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The Regulation of the Hong Kong Electricity Market: Its problems and the way forward (December 2006)

Stephen K.M. Luk

Abstract *- The current regulatory scheme of the electricity industry in Hong Kong has provided the two power companies an incentive to over-invest in generation capacity, thus resulting in an excessive amount of underutilized capacity and one of the highest electricity tariffs in the world. This paper outlines the structure of the electricity supply industry and its regulatory arrangement in Hong Kong. The causes and effects of the problems associated with the current regulatory scheme are discussed. And with a view to improve the efficiency of energy uses, a number of policy alternatives, both short-term and long-term, for future market reform are proposed.*

***Keywords*— Regulation, Excess Capacity, Market Reform, Policy Alternatives**

1. INTRODUCTION

Despite the recent slowdown in economic growth due to the Asian Financial crisis and SARS, overall GDP growth in Hong Kong over the past few decades has been impressive. This rapid economic development has led to an extraordinary increase in the demand for electricity. During the 2004 fiscal year, the two local electricity suppliers: China Light and Power (CLP) and Hongkong Electric (HEC), had a combined revenue from the sales of electricity alone amounting to HKD $38.1 billion (or USD $4.9 billion). With a total population of approximately 6.94 million, this number translates to an annual per capita spending of $5,490 on electricity.

The provision of electricity in Hong Kong is governed by a regulatory arrangement called the Scheme of Control (SOC). The SOC, which was originally proposed by the industry itself back in 1964, resembles the rate-of-return regulation carried out in many different parts of the world. It stipulates that the return of a regulated firm is limited to a certain percentage of the amount of its fixed assets, and that the tariffs a firm is allowed to levy are subject to careful scrutiny by the government or the regulator.

The main purpose of the SOC is to protect consumers and to discourage any unreasonable profit-seeking behavior by the electricity suppliers, and also to ensure a safe, steady, and ample stream of electricity supply to every household.

The idea of establishing the SOC came under a goodwill concept, however, despite its many desirable features, the mechanism has encouraged the two utilities to operate inefficiently by over-investing in capital, and over-charging their customers for the under-utilized production facilities.

The objective of this paper is to point out the drawbacks of the SOC, to provide arguments to support tariffs reduction, and to lay the foundation and provide arguments for future amendments to the SOC. This paper is organized as follows: the ensuing section provides a brief industry background. Problems associated with the SOC, and cross-countries comparisons of certain issues are discussed in the third section. Then a number of policy alternatives for rectifying the problem on a short-term basis, and possible steps towards a market reform in the long-term, are provided. The final section concludes.

Stephen Luk, Assistant Professor, School of Accounting and Finance, Hong Kong Polytechnic University, Hung Hom, Hong Kong; phone: (852)2766-7953; fax: (852)2356-9550; e-mail: afsteve@polyu.edu.hk

2. INDUSTRY BACKGROUND

Electricity in Hong Kong is provided by two companies: CLP and HKE. Both of these investor-owned companies control and operate their power stations, transmission lines, and substations. In other words, CLP and HKE are two vertically integrated firms that have absolute control over the entire spectrum of electricity provision, from generation, transmission, to distribution. In addition, with mutually exclusive coverage areas and the ability to set electricity tariffs within their own exclusive territories, and having no direct or indirect competition between them, these two utilities can be treated as regional monopolies.

Owing to the importance of electricity as a primary source of power usage, and the unique structure of the industry, these two companies are subjected to a special regulatory arrangement called the Scheme of Control (SOC). The historical development of the industry and the SOC regulatory arrangement are outlined in detail by Coates [1], Cameron [2], Lam [3], [4], and Cheng and Wu [5]. This specific form of regulatory scheme came into existence in 1964; it is essentially a formal long-term contract between the Hong Kong Government and the two utilities. Each phase of the SOC lasts for 15 years before it is renegotiated and signed. The SOC laid down the guidelines for the utilities' price-setting mechanism and the profits they are allowed to earn, with a view to preventing and discouraging any unreasonable manipulations of tariffs to increase profits, while providing the utilities sufficient incentives to maintain an uninterrupted power supply to every household and commercial user.

The objectives of the SOC regulation were to limit the disposable profits of the companies to a reasonable return on their equity capital, while providing sufficient incentives towards the efficient use of capital and expansion of generation facilities. In particular, it would ensure that the benefits from any capital for expansion obtained from additional profits would go primarily to the consumer. As indicated clearly in CLP Power's annual report [6]:

"The SOC specifies the SOC Companies' obligations to supply adequate and reliable electricity supplies to customers at the lowest reasonable cost and the mechanism for Government to monitor their financial affairs and operating performance. In return, CLP Power is allowed to charge tariffs designed to recover the operating costs and allowed net return of the SOC Companies"

Numerous changes to the SOC have been made over the past few decades. Under the current phase of the SOC, which expires in 2008, HKE and CLP are allowed to earn a rate of return of 13.5% of their average net fixed assets, plus 1.5% of shareholders' investment made within the period of the contract. That is, the allowed rates of returns for debt capital and equity capital are 13.5% and 15% respectively.

In addition, both firms are required to create a development fund. The purpose of this fund is to assist the company in financing the acquisition of fixed assets, and to serve as a buffer to guarantee that the allowed return can be attained. The balance of this development fund depends on the regulated firm's profit. If the firm earns more than the allowed return in a particular year, the excess profit will be transferred to this fund. Conversely, if it earns less than the allowed rate, then the deficiency will be compensated by transfer from the fund. Note that this transferring mechanism purely allows for transfer of funds to reach a certain level, it is by no means designed as a way to guarantee that the regulated firm must be able to earn the entire amount of the allowable return.

Furthermore, assets equivalent to 8% of the average of the opening and closing balances of the development fund will be transferred from the allowed return to a rate reduction reserve. If the balance of this reserve exceeds the sum of the transfer from the past 3 years plus that of the current year, then that outstanding balance will be used for a tariff rebate in the ensuing year.

3. PROBLEMS WITH THE REGULATION

Given the specific structure of the regulatory arrangement, the primary objective of the scheme, namely, to provide adequate and reliable electricity supplies to customers at the lowest reasonable cost, could not been materialized. In addition, the scheme provides the power companies an incentive to over-invest in generation capacity, and legitimize the higher-than-average tariffs charged to customers.

Excess Capacity

The classic result of pegging allowed profits to a permitted rate of return is over-investment in capital, Averch and Johnson [7], Courville [8], and Spann [9]. As is well-documented in Cheng and Wu [5], Lam [3], [4], and [10], Peles and Whittred [11], and Luk [12], the structure of the SOC provides both power companies an incentive to over-invest in capital, leading to a massive buildup of excess capacity. Table 1 shows the level of excess capacity maintained by both utilities over the years.

Table 1. Level of excess capacity

Year	Excess Capacity (%)	
	CLP	HEC
1979	24.0	52.7
1980	22.0	33.3
1981	25.9	24.4
1982	32.5	54.0
1983	35.6	54.2
1984	38.2	58.4
1985	38.4	46.5
1986	39.6	33.8
1987	38.9	38.9
1988	51.8	41.1
1989	40.2	30.2
1990	51.1	39.8
1991	46.7	34.2
1992	47.4	43.2
1993	45.1	37.8
1994	59.4	28.9
1995	46.0	47.3
1996	50.4	39.5
1997	50.8	49.9
1998	50.0	42.7
1999	54.3	41.0
2000	47.6	36.7
2001	41.4	31.4
2002	41.8	40.1
2003	40.7	40.2
2004	31.0	32.1

Table 2. Cross-countries comparison of excess capacity (numbers in %)

Year	Taiwan	Korea	Thailand	CLP	HEC
1994	5.9	7.8	20.0	59.4	28.9
1995	4.9	6.4	21.0	46.0	47.3
1996	2.7	10.7	20.0	50.4	39.5
1997	9.0	13.1	19.5	50.8	49.9
1998	12.0	13.1	19.2	50.0	42.7
1999	17.7	19.1	28.5	54.3	41.0
2000	14.6	16.8	29.1	47.6	36.7
2001	14.6	15.1	33.4	41.4	31.4
2002	17.7	15.3	32.8	41.8	40.1
2003	16.4	18.3	32.4	40.7	40.2
2004	19.2	17.0	32.6	31.0	32.1

As the numbers suggest, the percentages of the excess capacity of the two companies are found to be exceptionally high, far exceed the 25% international norm, a level at which most countries would consider reasonable and safe.

When compared with other Asian countries, the amount of excess capacities maintained by the two power companies is also found to be the highest (Table 2).

High Electricity Tariffs

The SOC led not only to the excess capacity problem, but more importantly, it has an adverse effect on what consumers concern most, electricity tariffs. According to the International Energy Agency (IEA) [13], in 2005 the electricity tariffs in Hong Kong are one of the highest among all developed nations, (Table 3).

Table 3. Electricity tariffs in major countries/cities

Country/City	Average Tariffs (kWh in USD)
Japan	0.1704
Germany	0.1398
HEC	0.1391
United Kingdom	0.1156
CLP	0.1129
Spain	0.1108
France	0.1006
Korea	0.0715
United States	0.0693
Taiwan	0.0644
Norway	0.0549

In addition, the Audit Commission of the Hong Kong Government published a report in 1999 [14], indicating that local consumers not only paid a higher than average tariffs, they were also overcharged an estimated average of approximately (HKD) $60 per month by CLP Power during the period from 1996 to 1998 in order to pay for the maintenance of the underutilized generation capacity. Even though the corresponding figures for HEC are not available, judging from its operating statistics, it is highly likely that similar conclusion can be drawn for HEC.

It has been argued that one of the reasons for high tariffs is for covering the cost of maintaining a respectable level of supply reliability. As often cited in both utilities' annual reports [6] and [15], the supply reliability has consistently been kept over 99.99%, and in order to provide such level of uninterrupted service, higher than average tariffs to pay for the extra capacities are necessary and justifiable.

However, when compared with other major cities in Mainland China (Table 4), it can easily be seen that electricity supply in Hong Kong is indeed more reliable, though at a much higher cost to the consumers, Lam [16]. The outstanding performance in supply reliability was achieved through excessive production capacity and equipment redundancy, and these in turn put an upward pressure on the overall production cost for the power companies.

Table 4. Supply reliability and electricity tariffs in major Chinese cities

City	Supply Reliability (%)	Average Tariffs (HK cents/kWh)
Beijing	99.825	38.60
Tianjin	99.859	36.93
Shanghai	99.843	46.84
Chongqing	99.614	33.79
CLP	>99.99	87.80
HEC	99.99	90.30

As the numbers in Table 4 suggest, consumers in Hong Kong paid an average 2 to 3 times more than their counterparts in the Mainland for about a mere 0.2% increase in supply reliability. Whether the cost of this extra reliability is justifiable remains a question of value judgment and needs to be addressed by considering the opportunity cost of daily convenience and economic impact. Nonetheless, it cannot be denied by the fact that, in terms of reducing the gap between average tariffs paid and overall supply reliability, there are still rooms for improvement.

Over-optimistic Demand Growth

With the rapid economic development experienced in Asia over the last two decades, the two utilities have long maintained a very optimistic view about the expected growth in demand for electricity. As such, they favor a rapid expansion policy towards generation capacity as mentioned above. However, the investment and construction of a new power plant usually takes years to complete, and once the plant is built, it has virtually no alternative uses. Thus the utilities argued that it is necessary for them to constantly maintain a high level of reserve margin to cope with the "anticipated" growth, and to protect the system from any unexpected surge in demand.

However, electricity demand growth over the past few years has refuted this line of argument. Actual growth in local electricity consumption during the last decade was substantially below what was forecasted previously. In fact, according to CLP, the trended actual growth in electricity usage during the 1990s was only 3.7%, much lower than the company's forecast of 7.6% annual growth rate.

Further, it must be remembered that excess capacity is calculated based on the maximum system demand. A 30% excess capacity indicates that capacity is actually 30% above that of the maximum level of electricity the entire economy would consume at any point in time, not simply the average usage. Thus, one should interpret this level of demand as already a rather comfortable cushion for the generators in the case of any sudden surge in electricity consumption. Even if the annual system demand growth were assumed to hover around 10% (almost three times its actual recent growth), the current level of excess capacity maintained by both utilities still seems unreasonably high.

The high level of excess capacity also imposes enormous pressure on the tariffs. In an in-depth empirical

study by Luk [12] and [17], the author discovered striking facts about the two electricity suppliers in Hong Kong. Firstly, both companies consistently utilize an excessive amount of capital, and did not adjust their capital stock to reach a cost-minimizing equilibrium. Secondly, the two firms consistently over-estimate the demand growth in electricity, possibly as a lobbying device to persuade the Government to approve the construction of new generation facilities.

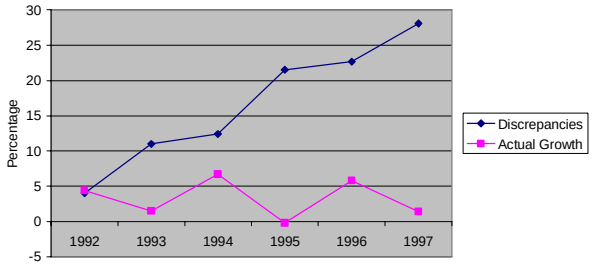

Fig. 1. Actual electricity demand growth and the magnitude of over-estimation.

Figure 1 shows the year-to-year overestimation. As the numbers suggest, even during the rapid economic growth experienced in the 1990s, actual electricity demand increased at a very stable rate of around 5%. Though, CLP was overly optimistic during the same period, consistently over-estimated the growth in electricity demand by a substantial margin. The percentage of over-estimation gradually enlarged over much of the nineties. As shown, the discrepancy between the actual growth rate and CLP's estimation kept increasing, reaching 28% in 1997.

To find out how the misjudgment of demand growth affect the monetary cost of the firm, one can calculate the cost of excess capacity maintained by the two utilities. Luk [12] shows that given the utilities' reserve margins, if the capacity utilization rate, which was measured at 54%, were raised to 70%, the utilities' cost would be lowered by approximately 32% even when they produce the same level of output. In other words, if the current excess capacity was lowered to 30%, then the savings in utilities' costs could be considerable (Note that 30% is still above the 25% international norm, which represents a fairly generous safety margin). For instance, the total expenditure by HEC in 1998 was HK$6,750 million. At this level of expenditure, if capacity utilization rose to 70% (or allow only 30% excess reserve), either by eliminating the excess capacity or correctly forecasting the demand growth, total cost could be brought down to approximately $4,594 million, which translates into a substantial saving of $2,162 million (32% savings in total cost).

The same conclusion can be made for CLP. If the same amount of underutilized capacity were eliminated, CLP's cost for producing the same amount of electricity will go down by $2,281 million.

How might this translate to potential savings for average consumers? Assume that all cost savings are passed on to the consumers evenly as a rebate. If both utilities could indeed reduce their underutilized capacity to the international standard (even then, Hong Kong will still enjoy a reliable and uninterrupted supply of electricity), then the combined savings in costs as of 1998 would amount to $4,443 million.

Considering that the total population in Hong Kong in 2004 was approximately 6.94 million, if all of this saving was to be reimbursed evenly to all consumers, then even if there were no reduction in the amount of electricity produced, each consumer would receive over $640 in rebate per year, an amount equivalent to one-sixth of their annual spending on electricity.

Alternatively, there were 2,231,500 households in Hong Kong in 2004 (i.e. approximately 3.1 persons per household). If this entire amount of savings were to return as rebate, then each household would receive $1,985 on average. Noted also that this estimated amount is calculated by assuming all households are of the same size as commercial users. In Hong Kong, commercial and industrial users account for about 75% of the utilities' revenues, if we take the size of these users into consideration, the actual saving per commercial user will be substantially more than $1,985, and the saving per household will be less than this amount.

Another way to interpret these numbers is to treat it as an over-charge. Since the amount of savings could be avoided in the first place, it follows that both utilities overcharged the customers ($1,985 per household per year) simply for maintaining the underutilized capacities. In other words, if the utilities regularly maintain the excess reserve at 30%, this $1,985 per household overcharge would be unnecessary. It is also important to point out that if one takes into account the interest utilities earned from the overcharge, the actual loss per household indeed exceeds $1,985.

It must be noted that the estimated saving mentioned above is merely an average, corresponding to the lower volume electricity consumers. For large (high volume) commercial users who pay a much higher electricity bill under block pricing, if the rebates were indeed returned to them, the actual savings per company could be enormous.

In addition, one should also keep in mind that the above figures only represent the measurable monetary cost created by the excess capacity. There are other hidden costs associated with excess capacity that one cannot, or extremely difficult, to estimate. For instance, if one takes into account the non-measurable social costs such as the adverse environmental impact when the underutilized power plant is built and the impact of high energy prices on the economy's competitiveness, the actual "cost" of excess capacity to the society may well beyond what the figures above indicate.

4. THE WAY FORWARD

Electricity supply is a vital industry in any parts of the world and the importance of its regulation cannot be taken lightly. As the current phase of the regulatory regime in Hong Kong will come to an end in 2008, and with the problems discussed above, it is imperative for the Hong Kong Government to thoroughly review and re-evaluate

the entire regulatory arrangement, and implement alternative arrangements wherever appropriate.

Reforming or restructuring the regulatory arrangement of a unique industry like the electricity supply industry cannot happen overnight, and it takes time to implement and fine-tune every new initiatives. This section introduces several alternative policy changes. They are categorized into short term and long term plans, depending on the time it takes to implement the new policy and for it to take effect.

A brief summary of the proposal suggested by the Hong Kong Government on the post-2008 regulatory environment, and discussion of where the proposal needs further clarifications follows suit. Together it will become clear that refining the current SOC with the suggested changes is preferable than a complete overhaul of the regulatory regime or outright abolishment of it.

Short Term Plan

One of the most direct concerns to the consumers is the level of electricity tariffs. As pointed out in section 2, electricity tariffs in Hong Kong is set on an annual basis, based on projected sales, operating expenses and the permitted rate of return, without much transparency. And CLP and HEC are charging their customers one of the highest tariffs in the entire world. Thus, the most direct improvement can be done is to re-evaluate the tariffs level.

1) To ameliorate the burden of the consumers, electricity tariffs should be regulated and approval must be obtained prior to any changes. Alterations in tariffs should be linked to certain economic indicators, such as the consumer price index (CPI), or other efficiency gain measures. Such approach should bring tariffs more in line with the overall economic situation and would provide incentives for efficiency improvement.

As pointed out by Luk [17], the CPI in Hong Kong has been decreasing over the past few years while electricity tariffs, especially HEC tariffs, have been rising during the same period. As such, if all values are expressed in real terms, actual profits earned by the utilities were in fact more than the permitted rate.

Table 5 shows the CPI and the indexed tariffs charged by both utilities since 1978.

As the numbers indicate, the tariffs have always been on an upward trend. If one examines the numbers carefully, the real tariffs charged by both utilities have been rather stable, and nominal tariffs move generally in line with the CPI. However, during the past few years, the Hong Kong economy entered into a period of recession, with all major economic indicators moved southward for six consecutive years. Electricity tariffs especially that of HEC's, on the other hand, remained on an upward trend, thus imposing a heavy burden on the consumers.

Incorporating the CPI, or inflation rate, as a tariff-setting benchmark is straightforward; the regulator can use the average change of the CPI over the past 2 years as a proxy and then adjust the level of tariffs accordingly. If there was a deflation, as exactly what has happened in Hong Kong over the past 6 years, the regulator can calculate the percentage drop in CPI, with adjustment for fluctuations of fuel prices in the world market, and then require the tariffs charged to adjust accordingly. The reverse can be applied during economic boom, ensuring that the power companies' profit will not be eroded by fluctuations in the overall price level, and will always earn a stable and reasonable level of return for their investments.

Table 5. Indexes of CPI and tariffs charged

Year	CPI	CLP Tariff	HEC Tariff
1978	100.00	100.00	100.00
1979	111.63	121.26	124.56
1980	128.94	174.81	167.11
1981	148.80	259.31	243.42
1982	164.48	256.00	243.86
1983	180.86	266.70	265.79
1984	195.59	265.69	265.35
1985	201.77	254.89	264.04
1986	207.42	264.64	254.39
1987	218.83	264.11	247.37
1988	235.20	262.24	246.49
1989	258.87	268.09	257.02
1990	284.15	273.61	278.07
1991	318.35	276.92	296.93
1992	348.17	283.83	311.84
1993	377.73	286.76	324.56
1994	408.40	316.79	339.91
1995	444.03	359.84	352.63
1996	470.18	383.16	366.23
1997	499.52	416.51	378.95
1998	513.83	420.11	396.05
1999	493.42	425.14	396.05
2000	479.62	422.26	396.05
2001	471.63	422.26	421.93
2002	455.50	420.83	444.30
2003	443.66	420.40	444.30
2004	441.89	419.14	444.30

2) Besides revising the tariffs-setting mechanism, the Government should also lower the permitted rate of return from its current 13.5% and 15% down to the single-digit level. Notice that the current rate of return was determined back in 1964 when the first phase of SOC was introduced, and nothing has been changed ever since. The overall economic environment in Hong Kong has experienced drastic changes over the past few years and what deemed appropriate some forty years ago is not necessarily the best solution for today's economic condition. Put it succinctly, at the time when interest rate was high, the 13.5% and 15 % return power companies entitle to seem reasonable, but when economy slows down, the permitted rate should also be adjusted accordingly.

Drawing reference to returns that could be obtained from comparable, alternative investments can provide transparency to rate-setting process and ensure that sufficient incentive for continuous and adequate investment in asset exists. And experiences from most utilities in the world indicate that the current permitted rate in Hong Kong

is unreasonably high. It has been pointed out by Lam [16] that over the past decade CLP and HEC have been able to deliver returns that are typically twice as those achieved by other utilities considered to be performing well elsewhere around the world. These profit margins and rates of return for little investment risk and in the current economic climate are excessive to consumers. If the permitted rate of return, either on equity capital or debt capital used to acquire fixed assets for power generation, is correctly determined to reflect the cost of capital, then the utilities' incentives to change their capital structure to increase the permitted return can be substantially subdued.

Based on the experiences from comparable utilities, the permitted rate of return for both power companies should be set at 8% on net fixed assets. However, in order to encourage a more efficient and environmentally friendly operation, an incentive/penalty scheme should be implemented into the system whereby the utilities will be rewarded for good performance against efficiency and air emission benchmarks or penalized for poor performance. This reward/penalty system can be in form of adjustment of the permitted rate level at 2%. In other words, the utilities may earn a maximum of 10% return and a minimum of 6% depending on how well they perform in terms of improving efficiency and environmental protection.

Moreover, the permitted rates of return should also be reviewed by the regulator on a regular basis. A constant revision mechanism provides flexibility in allowing the permitted rate to adjust to the prevailing economic environment, and better reflects the reasonable levels of return utilities should earn. The review interval can be set at five years. If such a review concludes that a change needs to be made to the permitted rate of return, whether upward or downward, any new investment made by the utilities in generation plants and transmission networks after the review should be subject to the new rate, while the old return levels will continue to apply to the existing assets and commissioned investment.

Long Term Plan

1) The success of a long term market reform in the electricity supply industry will involve the creation of an Independent Regulatory Authority (IRA). The advantages of an IRA is manifold, it can focus on the long-term interests of consumers with dedicated resources managing the necessary agreements and supply arrangements on a day-to-day basis. With more than one utility, there would be a central role in contributing towards a forward plan with sufficient capacity investment to ensure that long-term supply of electricity is secure and at a reasonable cost.

The main tasks of the IRA include continuous monitoring of the existing utilities, encourage interconnection between both companies, and most importantly, introduce competition to the market for the future.

Given that the physical area of Hong Kong is small and establishing a third power company may not be a socially desirable solution, both in terms of feasibility and environmental concern, the two incumbents should continue to be regulated by a revised SOC agreement overseen by the IRA. Details of a revised SOC arrangement should include a lower permitted rate of return and a more flexible price-setting mechanism mentioned above.

For a broader market reform, competition is feasible at the generation stage. The IRA should change the existing situation of a regional monopoly by encouraging competition at certain stages of electricity generation and supply. The generation and supply markets can be opened up in phase. First by strengthening the interconnection between the two power companies in order to allow them to compete and supply electricity to all areas of Hong Kong. This serves as a first step towards open competition under which consumers residing in either side of the city can choose the electricity provide of their choice freely.

2) Secondly, generation, transmission, and distribution networks of both utilities should be unbundled gradually to allow new entrants, including power suppliers from Mainland China, to supply electricity to the city. The unbundling process should be completed before 2018, ten years after the current phase of the SOC expires. With that, new entrants that can meet the requisite safety, reliability, service, and environmental standards to supply electricity to local consumers via the transmission and distribution networks unbundled from CLP and HEC, while both utilities receive an IRA-approved connection fee in return for the usage. On a separate study, Williams [18] suggests that future regulator should require both the existing incumbents to hive down their electricity transmission assets, including the supply grid and sub-stations, into a new electricity grid company. The floatation of this new company would involve the complete divesture of participation in the supply of electricity by CLP and HEC. And the proportionate distribution of the proceeds of the sale of the share capital of this new company would compensate the two power companies for their past investments in electricity supply assets. In addition, the regulator should prohibit any power producer from owning shares in this new company in order to avoid endless wrangles over the cost of access to the grid system between new potential suppliers and the company.

3) The production cost of electricity in Mainland China is much lower than that in Hong Kong, making the importation of electricity from the Mainland an option to lower local electricity prices. As such, the IRA should also draft detail rules and regulations and get the necessary legislation completed for the eventual opening of the electricity market to new entrants, especially to approved suppliers from Mainland China. The IRA could issue licenses to qualified new suppliers who wish to compete in the Hong Kong electricity market. These suppliers should be able to fulfill certain conditions in financial strength, size, safety, and environmental standards prescribed by the IRA before licenses are granted.

Once the market is opened, the approved participants will make their own investment plans. And the role of the

IRA is to identify when there is insufficient investment to meet future demands. In addition, the IRA can invite participants to invest in new generation capacity and new networks in an open competitive tender process.

Although it is true that Mainland China still has shortages of electricity supply, the situation may easily be reversed in a few years' time. And when the time has come, the IRA can make it a mandatory requirement for CLP and HEC to purchase electricity from the Mainland, and if the price of imported electricity is lower, they need to pass on the benefits of this cheaper cost to consumers in the form of lower electricity tariffs.

4) Long term market reform should also include incentives to promote renewable energy sources into the integrated resource pool, and to ensure the utilization of new, clean, and sustainable technologies as they mature.

The IRA should clearly define procedures and agreements so that renewable energy generators and co-generators that have met the requisite technical, service, and environmental standards, should be able to use the networks owned by the incumbents or the grid controlling company. Priority or discount on the connection fee to the grid can also be given to these generators if they can attain a lower emission standard.

In addition, the IRA can mandate the incumbents and other suppliers of electricity to purchase a portion of renewable energy for distribution. And to further tighten the environmental standards, trading of emission permits can be introduced, or monetary incentives can be provided to the incumbents for installing pollution-reduction devices in the generation plants.

Government's Proposal

In December 2005, the Hong Kong Government [19] issued a "Consultation Paper on Future Development of the Electricity Markets in Hong Kong: Stage II Consultation", which presumable is the result of the many suggestions made to the Stage I consultation paper [20]. In this latest edition of the consultation paper, the Government proposes several amendments to the current SOC, most notably: (1) the excess capacity mechanism used for a rate-based calculation; (2) the rate-of-return (ROR) linkage provision intended to achieve emission reduction; (3) allowing varying returns by asset type; and (4) lowering the utilities' allowable rates of return to the 7-11% range from the current 13.5-15% range.

The second and third points raised by the Government are in line with some of the suggestions mentioned in this paper. One of the aforementioned proposals is the inclusion of incentives to promote renewable energy sources. In the Government's plan, several incentive measures were recommended in order to achieve this end, and to put the concepts of efficiency-oriented and environmentally friendly regulatory regime as the broad framework of the post-2008 regulatory reform.

As far as tariffs reduction and the magnitude of consumers' savings are concerned, the new proposal did not provide us with any specific range. However, it is widely believed that under the new scheme, with utilities' allowable rates of return lowered to single-digit level as suggested earlier, there will be rooms for tariffs reduction, and the savings could be substantial. The actual amount of savings resulted depends on how far the allowable rates of return is lowered. Rounds of negotiations between the Hong Kong Government and the two regulated firms are currently taking place in order to reach a mutually agreed level. And when the future rates of return are finalized, it will then be able to accurately estimate the extent of monetary benefits consumers can enjoy.

These measures nothwithstanding, Luk [21] pointed out that the Government's latest proposal is not without flaws. One important issue need to be addressed is the recovery of stranded cost. As suggested in the proposal, the power industry should move towards a more open one through the injection of competition into the market and allow broad access to the incumbent firms' privately owned network, measures that are mentioned in the previous section. However, investments in the power industry are typically large, long-term, immobile, and have almost no alternative use. The long lifespan of fixed assets and long-term fuel purchase commitment typically demanded by international fuel suppliers can easily bankrupt the incumbent firms if the Government enforces the new proposal without clearly stipulate how they can recover their stranded cost, or at the very least guarantee the return of investment, under their unforeseeable future customer base.

When entrants are allowed to tap into the incumbent firms' grids, competition will force the tariffs down. This translates into a lower return on invested capital by the incumbent firms. As such, it is imperative for the Government to specify clearly in the consultation paper how the incumbent firms can recover the cost of their invested capital, or stranded cost, when the market is to be opened for competition. This is to ensure a healthy long term development of the market and to preserve the industry's excellent record of supply reliability.

5. CONCLUSION

This paper outlined the background and structure of the electricity supply industry and its regulatory arrangement in Hong Kong. The problems and drawbacks associated with the current regulatory scheme are also discussed in detail. With a view to rectify those problems and to create a more efficient regulatory environment for the future, a number of policy alternatives, both for short term and long term, are suggested. Many of these amendments can easily be implemented and incorporated into the current regulatory arrangement without compromising production efficiency.

It must be pointed out that given all the problem and drawbacks discussed, the current SOC regulation is by no means a total failure. Instead it has served the industry well by providing sufficient incentive for the two power companies to ensure that there is an adequate and stable supply of electricity to the city, albeit at the cost of high

electricity tariffs and high level of excess capacity. As evidenced by the fact that there has not been any major power outage over the past few decades, it cannot be denied that the SOC has done an outstanding job of securing an ample supply of electricity to the city.

In light of the rapidly changing economic environment, constant evolving industry structure, and the development of alternative power sources, certain elements of the SOC have become obsolete and required thorough amendment. However, it must be noted that given its outstanding record of ensuring supply security, it is a common consensus in Hong Kong that the SOC should remain in place. The Hong Kong Government, the public, and the two power suppliers all agree that it is beneficial to keep the SOC rather than taking the risk of introducing a major reform to the regulatory environment, which may jeopodize Hong Kong's position as a major financial center in the region.

The proposed policy alternatives can serve as the first step towards a major overhaul of the scheme, they inject flexibility and transpancy to the SOC which enable the scheme to better cope with the current industry and economic conditions. Actual implementation of these policy alternatives and how to deal with certain technical difficulties that may arise require further and more in-depth research in the future.

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