficiency improvement. • Regulatory review period should provide flexibility for introducing changes. 	<ul style="list-style-type: none"> • Could give rise to uncertainty that could increase business risks and discourage investment. • Would require more administrative oversight and higher cost. • Would require other measures to ensure that the objective of maintaining safe and reliable electricity supply would not be compromised.

* * * * *

(II) A Regime with New Features

3.28 We could also consider introducing new features such as the following, either individually or severally, to a regulatory regime. However, implementation of these features would be dependent on the market conditions and relevant infrastructure being in place.

(A) *Increased Interconnection*

3.29 The two power companies in Hong Kong have been interconnected since the early 1980's, primarily for mutual emergency support[△]. The transmission network of CLP Power is also interconnected with the Guangdong power system for transmitting contracted power purchase from the Guangdong Nuclear Power Station at Daya Bay and the Guangzhou Pumped Storage Power Station at Conghua to CLP Power, and for selling CLP Power's surplus electricity to Guangdong.

3.30 Two consultancy studies¹⁷ completed respectively in 1999 and 2003 concluded that, prima facie, there would be overall economic benefits in increasing the interconnection capability between HEC and CLP Power, and that this project is technically feasible.

3.31 The 2003 technical consultancy study recommended the laying of a new interconnector of two 400kV circuits, each of 700MW in capacity, connecting CLP Power's 400kV system with HEC's 275kV system through a new transformer station[△] to be built on the Hong Kong Island. Some five years would be required for the implementation of this project, and certain reinforcements in both power companies' networks would be required to make them compatible with the transfer capability of increased interconnection. The consultancy study focused mainly on the technical aspect of increasing interconnection for enhancing system efficiency (e.g. capacity reserve sharing), but not to the extent that would facilitate customers' unconstrained access¹⁸ to choose a supplier.

Operational Consideration

(i) Choice of Suppliers

3.32 There are suggestions that interconnection between HEC and CLP Power should be enhanced to provide the customers with a choice of obtaining electricity supply from either of the two existing power companies.

3.33 Conceptually, increasing the interconnection capability to this "full access" level is technically possible. Our assessment has shown that to provide this "full access" capability would be very costly and might not be economically viable. The reasons are:

¹⁷ ERM Study on "Interconnection and Competition in the Hong Kong Electricity Supply Sector", November 1999 and MCL Study on "Investigation Study of Increasing Power Interconnection in Hong Kong", June 2003.

¹⁸ It means that the relevant transmission circuit should have large enough capacity to handle the highest possible level of electricity supply required to meet the demand of all customers.

- firstly, in order to allow all customers in one service area to have full access to supply sources in the other service area, the interconnection as well as the networks of the two power systems would have to be much enhanced. There would also be significant environmental and space requirement issues associated with the network enhancement; and
- secondly, the two power companies would need to develop substantial additional generation capacity to cater for supplying customers in both service areas.

In short, a large amount of upfront cost would have to be borne by all consumers while the perceived benefits would be uncertain and long in coming. Moreover, there would be transmission charges levied by the 'local' power company for transferring electricity supply obtained from the power company in another service area.

3.34 Customer choice[△] is a means rather than an end in itself, and having a choice of suppliers is not necessarily the only means to achieving the objective of providing a reliable electricity supply at reasonable prices. Lessons from other economies have indicated that introducing more players into the electricity market to provide customer choice is not without risks, and lower supply reliability and price fluctuations could be the outcome.

3.35 If customer choice were to be pursued in Hong Kong in the long run, a key prerequisite, among others, is having more (number of) alternative electricity suppliers. This issue is further explored under the options for new supply sources (see paragraphs 3.44 to 3.58).

(ii) Enhancing System Efficiency

3.36 While increasing interconnection within limits between the two power companies by itself might not enable customer choice and would not displace the need for new generation capacity to meet increased demand, it could help optimise installed generation capacity and improve overall system efficiency. Generally speaking, the pros and cons of increased interconnection are:

<i>Pros</i>	<i>Cons</i>
<ul style="list-style-type: none"> • Could facilitate increased reserve capacity[△] sharing, which may result in deferring generation addition, and hence avoid/defer tariff increase. • Could support future market development where desired. • Could serve as a replacement for the existing interconnector when it reaches the end of its useful life¹⁹. 	<ul style="list-style-type: none"> • Would need significant upfront costs²⁰ that will have to be borne by the consumers through the tariff, while the associated benefits would likely take some years to realise. • Would not in itself provide customer choice and would not displace the need for new generation capacity to meet growth in demand.

3.37 Whether or not increased interconnection should be pursued would to a great extent depend on the net economic benefit it could provide. While some of the potential economic benefits might be estimated in broad terms, others are difficult to quantify as they would be affected by many parameters, such as the amount and cost differential in economy power exchange[△], the level of reserve capacity sharing[△]. Moreover, to obtain the full benefit of increased interconnection, other options, such as optimising system resources, would need to be considered.

(iii) Optimising System Resources

3.38 At present, the two power companies in Hong Kong prepare separately their own demand forecasts and power system development plans, using their own planning criteria[△], to ensure the timely provision of adequate electricity supply infrastructure to meet demand growth. This planning process ensures adequacy of the individual systems, but does not lend itself to optimising the overall system's planned and available resources.

¹⁹ The useful life of 30 years for cables as specified in the SCAs is assumed for the existing interconnector. However, its actual life span would depend on detailed engineering assessments to be conducted by the power companies.

²⁰ According to the estimate of the consultants, the overall cost of the new interconnector would be in the order of HK\$2.1 billion at 2002 price, which includes the cost of the proposed interconnector at around HK\$1.6 billion and the costs of rescheduling the necessary network reinforcements in the two power systems at around HK\$0.5 billion.

3.39 To optimise the use of planned and available resources in the two systems, an alternative would be to increase coordination between the two power companies or to have central planning in developing the overall system plans. This would mean demand forecasting and system planning functions being undertaken either jointly by the two power companies or by a central agency, having regard to possible resource (e.g. generation capacity) sharing through the increased interconnection.

3.40 Nevertheless, increasing coordination in planning would entail additional resources for the two power companies or the central planning agency (should that be established), and more administrative interfaces between the two power companies. Moreover, issues including liability for demand forecast and planning decision would need to be addressed.

Implementation

(i) Ownership and Operation of the New Interconnector

3.41 HEC and CLP Power are the owners and operators of the existing electricity supply networks to which the new interconnector would need to be linked up and in which associated network reinforcements[△] would be required to cope with increased power transfer across the new interconnector. Funding and operation of the new interconnector could be undertaken either:

- (a) jointly by the two power companies, e.g. in the case of the existing interconnector; or
- (b) by a third party.

3.42 The pros and cons of the two approaches include:

<i>Option</i>	<i>Pros</i>	<i>Cons</i>
(a) Funded/ Operated Jointly by the Two Power Companies	<ul style="list-style-type: none"> • Would be a system addition hence operation could follow the arrangement for the existing interconnection. • Would simplify the technical and operational interface. 	<ul style="list-style-type: none"> • Would deprive others the opportunity to participate in electricity supply infrastructure development.
(b) Funded/ Operated By a Third Party	<ul style="list-style-type: none"> • Would provide opportunity to introduce additional market player. 	<ul style="list-style-type: none"> • Would involve complex technical, cost, legal, liability and interface issues.

(ii) Reliability Considerations

3.43 Experience in overseas electricity markets has illustrated that the economic benefits and interchangeability of electricity from strong interconnection between power systems have to take into account the importance of effective coordination in operation and planning of interconnected systems as well as effective monitoring to guard against adverse impacts of operational and system disturbances, to ensure reliability performance, as illustrated in major blackouts in North America and Europe in 2003.

* * * * *

(B) New Supply Sources

3.44 As discussed above, existence of alternative electricity suppliers supplying from either local sources or facilities across the border is the key to enabling consumers to have a choice of suppliers.

(i) Supply from Mainland China

3.45 Importing electricity from the Mainland to meet part of the demand in Hong Kong could relieve dependency of and reduce emissions from local power generation, and introduce new suppliers to the local

List of relevant papers

Issued by	Meeting date/ Issue date	Paper
Panel on Economic Development	11 December 2012	Agenda Minutes Background brief Information from power companies on five-year development plans and annual tariff reviews elaboration on the notes on confidential information
	10 December 2013	Agenda Minutes Background brief Legislative Council Brief - 2014-18 Development plan and 2014 tariff review of the two power companies
	6 February 2014	Agenda Minutes Background brief Legislative Council Brief - 2014-18 Development plan and 2014 tariff review of the two power companies
	16 December 2014	Agenda Minutes Background Brief Presentation materials provided by The Hongkong Electric Company Ltd. Presentation materials provided by CLP Power Hong Kong Ltd.
	2 February 2015	Agenda Minutes
	23 November 2015	Agenda Administration's paper on future development of the electricity market

Issued by	Meeting date/ Issue date	Paper
Council Meeting	17 October 2012	<u>Written reply by the Secretary for the Environment to a question on "Measures to Facilitate Reduction in Electricity Tariffs" raised by the Dr Hon Kenneth CHAN Ka-lok</u>
	23 January 2013	<u>Written reply by the Secretary for the Environment to a question on "Electricity Expenditure of Government Departments and Public Organizations, Government's Subsidies on Electricity Expenditure for Specific Industries, and Electricity Tariffs" raised by the Hon TANG Ka-piu</u>
	23 October 2013	<u>Written reply by the Secretary for the Environment to a question on "Use of Solar Energy to Generate Electricity" raised by the Hon CHAN Hak-kan</u>
	11 December 2013	<u>Written reply by the Secretary for the Environment to a question on "Electricity Demand and Power Grid" raised by the Hon Cyd HO</u>
	9 April 2014	<u>Written reply by the Secretary for the Environment to a question on "Options on Future Fuel Mix for Electricity Generation" raised by the Hon Kenneth LEUNG</u>
	11 June 2014	<u>Written reply by the Secretary for the Environment to a question on "Future Fuel Mix for Electricity Generation" raised by the Hon Kenneth LEUNG</u>
	3 June 2015	<u>Written reply by the Secretary for the Environment to a question on "Electricity Tariffs" raised by Hon TANG Ka-piu</u>

Issued by	Meeting date/ Issue date	Paper
	24 June 2015	<u>Written reply by the Secretary for the Environment to a question on "Future Development of the Electricity Market" raised by Hon James TIEN</u>