
N
W
E
S
Pearl River Estuary
Sheng Shui
New Territories
Kwun Tong
Kowloon
Hong Kong Island
Lantau Island
Cheng Chau
Lamma Island
South China Sea

Hong Kong SAR

Industry Overview

Hong Kong relies on two investor-owned companies – CLP Power Hong Kong Limited (CLP) and The Hongkong Electric Company, Limited (HK Electric) – to provide electricity to its 7 million population.

CLP, a principal subsidiary of CLP Holdings, is the larger electric utility business in the territory, supplying power to the population in Kowloon, New Territories, as well as to Lantau, Cheung Chau and most of the outlying islands. It has 8,888 MW of installed generating capacity from its three power stations in Hong Kong and two generation facilities in the Chinese Mainland.

Older in history, HK Electric supplies power to Hong Kong Island and Lamma Island. Since 1990, electricity generation has been carried out entirely at Lamma Power Station, which has a total installed capacity of 3,736MW. HK Electric does not import electricity from or export electricity to Mainland China or other countries.

The two companies are connected by three 240 MVA submarine cable circuits to ensure security of supply and to achieve fuel savings through economic transfers and lowering operating reserve requirements.

The electricity market in Hong Kong is governed by the Scheme of Control (SoC) Agreements, which monitor the operations of power companies and set out the tariff setting mechanism, the calculation of net return and the procedures for government monitoring. The current SoC Agreements, renewed in October 2008 for CLP and January 2009 for HK Electric, will expire at the end of September 2018 and December 2018 respectively. They carry key features including a lowered rate of return for investment, linkage of rate of return to operational and environmental performances and a 10-year tenure during which the Government would make necessary preparations to pave the way for possible market opening.

Photo: Bloomberg

Generation

CLP's three power stations in Hong Kong - namely, Castle Peak, Black Point and Penny's Bay – have an installed capacity of 6,908 MW. They are fully owned by Castle Peak Power Company Limited (CAPCO), a partnership between ExxonMobil Energy Limited (60%) and CLP (40%).

CLP also obtains power from the pressurised water nuclear power station at Daya Bay and the pumped storage power station at Conghua, both in Guangdong Province in China. In all, CLP has an installed generating capacity of 8,888 MW.

In 2008, the local demand in Hong Kong was 6,749MW and system demand reached 8,199MW.

CLP has been committed to providing a reliable electricity supply to Hong Kong at a reasonable price and in an environmentally friendly way. By adopting a balanced fuel mix strategy and other effective environmental measures, emissions have been reduced by 70% to 80% over the past 18 years while the electricity demand has increased 80% during the period.

PROFILE

Capital	–	Installed Capacity	12,643.8MW
Area	1,092 km²	Population Electrified	100%
Population	6.86 million	Main Voltages (kV)	400, 275, 132, 66, 33, 11, 0.38
GDP	US$258.6 billion		
Currency	Hong Kong Dollar (HK$)	Natural Resources	-

To further reduce emissions towards the 2010 emissions reduction targets set by the Hong Kong and Guangdong Governments, CLP has been using natural gas in power generation and increasing the use of ultra low sulphur coal in coal-fired generation since 1996 and 2005 respectively. In addition, retrofitting of the emissions control facilities at Castle Peak "B" Power Station is in good progress, with further reduction of sulphur dioxide, nitrogen oxide and particulates expected when the project is completed in phases starting 2009. Furthermore, implementation of the memorandum of understanding between the Chinese Central People's Government and Hong Kong Government on the continued supply of natural gas and nuclear power to Hong Kong from the Chinese Mainland is underway.

The maximum demand in HK Electric's system was 2,589MW in 2008, compared with 2,552MW in 2007.

HK Electric's Lamma Power Station has a total installed generating capacity of 3,736MW, consisting of eight coal-fired units, five oil-fired simple-cycle gas turbine units, and two gas-fired combined-cycle units, one of which is a 1-on-1 single shaft machine newly commissioned in 2006, and the other one a 2-on-1 unit converted from two old gas turbines by retrofitting a steam bottoming system. There is also a single 800kW wind turbine located on Lamma island but a few kilometers off-site the power station.

Photo: Bloomberg

The eight coal-fired units are normally the base-load units firing on coal. Oil firing is only used during start-up, shutdown or flame stabilisation at low loads. In 2008, coal consumption was around 3.7 million metric tonnes (i.e. around 13% decrease compared with around 4.3 million metric tonnes in 2005 when no gas-fired combined-cycle unit was yet available). The oil-fired simple-cycle gas turbines serve as peak lopping units and also as back-up power supply during emergencies.

The new gas-fired combined-cycle unit, designated as Lamma Unit 9, is located in Lamma Power Station Extension site. Commissioned in October 2006, it is the first combined-cycle unit adopting re-gasified liquefied natural gas (LNG) as fuel in Hong Kong. Re-gasified natural gas is being fed from the Guangdong Dapeng LNG Terminal located in Shenzhen via a 92 km submarine gas pipeline connecting the LNG terminal and Lamma Power Station Extension.

The wind turbine in HK Electric's system, the Lamma Winds, is the first grid-connected commercial wind turbine in Hong Kong. Since its official opening in February 2006, the turbine and its adjacent exhibition centre have since become a major landmark on Lamma Island, attracting numerous visitors from professional, environmental, educational and community groups.

Transmission and Distribution

Hong Kong is 100% electrified with power grids covering the majority of the population.

CLP delivers supplies to its 2.29 million customers over its transmission and distribution network comprising:

554km of 400kV circuits
1,386km of 132kV circuits
62km of 33kV circuits
11,240km of 11kV circuits

The network involves overhead, underground and submarine cables. The CLP transmission and distribution network contains 214 primary substations and 12,914 secondary substations and the total capacity of the transformers is 57,187MVA. With the deployment of advanced technologies and the services of a highly-trained,

2008	CLP	HK Electric	Total	%
Coal	4,108	2,500	6,608	52.35
Oil	300	555	855	6.77
Gas	2,500	680	3,180	25.19
Nuclear	1,380	0	1,380	10.93
Pumped Storage	600	0	600	4.75
Renewables	0	0.8	0.8	0.01
Total	**8,888**	**3,755.8**	**12,624**	**100**

2007	CLP	HK Electric	Total	%
Coal	4,108	2,500	6,608	52.26
Oil	300	920	1,220	9.65
Gas	2,500	335	2,835	22.42
Nuclear	1,380	0	1,380	10.91
Pumped Storage	600	0	600	4.75
Renewables	0	0.8	0.8	0.01
Total	**8,888**	**3,755.8**	**12,644**	**100**

experienced and dedicated team of engineers, CLP Power manages to maintain a world-class level of supply reliability of over 99.99%.

Power generated at HK Electric's Lamma Power Station is transmitted at 275 kV to switching stations on Hong Kong Island, where it is stepped down to 132 kV before it is merged with the 132 kV transmission network, or stepped down directly to 11 kV or 22 kV for distribution. 275 kV submarine cables have been laid below the East Lamma Channel with a 40 m water depth. This installation is one of the highest capacity submarine cable networks in the world.

Up to 2008, there were 61 cable circuits with a total circuit length of 157 km, 12 switching stations and five zone substations in the 275 kV transmission network. For the 132 kV network, there were 12 switching stations, 21 zone substations and 283 km of circuit lengths.

HK Electric's 22 kV/11 kV/LV network comprises cables buried directly underground. The total length of cables is about 5,138 km in 2007. HK Electric has 3,648 distribution substations serving 563,000 customers. The total rating of transmission and distribution transformers is 12,301 MVA.

For environmental and operational reasons, most of the cables on Hong Kong and Lamma islands are installed underground. Where cable-laying might cause serious disruption or affect the environment, the company builds cable tunnels, which are serviced by battery-operated

vehicles. There are currently seven cable tunnels: the 3.1 km Wah Fu-Bowen Cable Tunnel and the 5.7 km Nam Fung-Parker Cable Tunnel are both serviced by battery-operated vehicles. The other five are the Tin Wan-Wah Fu Cable Tunnel and Cyberport-Wah Fu Cable Tunnel, both of about 0.8 km, Yung Shue Wan Cable Tunnel and Bowen Road Cable Tunnel, both of about 0.2 km, and Pak Kok Tsui Cable Tunnel of about 0.1 km.

Tariffs

The process for determining tariffs is included as part of the SoC. The power companies are allowed to charge tariffs which recover their operating costs and earn a permitted return on their investment.

A tariff review, is also conducted annually in October and November to agree on tariff adjustment for the following year. Tariff charges are calculated based on a cost-plus-profit approach. The profit is determined by an agreed permitted rate of return on the average net fixed assets of the electric businesses in Hong Kong.

CLP's tariff has remained highly competitive notwithstanding an increasing pressure from rising fuel costs. Today CLP's tariff is still at a level comparable to that of 10 years ago.

CLP has four tariff classes - Domestic, General Service (for consumption that is not solely domestic), Bulk (for customers with monthly consumption of not less than 20,000 kWh), and large power (applicable to customers with demand not less than 3,000 kVA). CLP offers a concessionary tariff for those who are over 60 years of age, who live alone or with other similarly qualified elderly to assist, and who rely on or are entitled to social security assistance.

HK Electric has three tariffs – Domestic Tariff, Commercial, Industrial & Miscellaneous Tariff and Maximum Demand Tariff. Electricity tariffs include a basic charge and a fuel clause adjustment. The basic charge is used to recover total operating costs with fuel costs at a standard rate and the net return for shareholders. The fuel clause adjustment is to pass through the difference in fuel costs when the actual rate is higher or lower than the standard rate.

HK Electric offers the following concessionary tariff schemes and the successful applicants are entitled to receive 60% discount for the first 200 units of electricity consumed in a month.

- - Concessionary Tariff Scheme for the Elderly
- - Concessionary Tariff Scheme for the Disabled
- - Concessionary Tariff Scheme for Single-Parent Families
- - Concessionary Tariff Scheme for the Unemployed

Environment

In end 2007, CLP Holdings issued "CLP's Climate Vision 2050". In this manifesto, CLP commits to playing its part in the collective response to the threat of global warming by setting specific targets to reduce the greenhouse gas intensity of its generating portfolio upto 2050. As an intermediate goal, 20% of its generating capacity will be non-carbon emitting by 2020. In line with this manifesto, CLP further issued a primer entitled "Towards a Greener Pearl River Delta – A Roadmap for Clean Energy Generation for Hong Kong" in mid-2009. The primer sets out CLP's plan to bring in and use more clean energy for Hong Kong over the next decade. Key initiatives include strengthening infrastructure integration in support of the development of the Pearl River Delta's energy industry, shifting to using more clean energy sources for the company's power generation in Hong Kong, and supporting energy efficiency and conservation both within its own business and in the community as a whole.

CLP is a pioneer in Hong Kong in adopting a fuel diversification strategy to ensure fuel supplies and security as well as protect the environment. It was the first in the Asia Pacific region (except Japan) to use natural gas in power generation in 1996. This, complemented by the introduction of nuclear power from Daya Bay and various emissions reduction measures, has reduced the emissions by 70%-80% despite an 80% increase in total electricity demand since 1990. The implementation of the memorandum of understanding on the continued supply of natural gas and nuclear power to Hong Kong from the Chinese Mainland is another major step to meet the growing demand for a cleaner energy supply. In addition to using ultra low sulphur coal in its coal-fired operation, CLP is

undertaking additional emission reduction measures involving the retrofitting of flue gas desulphurisation and nitrogen oxides reduction facilities to its coal-fired power plant at Castle Peak. Upon completion in 2011, the measures will reduce sulphur dioxide and nitrogen oxides significantly. CLP continues to focus on improvements to increase the thermal efficiency of its power plants.

In the area of renewable energy, CLP Holdings has voluntarily committed to sourcing 5% of its group generating capacity from renewable energy sources by 2010. This target was achieved in end 2007, three years ahead of schedule, by active investment in renewable energy projects in the Asia Pacific region. As of mid-2009, the renewable energy proportion reaches 9%, with 30 projects spanning Australia, the Chinese Mainland, India, Laos with a diversity of renewable fuels, including wind, hydro, biomass, solar, and geothermal sources. In Hong Kong, CLP is currently involved in a feasibility study into the development of a 200MW offshore wind farm in the south-eastern waters of Hong Kong. The Environmental Impact Assessment Report was approved by Hong Kong Government in July 2009. The project will soon move on to the second part of the feasibility study on on-site data collection and economics. The work is being undertaken in concert with Wind Prospect, a leading international wind farm developer.

CLP conducts research, resource assessment, technology assessment, community projects and public education on environmental topics.

Public education programmes on energy efficiency and advisory services offered to customers help reduce electricity consumption, and ultimately reduce the environmental impacts arising from the use of energy. CLP's "PowerWise" is an energy efficiency education programme that has reached tens of thousands of students, families and businesses since 1993. ElectriCity, an interactive exhibition centre located in CLP's Castle Peak Power Station, receives 20,000 visitors annually. The company is also a sponsor of the energy efficiency centre at Hong Kong's Science Museum that gives tens of thousands of visitors each year new insights into energy conservation and environmental protection. The CLP Energy Innovation Fund, launched in 2003, has provided HK$5m in funding to 55 community projects in energy efficiency and renewable products. In 2009, CLP will be sponsoring The Hong Kong Institution of Engineers to continue with the new "Energy Innovation Fund" focused on educating secondary students on energy efficiency.

To minimise the impact of electricity generation on the environment, HK Electric embarked on retrofitting a Flue Gas Desulphurisation (FGD) Plant to one of its 350MW coal-fired generation units at Lamma Power Station as early as 1993. It is the first power company in Southeast Asia, and still the only one in Hong Kong, to have installed FGD for reducing Sulphur Dioxide (SO_2) emission during power generation. Up to 2008, it has three coal-fired units with FGDs. HK Electric introduced the use of renewable energy for power generation in Hong Kong by commissioning an 800 kW wind turbine at Tai Ling on Lamma Island, namely, Lamma Winds, in February 2006. An exhibition centre on the development and application of various forms of renewable energy for education purpose was built in the Wind Turbine premises, which has become a distinct landmark and attraction for residents and visitors alike. Since its commissioning, Lamma Winds has generated more than 2.3 million kWh of green electricity, displacing more than 2,000 tonnes of carbon dioxide emissions.

HK Electric is currently exploring a wider application of wind power by pursuing an Environmental Impact Assessment (EIA) study to gauge the development of a utility scale offshore wind farm on Hong Kong waters. Field surveys covering marine mammals, avifauna and the benthic zone for the potential sites commenced in August 2008. The EIA study is nearing completion with the target of submitting the EIA report to the Government later in 2009.

In order to further reduce emissions from power generation, HK Electric is in the course of implementing the retrofit of three more coal-fired units with FGDs and in addition among which two with Low NOx burners. Retrofit work for one of the three coal-fired units has been completed in mid 2009 while that for the remaining two units will be completed by 2010.

Natural gas from a liquefied natural gas (LNG) receiving terminal in Shenzhen is now available at Lamma Power Station extension, for operation of HK Electric's first gas-fired combined cycle unit (L9) commissioned in 2006. L9 CCGT unit is the most efficient and environmentally friendly generation unit operating in Hong Kong. With full operation in 2008, gas-fired generation accounted for approximately 17% of the total HK Electric's output in the year. In fact, L9 is Hong Kong's first generation unit fuelled by LNG, being one of the most efficient generation units in Hong Kong with an operational efficiency of over 55% at base load.

HK Electric continues to make strides to power our grid with natural gas, one of the cleanest fuels available. Further to the commissioning of L9, we successfully converted our GT57 from an oil-fired combined cycle unit to a gas-fired unit in February 2008. The addition of the gas-fired GT57 will allow HK Electric to increase the use of natural gas from 2010 onwards to help reduce emissions from Lamma Power Station. It is HK Electric's intention that after 2010 more than 95% of its generation will be from gas-fired units and the six coal-fired plants with low emissions of SO2, NOx and particulates.

To continue its efforts on energy efficiency and conservation promotion, HK Electric takes on a different theme every year for its Smart Power Campaign. The 2006/2007 Campaign focused on the importance of reliable power supply and energy conservation while the 2007/08 Campaign encouraged sustainable ways of living. Various activities including workshops, exhibitions, radio programmes, thematic competitions and open days were held to promote public understanding of energy efficiency and conservation. HK Electric has also conducted energy audits for its customers to help them identify energy saving potentials in their premises.

HK Electric has a long tradition of supporting and funding renewable energy applications in Hong Kong. We are also keen to promote green education in local schools. In 2006, the HK Electric Clean Energy Fund was established to support the study and development of renewable energy in local schools. Since its launch, more than HK$3 million in sponsorship has been granted for 36 projects (17 from primary schools, 14 from secondary schools and 5 from tertiary institutes) ranging from the study and application of solar, wind and hydro power to wave energy. Apart from these initiatives, HK Electric also continued its sponsorship of the Energy Efficiency Centre at Hong Kong's Science Museum and various energy efficiency and conservation activities organized by the Government.

The following figures for Hong Kong electric only: the CLP deatils are inculde above)

Voltage Level	1981	1991	2001	2005	2006	2007	2008
275kV/132kV	177	275	370	395	407	424	439
22kV/11kV/LV Distribution lines	908	2824	4543	4996	5039	5079	5138

Step down sub stations	2003	2004	2005	2006	2007	2008
Number	28	26	26	26	26	26
Aggregate capacity-MVA	4900	4800	4860	4920	4920	4920

Distribution Transformers	2003	2004	2005	2006	2007	2008
Number	5242	5295	5337	5370	5398	5444
Aggregate capacity-MVA	7118	7190	7245	7278	7319	7381