CONSULTATION PAPER
ON
FUTURE DEVELOPMENT OF THE ELECTRICITY MARKET IN HONG KONG

STAGE I CONSULTATION

Economic Development and Labour Bureau
Government of the Hong Kong Special Administrative Region
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CONTENTS

FOREWORD

This Consultation Paper summarises the key findings of initial phase of the electricity market review conducted by the Government on options for the future development of Hong Kong's electricity market after 2008 when the Scheme of Control Agreements (SCAs) which the Government separately signed with the two local power companies expire. We invite your views or suggestions on the issues and options identified in this Consultation Paper and any related matters.

This is Stage I of a two-stage consultation process. The views obtained during this stage will be considered when we formulate proposals on the framework for the future development of the electricity market. We will further consult the public on the proposed framework at Stage II of the exercise.

This Consultation Paper consists of four chapters. Chapter 1 outlines the background to the review. Chapter 2 provides an overview of the existing electricity market structure and regulatory regime in Hong Kong. Chapter 3 explores issues and options for development of our future electricity market. Chapter 4 considers options for implementation, covering regulatory and institutional arrangements. Further details on the key subjects presented in this Paper are available on our web site at http://www.edlb.gov.hk/edb.

Please send us your views and comments ***on or before 30 April 2005***:

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All responses will be treated as public information unless otherwise specified.

CHAPTER 1

INTRODUCTION

Policy Objective

1.1 Reliable electricity supply is vital to the economic development of Hong Kong and the livelihood of its people. In this respect, Government's policy objective is to ensure that consumers receive reliable, safe and efficient electricity supply at reasonable prices while minimising environmental impact caused by the generation and use of electricity. This will continue to be our policy objective.

The Electricity Market Review

1.2 The current Scheme of Control Agreements (SCAs) between the Government and the two power companies will expire in 2008. The Government has conducted an electricity market review with a view to drawing up a broad framework for the future development of Hong Kong's electricity market after 2008. The review aims to evaluate and identify options for future development of the electricity market that will:

- ensure that reliable, safe and efficient electricity supply will continue to be delivered to consumers at reasonable prices;
- address major criticisms and perceived shortcomings of the current regulatory regime; and
- have regard to environmental concerns.

1.3 The review encompasses a wide range of complex, interrelated economic, technical and regulatory issues, which have significant implications for the community, the existing market players, as well as potential new entrants to the market in future. Detailed studies undertaken during the review have drawn on a wide range of professional expertise and experience, including experience of other economies where electricity market reforms have been introduced or are underway, and the findings of consultancy studies commissioned by the Electrical and Mechanical Services Department (EMSD) on increasing interconnection

between the two local power companies. The Energy Advisory Committee (EnAC) has been consulted throughout the review.

1.4 This document summarises the key issues emanating from the initial phase of the review, and considers:

- how the existing regime might be improved and what new features might be introduced?
- whether the future regulatory arrangement should be based on bilateral agreements or a regulatory framework backed by legislation? and
- whether the Government should remain the regulator or an independent regulatory authority should be set up?

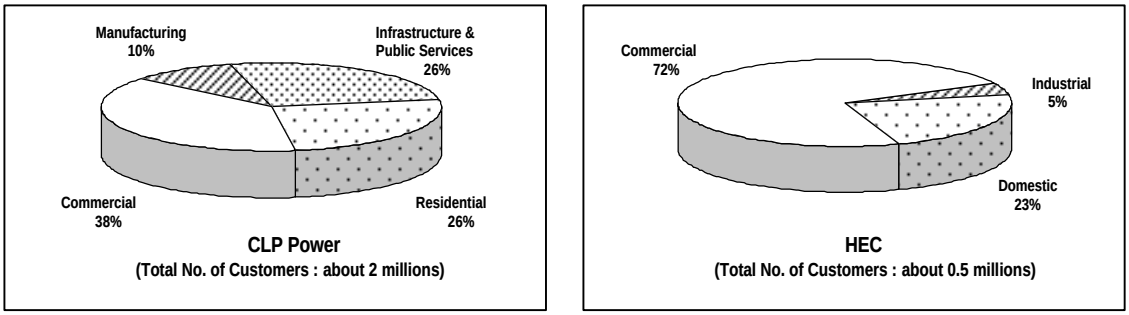
CHAPTER 2

THE EXISTING ELECTRICITY MARKET

Market Structure in Hong Kong

2.1 Electricity supply in Hong Kong has all along been provided by the private sector. The Hongkong Electric Company Ltd. (HEC)[1] supplies electricity to customers on the Hong Kong Island, Ap Lei Chau and Lamma Island, while CLP Power Hong Kong Ltd. (CLP Power) and Castle Peak Power Company Ltd. (CAPCO)[2] jointly supply customers in Kowloon, the New Territories and some outlying islands. Both power companies are investor-owned and vertically integrated, i.e. they own and operate the entire electricity supply chain, including generation plants, transmission and distribution networks, and supply directly to customers within their respective service areas. Figure 2.1 shows the electricity consumption in 2003.

Figure 2.1 – Electricity Consumption (by customer type) in 2003[3]



2.2 At present, local electricity demand is largely supplied by generation plants built in Hong Kong (except nuclear and pumped storage generation) by the two power companies, whose installed and committed capacities are summarised in the table below. Figure 2.2 shows the generation fuel mix of the installed capacities.

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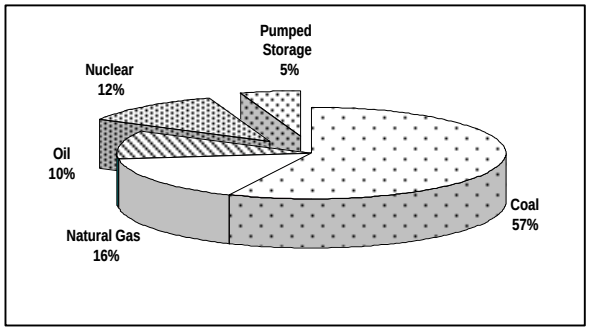
1 HEC is a subsidiary of the Hongkong Electric Holdings Limited.

2 CLP Power is a subsidiary of the CLP Holdings Limited. CAPCO is a joint venture generating company established between CLP Power and ExxonMobil. Where pertinent in this document, CLP Power would represent both companies.

3 Source: Annual reports of CLP Power and HEC.

Generation Capacity	*CLP Power*	*HEC*
Installed	8,263 MW[4]	3,420 MW
Under construction	625 MW	300 MW

Figure 2.2 – Present Generation Fuel Mix in Hong Kong[5]



The latest electricity demand forecast[6] indicates an annual growth rate of 2-3% over the next 10 years. The installed and committed generation capacities of the two power companies are expected to be able to meet local demand up to around the end of this decade. There is potential at the existing power plant sites for the two power companies to develop generation facilities to meet forecast demand well into the next decade.

Regulatory Arrangement

2.3 To protect consumers' interests, the Government regulates the safety, environmental and economic aspects of electricity supply:

- Safety and environmental regulations are enforced through legislative provisions under the relevant ordinances; and
- Economic regulation is exercised through the Scheme of Control Agreements (SCAs) signed between the Government and the individual power companies.

[4] Including CLP Power's generation in the Mainland, i.e. about 1380 MW from the Guangdong Nuclear Power Station in Daya Bay, and about 600 MW from the Guangzhou Pumped Storage Power Station in Conghua.

[5] Source: EDLB website.

[6] In tandem with a forecast 3.8% GDP growth rate per annum from 2004 to 2008 (2004-2005 budget speech) and a population growth rate of 0.8% per annum from 2003 to 2013 estimated by the Census and Statistics Department in June 2004.

The regulatory roles of different Government Bureaux/Departments are as follows:

Safety Regulation	*Environmental Regulation*	*Economic Regulation*
• The Economic Development and Labour Bureau (EDLB) oversees all policy issues relating to reliability, safety and efficiency of power generation, electricity supply and utilisation. • The Electrical and Mechanical Services Department (EMSD) enforces legislative provisions under the Electricity Ordinance.	• The Environment, Transport and Works Bureau (ETWB) oversees all environmental polices relating to power generation and electricity supply. • The Environmental Protection Department (EPD) enforces legislative provisions in the relevant Ordinances[7].	• EDLB oversees all policy issues relating to economic regulation[8]. • Economic regulation is based on the SCAs which the Government separately signed with the power companies.

The Scheme of Control Agreements

2.4 The Scheme of Control Agreements (SCAs) are not franchises and they do not provide exclusive rights to the power companies to supply electricity. Interested parties are at liberty to enter the electricity market. Nevertheless, new suppliers have yet to emerge due primarily to latent constraints in the electricity supply industry, such as intensive capital investment with long payback periods, the relatively small size of Hong Kong's electricity market, and the availability (or rather, the scarcity) of suitable land for infrastructure development.

2.5 The SCAs are 15-year bilateral agreements that set out the obligations and rights of the power companies, and provide a framework

[7] Including the Air Pollution Control Ordinance, Environmental Impact Assessment Ordinance, Noise Control Ordinance, Waste Disposal Ordinance and Water Pollution Control Ordinance.

[8] With technical support from EMSD and economic assistance from the Government Economist, EDLB conducts regular Financial Reviews, Tariff Reviews and Auditing Reviews jointly with the power companies in accordance with the SCAs.

for the Government to monitor the power companies' financial affairs and technical performance. Key features of the SCAs which contribute to achieving our policy objective of providing reliable, safe and efficient electricity supply at reasonable prices include:

- an obligation for the power companies to provide sufficient facilities to meet present and future electricity demand. For this obligation, the power companies are entitled to receive a 13.5% permitted rate of return on their fixed assets with an additional 1.5% for assets financed by shareholders' funds.

This has provided a stable environment and incentive for continued investments in supply facilities to meet growth in electricity demand. The power companies have made substantial, long-term investments to provide reliable and safe electricity supply that supported Hong Kong's economic development over the years. We enjoy a high level of supply reliability that currently exceeds 99.99%, which is among the highest in the world, when compared to that ranges between 99.95% and 99.99%[9] in some major cities such as San Francisco, London, Sydney, Seoul and Shanghai.

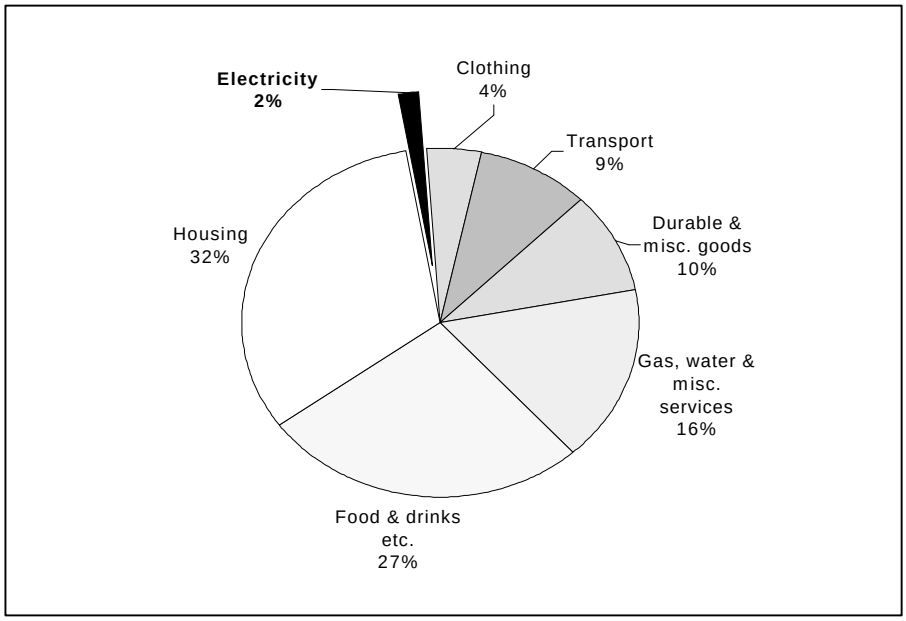
- an obligation for the power companies to supply electricity at lowest possible cost.

In general, the electricity bill accounts for less than 2% of the general household monthly expenditure (see Figure 2.3) for residential customers[10].

[9] Average Service Availability Index, expressed as a percentage of total customer–hour served to total customer–hour demanded, published by the power companies in different cities or calculated with reference to relevant data available from these companies.

[10] Source: 1999/2000 Household Expenditure Survey conducted by the Census and Statistics Department.

Figure 2.3 – Distribution of General Household Monthly Expenditure



Expenditure on electricity by non-residential customers, i.e. the commercial and industrial establishments and public organisations, varies significantly depending on the nature of their business, their size and their mode of operation. A recent survey[11] indicates that the electricity bill constitutes less than 10% of the monthly operating costs for the majority (77%) of the establishments and organisations surveyed.

- provision for periodic financial review and annual tariff review, and for annual audit of the technical and financial performances of the power companies.

This has enabled the Government to review the basis for the power companies' capital investments and for tariff adjustments, and monitor the power companies' actual performance to safeguard consumers' interest.

[11] Establishment Survey on Electricity Supply in Hong Kong conducted by EDLB in 2004.

2.6 The table below shows Hong Kong's residential electricity tariffs and those in other major cities[12].

Residential Tariff of Major Cities
(as at January 2005)

City	*Tariff range (HK$/kWh)*
Tokyo (Tepco)	1.41 – 1.73
London (London Energy)	1.17 – 1.68
San Francisco (PG&E)	0.89 – 1.41
Sydney (EnergyAustralia)	0.75 – 1.23
Hong Kong (HEC)	0.82 – 1.18
Brisbane (Energex)	0.75 – 1.15
Hong Kong (CLP Power)	0.85 – 0.99
Singapore (Singapore Power)	0.8
Taipei (Taipower)	0.51 – 0.65

Notes: Based on: (i) tariff rates of the respective companies as at January 2005, (ii) consumption of between 100kWh to 1500kWh per month, and (iii) exchange rates as at January 2005.

It is, however, very difficult to compare non-residential tariffs in the different cities because of the variety of tariff schemes offered by different power companies to different non-residential customer groups in the commercial, industrial and agricultural sectors, which in turn are affected by the policies and economic considerations, etc., of the countries or cities for each economic sector.

2.7 The SCA arrangement, a light-handed form of regulation, was first introduced in 1963 and has been the instrument for making available reliable and safe supply of electricity to consumers in Hong Kong for some 40 years. It is, however, not without drawbacks, and criticisms of the SCAs arise particularly with regard to those aspects that are less acceptable by the community during periods of economic downturn. For example:

[12] Electricity tariffs are affected by many local factors including, inter alia, market structure, generation and load mix, business ownership, land restriction, infrastructure development costs, fuel costs and dependency on external supply.

- the permitted rate of return of 13.5% on fixed assets and the additional 1.5% on assets financed by shareholders' funds are considered high in present-day economic climate;
- the permitted return, based on fixed assets, is perceived to have encouraged over-investment;
- the permitted rate of return fixed over a 15-year period lacks flexibility, as amendments to the SCAs cannot be made without consent of the parties involved; and
- the annual tariff and auditing reviews lack transparency.

CHAPTER 3

THE FUTURE ELECTRICITY MARKET

3.1 In addition to criticisms of the current SCAs, there are suggestions that our electricity market should encourage more competition; provide for third-party access to the power grid to give customers the choice of suppliers; and that alternative supply sources such as renewable energy and import from the Mainland should be pursued. The review has focused on these issues, and explored possible arrangements for future market development, bearing in mind the overarching objective of ensuring reliable and safe electricity supply at reasonable prices, with minimum impact on the environment.

3.2 Separately, we have also reviewed developments in other major economies, where electricity market reform has led to mixed outcomes. Our key observations are summarised below:

- The main drivers for market reform in other economies included privatisation of government-owned assets and improving supply reliability. These are not relevant in the Hong Kong context as electricity has always been supplied by the private sector, and supply has always been reliable and secure.
- There is no universal model for market reform as every market is unique. Local factors have to be taken into account, and reform experience of other markets can at best be used as a reference.
- Market reform is not a one-off exercise, but a continuous process necessitating adjustments to suit changing circumstances.
- The outcome of some of the market reforms points to the need for an evolutionary and progressive process in market development, and market readiness is the key to each process.
- Sufficient number of market participants is crucial for transforming a regulated regime to a market-driven regime to guard against price fluctuation arising from abuse of market power.

Prerequisites

3.3 Irrespective of the future market structure and regulatory regime, we should ensure that arrangements are in place to meet our policy objectives which are set out below:

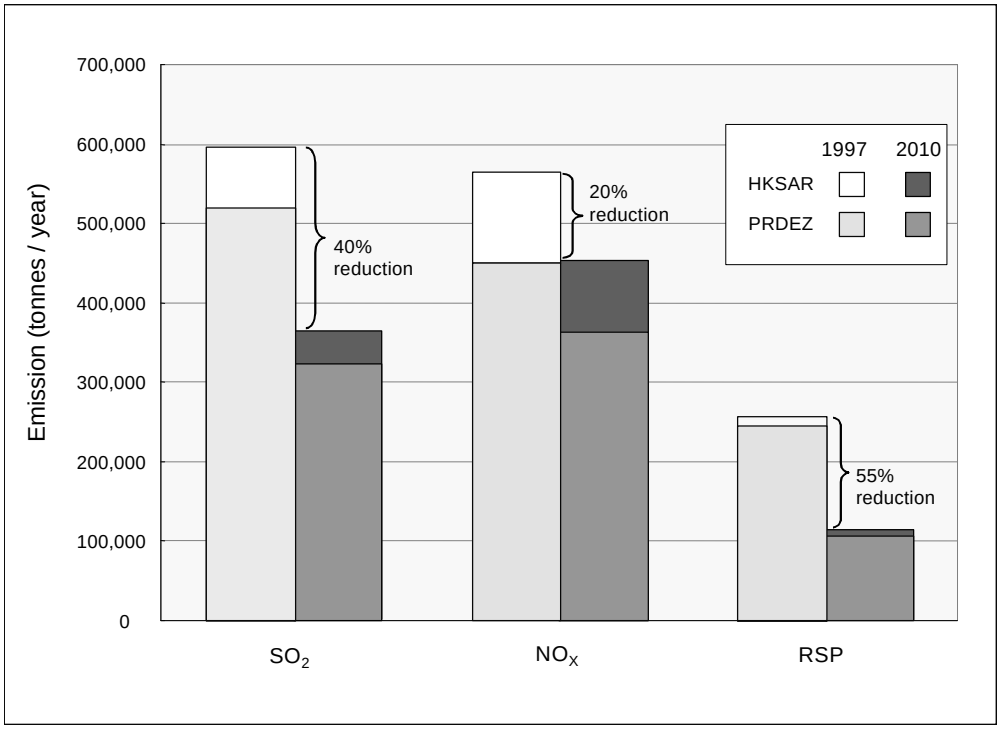
A. Ensuring Supply Safety

3.4 Ensuring safety in the supply and use of electricity is of paramount importance. We should not compromise on the existing high standards in these areas. At present, safety of electricity supply covering all aspects from registration of generating facilities to transmission, distribution and use of electricity is regulated under the Electricity Ordinance (Cap. 406) and enforced by EMSD. We intend to continue to subject all electricity supply facilities and practices to stringent legislative and administrative control on safety, and the regulatory regime to be adopted for the electricity market in future should also align with these safety standards.

B. Protecting the Environment

3.5 Minimising pollutant and greenhouse gas (GHG) emissions associated with the burning of fossil fuels is becoming an increasingly important factor in power generation. To improve regional air quality in the Pearl River Delta, the Hong Kong Government and the Guangdong Provincial Government are committed, on a best endeavour basis, to reducing the emissions of sulphur dioxide (SO_2), nitrogen oxides (NOx) and respirable suspended particulates (RSP) by 2010 (see Figure 3.1 below).

Figure 3.1 – Emissions Reduction Target of the Pearl River Delta[13]



Notes: PRDEZ refers to the Pearl River Delta Economic Zone, Mainland China

3.6 Reduction of emissions in power generation is important to Hong Kong's achieving the emission reduction targets. Following the extension of the United Nation Framework Convention on Climate Change and its Kyoto Protocol to HKSAR in May 2003, we also aim to reduce GHG emissions as far as practical. To achieve the required emission reduction targets, we will cap emissions from power generation in Hong Kong through specifying the maximum allowable emission quantities in future licences for power plants under the Air Pollution Control Ordinance.

3.7 While imposing emission caps through licences will be an effective means to reducing emissions from power generation, measures taken to achieve the emission reduction can lead to substantial costs. It is therefore necessary to explore means to optimise the costs involved, and we propose to work closely with the power companies to introduce measures and new technologies that aim at achieving emission reduction target, as well as ensuring sustainability, energy conservation and efficiency.

[13] Source: Final Report on the Study of Air Quality in the Pearl River Delta Region, April 2002.

C. Ensuring Supply Reliability and Reasonable Prices

3.8 We must have reliable supply in Hong Kong. Hong Kong is a densely populated city that relies on electricity for, among other things, vertical transportation within high-rise buildings and for moving people and goods on electrified massive transportation systems. Reliable electricity supply is also vital to the economic activities and financial and business operations in Hong Kong. Adequate and a reasonable level of investment in relevant infrastructure is crucial to maintaining this level of supply reliability. We should therefore ensure that the future regulatory regime includes appropriate provisions to induce adequate and reasonable investment in the electricity supply infrastructure.

3.9 The current regime based on the SCAs has provided a consistent regulatory framework over a 15-year period, on the basis of which investors have, in the light of clearly defined obligations and rights, made timely investments to meet growth in demand. With adequate infrastructure in place, consumers are enjoying very high supply reliability, which is among the highest in the world. A high level of supply reliability, however, comes at a price, and this has led to a number of criticisms on the existing SCA arrangement.

Possible Approaches to Future Regulatory Regime

(I) A Modified SCA-Type Regime

3.10 A major criticism of the current SCA regime is the alleged high permitted return and the resultant high electricity tariff. To address them, we propose to consider regulating the power companies' return on investment through the following means, either individually or in combination.

(A) Return on Investment

3.11 The permitted rate of return and rate base go hand in hand and are crucial to ensuring an appropriate balance between a reasonable price to the consumers and a fair and attractive return to the investors that encourages continuous investments to maintain stable and reliable

electricity supply. Presently in Hong Kong, the two power companies are regulated under a Rate of Return (ROR) type of regime with a permitted rate of return applied to a rate base, which is the average net fixed assets (ANFA).

Determining the Rate Base

3.12 In general, investment in the electricity supply infrastructure constitutes a base on which the permitted rate of return would be determined and regulated. There are two basic approaches to establishing this base:

(a) Asset Base Approach, which links return to the value of the aggregated assets (return on asset or ROA); or
(b) Equity Base Approach, which uses shareholders' funds (i.e. aggregate assets minus liability) as the base to determine the return (return on equity or ROE).

3.13 The pros and cons of these approaches are summarised below:

Rate Base	***Pros***	***Cons***
(a) Asset Base	• Would provide incentive to ensure continued and adequate investment in asset.	• Could expose the regime to potential over-investment. • Determination of the appropriate rate of return would be affected by the proportion of debt and equity in acquiring the assets.
(b) Equity Base	• Would encourage shareholders to inject funds for investment.	• Lacks incentive for efficient financing, e.g. under-utilisation of debt capital.

Determining the Permitted Rate of Return

3.14 Having determined the base, the permitted rate of return could be determined by one of the following approaches:

(a) Drawing reference to returns that could be obtained from comparable, alternative investments such as the rates of return for other utilities; or
(b) Linking it to the cost of raising capital required to provide the electricity supply facilities (i.e. the cost of capital approach).

3.15 The first approach employs the opportunity cost concept and recognises the need to provide a return that can be earned from a similar investment (such as other utilities). The second approach determines a rate of return by systematically analysing the cost of equity and the cost of debt to the company taking into account the relevant risks involved.

3.16 The pros and cons of these approaches are:

Approach	***Pros***	***Cons***
(a) Comparing Returns Obtained from Investment in Other Utilities	• Current business data could be used as benchmarks.	• Finding suitable businesses locally for comparison could be difficult. • Could be criticised as crude or arbitrary.
(b) Cost of Capital	• Could be more objectively determined and more transparent.	• Might entail a protracted negotiation process in determining the basic parameters.

Overseas Practices in Regulating Return on Investment

3.17 Direct comparison of rates of return for electric utilities in different economies would be very difficult owing to, inter alia:

- difference in business ownership, which affects target rate of return and the equity and debt makeup in financing;
- different market structure, which affects the business makeup of the utility and earnings of individual business segments of the utility;

- business diversification, as other businesses such as gas supply and telecommunication services may also be operated by or associated with the same company; and
- different economic regulatory regime, as permitted return and the actual return could be quite different for different regimes.

3.18 The ROR regime is commonly adopted in the regulated electricity markets in the U.S.A. to regulate charges, which comprise all costs of service plus an appropriate return. The cost of capital approach is usually applied to determine the permitted rate of return, which is applied to either an asset or equity base. Typical permitted rate of return for vertically integrated investor-owned electricity supply utilities in the U.S.A. is in the range of 6-13%[14]. There is no fixed review period for setting the rate of return, and either the power companies or the regulator can initiate a review of the tariffs if the actual returns vary significantly from the permitted returns.

3.19 In electricity markets that have been deregulated, e.g. the U.K. and some states in Australia, only the power grids (i.e. the transmission and distribution networks), which operate as natural monopolies, are under regulatory oversight, and performance-based ratemaking (PBR) regulation in the form of price cap or revenue cap are usually adopted. The regulators do not regulate the return directly but would set the initial price or revenue targets for the regulatory review period in a manner similar to that under the ROR regime, applying the cost of capital approach to an asset base. Typical rates of return for regulated electric utilities in the U.K. and Australia are in the range of 6-7% and 6-9%[15] respectively. Regulatory review periods of such regimes range from three to five years.

Setting the Review Period

3.20 Under the current SCA, unless both sides agree to make revisions, the permitted rate of return and the components of the rate base are fixed over the entire 15-year period of the SCAs. To require regular

[14] Based on the allowed/authorised rates of return adopted for regulating the electricity supply businesses in some states of the U.S.A., with some of them on asset base and some on equity base.

[15] Based on the allowed rates of return applied to the regulatory asset base, which could be determined by different approaches, e.g. with reference to replacement costs of the assets or sale prices of the assets during privatisation.

reviews, say once every five years, of either the rate or the base of return or both and to make necessary changes could ensure a fairer balance between the interests of the consumers and investors. However, the uncertainties thus posed would deter continued or longer term investments by the power companies.

Development Fund

3.21 Under the current SCAs, a Development Fund (DF) is established which, among other purposes, provides a depository for net revenue in excess of the permitted return and, when necessary, provides funds up to the balance of the DF, to ameliorate the impact of tariff increase for consumers. The pros and cons of retaining the DF are:

Pros	***Cons***
• Provides a cushion to stabilise the tariff.	• Power companies may be inclined to build up a large balance in DF, which are monies belonging to consumers.

(B) Return Based on Performance

3.22 In addition to determining return based on investment, incentives may be introduced to encourage improvements in operating efficiency and service performance (e.g. to meet or exceed performance standards and targets, better utilisation of electricity supply facilities). This is an alternative form of PBR regulation commonly adopted for regulated utility business in a number of overseas electricity markets. This approach entails additional resources and costs in determining performance targets, and monitoring and assessing actual performance against the targets.

(C) Regulating Tariff

3.23 Given the importance of electricity supply to our economic and social development, we intend to continue with economic regulation to ensure that electricity tariffs are reasonable and will take into account the prevailing economic conditions. Apart from regulating return on investment and providing incentives to encourage efficiency and

performance improvements, tariff regulation is necessary to ensure reasonable pricing. In this connection, tariff could be set:

(a) on an annual basis as at present, i.e., based on projected sales, operating expenses and the agreed return for the power companies, but with more transparency in the tariff setting process; or
(b) over a fixed period with links to economic indicators, such as the consumer price index (CPI), and efficiency gain measures (see paragraph 3.26 below).

(a) Existing Tariff Setting Mechanism with Increased Transparency

3.24 The existing tariff setting process involves an annual tariff review and periodic review of the financial plans by the Government together with the respective power companies. Consideration may be given to continuing with this process, but making public the relevant information available for increased transparency. The pros and cons of this approach are:

Pros	***Cons***
• Would better apprise the public of the basis for tariff adjustment.	• Requires disclosure of information deemed commercially sensitive by the power companies. • Amount of information disclosed may not satisfy the public. • Requires longer time to complete the process.

Fuel Cost Adjustment

3.25 The current SCAs provide that fuel cost is to be borne by consumers and the Basic Tariff includes a standard fuel cost. Through the Fuel Clause Account mechanism, the difference between the standard fuel cost and the actual fuel cost will be returned to or recovered from the consumers each year by means of a Rebate or a Surcharge. The pros and cons of retaining this mechanism are:

Pros	*Cons*
• Power companies may not factor fuel price fluctuation in their running expenses. • There should be no profit or loss to the power companies in operating the Fuel Clause Account.	• Power companies may not have the incentive to ensure efficient fuel procurement.

(b) Linking Tariff to Economic Indicators

3.26 Linking tariff to economic indicators (such as consumer price index (CPI) or retail price index (RPI))[16] can be considered by adopting the price cap or revenue cap regime as is done in Australia and the U.K. In essence,

(a) an initial price or revenue target (price cap or revenue cap) would be determined, using an appropriate rate of return and rate base;
(b) the capped price or revenue would be indexed to inflation or deflation;
(c) incentives would be included to encourage the power companies to lower costs (relative to the baseline costs for each year), whereby the savings realised would be either kept by the power companies or shared between the consumers and the shareholders; and
(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.

[16] CPI/RPI is typically adopted by overseas regulatory authorities because it is most commonly understood, and cannot be influenced by the utilities being regulated. However, electricity-related operations involve cost components such as generating facilities and imported fuel that are not components of these indices and are influenced more by external economic conditions.

3.27 The pros and cons of this approach include:

Pros	*Cons*
• 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.	• 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 studies[17] 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.

[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.

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 access[18] 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:

- 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.

[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.

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:

Pros	*Cons*
• 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 life[19].	• Would need significant upfront costs[20] 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.

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

[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.

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:

Option	*Pros*	*Cons*
(a) Funded/ Operated Jointly by the Two Power Companies	• Would be a system addition hence operation could follow the arrangement for the existing interconnection. • Would simplify the technical and operational interface.	• Would deprive others the opportunity to participate in electricity supply infrastructure development.
(b) Funded/ Operated By a Third Party	• Would provide opportunity to introduce additional market player.	• 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

electricity market. An analysis of the present and forecast electricity supply situation in the Mainland, particularly in Guangdong, would assist us in assessing the extent and the timing of when this might happen.

Electricity Market Reform in Mainland

3.46 The electricity market in the Mainland has been and is still undergoing changes. Until December 2002, the State Power Corporation (SPC) owned about half of the total generation assets and the majority of the transmission assets in the whole country. In December 2002, a restructuring of the State Power Corporation was formally announced, including the formation of five major generation groups and two grid companies to take up the management and control of majority of the state-owned electricity supply assets across the whole country.

3.47 The regulatory functions of the electricity market are also undergoing reform. A new State Electricity Regulatory Commission was established in 2002 to take up the main regulatory role for the electricity market including implementing the reform and drawing up market development plans.

3.48 Electricity markets with generators competing through bidding to supply the power grid are being introduced and implemented on a trial basis in some regions. While electricity market reform is being pursued vigorously in Mainland China, the tight power supply situation in recent years has become a major issue.

The Supply Situation in Guangdong

3.49 Guangdong currently imports electricity from neighbouring provinces/areas, including Guangxi, Yunnan, Guizhou, Three Gorges and Hong Kong (through the existing interconnection between CLP Power and the Guangdong system), to meet part of its local demand. Some of the generation sources in Guangdong are "centrally dispatched" while some are not. "Non-centrally dispatched" supply sources, which amount up to some 30-40% of the total generation capacity in the province, are mainly small local generators which are not as dependable as their "centrally dispatched" counterparts.

3.50 Guangdong has experienced tight electricity supply situations in recent years owing to the much higher than expected demand growth driven by rapid economic development. In 2003, due to the much increased maximum demand, a high level of power import was required from neighbouring provinces/areas, and some power rationing was administered to reduce peak demand.

3.51 The tight supply situation continued in 2004. Shortage in water resources due to dry weather in the western provinces has affected Guangdong's power import from hydroelectric sources, and recent shortage in coal supply throughout the country has further aggravated the province's already tight power supply situation. While a new transmission line was commissioned in mid 2004 for importing power from the Three Gorges to Guangdong, limited support is available since power export from the Three Gorges is shared by other provinces/regions that have also suffered power shortage.

3.52 Although the forecast prepared earlier by the Development Planning Commission of Guangdong Province[21] indicated that balanced supply and demand situation in Guangdong could be achieved in the medium to long-term, there are still uncertainties due to the rapidly changing situation. For instance, the less dependable "non-centrally dispatched" supply sources and the phasing out of highly polluting small thermal power plants with low efficiency might cause the forecast generation capacity not fully realisable in short term.

The Outlook

3.53 The current tight supply situation in the Mainland and Guangdong and substantial demand arising from the continued rapid growth in economic activities expected in the next few years suggest that surplus electricity in the Mainland for supplying to Hong Kong would unlikely be available in the next few years. It would therefore appear prudent not to predicate as yet the development of the Hong Kong electricity market on supply from the Mainland. Nonetheless, as supply situation may change quite rapidly, we should continue to keep track of the

[21] Based on that forecasted in 2001 at the beginning of the Tenth 5-year Plan from 2001 to 2005.

electricity market development in the Mainland to consider possible sourcing opportunities and implications for our future electricity market.

3.54 While the existing interconnection capability between Hong Kong and Guangdong can support some level of power import from (and export to) the Mainland, it would need to be reviewed if and when Mainland's supply situation improves and the signs for possible substantive sourcing from the Mainland emerge.

(ii) Supply from Other Local Sources

3.55 Locally, possible alternative supply sources could include independent power producers, some of whom might wish to develop renewable energy sources. A consultancy study[22] in 2002 assessed that, despite local environmental and physical constraints such as lack of hydro resources, renewable energy has the potential to provide electricity supply to meet some of the electricity demand in Hong Kong (see table below).

Year	***2012***	***2017***	***2022***
Potential contribution from renewable energy sources (GWh/year)	261 - 686	417 - 1256	699 - 1536
% of 1999 electricity consumption	0.74% - 1.93%	1.18% - 3.54%	1.97% - 4.33%

3.56 Experimental use of photovoltaic panels and technical feasibility studies on the application of other types of renewable energy such as wind power are being conducted. At the same time, we have obtained the agreement of the two power companies, during the Interim Review of the SCAs in 2003, to set up two production-scale wind turbines for the purpose of understanding the benefits and limitations of wind power generation in Hong Kong.

3.57 More recently, the Council for Sustainable Development sought the views of the public[23] on, amongst other issues, how renewable

[22] Stage I Study on "Potential Applications of Renewable Energy in Hong Kong" completed in 2002.

[23] "Sustainable Development: Making Choices for Our Future" issued by the Council for Sustainable Development in July 2004.

energy should be introduced in Hong Kong, taking into account economic, social and environmental constraints. Feedback in this exercise will be taken into consideration as we map out the future direction for the development of the electricity market.

3.58 Separately, recent surveys conducted by the Government indicated that there is general but qualified public support[24] for the introduction of renewable energy sources. Various issues would need to be considered and addressed as we factor renewable energy into our future electricity market development. These include, for example:

- the reliance of solar and wind power on prevailing weather conditions, hence possible implications on supply reliability and backup requirements;
- the substantial capital costs taken against the relatively smaller amount of energy that can be produced by some renewable energy technologies, hence potential implications on tariff; and
- any financial incentives to encourage the development and use of renewable energy will have implications on the Government's established policy of no government subsidy or cross-subsidisation of business endeavours.

(C) Grid Access for Third-Party Users

3.59 Grid access for third-party users may facilitate entry of new suppliers and development of alternative supply sources such as renewable energy and energy-from-waste technologies. However, grid access by third party may also give rise to reliability, cost and liability issues. Two common approaches for introducing third-party grid access are discussed below.

(a) Voluntary Approach

3.60 Under this approach, the power companies would be encouraged by Government to make individual arrangements for

[24] Thematic Household Survey conducted by the Census and Statistics Department in 2003, and Establishment Survey on Electricity Supply in Hong Kong conducted by EDLB in 2004.

third-party access, with details on technical and reliability requirements, responsibilities and liabilities covered by bilateral agreements between the power company and the grid users. The pros and cons of this approach are:

Pros	***Cons***
• Would take less time to implement. • The power companies would retain accountability for system integrity and supply reliability, and be given latitude in their bilateral agreements with the grid users.	• There is no assurance that an agreement would be reached, or when reached, the arrangement would be fair and non-discriminatory. • Lacks transparency.

(b) Mandatory Approach

3.61 A more commonly adopted approach in overseas markets is to mandate third-party access as a condition for operating the grid. This could be achieved through introduction of regulatory framework that:

- stipulates issues (e.g. technical standards, liability, etc.) to be specified in the agreement between the grid owners and the users; or
- provides detailed specifications covering codes of conduct, technical standards for connection, liability, charging mechanisms and dispute resolution, to ensure fairness to both the grid owners and users, transparency to all market participants, compatibility with the entire power system, as well as the safe and reliable operation of the power grid.

3.62 The pros and cons of the mandatory approach include:

Pros	***Cons***
• Would ensure non-discriminatory access to the power grid by any interested parties who satisfy the stipulated connection requirements. • Would support development of renewable energy sources. • Would support future development of the market. • Would enable customers to access alternative supply sources.	• Would take longer time to implement and could be perceived as Government's intrusion into property ownership and private business operation. • Would involve increased Government's commitment and resources to develop and implement regulatory framework, establish and maintain technical standards and codes, and monitor and ensure compliance. • While enabling customers to access alternative supply sources, existing power companies might no longer be held responsible for meeting demands of all customers within their service areas.

3.63 To take forward the mandatory approach, overseas experience has shown that vertically integrated power companies had to separate the network business from other business segments to ensure a level playing field for all market participants. This process was usually conducted at the time when the electricity market was privatised/liberalised and relevant infrastructure passed on from the Government to the private sector. Moreover, additional costs, both for separating the business segments and for subsequent operation of the separated business entities, would be inevitable and would in all likelihood be passed onto the consumers. Accounts separation is the usual first step[25], followed by business separation, which could be in the form of function or corporate segregation.

[25] During the Interim Review of the SCAs in 2003, agreements were reached with the power companies to segregate, and present to the Government separate cost data pertaining to their generation and network businesses.

3.64 To ensure connection compatibility and to prevent potential adverse impact on supply reliability with multiple players connecting to the grid, a set of common reliability standards, codes and rules would need to be established. If this set of industry-wide standards were to be developed, it would entail oversight, either by the Government or an independent authority, leading to additional resource commitment and possibly perception of undue intrusion into the management of private business operation.

CHAPTER 4

ARRANGEMENT AND STRUCTURE FOR IMPLEMENTATION

Regulatory Arrangement

4.1 Our current regulatory framework is based on bilateral agreements which the Government separately made with the two power companies. In some economies, such as the U.S.A., Australia, Canada and the U.K., regulatory frameworks for the electricity supply sector are laid down in legislation, and market participants are required to register with or obtain operating licences from the regulatory authority.

4.2 The regulatory arrangement for the future electricity market in Hong Kong could be implemented in different forms.

Option 1 - Bilateral Agreement

4.3 Regulation through bilateral agreements between the Government and the power companies is a well established practice in Hong Kong. When the current agreements expire in 2008, we could choose to continue with this type of arrangement, either as a short-term or long-term option. The pros and cons of this option include:

Pros	*Cons*
• Requires low governance costs. • Provides reasonable assurance of a consistent business environment conducive to making timely investments to meet demand growth.	• Requires the consent of parties to the agreement before amendments could be made hence restricts the flexibility for introducing changes to take account of prevailing circumstances.

Consideration may also be given to shorter agreement periods, say of 5 or 10 years duration, to provide flexibility for amendments as circumstances may so require. However, the uncertainties thus posed would deter continued or longer term investments by the power companies.

Option 2 - Regulatory Framework Supported by Legislation

4.4 A regulatory framework supported by legislation could address the identified shortcomings of a bilateral agreement. Such legislation could, for example, empower an authority (the Government or an appointed regulator) to regulate the supply reliability, safety and economic aspects of the electricity market[26] by means of, inter alia:

- issuing licences or granting franchise rights to market participants including generators, grid and/or interconnector owners and operators; and/or
- regulating charges (tariff and/or grid connection and usage fees) and approving system development plans; and/or
- determining technical standards and codes, which may include reliability and safety standards, planning criteria and performance measures; and/or
- monitoring and enforcing licence/franchise conditions and provisions.

4.5 Appeal procedures against regulatory decisions of the authority and/or dispute resolution mechanisms would be established and penalties could be included to ensure compliance with the statutory conditions and provisions.

[26] Regulation of the environmental and safety aspects is already backed by legislation through the applicable Ordinances.

4.6 The pros and cons of this option include:

Pros	*Cons*
• Provides definitive authority and facilitates amendments to the regime as circumstance so requires.	• Would be perceived as Government's intrusion into private business operation. • Might entail a lengthy legislative process. • Would involve more bureaucracy and higher administrative costs. • Would mean complete overhaul of a regulatory framework that has generally operated satisfactorily for several decades.

Institutional Set-up

Option 1 - Current Approach

4.7 At present, regulatory oversight is undertaken by various authorities within the Government vide paragraph 2.3 above. The pros and cons of maintaining the current setup include:

Pros	*Cons*
• This organisation structure has worked well and has ensured that financial and supply reliability, safety and efficiency considerations are appropriately balanced against environmental considerations.	• Coordination and interfacing between different bureaux and departments do, at times, add to the administrative procedures.

Option 2 - Rationalisation within the Government

4.8 Some of the options discussed in Chapter 3 could precipitate increased involvement and resources by the Government in regulating the electricity market. An alternative to the existing setup would be to funnel relevant personnel and/or expertise from the various bureaux/departments to form a single agency within the Government to take over the electricity

supply and electricity-related environmental policies, and to execute all existing and new regulatory functions. The pros and cons of this option include:

Pros	*Cons*
• Would provide a one-stop unit to interface with the power companies, and deal with all related regulatory issues.	• Would require reorganisation which may necessitate legislative changes and funding.

Option 3 - Separate Regulatory Authority

4.9 Another alternative is to have the one-stop regulatory unit separated from the Government. The independent authority would be:

- established and empowered by legislation, with a governing board which represents interests of investors and consumers, to ensure independent and impartial decision making;
- responsible for executing all regulatory functions relating to the electricity market, and making recommendations to the Government on relevant policy issues; and
- funded by the Government, and/or through appropriate fees levied on the market participants.

Regulatory role being taken up by an independent authority[27] is found in various developed economies such as Office of Gas and Electricity Market (OFGEM) in the UK, the Federal Energy Regulatory Commission (FERC) in USA, the Ontario Energy Board (OEB) in Ontario, Canada.

[27] Most of these authorities regulate both the electricity and gas markets.

4.10 The pros and cons of this option include:

Pros	*Cons*
• Would provide a one-stop organisation with a governing board appointed to represent interests of all stakeholders.	• Would require reorganisation and enlistment of new legislation and funding. • Could be perceived as the Government relinquishing its responsibilities to ensure reliable, safe and reasonably priced electricity supply.

Implementation Schedule

4.11 The expiry of the SCAs in 2008 provides an opportunity to develop an enhanced regulatory framework which should continue to provide supply reliability and safety, and optimise benefits for consumers.

4.12 Implementation of some of the options will be contingent upon certain market, legislative and administrative environments. After the next (Stage II) consultation, we will map out the broad direction for the future development of the electricity market. By then we will also draw up a development plan and appropriate transitional arrangements. On the one hand, we want to ensure that consumers continue to enjoy reliable and safe electricity supply at reasonable prices and on the other, we do not want to undermine the power companies' business efficiency and investment confidence.

- ENDS -

GLOSSARY OF TERMS

Average net fixed assets
The average of opening and closing balances of the net fixed assets.

Average service availability index
An electricity supply reliability indicator, showing the total customer-hours served as a percentage of the total customer-hours demanded.

Basic tariff
Tariff rate calculated by dividing the total revenue from sale of electricity to consumers, excluding rebates or surcharges, by the corresponding number of electricity units sold by the power company.

Centrally dispatched supply sources
Referring to generation sources controlled centrally by the system control center.

Cost of capital
The cost involved in acquiring the required capital for funding a particular business, which generally reflects the market's perception of the risk associated with that business. The Weighted Average Cost of Capital (WACC) approach, which equates the rate of return to the weighted average of the costs of financing by equity and debt respectively, is commonly adopted by overseas regulators.

Customer choice
Customers can choose their electricity suppliers, usually at a price determined by the market force.

Economic indicators
Indicators, such as consumer price index (CPI) or retail price index (RPI), that reflect the economic situation.

Economic regulation
The prices (or tariff) of electricity and/or earnings of the power companies are subject to regulatory control of the government or the regulator.

Economy power exchange
In day to day operation, a power company may choose not to run its own generators that incur higher operating costs, but obtain power at a lower cost through interconnection from other power companies (which may have surplus capacity.

Energy-from-waste
An alternative source of energy, whereby energy is recovered in the treatment process of the waste, such as landfill gas and thermal treatment (e.g. incineration), etc.

Equity
The residual interest in the assets of an enterprise, after deducting all of its liabilities.

Fixed Asset
Assets of a long-term nature such as land, buildings, supply facilities, etc.

Financial review
A review conducted jointly by the Government and the power company on the financial plans prepared by the power company.

Fossil fuels
Including fuel sources such as coal, oil and natural gas.

Generation fuel mix
Proportion of different fuels used in the generation of electricity.

Greenhouse gas
Referring to gas, such as carbon dioxide, which is a major factor that contributes to global warming and related climate changes.

Independent power producer
Electricity generation business entity, which owns and operates generation facilities only, and hence needs to use the network facilities owned and operated by others to deliver the electricity generated to the customers.

Installed capacities
The sum of the capacities of all generation plants installed by a power company.

Interconnection
Electrical linkage by transmission circuits between separately controlled power systems.

Mutual emergency support
Sharing of reserve generation capacity between interconnected power systems in emergency situations, such as sudden outage of generators.

Net fixed assets
The cost of fixed assets net of accumulated depreciation.

Network reinforcement
Addition of new transmission circuits and associated equipment, and/or re-configuration of the existing electricity networks to increase the power transfer capacity.

Payback period
The length of time required to recover the cost of an investment, usually in terms of years.

Performance-based ratemaking (PBR) regime
Any rate-setting mechanism that attempts to link rewards (generally profits) to the achieving of desired results or targets. Some PBR regimes set rates or components of rates for a period of time, based on external indices rather than the utility's costs of service.

Photovoltaic panel
Group of modules of photovoltaic cells (devices that produce electricity from light sources) mechanically fastened together, pre-assembled and wired on a single frame, designed to serve as an installable unit for the formation of a photovoltaic array to generate electricity from sunlight.

Planning criteria
A set of rules or standards adopted by the power companies in planning power system development.

Power grid
Transmission and distribution networks to transmit electricity generated from power plants to customers.

Price/Revenue cap regime
Under a price cap regime, the price is pre-determined over a period of time during which the annual revenue may deviate from the projected amount. Under a revenue cap regime, it is the reverse where the projected revenue is pre-determined and the price may vary.

Rate of return (ROR) regime
A kind of economic regulatory regime that regulates the rate of return of the utility.

Reliability standards
Standards that stipulate the level of electricity supply system performance. Supply reliability is normally measured by the frequency, duration and magnitude of supply interruption to customers while system reliability is assessed by supply adequacy and system security.

Reserve capacity
Generation capacity above that is needed to meet the peak demand to cater for outages of generators or unexpected increase in demand.

Reserve capacity sharing
Sharing of reserve capacity by interconnected power systems to reduce the individual generation capacity requirements (planned or operational) while maintaining the same level of supply reliability, predicated on the assumption that the peak demand of individual power systems that are interconnected may occur at different times and/or the generators of these power systems may not encounter outages at the same time.

Transformer station
A building for housing transformers and associated equipment, which are used for converting the voltage of electricity to appropriate levels to facilitate power transmission.

Wind turbine
Rotating machine driven by wind to generate electricity.