

The Environment

The government is committed to enhancing the quality of the environment. Priorities in 2013 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 seven million people. But it is also one of the world's largest trading economies. Its steep mountains only leave about 263 square kilometres for people to 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. The impact of air pollution in the Pearl River Delta region also needs to be addressed.

Environmental protection is a major priority of the Hong Kong Special Administrative Region (HKSAR) Government. Tackling air pollution, stepping up action to improve water quality in Victoria Harbour, managing municipal solid waste better through sustainable use of resources, promoting energy efficiency and strengthening regional co-operation further are important for improving Hong Kong's quality of life and are government priorities.

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 Environment Bureau's Energy Division 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 bureau's Sustainable Development Division 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 2013-14 was budgeted at \$18.5 billion, or about 4 per cent of total public expenditure.

Environmental Awareness

The EPD works closely with the government-appointed Environmental Campaign Committee to enhance public environmental awareness through campaigns and community programmes, including activities promoting waste reduction and recycling, energy conservation and other environmental initiatives. The EPD's environmental resource and education centres provide the public with easy access to environmental information. By providing grants to local non-profit making organisations to implement educational, research and other projects relating to the environment and conservation, the Environmental Conservation Fund seeks to promote behavioural and lifestyle changes to protect the environment and achieve sustainable development.

Topography, Geology and Landforms

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 and 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 were deposited as river sediments approximately 400 million years ago. From 350 to 290 million years ago, limestones (now marble) and siltstones, found in western and central New Territories accumulated in a shallow sea. From 170 to 140 million years ago, violent eruptions depositing thick ash layers occurred from several volcanic centres. Volcanism ended with a colossal eruption from a giant volcano (High Island Supervolcano) centred in southeast Hong Kong. Subsequent uplift and erosion has revealed a cross-section from the top of the supervolcano in Sai Kung to its underlying magma chamber in Kowloon and northern Hong Kong Island. Layered rocks seen on the island of Ping Chau are younger sediments, laid down in a lake on the edge of a desert, about 50 million years ago.

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 50 million years ago.

Despite its small size, Hong Kong has a great variety of coastal landforms including sea cliffs, sea caves, sea arches, geos, tombolos, 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).

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 have been published, in Chinese and English, synthesising and giving a popular account of Hong Kong's geology. Geological information can be accessed from the website of the Civil Engineering and Development Department.

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 3,300 species of vascular plants, of which 2,100 are native to Hong Kong.

The major types of vegetation cover in Hong Kong currently comprise woodland, shrubland and grassland.

Remnants of the original forest cover can still be 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 micro-climate, or because they are protected for cultural reasons.

Continual afforestation efforts 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 protect water catchments from soil erosion.

Terrestrial Fauna

Hong Kong's climate and physical environment provide a wide range of habitats and support for a rich and varied fauna which includes around 520 species of birds, over 50 species of mammals, over 100 species of amphibians and reptiles, 236 species of butterflies and 117 species of dragonflies.

Besides having a rich terrestrial fauna biodiversity, a number of species are endemic to Hong Kong, including Romer's Tree Frog, Bogadek's Burrowing Lizard, Hong Kong Tusk-tail, Hong Kong Club-tail and Hong Kong Bent-winged Firefly. In addition, newly recorded species are discovered from time to time. Globally endangered or threatened species like the Three-banded Box Turtle, Yellow-breasted Bunting, Short-legged Toad, Green Turtle and Chinese Pangolin can also be found in Hong Kong.

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 waterbirds. Some 390 species of birds have been observed in this area. Thirty-six species are considered globally 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 different species of warblers, flycatchers, robins, thrushes, 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 is prohibited 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 their growth, Hong Kong supports 84 species of hard corals. 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 is important in protecting and conserving sites of special ecological and conservation value.

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 22 special areas covering about 44,300 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 hill fire, control of development, tree planting, planting enhancement, 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.

Besides designating protected areas, the government identifies and conserves 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.

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 control 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 on Lamma Island.

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.

The Genetically Modified Organisms (Control of Release) Ordinance controls the release into the environment, and the import and export, of genetically modified organisms (GMOs). It aims to protect the local biological diversity from possible adverse impacts arising from GMOs intended for release into the environment, which mainly involves farming or field trials for scientific researches.

Climate

Hong Kong has a sub-tropical climate. January and February are cloudier with spells of cold weather. March and April are milder and humid with fog. From May to August, it is hot and humid with occasional heavy rain and thunderstorms. Tropical cyclones usually affect Hong Kong between June and October, bringing squalls and heavy rain. November and December are generally fine and dry with pleasantly cool weather, although on occasions, it may be relatively cold at night and in the early morning.

The Year's Weather

In 2013, temperatures overall in Hong Kong were near normal. The first three months of the year were significantly warmer than normal. In particular, the mean temperature of February and March was around two degrees above normal and ranked the fifth highest for the same period on record. However, this warmer weather was offset by cooler weather in April, July and December, when the monthly mean temperatures were one to two degrees below normal.

It was also wet and thundery in 2013, with total rainfall about 19 per cent above normal. There were 53 days with thunderstorms, the most since 1947. A trough of low pressure brought

torrential rain and intense thunderstorms to Hong Kong on 22 May, requiring the observatory to issue the Black Rainstorm Warning. October was the driest month in the year with the monthly mean relative humidity of 66 per cent, ranking the third lowest for October since 1961.

Seven tropical cyclones affected Hong Kong in 2013 and local tropical cyclone warning signals were issued. No 8 Gale or Storm Signals were issued during the passages of Super Typhoons Utor and Usagi in August and September respectively. Severe Typhoon Krosa was the first tropical cyclone that called for tropical cyclone warning signals in a November since 2006.

Climate Change

The government attaches much importance to combating climate change, and has started various mitigation and adaptation measures to meet this global challenge. Measures include switching to cleaner fuels for power generation, enhancing energy efficiency (particularly in buildings), exploring the potential of renewable energy and waste-to-energy, developing an efficient and environment-friendly public transportation system, and raising public awareness of climate change issues.

In 2013, the government conducted energy-cum-carbon audits for about 60 government buildings and public facilities (including indoor markets, swimming pools, sports centres and schools) to identify carbon reduction measures. The government also developed a Carbon Footprint Repository, with a dedicated website for listed companies to disclose their carbon audit findings and to share their experiences in carbon management.

On regional cooperation, the Hong Kong-Guangdong Joint Liaison Group on Combating Climate Change held its second meeting in Hong Kong in July and agreed on plans for collaboration in 2013-14.

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 65 per cent of public light buses while natural gas is used for electricity generation and production of town gas. Hong Kong has about 1.78 million town gas and 0.49 million LPG customers respectively in the domestic, commercial and industrial sectors, of which town gas and LPG respectively accounted for 86.8 and 13.2 per cent of the total fuel gas sold in these sectors in terms of heating values.

Town gas is manufactured at plants in Tai Po and Ma Tau Kok which have daily throughput capacities of 9.6 and 2.6 million cubic metres respectively. A pipe network of some 3,500 kilometres supplies town gas to customers.

LPG is imported into Hong Kong by sea and stored at five terminals on Tsing Yi Island before being distributed to customers including 63 LPG filling stations for LPG vehicles.

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

The Hongkong Electric Company Limited (HEC) supplies electricity to Hong Kong Island and the neighbouring islands of Ap Lei Chau and Lamma, while CLP Power Hong Kong Limited (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 current SCAs are for 10-year terms ending in 2018, with an option exercisable by the government to extend for five more years (ie 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 SCAs ensure the continued supply of reliable, safe and efficient electricity at reasonable prices. As stipulated in the current SCAs due to expire in 2018, before implementing any changes to the regulatory regime the government will take into account all relevant factors, including the availability of new reliable and environmentally sound supply sources, safety, reliability and efficiency, and compatibility with the community's environmental and economic needs. The government will also discuss with the power companies market readiness and potential future changes to the electricity supply regulatory framework and transition issues before 2016.

Currently, HEC has a total installed capacity of 3,757 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 28 August 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 7 May 2014 onwards. The quantity of electricity supply will be no less than the current level. In addition, in September 2013, commissioning of the Hong Kong Branch Line facilities was completed to support operations using the new natural gas supplies through Mainland China's Second West-East Natural Gas Pipeline.

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.

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 2011 was 278,618 TJ, with the commercial, residential, industrial and transport sectors consuming 42 per cent, 21 per cent, 5 per cent and 32 per cent of the energy respectively. The Electrical and Mechanical Services Department's Energy Efficiency Office runs a range of programmes and initiatives to promote efficient use of energy, including a number of voluntary energy efficiency labelling and registration schemes; encouraging wider use of water-cooled air-conditioning systems and promoting effective energy management methods.

The Mandatory Energy Efficiency Labelling Scheme requires prescribed products for supply in Hong Kong to bear energy labels informing consumers of the products' energy efficiency performance. The scheme currently covers room air-conditioners, refrigerating appliances, compact fluorescent lamps, washing machines and dehumidifiers.

As buildings account for about 90 per cent of electricity consumed, promoting their efficient use of energy is instrumental in reducing greenhouse gas emissions. The Buildings Energy Efficiency Ordinance came into full force in September 2012, making implementation of the Building Energy Code mandatory to improve energy efficiency in new and existing buildings.

The government's district cooling system (DCS) at the Kai Tak Development provides 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. Phase I has been completed while Phase II and Phase III (Package A) are under construction. The chilled water from DCS is currently available to the first consumers in the Kai Tak Development, including the Kai Tak Cruise Terminal building and Ching Long Shopping Centre.

The government recognises the importance of promoting the use of renewable energy and Hong Kong's two power companies are making progress in their attempts to use clean energy to produce electricity. HEC has operated a wind turbine on Lamma Island since 2006. In 2013, CLP Power commissioned the stage 2 commercial scale photovoltaic system on Town Island in Sai Kung and HEC completed an extension to its thin film photovoltaic system at Lamma Power Station. Both companies plan to develop off-shore wind farms in Hong Kong waters and feasibility studies for these projects are under way.

Sustainable Development

The Council for Sustainable Development (SDC), appointed by the Chief Executive, promotes sustainable development in Hong Kong. In September, the SDC set off to engage the community and stakeholders on how best to implement quantity-based municipal solid waste charging in Hong Kong, before making appropriate recommendations to the government.

Since 2003 the SDC has invited 11 rounds of applications from organisations and individuals for grants from the Sustainable Development Fund to carry out work related to sustainable development. In the first 10 rounds, 57 projects were approved, involving grants of over \$56 million, and 42 of them have been completed so far.

The Sustainable Development Division oversees the government's sustainability assessment system, adopted since 2001 to integrate sustainability considerations into the decision-making process. All bureaus and departments must conduct sustainability assessments of their major initiatives and programmes and explain the implications in their submissions to the Policy Committee and Executive Council.

Legislation and Environmental Protection

Ten ordinances address environmental protection: 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, the Hazardous Chemicals Control Ordinance, the Product Eco-responsibility Ordinance; and the Motor Vehicle Idling (Fixed Penalty) Ordinance.

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 no higher than that needed to achieve conservation goals, which include making maximum use of the environment's natural capacity to absorb and recycle waste.

The EPD works with the construction, catering, vehicle repair, and property management sectors 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.

In 2013, EPD inspectors made over 58,600 visits to different locations around Hong Kong to enforce controls on air, noise, waste and water pollution and to deal with complaints about pollution, resulting in 424 prosecutions and about \$4.1 million in fines.

The Stockholm Convention on Persistent Organic Pollutants (the Stockholm Convention) and the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (the Rotterdam Convention) apply in Hong Kong. The Hazardous Chemicals Control Ordinance regulates via a permit system 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.

Pollution Prevention

The government applies 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 assessments of environmental implications.

Environmental Impact Assessment Ordinance

The Environmental Impact Assessment (EIA) Ordinance provides a transparent and systematic framework for assessing the environmental impact of designated projects and for identifying mitigating measures if needed. The EPD also promotes continuous public participation in the EIA process. As at 31 December 2013, 181 EIA reports had been approved since the ordinance was implemented.

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 EIA. In 2013, the EPD handled 111 monitoring and auditing programmes for major projects. As required by environmental permits, these projects must set up dedicated websites to publish the results and data obtained from the environmental monitoring and auditing process.

Land Use Planning

For major land use planning studies, strategic environmental assessments are required to incorporate environmental considerations into the formulation of land use plans. Under the EIA 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 integral parts 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 these reports incorporate, where appropriate, the principles of the 'Clean Air Charter' which the government supports to improve Hong Kong's air quality. To promote environmental performance reporting in the private sector, a dedicated EPD webpage provides links to the environmental and sustainability reports of listed companies in Hong Kong who choose to share this information.

Sewage disposal facilities in the rural areas

Improvements continue to sewage disposal facilities in the rural areas of the New Territories and in 2013 the government drew up plans to invest further in projects providing public sewers to convey domestic discharges from villages in rural and other un-sewered areas to sewage treatment works. Loan and grant schemes for eligible householders to connect houses to public sewers are available.

Air Pollution

The Environment Bureau released 'A Clean Air Plan for Hong Kong' in March, outlining the air quality challenges Hong Kong faces. It also gives an overview of the policies, measures and plans to tackle air pollution covering land and sea transport, power plants and industrial operations, and of collaboration between Guangdong and Hong Kong to deal with regional pollution to attain cleaner air and a healthier living environment.

The Air Pollution Control (Amendment) Ordinance 2013 was enacted in July to introduce new Air Quality Objectives (AQOs) from 1 January 2014. The new AQOs, benchmarked against targets under the World Health Organisation's Air Quality Guidelines, are broadly comparable to the air quality standards adopted by the European Union and the United States. The ordinance requires the AQOs to be reviewed at least once every five years.

The government launched a new health risk-based Air Quality Health Index (AQHI) system on 30 December 2013, replacing the Air Pollution Index system. The AQHI provides information about public health risks due to air pollution and gives advance warning of serious air pollution to enable the public (especially susceptible groups such as children, the elderly and those with heart or respiratory illnesses) to take precautionary measures.

Government control measures target different emission sources and between 1997 and 2011, emissions of sulphur dioxide (SO₂), nitrogen oxides (NO_x), respirable suspended particulates (RSP) and volatile organic compounds (VOC) have dropped by 23 per cent to 61 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 VOC contents in selected products. 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 a major source of emissions. To improve the local and regional air quality, the government issued Technical Memoranda in 2008, 2010 and 2012 to progressively tighten the emission caps on the power sector starting from 2010, 2015 and 2017 respectively. The emission caps for the three key pollutants from 2017 onwards will be 39 per cent to 59 per cent lower than the 2010 levels.

In 2013, the department handled some 12,300 complaints of air pollution and issued about 310 legal notices instructing offenders to abate air pollution.

Land Transport

Vehicle emissions are the major source of roadside air pollution. The government's policy is to apply the most stringent motor vehicle fuel and emission standards whenever they are practicable. Between 1999 and 2013, the concentrations of RSP, SO₂ and NO_x at roadsides, fell by 37 per cent, 59 per cent and 29 per cent respectively. Since June 2012, all newly registered vehicles are required to comply with the Euro V standards. Newly registered diesel private cars must meet emission standards comparable to those of petrol private cars as diesel vehicles emit more NO_x than petrol vehicles, which is a major contributor to smog. To encourage the supply and use of Euro V diesel, the government waived the tax for Euro V diesel in July 2008. Motor vehicle diesel and unleaded petrol standards were tightened to Euro V specifications and statutory control of the quality of motor vehicle biodiesel was introduced in 2010.

Nearly all of Hong Kong's taxis and over 65 per cent of public light buses now run on liquefied petroleum gas (LPG). To encourage the use of environment-friendly vehicles with low emissions and high fuel efficiency, the First Registration Tax is reduced for buyers of newly registered environment-friendly vehicles. An incentive scheme to encourage early replacement of pre-Euro and Euro I diesel commercial vehicles ended in March 2010, and the government launched a similar scheme for Euro II diesel commercial vehicles from July 2010 for a period of 36 months. In March 2011, the government set up a \$300 million 'Pilot Green Transport Fund' to subsidise the public transport sectors, goods vehicle owners and non-profit making organisations to try out green and innovative transport technologies.

To promote the use of electric vehicles (EV) in Hong Kong the First Registration Tax for EVs is waived till March 2014. Various EV models have been launched in the Hong Kong market and some 1,000 standard and 10 quick charging stations are in place for use by the general public.

The government has stringent controls against diesel vehicles with excessive smoke. Such vehicles must pass a smoke test with the aid of a chassis dynamometer to ascertain whether the defects have been rectified. In 2013, 7,431 smoky vehicles were reported, about 80 per cent fewer than in 1999.

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

Marine transport

Marine vessels have become the largest emission source in Hong Kong. To control marine emissions, the government has implemented a series of measures, including introducing MARPOL Annex VI requirements and upgrading marine fuel quality. In September 2012, the government launched a three-year Port Facilities and Light Dues Incentive Scheme to encourage ocean-going vessels to use cleaner fuel while berthing. The EPD intends to mandate this green practice starting 2015. The EPD is also preparing legislation to cap the sulphur content of marine light diesel at 0.05 per cent, a tenth of the current level.

Indoor Air Quality

To promote good indoor air quality (IAQ) and public awareness of its importance, the government has introduced an IAQ Management Programme, which includes a voluntary IAQ Certification Scheme for offices and public places 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 for controlling substances that deplete the ozone layer applies to Hong Kong. The Ozone Layer Protection Ordinance prohibits manufacture of these substances as well as their import for local consumption, except hydrochlorofluorocarbons (HCFCs). The import of HCFCs is now subject to quota control with a view to completely banning their import by 2020.

Noise Pollution

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 stays 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, since 2002 legislation requires 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 continues to explore 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 7 pm and 7 am 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 to facilitate the construction noise permit application process.

Intruder Alarm and Neighbourhood Noise

The police handle 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 87 per cent in 2013, and the percentage in the 'bad' and 'very bad' categories fell from 45 per cent in 1986 to 6 per cent, with no river falling into the 'very bad' category in 2013.

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 government commissioned a study in 2008 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 issues to be addressed and the review approaches were sought in 2009 and a 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 2.8 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. 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, which will be expanded to provide centralised chemical treatment to sewage from the entire HATS catchment. HATS Stage 2A works commenced in 2009 and the major works will be completed in 2014. Since commissioning in 2010, the Advance Disinfection Facilities have improved water quality in the Western Harbour and at Tsuen Wan beaches. Together with the completion of a local sewerage network and progressive connection to local residents' houses in the vicinity of the Tsuen Wan beaches, this has improved the waters at seven closed beaches so that they now comply with the Water Quality Objective for bathing beaches and are suitable for bathing. The government is studying the measures needed to further improve the water quality of the harbour.

Details of HATS are available on the 'A Clean Harbour for Hong Kong' website, www.cleanharbour.gov.hk.

Apart from HATS, the government has spent a further \$25 billion on other sewerage schemes since 1991 and will spend another \$17 billion on schemes over the next five years, including

sewerage for rural villages. The Water Pollution Control (Sewerage) Regulation empowers the EPD to direct house owners to connect their waste water pipes to new public sewers and since the regulation came into force in 1995, about 7,400 village houses have 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 support of the polluter-pays principle, since 2007 the government has initiated a gradual increase in the sewage charges for handling domestic waste water over a 10-year time frame. 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 21,500 tonnes of waste in 2013.

From the environmental protection perspective, livestock farming in urbanised Hong Kong is not sustainable in the long term. To address the problem, the Government introduced voluntary licence-surrender schemes in 2005 and 2006 to encourage respectively poultry and pig farmers to cease livestock farming permanently, in return for ex gratia payments. The schemes have decreased the number of pig and poultry farms and reduced the pollution load on the environment. The number of poultry farms has been further reduced by a buyout scheme launched in 2008.

Bathing Beaches

To protect the health of swimmers at bathing beaches, the government adopts strict standards for water quality control which indicate the pollution level measured in terms of *Escherichia coli* (the bacterium that can indicate the presence of sewage). Beaches in the 'good' and 'fair' categories in the following table meet the government's water quality objective for bathing, and all did in 2013.

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 2013
Good	Up to 24	Undetectable	24
Fair	25 to 180	10 or less	17
Poor	181 to 610	11 to 15	0
Very Poor	More than 610	More than 15	0

Beach water quality gradings to denote the recent water quality of open beaches are available on the EPD's website and hotline as well as through weekly press releases.

Waste Management

Waste Reduction

In May 2013, the government unveiled the 'Hong Kong Blueprint for Sustainable Use of Resources 2013 – 2022' which maps out the strategy, policies and plans for waste management in the coming 10 years to tackle the imminent waste problem through: (i) policies and legislation to drive behavioural changes to reduce waste at source; (ii) targeted territory-wide waste reduction campaigns to arouse public awareness and encourage community participation; and (iii) enhancement of waste-related infrastructure. The aim is to reduce Hong Kong's per capita municipal solid waste (MSW) disposal rate from 1.27 kg per day to 1 kg or less by 2017, and to 0.8 kg or less by 2022.

Waste reduction and recovery have always played an important role in waste management. Substantial quantities of recyclable materials are recovered and exported for recycling 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 also promotes local recycling and has developed a 20-hectare EcoPark in Tuen Mun Area 38 for exclusive use by the recycling industry. Fourteen lots in EcoPark have been let to waste recyclers.

The territory-wide Source Separation of Waste Programme covers over 80 per cent of the population. To further promote waste reduction and recycling and provide outlets for recyclables of low commercial value in the community, in 2011 the government launched the Community Recycling Network and, in collaboration with the District Councils, a programme to enhance community participation through district-based education, promotion and waste recycling programmes and activities.

International experience suggests that MSW charging can effectively reduce waste. A public consultation in 2012 showed majority support for a quantity-based charging system and the

Council for Sustainable Development launched a four-month public engagement process in September 2013 on the implementation details.

In line with the polluter-pays principle, the government aims to expedite the introduction of Producer Responsibility Schemes (PRSs) to encourage recovery, recycling and waste reduction at source. Legislative proposals to extend the Environmental Levy Scheme on Plastic Shopping Bags to cover all retailers were introduced in the Legislative Council in May 2013. The government also aims to introduce necessary legislative proposals to implement mandatory PRS on waste electrical and electronic equipment in 2014. Following positive public response to the introduction of a new mandatory PRS on glass beverage bottles, the government will prepare the necessary legislative proposals and continue to expand the collection network. Meanwhile, the EPD will continue to promote and support trade-funded voluntary recycling programmes.

In January 2013, the government announced the plan to develop five pilot community green stations (CGSs) in different parts of the territory to step up environmental education and facilitate collection of recyclables. The government will extend the initiative by progressively setting up a CGS in each of the 18 districts. The EPD will appoint a non-profit-making organisation by way of tender to operate each CGS.

Landfills

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

In 2013, 3.48 million tonnes of MSW was disposed of. About 69 per cent was domestic waste and the remainder was commercial and industrial waste. On average, each person in Hong Kong disposed of about 1.33 kilogrammes of MSW daily. It is estimated that the three landfills will reach their design capacities one-by-one by 2019. 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

MSW is collected and delivered to refuse transfer stations by refuse collection vehicles, containerised and then taken to landfills in bulk by sea or land transport. A network of six transfer stations and seven outlying islands transfer facilities handled 1.81 million tonnes of waste in 2013. At present, about 80 per cent of Hong Kong's domestic waste is delivered via this network to landfills.

Chemical and Special Waste

All chemical waste producers are required to pack, label and store their chemical waste 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 2013, a daily average of 26 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, which is

operated by a government contractor. Waste producers using its services are required to pay part of the treatment cost.

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

Clinical Waste

To safeguard public health, the government's Clinical Waste Control Scheme ensures that all clinical waste from healthcare practices is handled and disposed of in an environmentally sound and safe manner. Under the control scheme, clinical waste is collected by licensed waste collectors and sent to the Chemical Waste Treatment Centre (CWTC) for disposal by high-temperature incineration. The centre's air pollution control system meets the latest European Union emission standards. In 2013, the CWTC received on average 5.7 tonnes of clinical waste each day.

Construction Waste

The construction industry generated 28.7 million tonnes of construction waste in 2013. Of that, about 95 per cent was inert and suitable for re-use. To maximise the recovery and re-use of inert materials and minimise their disposal at landfills, a construction waste charging scheme 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

To deal with the large volume of non-recyclable MSW, Hong Kong needs new state-of-the-art, cost-effective facilities to reduce the volume of waste that requires landfill disposal. A multi-technology approach is needed so that different types of waste can be dealt with by the most suitable technology. The first phase of the government's large-scale Integrated Waste Management Facility (IWMF) will adopt advanced incineration as its core technology to reduce the waste volume by 90 per cent and to turn waste into energy, thereby reducing local greenhouse gas emission. The environmental impact assessment report for the IWMF and an Outline Zoning Plan have been completed. The preparatory work is ongoing for the first phase of IWMF at an artificial island near Shek Kwu Chau. In addition, Hong Kong also plans to develop Organic Waste Treatment Facilities (OWTF) that would adopt biological treatment technologies to turn source-separated organic waste such as food waste into biogas and compost. The first phase of the OWTF will be developed at Siu Ho Wan, North Lantau. However, even with such facilities, waste reduction at source is still necessary and the residual waste will still need to be disposed of at landfills.

The construction of a dedicated Sludge Treatment Facility at Tsang Tsui near Nim Wan, Tuen Mun is under way, with progressive commissioning started in late 2013. It will adopt advanced incineration technology to treat sewage sludge generated from sewage treatment works and has a treatment capacity of 2,000 tonnes per day. The facility will be equipped with a waste-to-energy installation and any surplus electricity generated from sludge incineration will be exported to the public power grid.

Import and Export of Waste

Import and export of waste are regulated by a permit system under the Waste Disposal Ordinance (WDO). The controls are 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 incorporates the Basel Ban, which prohibits the export of hazardous waste from developed countries to developing countries.

The EPD participates in international programmes deterring illegal waste shipments. It has established intelligence networks with many overseas control authorities and taken part in joint enforcement exercises. Since 2000, the mainland of China and the HKSAR have collaborated under a formal agreement to control movements of hazardous waste between the two areas. Joint enforcement action is taken regularly by the HKSAR and the Mainland control authorities to curb waste smuggling activities across the border. In 2013, the EPD and the Hong Kong Customs jointly stepped up the inspections of imported recyclables to complement the Green Fence operation by Mainland authorities.

Marine Refuse

The Marine Department deploys a fleet of about 70 contractors' vessels to collect marine refuse and refuse from vessels. In 2013, 10,900 tonnes of marine refuse and 4,350 tonnes of refuse from vessels were collected. In addition to law enforcement, the government also uses publicity and education to tackle the marine refuse problem.

In November 2012, the government set up an inter-departmental working group on Clean Shorelines to identify the sources of marine refuse, review the existing measures, formulate strategic policies to prevent and reduce marine refuse, and promote public awareness of the need to keep Hong Kong's shorelines clean. The EPD commenced a Marine Refuse Study in March of the sources, fates, distribution and movement of marine refuse in Hong Kong waters to help the working group's deliberations. The working group's Clean Shorelines Campaign in May sought to encourage the public to use reusable items, to reduce the use of disposable items, and to dispose of rubbish properly or to recycle it.

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 and the 1996 Protocol to which China is a Contracting Party. All marine dumping vessels operating under permits issued by the EPD have to be equipped with an automatic self-monitoring device that transmits real-time data to the EPD Control Centre to allow the authority to trace any illegal dumping. EPD 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 of bathing beaches are published weekly in the media and updated on the department's website and hotline during the bathing season.

Cross-boundary Co-operation

Since environmental pollution transcends administrative boundaries, Hong Kong works together with Guangdong and the Macao SAR on environmental matters.

The Pearl River Delta (PRD) Regional Air Quality Monitoring Network jointly established by the HKSAR Government and the Guangdong Provincial Government publishes the Regional Air Quality Index (RAQI) daily, and its reports on the monitoring results are released in April and October each year. The results show that there has been a substantial reduction in the average annual concentration of most pollutants in the region in recent years. Amidst continuing growth of the economy in the PRD region, from 2006 to 2012 the average annual concentrations of sulphur dioxide, nitrogen dioxide and respirable suspended particulates decreased by 62 per cent, 17 per cent and 24 per cent respectively. The number of days on which the RAQI met Class 2 National Ambient Air Quality Standards (applicable to general residential areas) also increased from 68 per cent to 84 per cent over the same period.

Hong Kong and Guangdong are continuing various air pollution abatement measures to achieve the mutually agreed PRD emission reduction targets for 2015 and 2020.

The Cleaner Production Partnership Programme encourages and facilitates Hong Kong-owned factories in the PRD region to adopt cleaner production technologies and practices, so helping improve the region's environmental quality. By the end of 2013, over 2,200 funding applications had been approved since the programme's launch in 2008. In addition, Hong Kong and Guangdong jointly organised the Hong Kong–Guangdong Cleaner Production Partners Recognition Scheme to recognise the efforts of enterprises in pursuing cleaner production. As at the end of 2013, 216 enterprises were holding the commendations.

Hong Kong and Shenzhen are jointly taking action to reduce pollution of the adjoining waters, including Deep Bay and Mirs Bay. Both sides have commenced the second review of the joint programmes for Deep Bay to gauge their effectiveness and to draw up necessary additional mitigation measures. Meanwhile, Hong Kong and Guangdong are jointly evaluating the pollution load carrying capacity of the Pearl River Estuary to provide a scientific basis for devising a water quality management strategy for the estuary.

Hong Kong and Macao are strengthening exchanges in areas such as regional air quality monitoring network, import and export of waste control, use of cleaner fuel by ocean-going

vessels at berth, reducing emissions from transport sectors, and environmental publicity and education.

To capitalise on environmental business opportunities in the Mainland, the government supported the local environment industry's participation at the 13th China International Environmental Protection Exhibition and Conference held in Beijing in July. In October, the government also supported the setting up of a Hong Kong Pavilion at the Eco Expo Asia 2013 held in Hong Kong to help the branding of local environmental industries in the region.

Meteorological and Geophysical Services

Hong Kong Observatory

Established in 1883, the Hong Kong Observatory provides meteorological, climatological, radiation monitoring, oceanographic, geophysical, time and astronomical services.

To celebrate its 130th anniversary in 2013, the observatory published a book of essays, *Under the Same Sky*, and co-organised the 'Under the Same Sky 130 Years' exhibition with the Hong Kong Museum of History between 9 July and 2 September, attracting more than 146,000 visitors.

Weather Forecast and Information Services

Weather information services are delivered to the public through the media, the Dial-a-Weather telephone enquiry system, the observatory website and social networking platforms. In 2013, the observatory website registered an unprecedented number of more than 65 billion page views.

The observatory also provides personalised weather information services to the public. Members of the public may create a personalised page for viewing items they desire, allowing more efficient access to weather information. In addition, the observatory enhanced its mobile application 'MyObservatory', available on popular smartphone platforms, to provide personalised weather services. In 2013 usage of the 'MyObservatory' smartphone application overtook that of the observatory website.

In 2013, the observatory launched a new version of 'Weather Wizard', a software tool delivering weather warnings and forecasts to personal computer users, and introduced a number of new features to its website, including a new webpage showing regional weather variations in Hong Kong and different weather elements on a detailed map, and a webpage providing hourly forecasts of air temperature, relative humidity, wind direction and wind speed for the next seven days at various locations.

The observatory broadcasts a weekly educational programme, 'Cool Met Stuff' since 30 December. It now produces free weather programmes for all TV stations and other media.

The observatory is active in international co-operation to enhance weather services. It coordinates the World Weather Information Service (WWIS) of the World Meteorological Organisation (WMO), a web-based project providing official weather forecasts for around 1,700

cities worldwide in 10 languages. A mobile version of the WWIS, 'MyWorldWeather', is available on smartphone platforms.

Apart from public weather services, the observatory also issues weather forecasts and warnings about hazardous weather to the shipping, aviation, industrial and engineering sectors. The observatory provides aviation weather services for the Hong Kong International Airport and the Hong Kong Flight Information Region. In 2013, it launched a mobile application 'MyAeroMET' giving the aviation community access to the latest aviation weather and related information.

Marine Meteorology Services

The observatory provides forecasts of wind, weather, wave and swells for fishermen and mariners. Automatic weather stations were set up on board two Hong Kong Voluntary Observing Ships for the first time in 2013, providing hourly observations of air temperature, pressure and relative humidity. The observatory also issues warnings or information bulletins about storm surges caused by tropical cyclones and tsunamis caused by earthquakes. In 2013, it coordinated the government's participation in the Pacific-wide tsunami exercise, organised by the UNESCO's Inter-governmental Oceanographic Commission. The observatory publishes annually the Hong Kong Tide Table, and advises government departments and the engineering community on physical oceanographic matters.

Climate Services and Climate Change Studies

The observatory provides a wide range of climatological information and climate prediction services, including updates of phenomena such as El Niño, annual outlook on rainfall and tropical cyclones, and predictions of seasonal temperature and rainfall. It conducts research on past trends and future projections of temperature, rainfall, sea level and extreme conditions in Hong Kong, based on the latest assessment of global warming, including the Fifth Assessment Report released by Working Group I of the United Nations Intergovernmental Panel on Climate Change in September.

Radiation Measurement and Assessment

The observatory operates a network of 12 radiation monitoring stations to monitor the ambient radiation level in Hong Kong and to measure the amount of radioactivity in environmental samples. In the unlikely event of a nuclear accident, the observatory would step up its radiation monitoring to detect the presence of artificial radionuclides in the environment. With other relevant departments, it would also assess the radiological consequences and provide advice to decision-makers on the actions to take. Relevant information on radiation and the latest developments would be provided to the public through various channels. Enhancements of radiation monitoring and assessment capabilities as well as further collaboration with Chinese and international counterparts are on-going.

Geophysical Services

The observatory monitors earthquakes in the vicinity of Hong Kong and around the world. It provides information on these occurrences through its website, the mass media and other social media platforms, as well as through SMS and emails for special users. A trial operation to relay messages on global earthquakes of magnitude 5.0 or above on Twitter was launched in

April. In 2013, the observatory also started to receive data from seismograph stations in Guangdong to enhance its capability in detecting earthquakes in southern China.

Astronomical Services

The observatory provides information about astronomical phenomena such as solar and lunar eclipses. It also publishes astronomical almanacs, providing the traditional Chinese calendar and various types of astronomical and geophysical information. During the ISON comet's approach to the Sun in November, the observatory organised a joint observation session with the Hong Kong Space Museum.

Official Time Standard

As Hong Kong's official time keeper, the observatory maintains a Time Standard that is accurate to within one ten-millionth of a second per day and contributes to the determination of Co-ordinated Universal Time by the International Bureau of Weights and Measures. Time checks are available to the public through the Dial-a-Weather System, local radio stations, web clocks and the internet network time service, with the latter handling around 10 billion checks in 2013, about twice that of 2012.

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' (Co-WIN), operated 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. Co-WIN's 'Community Weather Observing Scheme' (CWOS) encourages members of the public to take part in weather observations and provides multiple online platforms for participants to upload and share weather photos and observation reports.

In 2013, the observatory organised briefing sessions on climate change following the release of the Fifth Assessment Report by Working Group I of the United Nations Intergovernmental Panel on Climate Change, and, in collaboration with the Institution of Engineering and Technology Hong Kong, delivered talks at secondary schools to promote energy efficiency and conservation.

Government Laboratory

The Government Laboratory supports the enforcement of environmental protection legislation and implementation of various environmental programmes through the provision of comprehensive analytical and advisory services. In 2013, numerous tests on environmental samples of air, water, sediment, soil, biota, waste, motor vehicle fuel (including biodiesel) were conducted to furnish various environmental programmes with necessary data. The Government Laboratory also offers analytical services for chemicals regulated under the Stockholm Convention on Persistent Organic Pollutants to facilitate government departments in pursuing actions for the HKSAR Implementation Plan.

Websites

Agriculture, Fisheries and Conservation Department: www.afcd.gov.hk

Civil Engineering and Development Department: www.cedd.gov.hk

Council for Sustainable Development: www.susdev.org.hk

Electrical and Mechanical Services Department: www.emsd.gov.hk

Environment Bureau: www.enb.gov.hk

Environmental Protection Department: www.epd.gov.hk

Hong Kong Observatory: www.hko.gov.hk and www.weather.gov.hk

Hong Kong Observatory Mobile Web Services: <http://m.weather.gov.hk/links.htm>

MyObservatory: www.weather.gov.hk/myobservatory_e.htm

MyWorldWeather: worldweather.wmo.int/myworldweather

Sustainable Development Division: www.susdev.gov.hk