

## Chapter 14

# The Environment

*The Environment Bureau and the Environmental Protection Department are committed to enhancing the quality of the environment. During 2010, priority areas included combating air pollution, implementing a solid waste management policy, improving harbour water quality, promoting energy efficiency and conservation, and tackling climate change.*

Hong Kong, with only 1 104 square kilometres of land, is home to some 7 million people. But it is also one of the world's largest trading economies. Its steep mountains allow it about 263 square kilometres on which people live and work. Strict control over urban development is, therefore, imperative. Over 500 square kilometres of the remaining land are designated as 'protected areas'. These include country parks, special areas and conservation zones. Inevitably, the heavy concentration of people and activities in a small area strains the environment, particularly the air. Hong Kong is also increasingly affected by air pollution in the Pearl River Delta (PRD) region.

Environmental protection is a major policy area for the third term of the Hong Kong Special Administrative Region (HKSAR) Government. The policy initiative is important for the building of a quality city and a quality life for local citizens. Tackling air pollution, stepping up action to improve water quality in Victoria Harbour, better management of municipal solid waste, promotion of energy efficiency and further strengthening of regional co-operation continue to be Government priorities. Through activities of an 'I Love Hong Kong! I Love GREEN!' campaign, the public is encouraged to change various aspects of daily living and to nurture a greener and more environmentally friendly lifestyle.

### **Administrative Framework**

The Environmental Protection Department (EPD), under the Environment Bureau, has overall responsibility for protecting the environment, including nature conservation. It executes environmental policies, vets environmental planning and assessment findings, enforces and reviews environmental laws, plans and develops facilities for liquid and solid waste disposal, and promotes environmental

management, auditing and reporting. It also promotes environmental awareness in the community.

The EPD receives professional support from several government departments and advice from the Advisory Council on the Environment, which comprises 18 members appointed by the Chief Executive, including members from non-governmental environmental organisations, business groups, academic institutions and professional bodies.

The Energy Division of the Environment Bureau oversees Hong Kong's energy policy to provide reliable supplies of energy at reasonable prices and promote their economical and safe use while minimising the environmental impact of energy usage and production.

The Sustainable Development Division, now established under the Environment Bureau, promotes sustainable development in both the Government and the community and provides secretariat support to the Council for Sustainable Development.

Government spending on the environment in 2010-11 was budgeted at \$11.70 billion, or about 3.5 per cent of total public expenditure.

### **Pollution Prevention**

The Government has successfully applied an environmental assessment process to policy planning and project proposals. Development and policy proposals submitted to the Executive Council that involve environmental issues and all submissions to the Public Works Subcommittee of the Legislative Council's Finance Committee must contain an assessment of the environmental implications.

#### *Environmental Impact Assessment Ordinance*

The Environmental Impact Assessment Ordinance provides a transparent and systematic framework for assessing the environmental impact of designated projects and for identifying mitigating measures if needed. It is supplemented by a technical memorandum setting out clear and consistent technical guidelines and criteria. Since the implementation of the ordinance, 157 environmental impact assessment (EIA) reports were approved up to December 31. In addition, the EPD has been promoting continuous public participation in the EIA process.

#### *Environmental Monitoring and Auditing*

The environmental monitoring and auditing process seeks to validate the assumptions made in the planning stage of development projects and monitors the effectiveness of mitigation measures to ensure every project meets the environmental performance promised in the impact assessments. In 2010, the EPD handled 120 monitoring and auditing programmes for major projects.

For these projects, permit holders are required to set up dedicated websites to publish the results and data obtained from the environmental monitoring and auditing process. Since 2002, proponents of major projects have been required to set up web camera systems to enable the public to see conditions at their sites.

### *Land Use Planning*

For major land use planning studies, a Strategic Environmental Assessment is required to incorporate environmental considerations into the formulation of land use plans. Under the Environmental Impact Assessment Ordinance, an EIA must be carried out as part of the engineering feasibility study of urban development or redevelopment projects with a study area of more than 20 hectares or involving a population of more than 100 000 people. These environmental assessments are an integral part of the planning studies and help identify major environmental issues and possible mitigation measures for inclusion in the land use plans.

### *Environmental Management and Sustainability*

The Government promotes environmental management in both the public and private sectors through the Green Manager Scheme, environmental auditing, environmental management systems and environmental performance reporting. All bureaux and departments have appointed Green Managers and publish annual reports of their environmental performance. Since 2007, all annual environmental performance reports incorporate, where appropriate, the principles of the 'Clean Air Charter' which the Government supports to improve Hong Kong's air quality. To further promote environmental performance reporting in the private sector, the EPD has established a dedicated webpage encouraging listed companies in Hong Kong to share their environmental or sustainability information with their stakeholders.

### *Rural Developments*

The Government is committed to improving the quality of life in rural areas and to ending or removing land uses that downgrade the rural environment. Sewage disposal facilities in the rural areas of the New Territories are better than before and are still being improved. In 2010, while continuing its efforts on the construction of such sewerage facilities, the Government drew up plans to invest further in projects with village sewerage components to provide public sewers to enable domestic discharges from villages in rural and other unsewered areas to be conveyed to sewage treatment works. Loan and grant schemes for eligible householders to make house connection to public sewers are available.

### **Cross-boundary Co-operation**

Since environmental pollution transcends administrative boundaries, Hong Kong and Guangdong have been working together on environmental matters for over 20 years.

The HKSAR Government and the Guangdong Provincial Government have drawn up a Regional Air Quality Management Plan that aims to reduce emissions of four major pollutants in the region by 20 per cent to 55 per cent by 2010, taking 1997 as the base year. Since November 2005, a regional air quality monitoring network, comprising 16 monitoring stations, has published a daily Regional Air Quality Index, and the reports on the monitoring results were released in April and October 2010.

In April 2008, the two sides launched a five-year Cleaner Production Partnership Programme to encourage and help more than 56 000 Hong Kong owned factories in the PRD region to adopt cleaner production technologies and practices. In January 2010, its scope was expanded to provide professional advice and technical support in the treatment and reduction of effluent discharges. By improving energy efficiency and implementing emission reduction measures, Hong Kong-owned factories can make a positive contribution to improving the region's environmental quality. Up to the end of 2010, over 1 000 funding applications had been approved. In addition, the two sides jointly launched the Hong Kong–Guangdong Cleaner Production Partners Recognition Scheme in August 2009 to recognise the efforts of Hong Kong-owned enterprises in pursuing cleaner production. By the end of 2010, a total of 166 enterprises had received the commendation.

To strengthen this collaboration further, the two sides are undertaking a joint study on the post-2010 air emission reduction arrangements for the region. On the water quality front, Hong Kong and Shenzhen are jointly implementing action programmes to reduce pollution of the adjoining water bodies, including Deep Bay and Mirs Bay. Both sides are conducting a joint review of the regional water quality management strategy for Mirs Bay. Meanwhile, the EPD commissioned a three-year joint study with Guangdong in early 2010 to evaluate the carrying capacity of the water bodies in the Pearl River Estuary. This will provide the two governments with solid scientific bases for devising management plans and strategies for controlling water pollution in the Pearl River Estuary.

Hong Kong and Shenzhen, meanwhile, are working together closely to encourage the adoption of cleaner production practices by Hong Kong-owned factories in Shenzhen. Both sides will also enhance co-operation in the areas of promoting development of clean energy, green transportation and environmental service business. In addition, exchanges between Hong Kong and Macao are taking place in areas such as air quality monitoring, environmental infrastructure management and public awareness programmes.

In addition, the HKSAR, Guangdong Province and Macao authorities are working together to formulate a Regional Co-operation Plan on Quality Living Area. The three sides will seek to widen collaboration efforts to address the environmental issues facing the PRD region, with a view to enhancing the living quality of the PRD region, and achieving economic, social and environmental sustainability.

## **Climate Change**

Climate change has become one of the most important challenges to the international community. In September 2010, the Government launched a public consultation on Hong Kong's climate change strategy and action agenda. A carbon intensity reduction target of 50-60 per cent by 2020, as compared with 2005 level, was proposed. An action agenda comprising measures to maximise energy efficiency and green road transport; to promote use of clean fuels for motor vehicles; to turn waste into energy; and to revamp fuel mix for electricity generation were also

recommended. By implementation of the proposed mitigation measures, the HKSAR aspires to be one of the greenest cities in China.

The HKSAR has joined the C40 Cities Climate Leadership Group to enhance co-operation with participating cities to combat climate change. A C40 Hong Kong Workshop, which focused on green transport and low carbon built environment, was organised on November 5 and 6, 2010 to share strategies and experience in combating climate change.

## Energy Efficiency

Energy consumption is closely related to greenhouse gas emissions. Improving energy efficiency helps address the growing concerns of climate change and global warming. The total energy consumption at end-use level in Hong Kong in 2008 was 284 430 TJ, with residential, commercial, industrial and the transport sector consuming 19 per cent, 39 per cent, 10 per cent and 32 per cent of the energy respectively. To meet the challenges of climate change, the Energy Efficiency Office of the Electrical and Mechanical Services Department has implemented a range of programmes and initiatives to promote efficient use of energy, including implementing a number of voluntary energy efficiency labelling and registration schemes; promoting wider use of water-cooled air-conditioning systems and promoting effective energy management methods.

The initial phase of the Mandatory Energy Efficiency Labelling Scheme (MEELS) came into full implementation on November 9, 2009. Under the MEELS, energy labels are required to be shown on prescribed products for supply in Hong Kong to inform consumers of their energy efficiency performance. Three types of prescribed products covered in the initial phase of MEELS are room air-conditioners, refrigerating appliances and compact fluorescent lamps. The second phase of the MEELS extends the coverage to two more electrical appliances: washing machines and dehumidifiers. The second phase commenced on March 19, 2010 with an 18-month grace period for the trades to make necessary preparations.

As buildings account for about 89 per cent of electricity consumed, promoting their efficient use of energy is instrumental in reducing greenhouse gas emissions. To improve further energy efficiency in new and existing buildings, the Government introduced the Buildings Energy Efficiency Bill into the Legislative Council in December 2009 for mandatory implementation of the Building Energy Codes. The Bill was passed by the Legislative Council in November 2010. Upon the enactment of the subsidiary legislation, eligible persons will be encouraged to be registered as Registered Energy Assessors over a period of 18 months to undertake duties under the ordinance. It is expected that the ordinance will be fully implemented in the third quarter of 2012.

To promote adoption of energy-efficient air-conditioning systems, the Government plans to implement a district cooling system (DCS) at the Kai Tak Development (KTD). The DCS will provide chilled water to non-domestic developments for air-conditioning. It is an energy-efficient system which consumes

35 per cent less electricity compared with traditional air-cooled air-conditioning systems.

The DCS will be developed and commissioned for operation in three phases to suit the development schedule of the KTD. The first phase is expected to be completed by the end of 2012 for operation from 2013 onward to match the early developments at the KTD.

The Government recognises the importance of promoting the use of renewable energy in Hong Kong. In 'A First Sustainable Development Strategy for Hong Kong', it sets a target of generating 1 per cent to 2 per cent of Hong Kong's total electricity supply from renewable sources by 2012. Meanwhile, Hong Kong's two power companies are making progress in their attempts to use clean energy to produce electricity. Hongkong Electric Company Limited (HEC) started operating its wind turbine on Lamma Island in 2006. CLP Power Hong Kong Limited (CLP Power) commissioned its commercial scale photovoltaic (PV) system on Town Island in Sai Kung in 2009 while the HEC completed its PV system on Lamma Power Station in 2010. Both companies are planning the development of off-shore commercial wind farms in Hong Kong waters and have completed the Environmental Impact Assessment for their wind farm project.

### **Legislation and Pollution Control**

Hong Kong has eight ordinances on pollution control. These are the Waste Disposal Ordinance, the Water Pollution Control Ordinance, the Air Pollution Control Ordinance, the Noise Control Ordinance, the Ozone Layer Protection Ordinance, the Dumping at Sea Ordinance, the Environmental Impact Assessment Ordinance and the Hazardous Chemicals Control Ordinance. Most of them have subsidiary regulations and other statutory provisions such as technical memoranda.

The Government follows a set of environmental quality objectives for better protection of public health and to preserve a natural ecosystem. The cost of imposing limits on polluting emissions is not higher than that needed to achieve conservation goals. These goals include making maximum use of the environment's natural capacity to absorb and recycle waste.

In 2010, EPD inspectors made about 59 000 visits to different locations around Hong Kong to enforce controls on air, noise, waste and water pollution and to deal with complaints about pollution. This resulted in some 394 prosecutions and nearly \$2.3 million in fines.

The Stockholm Convention on Persistent Organic Pollutants (the Stockholm Convention), became effective in Hong Kong in November 2004 and the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (the Rotterdam Convention) became effective in Hong Kong in August 2008. A local legislation, the Hazardous Chemicals Control Ordinance, came into operation in April 2008 to regulate the import, export, manufacture and use of non-pesticide hazardous chemicals, including those subject to the regulation of the Stockholm Convention and the Rotterdam Convention.

The EPD also works with the construction, catering, and vehicle repair industries, the property management sector and other trades to promote good practices and compliance with environmental regulations.

The EPD runs a Compliance Assistance Centre where businesses may obtain updated information and advice on environmental compliance, pollution prevention and environmental management.

## **Air Pollution**

Like most modern cities, Hong Kong's air is affected by pollutants emitted from a multitude of sectors, including transport, power generating and construction. The Government has been implementing various measures to improve air quality. Between 1990 and 2009, emissions of sulphur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), respirable suspended particulates (RSP) and volatile organic compounds (VOC) have dropped by 51 per cent to 64 per cent.

The EPD operates a range of controls under the Air Pollution Control Ordinance (APCO) and its subsidiary regulations, including licensing of some large industrial facilities and specific controls on fuel quality, furnace and chimney installations, dark smoke emissions, open burning, dust emissions from construction works, emissions from petrol filling stations, perchloroethylene emissions from dry-cleaning facilities, and VOC emissions from printing machines and the levels of VOC in selected products. In 2009, the regulation limiting the content of VOC in products was amended to extend its control in phases starting from January 1, 2010 to vehicle refinishing paints/coatings, vessel and pleasure craft paints/coatings, adhesives, and sealants.

The APCO also bans the import and sale of the more dangerous types of asbestos, amosite and crocidolite. Moreover, anyone intending to remove asbestos must engage registered professionals, and submit asbestos investigation reports and plans to the department.

Power plants are the largest sources of emission. To ensure smooth, timely and transparent implementation of the emission caps imposed on power plants, the APCO was amended in 2008 to give statutory effect to the emission caps for power plants in 2010 and beyond. To improve further the local and regional air quality, we have issued the Second Technical Memorandum to tighten further the emission caps of the power sector for 2015 and beyond by 34 per cent to 50 per cent from the 2010 levels.

The Government is also actively considering the best way to update Hong Kong's Air Quality Objectives (AQOs) in light of the responses of the public consultation. In parallel, the Government is pursuing those improvement measures that have garnered community support with the aim of achieving early improvement to the quality.

Air pollution is a cause of public concern, especially when the emission sources are near homes. In 2010, the department handled some 11 000 complaints of air

pollution, of which some 4 900 were about vehicle emissions, and issued about 1 000 legal notices instructing offenders to abate air pollution.

### *Transport*

Vehicle emissions are the major source of air pollution and nuisance experienced at roadsides. The Government's policy is to apply the most stringent motor vehicle fuel and emission standards whenever they are practicable. Between 1999 and 2010, the concentrations of RSP, SO<sub>2</sub> and NO<sub>x</sub> at roadsides, fell by 34 per cent, 63 per cent and 30 per cent respectively.

Hong Kong largely follows the European Union's standards on emission and fuel. All newly registered vehicles are required to comply with the Euro IV standards, except for newly registered diesel private cars, which must meet emission standards of stringency similar to those of petrol private cars. Diesel vehicles emit more NO<sub>x</sub> than petrol vehicles, which is a major contributor to smog.

Nearly all of Hong Kong's taxis now run on liquefied petroleum gas (LPG) and over 60 per cent of public light buses are also fuelled by LPG. To control emissions from older vehicles, the Government has made the installation of emission reduction devices a statutory requirement for all pre-Euro diesel vehicles. This regulation went into force on April 1, 2007. Two new schemes were also launched on the same day to provide financial incentives to encourage early replacement of pre-Euro and Euro I diesel commercial vehicles with new ones compliant with the prevailing emission standards (the Euro IV standards) and the use of environmentally friendly private cars. Another incentive scheme was launched on April 1, 2008 to encourage the use of environmentally friendly commercial vehicles. The incentive scheme for the early replacement of pre-Euro and Euro I diesel commercial vehicles ended on March 31, 2010. As some vehicle suppliers are not able to supply compliant new commercial vehicles to those owners who have placed an order for the new vehicles within the incentive period in time for registration, the Government introduced a special arrangement for them to retain their eligibility for the grant until March 31, 2011. To improve roadside air quality further, the Government offers a one-off grant to owners of Euro II diesel commercial vehicles to encourage them to replace their vehicles with new ones from July 1, 2010 for a period of 36 months.

The Government is also promoting the use of electric vehicles (EV) in Hong Kong. The exemption of the First Registration Tax for electric vehicles has been extended to May 2014. A steering committee has been set up under the leadership of the Financial Secretary to make recommendations on strategy and specific measures to promote the use of electric vehicles. Three EV models, including EuAuto 'MyCar', Mitsubishi 'i-MiEV' and Tesla 'Roadster', have already been launched in the Hong Kong retail market. Nissan has also agreed to advance the supply of their EVs, 'LEAF', to Hong Kong. It will set aside 200 vehicles in the first batch of production of 'LEAF' for supply to corporate users in Hong Kong. Subject to market response, this batch of EVs is expected to arrive in Hong Kong in February to April 2011 at the earliest.



To encourage the supply and use of Euro V diesel, the Government waived the fuel tax for Euro V diesel on July 14, 2008. The Government has tightened the standards of motor vehicle diesel and unleaded petrol to Euro V specifications and implemented the statutory control on the quality of motor vehicle biodiesel from July 1, 2010.

Another motor vehicle emission control strategy is to tighten control over smoky vehicles. Under the Smoky Vehicle Control Programme, all vehicles reported must be tested for smoke levels to find out whether the owners have corrected the smoke defects. The number of smoky vehicles on roads has decreased by about 80 per cent since 1999. The Government is also bringing the Motor Vehicle Idling (Fixed Penalty) Bill through the Legislative Council to introduce statutory prohibition against idling vehicles with running engines.

Apart from cleaner vehicles and fuels, it is essential to promote mass transit systems that are pollution-free at street level. The Government has adopted a policy that gives priority to rail over road and encourages innovation wherever practical.

## **Indoor Air Quality**

To promote good indoor air quality (IAQ) and public awareness of its importance, the Government has introduced an IAQ Management Programme, a core element of which is a voluntary IAQ Certification Scheme for offices and public places that are served by mechanical ventilation and air-conditioning systems. It aims to recognise good IAQ management practices and to provide incentives for owners of buildings/premises or property management companies to pursue the best level of indoor air quality.

## **Ozone Layer Protection**

The Montreal Protocol, which aims to control substances that deplete the ozone layer, is applicable to Hong Kong. The Ozone Layer Protection Ordinance prohibits manufacture and import of chlorofluorocarbons (CFCs) and halons for local consumption. The EPD also sets a quota to control the import of hydrochlorofluorocarbons (HCFCs). To comply with the accelerated phase-out programme for HCFCs under the Montreal Protocol, the Government amended the Ozone Layer Protection (Products Containing Scheduled Substances) (Import Banning) Regulation in 2009 to extend the banning of import of controlled products to those containing HCFCs such as air-conditioners, portable fire extinguishers and aerosols containing CFCs such as metered dose inhalers in phases starting from January 1, 2010.

## **Noise**

### *Road Traffic Noise*

Under the existing policy, project proponents are required to assess traffic noise impact when planning new roads and provide necessary direct mitigation measures to ensure traffic noise at the noise sensitive receivers stay within acceptable levels. Where direct measures are inadequate, indirect noise mitigation measures must be used.

To address traffic noise from existing roads, a programme to retrofit noise barriers on noisy road sections is being carried out in phases under the Public Works Programme. All high-speed (70 kilometres per hour or above) roads have been resurfaced with low-noise material wherever practicable. In addition, a trial programme to surface local roads with low-noise material is being implemented.

To prevent individual vehicles from producing excessive noise, the Government tightened legislation in 2002 to require all newly registered vehicles to comply with the latest internationally recognised noise standards.

### *Railway Noise*

Various noise reduction programmes have been implemented by the railway operators since the early 1990s to address noise problems along railways, bringing relief to some 110 000 affected residents thus far. New railway projects are required to undergo environmental impact assessments to ensure their noise impact is properly addressed.

### *Aircraft Noise*

The impact of aircraft noise on almost all residents in the vicinity of Hong Kong International Airport flight paths is within the planning standard. However, there is still concern about aircraft noise nuisance, especially during evenings and early mornings. The Government will continue exploring and implementing all practicable aircraft noise mitigating measures.

### *Noise from Industrial or Commercial Activities*

Noise from industrial or commercial activities is controlled through the issuance of noise abatement notices. The EPD serves abatement notices requiring the owners or occupants of premises causing excessive noise to reduce it within a given period.

### *Construction Noise*

Noise from general construction works between 7pm and 7am and on public holidays is controlled through construction noise permits. These restrict the use of equipment in accordance with strict criteria and ban noisy manual activities in built-up areas. Percussive piling is prohibited at night and on public holidays and requires a permit during the daytime on any day that is not a public holiday.

The Government has phased out the use of noisy diesel, steam and pneumatic piling hammers. The law also requires hand-held percussive breakers and air compressors for construction to meet strict noise standards and to have 'green' noise emission labels.

To deter repeated industrial, commercial and construction noise offences, the Noise Control Ordinance stipulates that the senior management of a body corporate will be held liable for repeated offences committed by that body corporate.

The EPD has introduced a Quality Powered Mechanical Equipment system to promote the use of more environmentally friendly construction equipment and facilitate the construction noise permit application process.

### *Intruder Alarm and Neighbourhood Noise*

The Police handles complaints about intruder alarms and neighbourhood noise from domestic premises and public places.

### **Water Quality and Sewerage**

Water pollution, if left unchecked, tends to increase with urban development and population growth. The lack of proper treatment for most of the sewage from older urban areas around Victoria Harbour resulted in poor water quality there but since the Harbour Area Treatment Scheme (HATS) Stage 1 went into operation at the end of 2001, there has been a marked improvement. The Government is now implementing HATS Stage 2A which will collect and properly treat the remaining 25 per cent of sewage around the harbour.

In addition, pollution control at source has yielded positive results, and river quality has also improved. The percentage of rivers in the 'good' and 'excellent' categories increased from 34 per cent in 1986 to 82 per cent in 2010, and the percentage in the 'bad' and 'very bad' categories fell from 45 per cent in 1986 to 9 per cent in 2010.

The Government commissioned a study to review and develop Hong Kong's marine water quality objectives in October 2008. The marine water quality objectives were introduced under the Water Pollution Control Ordinance and gradually applied to the 10 water control zones from 1982 to 1996. The study aims to review the existing water quality objectives in light of local conditions, overseas best practices and scientific advances; and to examine the technical attainability and potential socio-economic implications of any proposed changes to the water quality objectives.

Views from the public and stakeholders on the study findings are to be collected through a two-stage public engagement exercise. The first stage public engagement, conducted from September to December 2009, was to seek views from the public on the issues to be addressed and the review approaches. The second stage public engagement will be held after any proposed changes to the water quality objectives are formulated.

### *Sewage Treatment and Disposal*

At present, the public sewerage system serves 93 per cent of the population and collects about 2.7 million cubic metres of waste water every day. About 70 per cent of the collected sewage receives chemical or higher levels of treatment before being discharged.

HATS Stage 1 collects sewage from the urban areas of Kowloon, Tsuen Wan, Kwai Tsing, Tseung Kwan O and the north-eastern part of Hong Kong Island and transports it through a network of deep tunnels to Stonecutters Island for treatment.

The Government is implementing the second stage in two phases, HATS Stages 2A and 2B. HATS Stage 2A involves extending the deep tunnel system to take the untreated sewage from the remaining parts of Hong Kong Island to the Stonecutters Island Sewage Treatment Works. The treatment plant will be expanded to provide

centralised chemical treatment to sewage from the entire HATS catchment with fast track provision of part of the disinfection facilities which were commissioned in March 2010. The critical construction works for HATS Stage 2A commenced in 2009 and the whole project costing a total of about \$17 billion is targeted for completion in 2014. The operation of the Advance Disinfection Facilities (ADF) since its completion in March 2010 has resulted in water quality improvements in the Western Harbour and at Tsuen Wan beaches. The ADF together with the completion of a local sewerage network and progressive house connection by local residents in the hinterland of the Tsuen Wan beaches, resulted in the waters at all seven closed beaches improving to the extent that in 2010 they were found to comply with the Water Quality Objective for bathing beaches and are suitable for bathing. Under the second phase (HATS Stage 2B), biological treatment facilities will be provided on an adjacent site, the implementation programme being based on the results of a review in June 2010 of water quality trends and population and sewage flow build-up.

Details of HATS are available on the 'A Clean Harbour for Hong Kong' website, [www.cleanharbour.gov.hk](http://www.cleanharbour.gov.hk).

Apart from HATS, the Government has spent a further \$19 billion on other sewerage schemes since 1991 and will spend another \$12 billion on schemes over the next five years. These include sewerage for rural villages. Under the Water Pollution Control (Sewerage) Regulation, the EPD is empowered to direct house owners to connect their waste water pipes to new public sewers. Since the regulation came into force at the end of 1995, about 6 100 village houses have already made connections to the public sewers.

### *Sewage Charges*

All water users who discharge their sewage into public sewers have to pay a basic sewage charge in accordance with the Sewage Services Ordinance. Also, 27 trades and industries whose effluent strength exceeds that of domestic sewage, have to pay a trade effluent surcharge reflecting the additional cost of treating their stronger effluent. These charges are used to recover the operation and maintenance costs of sewage collection, treatment, and disposal facilities, while the Government provides funds for construction.

In May 2007, the Government's proposals for a gradual increase in the sewage charge for handling domestic waste water over a 10-year time frame was approved by the legislature. This reflects the community's continued support of the polluter-pays principle and joint commitment to further enhancement of the water environment. The average bill for domestic accounts will rise from the 2007 level of \$11 per month to \$27 per month over a period of 10 years.

### *Livestock Waste Pollution*

The Waste Disposal Ordinance bans the keeping of livestock in new towns and environmentally sensitive areas. Where they are allowed, livestock farms must have proper waste treatment systems. The Government provides a free livestock waste collection service which collected about 19 000 tonnes of waste during the year.

From a public health and environmental protection standpoint, livestock farming in urbanised Hong Kong is not sustainable in the long term. To address the problem, the Government has introduced licence-surrender schemes to encourage poultry and pig farmers to cease permanently the keeping of poultry and pigs. Livestock farmers are given ex gratia payments and the schemes are entirely voluntary.

The poultry and pig schemes were introduced in 2005 and 2006 respectively and farmers had up to one year to decide whether or not to join them. The two schemes have decreased effectively the number of pig and poultry farms and reduced the pollution load on the environment. Through the buyout scheme launched in 2008 for the live poultry trade, the number of poultry farms has been further reduced.

### Bathing Beaches

The Government has adopted strict standards for water quality control to protect the health of swimmers at bathing beaches. These standards indicate the pollution level measured in terms of *E. coli* (the bacterium that can indicate the presence of sewage). The following table shows how beaches were classified in 2010. Beaches in the 'good' and 'fair' categories meet the Government's water quality objective for bathing. In 2010, all bathing beaches met the water quality objective.

Beach water quality ranking	Bathing season geometric mean of <i>E. coli</i> count per 100ml of beach water	Minor health risk cases per 1 000 swimmers	Number of beaches in 2010
Good	Up to 24	Undetectable	23
Fair	25 to 180	10 or less	18
Poor	181 to 610	11 to 15	0
Very Poor	More than 610	More than 15	0

Beach water quality gradings for open beaches are available on the EPD's home page, hotline and weekly press releases.

## Waste Management

### Waste Reduction

The Policy Framework for the Management of Municipal Solid Waste (2005-2014), published in 2005, sets out the strategy and measures to address the municipal solid waste problem in Hong Kong and proposes simple yet effective economic tools that will create incentives for the community to recycle more and discard less.

Waste reduction and recovery have always played an important role in waste management, resulting in the export of substantial quantities of recovered recyclable materials for re-manufacturing outside Hong Kong. Plastics, paper and metals are the major recyclables exported for recycling, contributing to over 90 per cent of the total quantity of recovered waste.

The Government is also promoting local recycling, with the development of a 20-hectare EcoPark in Tuen Mun Area 38 for exclusive use by the recycling and environmental industry. All lots in Phase 1 of the EcoPark have been let to waste recyclers. Tenders for leasing the remaining lots in Phase 2 will commence in 2011.

To encourage waste reduction, recovery and recycling, the Government launched a territory-wide Source Separation of Domestic Waste Programme in January 2005. The programme was extended to the commercial and industrial sector in October 2007. As at the end of 2010, the programme covered more than 80 per cent of the population.

In line with the polluter-pays principle, the Government aims to create economic incentives for waste reduction, recovery and recycling by introducing producer responsibility schemes (PRS). An environmental levy scheme on plastic shopping bags was implemented in July 2009 as the first mandatory PRS under the Product Eco-responsibility Ordinance. Having completed a public consultation, the second scheme targeting waste electrical and electronic equipment is being developed.

Meanwhile, the EPD continues to promote and support trade-funded voluntary recycling programmes. In addition, it is examining possible charging options for Hong Kong in respect of municipal solid waste.

### *Landfills*

All municipal solid waste is disposed of at three large modern landfills in the New Territories, which are operated to high environmental standards.

The community disposed of 3.33 million tonnes of municipal solid waste in 2010. Of this, about 67 per cent was domestic waste and the remainder was commercial and industrial waste. On average, each person in Hong Kong disposed of about 1.29 kilogrammes of municipal solid waste daily.

It is estimated that the three landfills would be filled to capacity during mid- to late-2010s. Planning work for the extension of all three landfills is under way.

Hong Kong has 13 old landfills, which have been restored for safety and environmental reasons. Recreational facilities have been or will be built on most of the restored sites.

### *Refuse Transfer Stations*

Municipal solid waste is collected and delivered to refuse transfer stations by refuse collection vehicles, containerised and then taken to landfills by sea or land transport. A network of six transfer stations and seven outlying islands transfer facilities handled 1.79 million tonnes of waste in 2010. About 80 per cent of Hong Kong's domestic waste is delivered via this network to landfills.

### *Chemical and Special Wastes*

All chemical waste producers are required to pack, label and store their chemical wastes correctly before disposal at licensed treatment facilities. A trip ticket system tracks the movement of chemical waste from its origin to the final disposal point.

In 2010, a daily average of 51 tonnes of chemical waste, including MARPOL Annexes I and II waste from ocean-going vessels, were treated at the Chemical Waste Treatment Centre on Tsing Yi Island. A Government contractor operates the treatment centre. Waste producers using its services are required to pay part of the treatment cost.

Following the commissioning of the Low-level Radioactive Waste Storage Facility at Siu A Chau, most of the low-level radioactive waste generated in Hong Kong has been transferred to the facility for long-term storage. The facility is purpose-built to meet stringent international standards for the safe storage of low-level radioactive waste.

### *Clinical Waste*

To safeguard public health, the Government proposes to implement the Clinical Waste Control Scheme to ensure that clinical waste is handled and disposed of in an environmentally sound and safe manner. Under the control scheme, clinical waste will be sent to the Chemical Waste Treatment Centre for disposal by high-temperature incineration. The Government is installing additional facilities at the Chemical Waste Treatment Centre to receive and treat clinical waste and to upgrade the air pollution control system to meet the latest European Union emission standards.

### *Construction Waste*

The construction industry generated 12.6 million tonnes of construction waste in 2010. Of that, about 90 per cent was inert and suitable for re-use. The policy has been to maximise the recovery and re-use of inert materials and minimise their disposal at landfills. The construction waste charging scheme introduced in December 2005 provides an economic incentive for reducing construction waste. The Government continues to deliver inert materials to the Mainland for re-use in reclamation projects there.

### *Large-scale Waste Treatment Facilities*

Hong Kong has to deal with a large volume of non-recyclable waste and needs new state-of-the-art, cost-effective facilities to treat such waste and reduce its volume. A multi-technology approach is needed so that wastes of different nature can be dealt with by the most suitable technology. The Government aims to commission the first phase of a large-scale Integrated Waste Management Facility (IWMTF) that will adopt advanced incineration as its core technology in mid-2010s. It will also develop Organic Waste Treatment Facilities (OWTF) to treat source-separated organic waste such as food waste and turn it into useful resources. It plans to

commission the first phase of OWTF before mid-2010s. However, even with such facilities, residual waste will still need to be disposed of at landfills.

In order to deal with the ever-increasing sewage sludge generated from the sewage treatment works, the design and construction of a dedicated Sludge Treatment Facility at Tsang Tsui near Nim Wan, Tuen Mun commenced in October 2010 with a view to starting operation in late 2013. It will adopt advanced incineration technology and has a treatment capacity of 2 000 tonnes per day.

### *Import and Export of Waste*

Import and export of waste are regulated by a permit system under the Waste Disposal Ordinance (WDO). The control is in line with the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, which adopts a prior informed consent procedure for shipments of controlled waste. The WDO was amended to incorporate the Basel Ban in 2006 and no import permits will be issued for hazardous waste from developed countries.

The EPD participates actively in international programmes deterring illegal waste shipments. It has established intelligence networks with many overseas control authorities and taken part in joint enforcement exercises against these shipments. Also, the mainland of China and the HKSAR have collaborated to control transboundary movements of hazardous waste between the two areas under a formal agreement since 2000. Joint enforcement actions amongst the HKSAR and the Mainland control authorities were regularly made to curb waste smuggling activities across the border.

### *Floating Refuse in the Harbour*

The Marine Department deploys a fleet of about 70 contractors' vessels to collect floating refuse and refuse from vessels. In 2010, 15 788 tonnes were collected. In addition to law enforcement, the Government also uses publicity and education to tackle the floating refuse problem.

### *Marine Dumping*

The EPD maintains strict control over marine dumping operations via a permit system under the Dumping at Sea Ordinance. These operations follow the requirements of the London Convention to which Hong Kong is a Contracting Party.

Since August 2008, all marine dumping vessels operating under permits issued by EPD have to be equipped with an automatic self-monitoring device that transmits real-time data to the EPD Control Centre to allow the authorities to trace any illegal dumping in a cost-effective manner. The department's inspectors conduct frequent patrols of Hong Kong waters to prevent illegal dumping.

### *Monitoring and Investigation*

Assessing the progress made in achieving policy goals is one of the EPD's key activities. The results gained from routine monitoring and special investigations form the basis for much of the department's strategic planning, provision of facilities and statutory controls. The department has 94 sampling stations in marine waters



including enclosed bays and typhoon shelters, and another 82 stations for inland waters. It also monitors 41 bathing beaches.

The water quality monitoring programme provides a comprehensive record of the physiochemical and microbiological condition of Hong Kong waters. Annual reports of monitoring data are available on the EPD's website. Water quality of the major marine and river stations is published monthly on the website and gradings of water quality at bathing beaches are published weekly in the media and updated daily on the department's website.

### **Sustainable Development**

The Council for Sustainable Development was appointed by the Chief Executive in March 2003 to promote sustainable development in Hong Kong. The council has so far addressed six key sustainability issues — solid waste management, renewable energy, urban living space, population policy, better air quality and building design to foster a quality and sustainable built environment — since launching its first public engagement exercise to consult stakeholders in 2004. The council is now planning the next public engagement on climate change-related issues to be launched in early 2011.

Since 2003 the council has invited eight rounds of applications from organisations and individuals for grants from the Sustainable Development Fund to carry out work related to sustainable development. Thirty-eight projects were approved in the first seven rounds, involving grants of \$35 million, and 26 of them have been completed so far.

To facilitate the integration of sustainability considerations in the decision making process, in 2002 the Government has adopted a sustainability assessment system, the implementation of which is overseen by the Sustainable Development Division. All bureaux and departments are required to conduct sustainability assessments of their major initiatives and programmes and to explain the implications in their submissions to the Policy Committee and Executive Council.

### **Government Laboratory**

The Government Laboratory supports the enforcement of environmental protection legislation and the implementation of various environmental programmes through the provision of comprehensive analytical and advisory services. In 2010, it conducted numerous tests on environmental samples of air, water, sediment, soil, biota, waste, motor vehicle fuel including biodiesel and other substances, providing a large volume of useful data for various environmental programmes. In 2011, it will continue with the provision of this comprehensive analytical and advisory service. It will also continue to develop new test methods targeting additional groups of chemicals that have come under the control of the Stockholm Convention on Persistent Organic Pollutants.

## Flora

Hong Kong is situated near the northern boundary of the distribution of tropical Southeast Asian flora, sharing similar species and structure with the flora of Guangdong Province. Despite its small size, Hong Kong has a rich flora with about 3 100 species of vascular plants, of which 2 100 are native to Hong Kong. Continual efforts in afforestation coupled with various conservation measures have transformed formerly bare hillsides and slopes into impressive woodlands. Besides greening and beautifying the countryside, woodlands are important habitats for wildlife and are essential to protecting water catchments from soil erosion. They also provide recreational opportunities for the public.

Remnants of the original forest cover, either scrub forest or well-developed woodlands, are still found in steep ravines or behind traditional villages in rural areas. They have survived as a result of their location in precipitous topography and the moist winter micro-climate, or because they are protected for cultural reasons.

## Terrestrial Fauna

Hong Kong's climate and physical environment provide a wide range of habitats and support for a rich and varied fauna which include about 500 species of birds, over 50 species of mammals, over 100 species of amphibians and reptiles, 238 species of butterflies and 115 species of dragonflies.

The Mai Po Marshes form one of the most important wildlife conservation sites in Hong Kong. Together with the Inner Deep Bay area, the Mai Po Marshes area has been listed as a 'Wetland of International Importance' under the Ramsar Convention. About 1 500 hectares of inter-tidal mudflats, fish ponds, marshes, reedbeds and dwarf mangroves provide a rich habitat for migratory and resident birds, particularly ducks and waders.

Some 380 species of birds have been observed in this area. Thirty-five species are considered globally threatened and near-threatened including the Black-faced Spoonbill, Baer's Pochard, Nordmann's Greenshank and Spoon-billed Sandpiper. The Agriculture, Fisheries and Conservation Department (AFCD) implements a wetland conservation and management plan to conserve the ecological value of the area.

The traditional fung shui woods near old villages and temples and the secondary forests provide important habitats for many woodland birds. Birds sighted in the wooded areas include warblers, flycatchers, robins, bulbuls and tits.

Areas around the Kowloon reservoirs are inhabited by monkeys which are the descendents of individuals released there in the early twentieth century. There are breeding groups of Rhesus Macaque and hybrids of Rhesus Macaque and Long-tailed Macaque. Some monkeys have migrated to the forested areas of Shing Mun Reservoir and Tai Po Kau. Feeding of monkeys has been prohibited since July 1999 to make them revert to foraging for natural food in the countryside.

Other mammals such as Red Muntjac, and Eurasian Wild Pig are very common in the countryside, while the Leopard Cat, Small-toothed Ferret Badger and Masked

Palm Civet are relatively uncommon. Bats including the Himalayan Leaf-nosed Bat, Pomona Leaf-nosed Bat and Chinese Horseshoe Bat are found in caves and water tunnels. Sightings of rare species such as the Eurasian Otter, Crab-eating Mongoose and Chinese Pangolin are reported occasionally.

Hong Kong has over 100 species of amphibians and reptiles. There are 24 species of the former and three of them — the Hong Kong Cascade Frog, the Hong Kong Newt and the Romer's Tree Frog — are protected under the Wild Animals Protection Ordinance. Most of the 52 species of snakes are non-venomous, and reports of people being bitten by highly venomous snakes are rare. Among the 10 native species of chelonians, the Green Turtle is of particular conservation interest as it is the only known species of sea turtle breeding in Hong Kong.

### Marine Fauna

Hong Kong's subtropical marine environment supports species found in both tropical and temperate climates. Local waters contain a wide diversity of fish, crustaceans, molluscs and other marine life, of which at least 150 species are of fisheries significance.

Situated on the eastern bank of the Pearl River Estuary, Hong Kong receives fresh water from the river, especially in its western waters. The waters on the eastern side, on the other hand, are little influenced by the Pearl River outflow and are predominantly oceanic in nature. This unusual hydrography helps to contribute to the diversity of marine life.

Despite being close to the northern geographic limit for the growth of hard corals, Hong Kong supports 84 species of these. This diversity is quite rich by international standards. A variety of marine fish also breeds in Hong Kong waters. Typical of the eastern waters is the red pargo, one of several sea bream varieties whose fry are abundant along the shore of Mirs Bay in early spring.

Two marine mammal species can be found throughout the year. The Indo-Pacific humpback dolphin, also known as the Chinese white dolphin, is the best known. The other is the Indo-Pacific finless porpoise. The humpback dolphin prefers an estuarine environment and inhabits the western waters of Hong Kong while the finless porpoise lives in the eastern and southern part, where the waters are predominantly oceanic.

To enhance inshore marine resources, the AFCD has installed artificial reefs to improve fishery resources and biodiversity. The Marine Parks programme continues to be important in protecting and conserving sites of special ecological and conservation value.

### Geology and Landforms

Despite its small size, Hong Kong has a unique geology and a great variety of landforms including sea cliffs, sea caves, sea arches, geos, tomolos, wave-built terraces, sea stacks, notches and blowholes.

While most of the hexagonal volcanic rock columns in other regions of the world are composed of basic basaltic lava, those in Sai Kung are made up of acidic silica-rich rhyolitic volcanic rock. Apart from its extraordinary composition, the columns are considered to be unique for their large area (over 100 square kilometres) and size (average diameter of 1.2 metres).

The Northeast New Territories represents the most comprehensive stratigraphy of sedimentary rocks in Hong Kong, ranging from Devonian sandstone and conglomerate aged about 400 million years to Paleogene siltstone formed 55 million years ago. Fossils including ammonite, brachiopod, crinoids and insects have been found in these sedimentary rocks.

### **Legislation and Nature Conservation**

The Director of Agriculture, Fisheries and Conservation, who is also the Country and Marine Parks Authority, is responsible for the conservation of terrestrial and marine ecological resources and for the enforcement of legislation on nature conservation issues.

The Forests and Countryside Ordinance provides for the general protection of trees and vegetation. Its subsidiary Forestry Regulations controls the selling and possession of certain attractive plants to deter illegal collection. These include native camellias, magnolias, orchids, azaleas and the Chinese New Year flower.

The Wild Animals Protection Ordinance prohibits the wilful disturbance, hunting, possession and sale or export of protected wild animals found in Hong Kong. It also restricts entry into three important wildlife habitats that are designated as 'restricted areas'. These are the Mai Po Marshes, the Yim Tso Ha Egretty and the Green Turtle nesting beach at Sham Wan.

The Protection of Endangered Species of Animals and Plants Ordinance imposes controls on the import, export, re-export, introduction from the sea or possession of endangered species to prevent their over-exploitation.

The Country Parks Ordinance provides for the designation, control and management of country parks and special areas for nature conservation, education and scientific research purposes. Country parks may be used for compatible recreation and tourism purposes.

The Marine Parks Ordinance provides for the designation, protection and management of marine parks and marine reserves for nature conservation, education and scientific research purposes. Recreational activities such as swimming and diving are allowed in marine parks.

The Fisheries Protection Ordinance provides for the regulation of fishing practices and the prevention of destructive fishing activities such as those involving the use of explosives or toxic substances to catch fish.

## Protected Areas

About 40 per cent of Hong Kong's total land area has been designated as country parks and special areas for conservation and recreation. There are 24 country parks and 17 special areas covering 44 000 hectares of scenic hills, woodlands, reservoirs, islands, indented coastlines, marshes and uplands. All are carefully protected for nature conservation, education and scientific studies. Management responsibilities include the protection of woodland and vegetation against fire, control of development, tree planting, litter collection, the provision of educational and recreational facilities, and the promotion of a better understanding of the countryside.

There are four marine parks and one marine reserve covering 2 430 hectares of scenic coastal areas, seascapes and important biological habitats. Marine reserves are dedicated to conservation, education and scientific studies. Fishing in marine parks is controlled through a permit system while it is totally banned in marine reserves. Publicity and educational activities are organised for students and members of the public.

To improve the preservation and management of the Hong Kong National Geopark, five geologically important sites, Double Haven, High Island, Sharp Island, the Ung Kong Group and the Ninepin Group covering a total of 235 hectares will be designated as special areas in early 2011. Located in the Northeast New Territories, the geology of the Double Haven Special Area is characterised by sedimentary rocks of the Jurassic and Cretaceous periods. The other four special areas are located in the Sai Kung district, and their geology is characterised by volcanic rocks of the Cretaceous period.

Besides designating protected areas, the Government has been identifying and conserving sites of special scientific interest (SSSI), such as areas with special geological features and natural habitats of rare plants or animals, by exercising strict land use planning and development controls. There are 67 sites listed in the SSSI register.

## Topography and Geology

Hong Kong's natural terrain is characterised by rugged uplands flanked by steep slopes. The highest point is Tai Mo Shan (957 metres above Principal Datum) in the central New Territories, and the lowest point (66 metres below Principal Datum) is in Lo Chau Mun (the Beaufort Channel) to the north of Po Toi Island. The mountains are predominantly formed of volcanic rocks, whereas the lower hills consist mainly of granite. Low-lying areas are generally underlain by granite or sedimentary rocks. A layer of soft, weathered rock covers the bedrock in most places, slope debris mantles the natural hillsides, and alluvium fills many of the valleys. Offshore, the seabed is covered with marine mud, with sand sheets occurring near the coast and in channels.

The oldest exposed rocks in Hong Kong are composed of river sediments that were deposited approximately 400 million years ago. From 350 to 290 million years

ago, the region was inundated by a shallow sea, where limestones (now marble) and siltstones, found in western and central New Territories were deposited. From 170 to 140 million years ago, violent volcanic eruptions occurred with deposition of thick ash and lava layers and the development of several calderas (giant craters). At deeper levels, molten magma was intruded and slowly crystallised to form granite. Layered rocks now seen on the island of Ping Chau are younger sediments, laid down in a lake on the edge of a desert, about 55 million years ago.

During the last 2.6 million years, major glaciations caused successive lowering of sea level by up to 120 metres. This resulted in the coastline receding by about 100 kilometres south of Hong Kong. During interglacial periods, including the present time, the sea level rose and marine sediments were deposited.

A series of fifteen 1:20 000-scale geological maps and six accompanying geological memoirs have been produced by the Hong Kong Geological Survey. Two summary memoirs and a set of 1:100 000-scale geological and thematic maps that synthesise the geology of Hong Kong as well as a popular account of the geology of Hong Kong, in Chinese and English, have also been published. Geological information can be accessed from the website of the Civil Engineering and Development Department.

## **Energy**

### *Gas*

Town gas and liquefied petroleum gas (LPG) are the main types of fuel gas used in Hong Kong for domestic, commercial and industrial purposes. LPG is also used as a fuel by nearly all taxis and over 60 per cent of public light buses while natural gas is used for electricity generation and production of town gas.

Hong Kong has about 2.3 million gas customers in the domestic, commercial and industrial sectors, of which town gas and LPG respectively accounted for 84.7 and 15.3 per cent of the total fuel gas sold in these sectors.

Town gas is manufactured at plants in Tai Po and Ma Tau Kok which have daily throughput capacities of 9.66 and 2.6 million cubic metres respectively. A pipe network of some 3 400 kilometres supplies town gas to about 1.7 million customers.

LPG is imported into Hong Kong by sea and stored at five terminals on Tsing Yi Island before being distributed to approximately 631 000 customers and 62 LPG filling stations.

Natural gas is imported from the Mainland via submarine pipelines to the Black Point, Castle Peak and Lamma Power Stations for electricity generation and to the Tai Po Plant for production of town gas.

The Gas Safety Ordinance regulates the importation, manufacture, storage, transport, supply and use of fuel gas. All gas supply companies, gas installers and contractors must be registered with the Gas Authority (the Director of Electrical and Mechanical Services).

## Electricity

HEC supplies electricity to Hong Kong Island and the neighbouring islands of Ap Lei Chau and Lamma, while CLP Power supplies Kowloon and the New Territories, including Lantau and several other outlying islands. The electricity supply to consumers is 50 hertz alternating current while the voltage is 220 volts single-phase and 380 volts three-phase.

Both power companies are investor-owned. The Government monitors them through mutually agreed Scheme of Control Agreements (SCAs). These require the companies to seek the Government's approval for certain aspects of their development plans, including their projected basic tariff levels. The SCAs do not give the companies any exclusive rights. They are not franchises, nor do they define a supply area for either company, or exclude newcomers to the market.

The Government signed post-2008 SCAs with each of the two power companies in January 2008. The new agreements took effect upon the expiry of the previous ones on September 30, 2008 and December 31, 2008 for CLP Power and HEC respectively. The new SCAs are of 10-year term, with an option exercisable by the Government to extend for five more years, i.e. until 2023, after review of the prevailing market conditions.

The permitted rate of return of the power companies on their average net fixed assets is 9.99 per cent. The permitted rate of return is also linked to the emission performance of the power companies in the interest of better environmental protection. The new SCAs ensure the continued supply of reliable, safe and efficient electricity at reasonable prices. The Government will proceed with preparations for the opening up of the electricity market, including the formulation of a new market mechanism and the associated regulatory framework, in the current regulatory period (i.e. from 2008 to 2018).

Currently, HEC has a total installed capacity of 3 756 megawatts (MW) at its Lamma Power Station. The Castle Peak Power Company Limited (CAPCO) supplies electricity to CLP Power from its power stations at Black Point (2 500MW), Castle Peak (4 108MW) and Penny's Bay (300MW).

CLP Power and HEC own their respective transmission and distribution systems. The two transmission systems are interconnected by a cross-harbour link, which provides emergency back-up and some sharing of generating capacity reserve between the two systems. The link has a current total capacity of 720 megavoltamperes (MVA).

CLP Power's transmission system is also connected to the electricity network in Guangdong Province which facilitates the export and import of electricity to and from the province. The electricity sold to Guangdong is from CLP Power's existing reserve generating capacity. Its sale is governed by an agreement with the HKSAR Government under which CLP Power's consumers are given priority of supply and 80 per cent of the profit from the sales. At the same time, CLP Power buys about 70 per cent of the power generated by the Guangdong Nuclear Power Station at Daya

Bay, which has two 984MW pressurised water reactors, to meet part of the longer-term demand for electricity in its supply area.

According to the memorandum of understanding signed between the HKSAR Government and the National Energy Administration on August 28, 2008, the Central People's Government supported the China Guangdong Nuclear Power Holding Company Limited in the renewal of its supply agreement with Hong Kong for a further term of 20 years. In September 2009, the Government gave approval for CLP Power to extend the contract for the supply of nuclear electricity from Daya Bay Nuclear Power Station for another term of 20 years from May 7, 2014 onwards. The quantity of electricity supply will be no less than the current level.

CLP Power also has the right to use up to 50 per cent of the 1 200MW capacity of Phase 1 of the Guangzhou Pumped Storage Power Station at Conghua. Off-peak period electricity from the CAPCO system and the Guangdong Nuclear Power Station is stored in the pumped storage power station, which generates hydro-electricity to meet Hong Kong's demand during peak periods.

There are regulations under the Electricity Ordinance governing the registration of electrical contractors and workers and competent persons, safety of electrical wiring, supply of safe household electrical products and protection of electricity supply lines from third party damage.

## **Climate**

Hong Kong has a sub-tropical climate. About 80 per cent of its annual rainfall occur between May and September. August is the wettest month while January is the driest.

Tropical cyclones usually affect Hong Kong between June and October, often bringing high winds and widespread heavy rain. Landslips and flooding sometimes cause considerably more damage than the winds.

### *The Year's Weather*

Both temperature and rainfall were near normal in 2010. Five tropical cyclones required the issuance of Tropical Cyclone Warning Signals, less than the average of six to seven a year.

## **Meteorological and Geophysical Services**

### *Hong Kong Observatory*

Established in 1883, the Hong Kong Observatory provides meteorological, geophysical, oceanographic, astronomical and climatological services. It also monitors environmental radiation, and administers Hong Kong's official time standard.

### *Weather Forecast and Information Service*

The observatory issues weather forecasts and warnings of hazardous weather to the public, as well as to the shipping, aviation, transport and logistics communities. It also provides ultra-violet radiation information and personalised lightning alert services. A high-performance computer system was commissioned in 2010, enabling



the observatory to provide weather forecast to the local community with high spatial and temporal resolution through new services, including 'Wind Forecast for Water Sport Activities' and 'Digital Weather Forecast'. The observatory also provided the World Exposition 2010 Shanghai China, the New Delhi Commonwealth Games and the Guangzhou 2010 Asian Games with meteorological support.

Its Airport Meteorological Office provides the Hong Kong International Airport and the Hong Kong Flight Information Region with world-class weather services. In 2010, the observatory's Assistant Director, Mr C M Shun, was elected President of the Commission for Aeronautical Meteorology of the World Meteorological Organisation, which steers the development of aviation weather service worldwide for the next four years.

Weather information is disseminated to the public through the media, an automatic Dial-a-Weather telephone enquiry system and the observatory's website which registered about 1.8 billion page views in 2010 making it one of the most popular government websites. A new personalised weather service, 'MyObservatory', also disseminates weather information through mobile phones anytime anywhere. In addition, the observatory presents weekly videos on YouTube to promote meteorological knowledge and disseminates weather news through Twitter. Both initiatives were launched in 2010 and are gaining popularity.

### *Radiation Measurement and Assessment*

The observatory monitors the ambient radiation level in Hong Kong as well as the amount of radioactivity in the environmental samples. In the unlikely event of a nuclear accident, it will step up radiation monitoring immediately, assess the radiological consequences with other concerned departments and provide advice to policy bureaux on the kind of action to take.

### *Climate Services and Climate Change*

The observatory provides a wide range of climatological information services to meet the needs of the general public and different sectors of society. It issues an annual outlook bulletin on rainfall and tropical cyclones, predicts seasonal temperature and rainfall, as well as studies the relationship between climate and health. The observatory conducts research on past trends and future projections of temperature, rainfall, sea level and extreme events, providing a scientific basis for climate change impact assessments.

### *Oceanographic Service*

The observatory produces an annual tide table for Hong Kong and provides forecasts of wave and swell for fishermen and mariners as well as warnings of possible storm surges and tsunamis. It advises government departments and the engineering community on physical oceanographic matters. A Liaison Group for the Shipping Community was established in 2010 to enhance communication between the observatory and the shipping sector.

### *Geophysical Service*

The observatory monitors earthquakes in the vicinity of Hong Kong and around the world. Relevant information is issued through the media and the observatory's website. In 2010, the observatory commissioned the Po Shan Seismograph Station, enhancing the monitoring of earthquakes in the South China Sea. In addition, the observatory conducted a geomagnetic survey and published a webpage to promote understanding of geomagnetism.

### *Official Time Standard*

As Hong Kong's official time keeper, the observatory maintains a Time Standard that is accurate to within one-tenth of a microsecond per day and contributes to the determination of Co-ordinated Universal Time. Time checks are available to the public through its Dial-a-Weather System, local radio stations, web clock and the Internet network time service, with the latter handling more than 950 million checks in 2010, an increase of about 34 per cent over 2009.

### *Public Education*

To promote public awareness of hazardous weather and climate change, the observatory carries out a broad range of educational and outreach activities. The Community Weather Information Network, managed by the observatory in collaboration with the Hong Kong Polytechnic University, fosters close co-operation with schools and the community to enhance weather education in Hong Kong.

### *Websites*

Environment Bureau: [www.enb.gov.hk](http://www.enb.gov.hk)

Agriculture, Fisheries and Conservation Department: [www.afcd.gov.hk](http://www.afcd.gov.hk)

Environmental Protection Department: [www.epd.gov.hk](http://www.epd.gov.hk)

Electrical and Mechanical Services Department: [www.emsd.gov.hk](http://www.emsd.gov.hk)

Sustainable Development Division: [www.susdev.gov.hk](http://www.susdev.gov.hk)

Council for Sustainable Development: [www.susdev.org.hk](http://www.susdev.org.hk)

Civil Engineering and Development Department: [www.cedd.gov.hk](http://www.cedd.gov.hk)

Hong Kong Observatory: [www.hko.gov.hk](http://www.hko.gov.hk) and [www.weather.gov.hk](http://www.weather.gov.hk)