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Hong Kong's Macro Economic Trends and Power Industry Structure

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I. Macro Economic Trends for Hong Kong

Main Indicators of National Economy and Growth Rates

Hong Kong is situated on the southeast coast of China, about 95 kilometers southeast of Guangdong. It consists of Hong Kong island, the ceded territory of Kowloon on the mainland, the New Territories, which cover a large area on the mainland north of Kowloon and about 230 outlying islands. Hong Kong's land area is limited (1,050 square kilometers) and Hong Kong is the most densely populated territory in the Asia-Pacific region. The area around the harbor of Hong Kong accounts for less than 15 percent of the land area but over 93 percent of the population.

Hong Kong is primarily a trading center. It has virtually no natural resource base, therefore is totally dependent on imports for energy, raw materials, and food. Hong Kong's GDP grew at an average annual rate of 6.9 percent over the 1980-1991 period but slowed to 5.2 percent in 1992 and 5.6 percent in 1993. The GDP growth rate for the remainder of 1990s is projected to be around 5 percent per year (Table 1). Approximately 75 percent of Hong Kong's GDP is generated in the service sector, and only 25 percent is generated from industry. In 1992, Hong Kong's total trade was US\$242 billion (imports were US\$123 billion and exports were US\$119 billion). About 75 percent of total exports are actually re-exports from other countries.

Under the December 19, 1984 Sino-British Joint Declaration Hong Kong will become a Special Administrative Region of China on

July 1, 1997. The process of economic integration with the mainland is already well advanced. Currently, most of the value-added component is actually "added" across the border in China. By the end of 1993 there were 106,914 firms with some Hong Kong ownership in China. Hong Kong also exports service jobs across the border.

In spite of concerns about post 1997, Hong Kong continues to grow. There are also concerns that the cost of living and doing business in Hong Kong is becoming too high. However, one of the colony's strongest selling points has always been its quality of life. In 1991, the purchasing power parity adjusted per capita GDP was US\$18,520, or about 83.7 percent of the U.S. level.

To maintain its competitiveness, Hong Kong is speeding up its infrastructural development. Although the new airport remains a hostage to the political tensions between China and Britain, fund-raising for the new western harbor crossing is quietly proceeding. The government intends to increase spending on roads and public housing as well. Although growth will probably moderate in the future, the strong comparative advantage built up by Hong Kong is likely to be maintained beyond 1997.

Energy Consumption and Mix

Hong Kong imports all of its oil and coal requirements. In the 1980s, primary commercial energy supply growth averaged 7.6 percent per year, with energy supply increasing from 4.8 million tonnes of oil equivalent (Mtoe) to 10 Mtoe. The relative mix of

energy supply has changed dramatically. Oil's share has declined from about 100 percent to 36 percent, while coal's share has increased from almost zero to 65.6 percent (Table 2). Coal is used to generate electricity in Hong Kong. In 1990, 3.6 million tonnes of oil was imported of which only 2.6 percent was consumed in electricity generation as compared to almost 50 percent in 1980.

The total final energy consumption in 1990 was 5.63 Mtoe, of which the industrial sector accounted for 18.9 percent, the residential and commercial sectors together accounted for 37.3 percent, and the transportation sector accounted for 42.6 percent. During the 1980s, the final energy elasticity with respect to GDP was 0.95, while the electricity elasticity with respect to GDP was 1.28.

II. POWER INDUSTRY STRUCTURE IN HONG KONG

Energy Policy and Institutional Setting

Government intervention in Hong Kong's energy sector is limited beyond environmental issues. The Economic Services Branch of the Secretariat deals with energy policy issues. Economics is the main factor in determining fuel selection in Hong Kong's power plants. Following oil price increases in 1974, the prospect of future price increases and the possibility of future oil supply shortages led the government to adopt an energy policy geared towards reduced dependence on oil without sacrificing economic growth.

Most of Hong Kong's electricity is supplied by two private companies, China Light & Power Company, Ltd. (CLPC) and Hong Kong Electric Holdings Ltd. (HEH). Each company is subject to prior government approval of their financial plans, including tariff levels and profits. The utilities seek to provide a reliable and sufficient electricity supplies at the lowest reasonable cost and to provide shareholders with a fair return on their investment.

CLPC, together with three associated generating companies, the Peninsula Electric Power Company (PEPCO), the Kowloon Electricity Supply Company (KESCO), and the Castle Peak Power Company (CAPCO), accounts for about 70 percent of Hong Kong's total installed capacity and provides electricity to almost 1.6 million customers out of a population of about 5 million. CLPC owns 40 percent of each company, while Exxon Energy Limited (whose ultimate parent is

Exxon Corporation) owns the remainder. CLPC provides electricity to Kowloon and the New Territories, including Lantau, Cheung Chau and a number of other outlying islands. Its supply area extends to about 1,000 square kilometers. HEH supplies 472,000 customers on Hong Kong island, as well as on the nearby islands of Ap Lei Chau and Lamma.

Installed Capacity and Mix

Between 1980 and 1993, Hong Kong's installed capacity grew 7.7 percent per annum from 3,445 MW to 9,037 MW (Table 3). Both companies have shifted from oil to coal-fired generation and currently operate dual-fired units. During 1980-1993, the share of oil-fired capacity decreased from 88.5 to 16.8 percent, while coal-fired capacity rose from zero to 65.4 percent. The share of gas turbine capacity increased from 11.5 to 17.8 percent.

Currently Hong Kong has four major power stations. The Castle Peak Power Station, the Tsing Yi Power Station, and the Penny's Bay Gas Turbine Power Station are managed by CLPC; and the Lamma Power Station is owned by HEH.

The Castle Peak Power Station (4,460 MW) accounts for about half of Hong Kong's total installed capacity and more than two-thirds of total electricity generation (Table 4). Until recently it had four 350 MW and four 677 MW coal-fired generating units and six gas turbines with a total capacity of 352 MW. Two of the gas turbines have recently been relocated from Hok Un. In 1993, due to an increase in utilization, annual sent-out electricity at Castle

Peak has increased to 25,157 GWh, representing an 8.4 percent increase over the 1992 level. Annual station sent-out efficiency was high at 36 percent for the 350 MW units and a record 37 percent for the 677 MW units. Machine reliability was maintained at consistently high levels with an overall availability of more than 94 percent.

The Lamma Power Station has installed capacity of 2,606 MW, which accounts for about 30 percent of Hong Kong's total capacity and about one-quarter of total electricity generation. Its six coal-fired units comprise a total installed capacity of 1,800 MW (units 1-3 have capacity of 250 MW each and units 4-6 350 MW each). These units produced 99.9 percent of the electricity generated at Lamma. These units have a thermal efficiency of 36 percent, an availability of 93.1 percent, and an reliability of 99.4 percent. The seven gas turbines at Lamma (combined capacity of 805 MW) are used for peak lopping, emergency stand-by and spinning reserves. In the future, HEH plans to add two more 350 MW coal-fired units in Lamma. The No.7 unit is scheduled to be in operation by 1995, and the No.8 unit is scheduled for 1997.

The Tsing Yi Power Station has a total installed capacity of 1,672 MW comprising six 120 MW and four 200 MW oil-fired generating units and two gas turbines with a total capacity of 152 MW. In 1993, the six 120 MW units produced 416 GWh of electricity and overall availability was 97.2 percent, while the four 200 MW units produced 965 GWh of electricity and overall availability was 97.2 percent. The two gas turbines were relocated from Hok Un.

The Penny's Bay Gas Turbine Power Station, which is comprised of three 100 MW gas turbines, was completed in March 1992. The Penny's Bay plant, together with the gas turbines relocated from Hok Un to Castle Peak and Tsing Yi, are utilized only for peak lopping or emergency generation.

In December 1992, the Executive Council of Hong Kong approved CLPC's Financing Plan, allowing CLPC to proceed with the development of a 2,500 MW combined cycle gas turbine plant at Black Point. The plant will be fuelled by natural gas piped 440 miles from Yacheng 13-1, south of Hainan Island in the South China Sea. The gas supply contract with ARCO and the China National Offshore Oil Corporation was signed in December 1992, securing 20 years of piped natural gas supply. The construction started on February 1, 1993. All site work is currently proceeding on schedule. The first two units, corresponding to a total of 625 MW, will enter into commercial operation in January 1996. The ultimate planned capacity of the power station will be about 6,000 MW.

The Daya Bay Nuclear Power Station is a joint venture between the state-owned Guangdong Nuclear Investment Company and the Hong Kong Nuclear Investment Company (HKNIC), a wholly owned subsidiary of CLPC. HKNIC has a 25 percent interest in the 2x900 MW Daya Bay Nuclear Power Station of China and intends to purchase 70 percent of its output. The second 900 MW unit at Daya Bay has been in commercial operation since March 25, 1994.

Hong Kong Pumped Storage Development Company, Ltd. (PSDC), was formed in April 1989, with 51 percent of its shares held by Exxon

and 49 percent by CLPC. PSDC has acquired 50 percent of the 1,200 MW capacity pumped storage project at Conghua in Guangdong Province of China. The first two of the four 300 MW units are now under commercial operation and the remaining units are scheduled for commissioning in the first half of 1994.

CLPC signed a letter of intent with the Shandong Electric Power Company of China in April 1993 to invest in three power plants with a total capacity of 3,600 MW located in the counties of Shiheng, Heze and Jining. These projects are listed in the 8th and 9th Five Year Plans of China, but those in the 9th Five Year Plan have not yet been approved by the State Planning Commission of China. Discussions with several other power organizations in China are also underway.

Electricity Generation and Fuel Consumption

Hong Kong's electricity generation growth has been faster than capacity growth. During the 1980 and 1993 period, generation growth averaged 10.5 percent per year (Table 5) with gross generation increasing from 10,065 GWh to 37,035 GWh. During the same period, the share of oil-fired electricity decreased from 99.6 percent to 3.7 percent, while the share of coal-fired electricity increased from zero to 96.1 percent. The share of diesel generated electricity is insignificant.

When the oil crisis of the 1970s sent oil prices skyrocketing, Hong Kong was already searching for alternative energy sources. The possibility of using hydro-electric power was

examined, but no suitable site for a pumped storage power station was available. Other options such as tidal power, wind power, and solar energy were also considered, but the geographical constraints made each of these commercially impracticable. The best economic choice was coal. By 1990, the share of coal-fired electricity reached a peak of 99.4 percent. With lower oil prices in recent years, the share of oil-fired electricity has increased from its 1990 level.

Coal is projected to remain Hong Kong's primary fuel for electricity generation. In 1993, coal consumption reached 12.4 million metric tonnes (Mt) -- 9.2 Mt at the Castle Peak Power Station and 3.2 Mt at the Lamma Power Station. Hong Kong imports most of its coal from Indonesia (25%), South Africa (20%), and Australia (13%). The key criteria in coal purchases is price per unit of energy. Coal costs in Hong Kong are about HK\$11.74 (US\$1.5) per million Btu, while fuel oil costs are about HK\$17.53 (US\$2.25) per million Btu thus unit Btu oil costs are about 50 percent higher than for coal.

Low-sulfur coal is used and low-nitrogen oxides burners are installed to reduce the amount of SO₂ and NO_x emissions. By 1990, total SO₂ emissions from CLPC were 40 percent lower than in 1981, despite a 100 percent increase in the amount of electricity generated.

Transmission and Distribution System Capability

The transmission system of CLPC and HEH are interconnected by

a 720 MVA capacity tie line which provides greater supply security to each company by allowing lower operating reserve requirements. During 1993, HEH exported 277.4 GWh of electricity to CLPC through the interconnection.

The interconnection contract between CLPC and Guangdong General Power Company (GGPC) permits sales of electricity to Guangdong. The Transmission Business Group of CLPC also draws electricity from the Daya Bay Nuclear Power Station and the Guangzhou Pumped Storage Power Station and sells surplus electricity to China.

In CLPC's transmission system, the 1993 overall and planned capacity availability were 97.9 percent and 99.7 percent respectively. In 1993, 21.6 circuit kilometers (cct-km) of 132 kV cables and 17 power transformers were installed. By the end of 1993, CLPC had 420 cct-km of 400 kV transmission lines, 835 cct-km of 132 kV lines, 160 cct-km of 66 kV lines, 681 cct-km of 33 kV lines, and 5,373 cct-km of 11 kV lines (Table 6). The 400 kV extra-high voltage lines connected the Castle Peak Power Station to the various load centers in Kowloon and the New Territories.

Electricity on Hong Kong island is supplied from HEH's power station at Lamma by a 275 kV submarine cable. Submarine cables were also laid between Lamma and Wah Fu in 1986. With the exception of a few short lengths of 132 kV (23 cct-km) overhead transmission lines, HEH's transmission system is entirely underground.

Technology Sophistication and Efficiencies

Table 6 and Table 7 show the key indicators of CLPC and HEH respectively. Both utilities are very efficient in contrast to most state utilities in Asia. Thermal efficiencies in Hong Kong are about 36 percent based on electricity send-out and more than 38 percent based on total generation. Plant availabilities are more than 92 percent. The reliability of power supply in both systems is very high. In both systems generation failure was zero, while transmission and distribution failure was less than 0.1 percent.

As a percentage of gross electricity generation, the average plant auxiliary consumption levels in CLPC increased gradually from 5.6 percent in 1980 to 6.6 percent in 1990, as coal-fired generation increased. Transmission and distribution losses (as a percentage of units sent out plus net transfers from HEH) declined from 5.8 percent to 5.1 percent during the same period, with an increase in EHV transmission through 400 kV lines. About 30 percent of the transmission and distribution losses occurred in the transmission and subtransmission system, while 70 percent occurred in the distribution system. In the HEH system, auxiliary consumption plus transmission and distribution losses declined from 13.2 percent in 1983 to 12 percent in 1990.

The four 677 MW units at Castle Peak have been completely retrofitted with low NO_x burners that reduce the generation of NO_x by about 50 percent. A similar program has now been concluded for the four 350 MW units at Castle Peak.

In September 1993, Hong Kong's first FGD system was installed.

This unit removes over 90 percent of the SO₂ emissions of Lamma Unit 6. Its limestone loading and gypsum unloading facilities utilize pipe and enclosed conveyor systems to eliminate dust emissions. Coal handling plants of Lamma Units 7 and 8 (Stage III) will utilize similar conveyor systems.

Electricity Consumption by Sector

Hong Kong's total annual electricity sales increased 9 percent on average between 1985 and 1993, from 16,689 GWh to 33,349 GWh (Table 8). During the same period, the shares of the commercial sector, the domestic sector, and the government sector remained at about 36 percent, 21 percent, and 10 percent respectively of total electricity consumption. The share of the manufacturing sector decreased from around 27 percent to 16 percent due to the relocation of factories to southern China and to sluggish export demand. Rapid infrastructural and economic development in China's Guangdong Province has led to increased electricity sales to China. Sales to Shekou increased by 13.7 percent to 417.7 GWh and to Guangdong General Power Company by 33.3 percent to 5,360 GWh in 1993. This increase in sales compensated for the loss of direct sales to the Hong Kong manufacturing sector. The growth of electricity sales to China is expected to slow in the years to come as local generating facilities are brought on stream.

Electricity consumption patterns are quite different between the two utilities. For the CLPC system, the commercial sector accounts for only 26 percent of total electricity sales, while in

the HEH system the commercial sector accounts for 68 percent of total sales (Table 7).

Currently, electricity consumption in Hong Kong per U.S. dollar of GNP is about 0.32 KWh.

Electricity Tariffs

Consumers of both utilities in the manufacturing (served at high and medium voltages) and commercial sectors pay demand and energy charges. Also, all consumers are charged according to a decreasing block tariff structure. The rates charged by each utility differ.

In 1993, the average electricity prices of CLPC and HEH were HK\$0.568/kWh (US\$0.073/kWh) and HK\$0.74/kWh (US\$0.095/kWh) respectively. In 1993, average electricity prices were HK\$0.413/kWh (US\$0.053/kWh) for electricity sold to China and HK\$0.614/kWh (US\$0.079/kWh) for electricity sold to CLPC's local consumers.

The Consumer Price Index in Hong Kong has risen by 90.7 percent over the past 10 years, while CLPC's electricity price has increased by a very low 2.8 percent in nominal terms. Since the HEH system began its first full year of operations in 1983, average net tariffs have increased by 28 percent in nominal terms, but decreased 44 percent in real terms. Each utility has fuel cost adjustment clauses and the operational savings are passed on to the consumers. Reductions in real tariff rates in recent years are primarily due to the effect of increased lower cost fuel (coal).

High plant availability and high operational efficiency have also contributed to a reduction in generation costs.

The financial operations of both utilities are subject to a Scheme of Control approved by the Hong Kong Government. According to the Scheme, the annual permitted return earned must be 13.5 percent on any fixed assets plus 1.5 percent on any average net fixed assets financed by shareholders' investment after September 30, 1978. Any difference between the permitted return and profit is to be transferred to, or from, a Development Fund. The Development Fund assists in financing the acquisition of fixed assets, and is not a part of the distributable shareholder's fund.

CLPC has a Non-Scheme of Control Business Group, which is responsible for the investment in China's Daya Bay Nuclear Power Station and the pumped storage power station in China's Guangdong Province.

III. Projections of Hong Kong's Power Industry

Peak Load, Gross Generation, and Electricity Consumption by Sector

Projections of Hong Kong's peak demand, gross generation, net electricity supply available, and electricity consumption by sector in the 1994-2010 period are listed in Table 9. The assumptions behind these projections are discussed below.

CLPC projects that Hong Kong's GDP will grow at about 5 percent per year over the next 10 years and reduce to around 4 percent thereafter. According to CLPC, Hong Kong's demand for

electricity will increase by 6 to 7 percent a year over the next 10 years. The projections of HEH are, however, more conservative. Our projection is that annual GDP growth rates will average 5 percent during the 1994-2000 period. After 2000, economic growth is projected to slow down in Hong Kong, mainly due to Hong Kong's high labor costs relative to mainland China and the competition from mainland China.

In Hong Kong, electricity supply is determined by demand. During the 1980-1993 period, peak demand growth averaged 7.6 percent per year, slightly faster than the growth of GDP (6.7 percent per year). We project that in the future peak demand will continue to grow slightly faster than GDP growth in Hong Kong, and the annual growth rate of peak demand will average 5.8 percent during the 1994-2000 period and 4.6 percent in the 2001-2010 period. Therefore Hong Kong's total peak demand is projected to reach 10.64 GW by 2000 and 16.68 GW by 2010.

During the 1980-1993 period, the overall load factor in Hong Kong increased from 41.4 percent to about 59 percent, due to increased utilization of capacity caused by rapid growth of electricity exports to China and the introduction of large-size coal-fired units. However, Hong Kong utilities project that the rapid growth of electricity exports to mainland China will slow in the future. Therefore Hong Kong's load factor is projected to remain at the 1993 level in the 1994-2010 period.

Future gross generation of electricity can be calculated based on the projection of the future peak load demand and the load

factor. Given the projected peak demand and load factor above, Hong Kong's gross generation is projected to reach 54,956 GWh by 2000 and 86,165 GWh by 2010.

Between 1980 and 1993, Hong Kong's system loss rate decreased from 11.3 to 10 percent, and it is assumed that Hong Kong's system loss rate will remain at the 10 percent level during the 1994-2010 period. With this assumption, total electricity consumption is projected to reach 49,460 GWh by 2000 and 77,548 GWh by 2010.

During the 1980-1993 period, the shares of the residential and commercial sectors in total electricity consumption have been very stable, while the share of the industrial sector decreased rapidly and the share of electricity exported to China increased rapidly. It is assumed that the 1994-2010 period will follow the same trend. The projected shares of electricity consumption by sector are shown in Table 7.

Installed Capacity by Fuel

Projections of Hong Kong's installed capacity by fuel are given in Table 10. In the CLPC system, increased electricity demand until the mid-1990s will be met by the completion of two projects in 1993 and 1994 - a joint venture nuclear power station at Daya Bay in Guangdong Province, and a pumped storage hydropower plant at Conghua, also in Guangdong Province - these two projects can supply a total of 1,860 MW of power capacity to the CLPC system.

From 1996 onwards, there is a need to initiate phased

commissioning of a new power station to ensure a continuous, reliable supply of electricity. As part of its long-term planning process, CLPC has investigated the best fuel for Hong Kong. Due to public concern for the environment, CLPC initially studied the feasibility of using liquefied natural gas to generate electricity. However, heavy capital and operating costs required for the processing of the liquefied fuel made this option unattractive.

The choice of natural gas became viable following the confirmation of the availability of gas reserves south Hainan Island in the South China Sea. A contract has been signed between Castle Peak Power Co. and gas suppliers for a 20-year supply of natural gas beginning in 1996. A 780 km pipeline will supply 2.9 billion cubic meters of natural gas to Hong Kong each year after January 1, 1996. The first 625 MW combined cycle units at the Black Point Power Station will also be in operation in 1996. The gas supply will enable the development of 2,500 MW generating capacity.

Two additional 350 MW coal-fired units will be installed in the HEH system. The first one is scheduled to be in operation by 1995, and the second one by 1997.

During the 1980-1993 period, Hong Kong's generating capacity reserve margin was fluctuating around the 20 percent level. In the long run we assume that total generating capacity reserves will be kept around 20 percent of total installed capacity in Hong Kong. The above mentioned additional capacity will meet all peak demand and reserve requirements until early next century; however, after

2000 further new capacity will be required to meet growth in electricity demand.

It is not clear whether future expansions in electricity needs will be met from plants located in Hong Kong or mainland China. Some utility executives in Hong Kong believe that China will require stringent environmental controls on plants exporting electricity to Hong Kong, and this may remove any advantage of locating plants in mainland China.

To meet the 20 percent reserve margin by 2010, around 6,700 MW of additional generating capacity will be required between 2001 and 2010. An additional 3,500 MW of capacity has been scheduled at the Black Point Power Station. So far the fuel option of these units is still uncertain. If natural gas is available at a competitive price, these units will probably be fueled by natural gas. In our projection, we assumed that this natural gas is available for the combined cycle power plant by 2010. If, however, natural gas is not available, then coal is likely to be the second choice.

Another 3,200 MW of new capacity will have to be installed in addition to the currently planned generating units during the 2001-2010 period. Since the annual operating hours of Hong Kong's reserve units is very low, it is cheaper to use gas turbines and pumped storage hydro units as reserve units. Therefore we project that about 2,000 MW of gas turbines will be added between 2001 and 2010. Together with current gas turbines and pumped storage hydro units (4,200 MW), these new turbines will be used as the 20 percent reserve by 2010. The remaining 1,200 MW of new capacity is

projected to be fueled by coal.

Electricity Generation by Fuel and Fuel Consumption

Table 11 shows the projections of Hong Kong's electricity generation by fuel and fuel consumption during the 1994-2010 period.

Nuclear power has the lowest fuel costs and will be utilized to serve the base load. CLPC projects that eventually the plant load factor of Daya Bay will be about 70 percent (6132 hours/year). Since CLPC is supposed to buy 70 percent of Daya Bay's electricity, Hong Kong's share of electricity from Daya Bay is projected to be around 7,700 GWh per year in the long run. The Daya Bay Nuclear Power Station has experienced some generating problems during 1994, and we assume it will operate below its potential in the near term.

Hong Kong will mainly use coal-fired generating units to serve its base load demand until 1996. However, due to the commissioning of Daya Bay Nuclear Power Station and the No.7 coal-fired units at the Lamma Power Station, the annual operating hours of coal-fired units is projected to decrease. The combined cycle units at Black Point Power Station will start operation after 1996, reducing the annual operating hour of coal-fired power units further. Coal consumption by Hong Kong's power sector is projected to increase from the current 12.4 Mt to 15.2 Mt by 2010.

The utilization of combined cycle units in Black Point is mainly determined by natural gas availability. If we assume the thermal efficiency in Black Point can reach 40 percent based on

gross generation, the scheduled 102 billion cubic feet (BCF) of natural gas supplied from China can generate 12,500 GWh of electricity, equivalent to 5,000 hours of operation annually. In the long run, the combined cycle units should be used to serve base load. The annual operating hours of combined cycle units is projected to increase to about 5,500 hours per year by 2010. The 6,000 MW Black Point Power Station will therefore require around 270 BCF of natural gas per year. Additional gas reserves will need to be discovered in order to sustain supplies at 270 BCF per year.

Electricity generated by fuel oil decreased dramatically in the 1980s, but has been increasing gradually since 1991 due to reduced oil prices. No growth of oil-fired electricity is projected in the future.

Since gas turbines will be utilized only for peaking or emergency generation, electricity generated by diesel will continue to be very limited.

Table 12 shows the projections of Hong Kong's electricity balance, in which we assumed that the ratios of auxiliary consumption and transmission & distribution losses will stay at current levels.

Table 1. Hong Kong's Key Economic Indicators

	Units	Year	Value
Population	Million	1993	5.92
Population Growth Rate	%/year	1983-1993	1.03
Population Growth Rate	%/year	1994-2010	0.37
Per Capita GNP	US\$	1991	13430
Total GDP	US\$Billion	1991	68
Services	% of GDP	1991	75
Industry	% of GDP	1991	25
Average Annual Growth of GDP	%	1980-1991	6.9
Average Annual Growth of GDP	%	1992-2000	5.0
Average Annual Inflation	%	1980-1991	7.5
Imports	US\$Billion	1992	123
Total Exports	US\$Billion	1992	119
Domestic Exports	US\$Billion	1992	30
Re-Exports	US\$Billion	1992	89
Major Industries			
Clothing	US\$Billion	1991	15.26
Plastics	US\$Billion	1991	2.09
Computer Machinery	US\$Billion	1991	2.55
Watches and Clocks	US\$Billion	1991	2.32
Primary Energy Consumption	Mtoe	1991	10.88
Average Annual Growth of Energy	%	1980-1991	7.7

Sources: Asia 1994 Yearbook; Hong Kong Monthly Digest of Statistics October 1993; and Coal in Asia-Pacific Jan. 1994;

Table 2. Hong Kong's Energy Consumption and Mix

	1980	1985	1990
Primary Energy Supply (%)			
Coal	0.1	53.0	65.6
Oil	100.4	48.3	35.9
Gas	0.0	0.0	0.0
Primary Electricity	-0.5	-1.3	-1.5
Hydro	0.0	0.0	0.0
Electricity Exports	-0.5	-1.3	-1.5
Final Energy Consumption (%)			
Residential/Commercial	32.9	37.8	37.3
Industry	26.8	28.7	18.9
Transport	39.3	32.8	42.6
Other/Non-energy	1.0	0.7	1.2
Other Indicators			
Self-Reliance in Energy (%)	0.0	0.0	0.0
Electricity in Primary Energy Supply (%)	46.8	67.7	66.5

Source: ADB, Electric Utility Data Book 1993.

Table 3. Installed Capacity By Plant Type in Hong Kong

	Installed Capacity (MW)				Growth (%/yr) 80-93*
	1980	1985	1990	1993	
Total	3445	5609	7710	9037	7.70
CLPC	2416	3924	5455	6432	7.82
HEH	1029	1685	2255	2605	7.41
Coal	0	2150	4881	5908	13.47
CLPC	0	1400	3431	4108	
HEH	0	750	1450	1800	
Oil	3050	2870	1520	1520	-5.22
CLPC	2090	2000	1520	1520	
HEH	960	870	0	0	
Gas Turbine	395	589	1309	1609	11.41
CLPC	326	524	504	804	
HEH	69	65	805	805	
Combined Cycle	0	0	0	0	
CLPC	0	0	0	0	
HEH	0	0	0	0	
Share in Total Capacity (%)					
Total	100.0	100.0	100.0	100.0	
CLPC	70.1	70.0	70.8	71.2	
HEH	29.9	30.0	29.2	28.8	
Coal	0.0	38.3	63.3	65.4	
CLPC	0.0	25.0	44.5	45.5	
HEH	0.0	13.4	18.8	19.9	
Oil	88.5	51.2	19.7	16.8	
CLPC	60.7	35.7	19.7	16.8	
HEH	27.9	15.5	0.0	0.0	
Gas Turbine	11.5	10.5	17.0	17.8	
CLPC	9.5	9.3	6.5	8.9	
HEH	2.0	1.2	10.4	8.9	
Combined Cycle	0.0	0.0	0.0	0.0	
CLPC	0.0	0.0	0.0	0.0	
HEH	0.0	0.0	0.0	0.0	

* Growth rate for coal-fired capacity is between 1985 and 1993.

Source: China Light & Power Company, Limited, "Annual Report 1993";

Hong Kong Electric Holdings, Limited, "Annual Report 1993"

Table 4. Hong Kong's Power Plants in 1993

	Capacity		Number of Units	Unit Size	Fuel Type
	MW	(%)			
Total	9037	100	42		
CLPC	6432	71	29		
(1) Castle Peak	4460	49	14		
Coal-fired	4108	45	8	350&677	Coal
Gas Turbine	352	4	6		Diesel
(2) Tsing Yi	1672	19	12		
Oil-fired	1520	17	10	120&200	Oil
Gas Turbine	152	2	2		Diesel
(3) Penny's Bay	300	3	3	100	Diesel
(4) <i>Black Point*</i>	<i>2500</i>				<i>Natural Gas</i>
HEH (1) Lamma	2605	29	13		
Coal-fired	1800	20	6	250&350	Coal
Gas Turbine	805	9	7		Diesel
<i>Coal-fired</i>	<i>700</i>		<i>2</i>	<i>350</i>	<i>Coal</i>

Note: units in italics are planned power capacity

* The ultimate capacity of Black Point will be 6,000 MW, the first 625 MW will be in operation in 1996.

Source: China Light & Power Company, Limited, "Annual Report 1993";

Hong Kong Electric Holdings, Limited, "Annual Report 1993"

Table 5. Gross Generation by Fuel Type in Hong Kong (GWh)

	Electricity Generation (GWh)				Growth (%/yr) 80-93*
	1980	1985	1990	1993	
Total	10065	18917	28629	37035	10.54
CLPC	9040	13903	21202	28256	9.16
HEH	1025	5014	7427	8779	17.96
Coal	0	14679	28460	35587	11.71
CLPC	0	9920	21059	26817	13.24
HEH	0	4759	7401	8770	7.94
Oil	10028	4231	139	1381	-14.14
CLPC	9028	3977	139	1381	-13.45
HEH	1000	254	0	0	
Diesel	37	7	30	67	4.63
CLPC	12	6	4	58	12.83
HEH	25	1	26	9	-7.56
Natural Gas	0	0	0	0	
CLPC	0	0	0	0	
HEH	0	0	0	0	
Share in Total Generation (%)					
Total	100.0	100.0	100.0	100.0	
CLPC	89.8	73.5	74.1	76.3	
HEH	10.2	26.5	25.9	23.7	
Coal	0.0	77.6	99.4	96.1	
CLPC	0.0	52.4	73.6	72.4	
HEH	0.0	25.2	25.9	23.7	
Oil	99.6	22.4	0.5	3.7	
CLPC	89.7	21.0	0.5	3.7	
HEH	9.9	1.3	0.0	0.0	
Diesel	0.4	0.0	0.1	0.2	
CLPC	0.1	0.0	0.0	0.2	
HEH	0.2	0.0	0.1	0.0	
Natural Gas	0.0	0.0	0.0	0.0	
CLPC	0.0	0.0	0.0	0.0	
HEH	0.0	0.0	0.0	0.0	

* Growth rate for coal-fired electricity is between 1985 and 1993.

Source: China Light & Power Company, Limited, "Annual Report 1993";

Hong Kong Electric Holdings, Limited, "Annual Report 1993"

Table 6. Main Indicators of China Light & Power Company

	Units	China Light & Power Company		
		1985	1990	1993
Customers	Million	1.2	1.5	1.6
Sales Analysis				
Commercial	HK\$M	1873	2907	4037
Manufacturing	HK\$M	2199	2987	2927
Domestic	HK\$M	1314	2261	3155
Government & Others	HK\$M	1013	1598	2043
China	HK\$M	401	636	2385
Total	HK\$M	6800	10389	14547
Average Price	HK\$/kWh	0.5509	0.5549	0.5683
Electricity Sales	GWh	12343	18723	25598
Peak Demand	MW	2992	4517	5281
Local	MW	2835	4058	4432
Local and China	MW	2987	4407	5244
Installed Capacity	MW	3924	6132	6432
System Load Factor	%	53	54	61
Generation	GWh	13903	21202	28256
Send Out	GWh	13004	19805	26471
Net Transfer from/(to)	GWh	151	-23	71
Fuel Consumption	Terajoules	134426	198234	266247
Thermal Efficiency*	%	37.23	38.50	38.20
Plant Availability	%	92.3	88.9	95.5
Transmission and Distribution				
400 kV Lines	cct-km	116	203	420
132 kV Lines	cct-km	406	584	835
66 kV Lines	cct-km	233	185	160
33 kV Lines	cct-km	609	671	681
11 kV Lines	cct-km	2999	4390	5373
Transformers	MVA	20752	30881	39457
Primary Substations		142	159	173
Secondary Substations		4517	6440	7916

* based on gross generation.

Source: China Light & Power Company, Limited, "Annual Report 1993";

Table 7. Main Indicators of Hong Kong Electric Holdings

	Units	1985	1990	1993
Customers	Million	0.47	0.44	0.35
Total Sales	GWh	4346	6557	7751
Commercial	GWh	2756	4311	5271
Manufacturing	GWh	550	636	561
Domestic	GWh	1040	1610	1919
Share of Sales				
Commercial	%	63.41	65.75	68.00
Manufacturing	%	12.66	9.70	7.24
Domestic	%	23.93	24.55	24.76
Net Tariff	HK\$/kWh	60.2	63.4	74
Installed Capacity	MW	1685	2255	2605
Generation	GWh	5014	7427	8779
Peak Demand	MW	1150	1613	1890
System Load Factor	%	49.5	52.7	53.1
Thermal Efficiency*	%	34.8	36	36
Coal-Fired Plant Availability	%	96.6	93.4	93.1
Switching Stations		9	12	16
Zone Substations		15	19	21
Consumer Substations		2201	2629	2899

Source: Hong Kong Electric Holdings, Limited, "Annual Report 1993"

Table 8. Hong Kong's Electricity Consumption by Sector

	Units	1985	1990	1993
Total Sales of Hong Kong	GWh	16689	25280	33349
Commercial	GWh	6080	9479	11850
Manufacturing	GWh	4452	5946	5331
Domestic	GWh	3372	5629	7061
Government & Others	GWh	1798	2841	3330
China	GWh	988	1386	5777
Share of total	%	100	100	100
Commercial	%	36	37	36
Manufacturing	%	27	24	16
Domestic	%	20	22	21
Government & Others	%	11	11	10
China	%	6	5	17
Total CLPC	GWh	12343	18723	25598
Commercial	GWh	3324	5168	6579
Manufacturing	GWh	3902	5310	4770
Domestic	GWh	2332	4019	5142
Government & Others	GWh	1798	2841	3330
China	GWh	988	1386	5777
Share in CLPC System	%	100	100	100
Commercial	%	27	28	26
Manufacturing	%	32	28	19
Domestic	%	19	21	20
Government & Others	%	15	15	13
China	%	8	7	23

Source: China Light & Power Company, Limited, "Annual Report 1993";
Hong Kong Electric Holdings, Limited, "Annual Report 1993"

Table 9. Projections of Hong Kong's Peak Load, Gross Generation, and Electricity Consumption by Sector

	1980	1990	1993	1995	2000	2010
Peak Demand (MW)	2775	6130	7171	8027	10641	16684
Load Facotrs (%)	41.40	53.31	58.96	58.96	58.96	58.96
Generation (GWh)	10065	28629	37035	41456	54956	86165
System Loss Rate (%)	11.3	11.7	10.0	10.0	10.0	10.0
Total Consumption (GWh)	8929	25280	33349	37310	49460	77548
Residential	1786	5554	7061	7835	10387	16285
Commercial	3214	9381	11850	13432	17806	27917
Industry	2679	5846	5331	5223	5935	7755
Other (Export to China)	1250	4499	9107	10820	15333	25591

Note: Bold figures represent actual statistics, others are estimated by the East-West Center.

Source: China Light & Power Company, Limited, "Annual Report 1993"; Hong Kong Electric Holdings, Limited, "Annual Report 1993"; and ADB, Electric Utilities Data Book 1993.

Assumed Shares of Electricity Consumption by Sector (%)

	1980	1990	1993	1995	2000	2010
Residential	20	22	21	21	21	21
Commercial	36	37	36	36	36	36
Industry	30	23	16	14	12	10
Others (including export)	14	18	27	29	31	33

Table 10. Projections of Installed Capacity in Hong Kong (MW)

	1980	1990	1993	<i>1995</i>	<i>2000</i>	<i>2010</i>
Total in Hong Kong	3445	7710	9037	<i>9387</i>	<i>12237</i>	<i>18928</i>
By Types of Plant						
Steam	3050	6401	7428	<i>7778</i>	<i>8128</i>	<i>9328</i>
Gas Turbine	395	1309	1609	<i>1609</i>	<i>1609</i>	<i>3600</i>
Combined Cycle	0	0	0	<i>0</i>	<i>2500</i>	<i>6000</i>
By Fuel						
Coal	0	4881	5908	<i>6258</i>	<i>6608</i>	<i>7808</i>
Fuel Oil	3050	1520	1520	<i>1520</i>	<i>1520</i>	<i>1520</i>
Diesel	395	1309	1609	<i>1609</i>	<i>1609</i>	<i>3600</i>
Natural Gas	0	0	0	<i>0</i>	<i>2500</i>	<i>6000</i>
Capacity in China	0	0	0	<i>1860</i>	<i>1860</i>	<i>1860</i>
Total Capacity	3445	7710	9037	<i>11247</i>	<i>14097</i>	<i>20788</i>
Reserves	670	1580	1866	<i>3220</i>	<i>3456</i>	<i>4104</i>
Share of Reserves (%)	19	20	21	<i>29</i>	<i>25</i>	<i>20</i>

Note: Bold figures represent actual statistics, figures in italics are planned by Hong Kong Utilities, others are estimated by the East-West Center.

Source: China Light & Power Company, Limited, "Annual Report 1993"; Hong Kong Electric Holdings, Limited, "Annual Report 1993"; and ADB, Electric Utilities Data Book 1993.

Table 11. Projection of Hong Kong's Electricity Generation by Fuel (GWh)

	1980	1990	1993	1995	2000	2010
Gross Generation	10065	28629	37035	41456	54956	86165
By Types of Plant						
Steam	10028	28599	36968	37101	36899	45245
Gas Turbine	37	30	67	77	76	194
Combined Cycle	0	0	0	0	12500	33000
Nuclear	0	0	0	4278	5481	7726
By Fuel						
Coal	0	28460	35587	35733	35683	43725
Fuel Oil	10028	139	1381	1368	1216	1520
Diesel	37	30	67	77	76	194
Natural Gas	0	0	0	0	12500	33000
Daya Bay	0	0	0	4278	5481	7726
Fuel Consumption						
Coal (1000 tons)	0	9114	12400	12451	12434	15236
Fuel Oil (Mil liters)	2.50	0.11	0.56	0.55	0.49	0.61
Diesel (Mil liters)	0.01	0.01	0.02	0.03	0.02	0.06
Natural Gas (BCF)	0	0	0	0	102	269

Note: Bold figures represent actual statistics, others are estimated by the East-West Center.

Source: China Light & Power Company, Limited, "Annual Report 1993"; Hong Kong Electric Holdings, Limited, "Annual Report 1993"; and ADB, Electric Utilities Data Book 1993.

Assumptions of annual operating hours (hours per year)

	1980	1990	1993	1995	2000	2010
Coal	0	5831	6024	5710	5400	5600
Fuel Oil	1387	91	909	900	800	1000
Diesel						
Natural Gas					5000	5500
Daya Bay				3395	4350	6132

Table 12. Projections of Electricity Balance in Hong Kong (GWh)

	1980	1990	1993	1995	2000	2010
Indigenous Production	10065	28629	37035	41456	54956	86165
Exports*	310	1386	5777	7093	10392	17846
Auxiliary Consumption	592	1968	2175	2435	3227	5060
T & D Loss	544	1381	1510	1690	2241	3513
Total System Losses (%)	11.3	11.7	10.0	10.0	10.0	10.0
Net Supply Available	8929	25280	33349	37330	49487	77590
Net Domestic Consumption	8619	23894	27572	30237	39095	59744

* including electricity sold from Hong Kong owned power plants in China.

Note: Bold figures represent actual statistics, others are estimated by the East-West Center.

Source: China Light & Power Company, Limited, "Annual Report 1993"; Hong Kong Electric Holdings, Limited, "Annual Report 1993"; and ADB, Electric Utilities Data Book 1993.