

The Environment

The Environment Bureau and the Environmental Protection Department are committed to enhancing the quality of the environment. During 2012, 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 seven 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 priority of the Hong Kong Special Administrative Region (HKSAR) Government. 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 are important for improving Hong Kong's quality of life and continue to be 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 2012-13 was budgeted at \$13.9 billion, or about 3.3 per cent of total public expenditure.

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, 168 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 2012, the EPD handled 110 monitoring and auditing programmes for major projects. These projects are required to 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 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, a dedicated EPD webpage encourages listed companies in Hong Kong to share their environmental or sustainability information with their stakeholders.

Sewage disposal facilities in the rural areas

Improvements continue to sewage disposal facilities in the rural areas of the New Territories and in 2012 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.

Cross-boundary Co-operation

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

A Regional Air Quality Index publishes the results daily from a network of 16 monitoring stations established by the HKSAR Government and the Guangdong Provincial Government and reports on the monitoring results are released in April and October each year. There has been a substantial reduction in the average annual concentration of most pollutants in the region in recent years. According to the monitoring results of the Pearl River Delta (PRD) Air Monitoring Network, from 2006 to 2011 the average annual concentrations of sulphur dioxide, nitrogen dioxide and respirable suspended particulates in the region have decreased by 49 per cent, 13 per cent and 14 per cent respectively, amidst continuing growth of the economy in PRD region.

In November, the Hong Kong-Guangdong Joint Working Group on Sustainable Development and Environmental Protection endorsed emission reduction targets for 2015 and 2020 for the PRD region.

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 2012, over 2,000 funding applications had been approved since the programme's launch in 2008. In addition, as at the end of 2012, 255 Hong Kong-owned enterprises had been commended under the Hong Kong-Guangdong Cleaner Production Partners Recognition Scheme, recognising their efforts in pursuing cleaner production. Hong Kong also works closely with Shenzhen to encourage the adoption of cleaner production practices by Hong Kong-owned factories there.

Hong Kong and Shenzhen are jointly implementing action programmes to reduce pollution of the adjoining waters, including Deep Bay and Mirs Bay. At the end of 2012, both sides 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 undertaking a joint evaluation of the pollution load carrying capacity of

the Pearl River Estuary to provide the two governments with a scientific basis for devising a water quality management strategy for the Pearl River Estuary.

There are exchanges between Hong Kong and Macao in areas such as environmental impact assessment, air quality monitoring, fuel switch by ocean-going vessels at berth, management of special waste, and the implementation of the Stockholm Convention on Persistent Organic Pollutants.

In June, the Hong Kong, Guangdong and Macao governments released their Regional Co-operation Plan on Building a Quality Living Area, setting out the direction for long-term co-operation in five areas: environment and ecology; low-carbon development; culture and social living; spatial planning; and green transportation systems. The plan aims to transform the Greater PRD region into a low-carbon, high-technology and low-pollution city cluster with good quality of life, enhancing the overall competitiveness and attractiveness of the region.

To capitalise on environmental business opportunities in the Mainland, the Government supported the local environment industry's participation at the International (Guangdong) Energy Conservation Expo 2012 held in June in Guangzhou. In October, the Government also supported the setting up of a Hong Kong Pavilion at the Eco Expo Asia 2012 held in Hong Kong to help the branding of local environmental industries in the region.

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 2012, the Government launched a three-year energy-cum-carbon audit programme to cover some 120 government buildings and public facilities. Workshops have been organised to introduce and promote carbon audits to listed companies.

In May, the Hong Kong-Guangdong Joint Liaison Group on Combating Climate Change held its first meeting to co-ordinate measures and activities in tackling climate change. A work plan was agreed for the coming year, including establishing an information exchange mechanism on severe climate events and organising seminars on climate change adaptation, renewable energy and electric vehicles.

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 2010 was 276,950 TJ, with the commercial, residential, industrial and transport sectors consuming 42 per cent, 20 per cent, 6 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 include energy labels informing consumers of the products' energy efficiency. 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 Codes mandatory to improve energy efficiency in new and existing buildings.

The Government is implementing a district cooling system (DCS) at the Kai Tak Development to 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. Phase I and Phase II are under construction. The DCS will be available to the first consumers in 2013. The Government will seek funding approval from the Legislative Council to proceed with the Phase III (Package A) works of the project.

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. Hongkong Electric Company Limited (HEC) has operated a wind turbine on Lamma Island since 2006. CLP Power Hong Kong Limited commissioned the stage 2 commercial scale photovoltaic system on Town Island in Sai Kung in 2012. HEC will complete an extension to its thin film photovoltaic system at Lamma Power Station in 2013. Both companies plan to develop off-shore commercial wind farms in Hong Kong waters and have begun preparation work to collect technical data on-site and feasibility studies for these projects.

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, 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.

In 2012, EPD inspectors made over 60,400 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 389 prosecutions and more than \$2.6 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) are effective 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.

Air Pollution

Emissions from power plants, vehicles, marine vessels and industrial operations affect Hong Kong's air quality. Government control measures target different emission sources and between 1997 and 2010, emissions of sulphur dioxide (SO₂), nitrogen oxides (NO_x), respirable suspended particulates (RSP) and volatile organic compounds (VOC) have dropped by 30 per cent to 59 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.

To better protect public health, the Government announced in January 2012 the adoption of new air quality objectives (AQOs) drawn up with reference to the World Health Organisation (WHO)'s guidelines and overseas practices. The Government is working on legislative amendments to make the new AQOs statutory standards in 2014. The Government is also taking forward a package of air quality improvement measures targeted at power plants and energy efficiency, roadside air pollution, marine emissions, infrastructure development and planning.

In 2012, the department handled some 13,000 complaints of air pollution and issued about 100 legal notices instructing offenders to abate air pollution.

Transport

Vehicle emissions are the major source of air pollution 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 2012, the concentrations of RSP, SO₂ and NO_x at roadsides, fell by 42 per cent, 63 per cent and 31 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 60 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. The Government's \$300 million 'Pilot Green Transport Fund' subsidises the public transport sectors and goods vehicle owners to try out green innovative transport technologies.

The Government also promotes the use of electric vehicles (EV) in Hong Kong, with an exemption of the First Registration Tax for electric vehicles extended to March 2014. Various EV models have been launched in the Hong Kong market and more than 1,000 charging points 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 chassis dynamometer to ascertain whether the defects have been rectified. In 2012, 7,932 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.

Besides land transport, marine vessels are also a major emission source. The Government has implemented a series of measures to control marine emissions, including the MARPOL Annex VI requirements and upgrading marine fuel standards. In September, EPD and the Marine Department launched a three-year Port Facilities and Light Dues Incentive Scheme to encourage ocean-going vessels to use cleaner fuel while berthing in Hong Kong waters.

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

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 85 per cent in 2012, 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 2012.

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 project is targeted for commissioning 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 \$23 billion on other sewerage schemes since 1991 and will spend another \$16 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 6,700 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 charge 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 22,000 tonnes of waste in 2012.

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 *E 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 2012.

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 2012
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

In addition, 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

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 effective economic tools that will create incentives for the community to recycle more and discard less. In 2012, the Government reaffirmed the importance of waste avoidance and reduction in its comprehensive strategy for the management of municipal solid

waste. Under this 'reduction first' strategy, the Government encourages waste reduction and recycling through various measures to achieve the goal of recovering 55 per cent of municipal solid waste by 2015 and plans adequate environmental infrastructure to tackle Hong Kong's waste problem.

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 and environmental industry. Fourteen lots in EcoPark Phases 1 and 2 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 municipal solid waste charging can effectively reduce waste. A public consultation in 2012 showed majority support for a quantity-based charging system and the Council on Sustainable Development will consult the public further on the implementation details.

In line with the polluter-pays principle, the Government aims to create economic incentives to encourage recovery, recycling and waste reduction. The Government has started drafting legislative proposals to extend the Environmental Levy Scheme on Plastic Shopping Bags to cover all retailers and has also taken further action on mandatory producer responsibility schemes on waste electrical and electronic equipment. Meanwhile, the EPD continues to promote and support trade-funded voluntary recycling programmes and 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 strategic landfills in the New Territories, which are operated to high environmental standards.

In 2012, 3.4 million tonnes of municipal solid waste was disposed of. About 68 per cent was domestic waste and the remainder was commercial and industrial waste. On average, each person in Hong Kong disposed of about 1.3 kilogrammes of municipal solid waste daily. It is estimated that the three landfills will be filled to capacity by the 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 in bulk by sea or land transport. A network of six transfer stations and seven outlying islands transfer facilities handled 1.78 million tonnes of waste in 2012. At present, 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 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 2012, a daily average of 27 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 installation of additional facilities at the CWTC, including the upgraded air pollution control system meeting the latest European Union emission standards, is fully operational to treat clinical waste. In 2012, the CWTC received on average 5.7 tonnes of clinical waste each day.

Construction Waste

The construction industry generated 27.8 million tonnes of construction waste in 2012. 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 municipal solid wastes, 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 on-going 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.

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 is under way and aims to start operation in late 2013. It will adopt advanced incineration technology 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.

Marine Refuse

The Marine Department deploys a fleet of about 70 contractors' vessels to collect marine refuse and refuse from vessels. In 2012, 11,000 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 organise public engagement sessions to promote public awareness of keeping our shorelines clean.

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 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. 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 of bathing beaches are published weekly in the media and updated on the department's website and hotline during the bathing season.

Sustainable Development

The Council for Sustainable Development, appointed by the Chief Executive, promotes sustainable development in Hong Kong. In March 2012, the council submitted to the Government its report and recommendations on 'Combating Climate Change: Energy Saving and Carbon Emission Reduction in Buildings', to which the Government promptly responded positively.

Since 2003 the council has invited ten 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 nine rounds, 51 projects were approved, involving grants of over \$49 million, and 37 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 bureaux 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.

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 2012, 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 testing services for chemicals regulated under the Stockholm Convention on Persistent Organic Pollutants to facilitate government departments in pursuing actions for the HKSAR Implementation Plan.

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. 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 514 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. Examples include Romer's Tree Frog, Bogadek's Burrowing Lizard, Hong Kong Tusktail, Hong Kong Clubtail and the firefly *Pteroptyx maipo*. In addition, newly recorded species are discovered from time to time. Globally endangered or threatened species like the Three-banded Box Turtle, Spoon-billed Sandpiper, 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 ducks and waterbirds. Some 380 species of birds have been observed in this area. Thirty-six species are considered globally threatened and near-threatened including the Black-faced Spoonbill, Baer's Pochard, Nordmann's Greenshank and Eurasian Curlew. 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 Longtailed 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, 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).

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 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.

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 44,239 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, 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.

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 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 55 million years ago.

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 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 86.3 and 13.7 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 2.4 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 61 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 Hong Kong Branch Line of the Second West-East Natural Gas Pipeline, constructed jointly by energy enterprises of the Mainland and Hong Kong, was completed in 2012. Hong Kong can benefit from improved air quality by increasing the use of clean energy and reducing the emission of power plants.

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 Hong Kong Electric Company (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 permitted rate of return is also linked to the emission performance of the power companies in the interest of better environmental protection. 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 environmental and economic needs of the community. The Government will also discuss with the power companies market readiness and potential future changes to the electricity supply regulatory framework and transition issue before 2016.

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 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.

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. January and February are cloudier, with occasional cold weather. March and April are milder but humid with occasional 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, often bringing high winds and widespread heavy rain. November and December are the months of the year with pleasant breezes, plenty of sunshine and comfortable temperatures.

The Year's Weather

While temperatures overall in 2012 were slightly above normal in Hong Kong, January and February were significantly colder than usual because of the stronger winter monsoon over South China under the influence of La Nina¹. The temperature at the Hong Kong Observatory fell to a minimum of 7.4 degrees on 25 January, the lowest during the Lunar New Year holidays since 1996. Rainfall in 2012 was about 20 per cent below normal.

Five tropical cyclones required tropical cyclone warnings to be issued, of which Severe Typhoon Vicente was the first tropical cyclone requiring the Hurricane Signal No 10 (the highest tropical cyclone warning signal in Hong Kong) since Typhoon York in September 1999. The Hong Kong Observatory issued the Hurricane Signal No 10 on 24 July during Vicente's passage. Packing estimated maximum sustained winds of 155 km/hr near its centre, Vicente passed about 100 km to the southwest of Hong Kong, and was the most distant tropical cyclone to require the No 10 Signal in Hong Kong since 1946. Vicente intensified rapidly within around 30 hours prior to its closest approach to Hong Kong, strengthening by three categories from a tropical storm to a severe typhoon. Such rapid intensification of tropical cyclones near the territory is rare. At least 138 people were injured during Vicente's passage and around 8,800 trees were felled.

Under the dominance of a warm maritime airstream, April and May were exceptionally warm. August was one of the hottest Augusts on record, which was mainly attributed to the prevalence of the dry subsiding airstream associated with tropical cyclones Saola, Kai-tak and Tembin.

¹ La Nina is characterised by sea surface temperatures significantly below normal in the central and eastern equatorial Pacific.

As a result of the frequent interchange between the cool northeast monsoon and the warm and humid maritime airstream over the south China coastal areas, November was marked by unusually gloomy and humid weather. The gloomy weather continued for most of December, contributing to 2012 being the year with the shortest duration of bright sunshine on record. Under an intense cold surge, the lowest temperature of the year at 7.1 degrees was recorded on 31 December at the Hong Kong Observatory, making this the third coldest New Year's Eve on record.

Meteorological and Geophysical Services

Hong Kong Observatory

Established in 1883, the Hong Kong Observatory provides meteorological, climatological, oceanographic, geophysical and astronomical services. The observatory monitors environmental radiation, and administers Hong Kong's official time standard and, through publicity, promotes public awareness of, and appropriate actions to cope with, natural hazards and climate change.

Weather Forecast and Information Services

The observatory issues weather forecasts and warnings about hazardous weather to the public, and to people in the shipping, aviation, transport and logistics industries. It also provides information on ultra-violet radiation, digital weather forecasts in fine spatial and temporal scales and a personalised service to warn people about possible lightning strikes.

Weather information services are delivered to the public through the media, the Dial-a-Weather telephone enquiry system and the observatory's website. In 2012, the online weather information service delivered through the observatory's website registered 30 billion page views, or five times more than in 2011. In addition, the observatory continued to enhance the content of the weather information disseminated through social-networking platforms including YouTube, Tudou, Twitter and Weibo.

The observatory also provides personalised weather information services to the public. While a mobile website was customised for better user experience on mobile devices, a mobile application 'MyObservatory' was also made available on smartphone platforms to provide personalised weather service. Users can access weather information through smartphones any time, anywhere, and are also automatically alerted to weather warning signals. In 2012, 'MyObservatory' was enhanced so that it could automatically inform users of approaching rain at their actual or selected location.

The observatory plays an active role in fostering international co-operation to enhance weather services. In addition to co-ordinating the World Weather Information Service (WWIS) of the World Meteorological Organisation, a web-based project providing official weather forecasts for over 1,600 cities worldwide in 10 different languages, the observatory also worked with meteorological services in other countries to enhance the mobile application 'MyWorldWeather' to extend the WWIS to smartphone platforms.

With its counterparts in Guangdong and Macao, the observatory developed a 'Greater Pearl River Delta Weather' website to better serve users on the move in the region. To foster international and regional collaboration on meteorological services, the observatory signed a Memorandum of Understanding on co-operation with the Korean Meteorological Administration in May, and a long-term co-operation agreement with the Guangdong Meteorological Bureau in numerical weather prediction technology in September.

The observatory provides the Hong Kong International Airport and the Hong Kong Flight Information Region with aviation weather services. The observatory provided special site and flight route forecasts and weather observations to the People's Liberation Army's 8.1 Parachute Brigade for their show at the Hong Kong Stadium and Victoria Park to celebrate the 15th anniversary of the HKSAR's establishment.

In 2012, the observatory continued to collaborate with the Government Flying Service and used a fixed wing aircraft to collect meteorological data on tropical cyclones over the South China Sea. The aircraft observational data were useful in monitoring the position and intensity of tropical cyclones.

Radiation Measurement and Assessment

The observatory monitors the ambient radiation level in Hong Kong and measures the amount of radioactivity in environmental samples. Two new radiation monitoring stations, at Chek Lap Kok and Cape D'Aguilar, began operations in 2012, bringing the number of radiation monitoring stations to 12. The observatory also participated in a major inter-departmental exercise for the Daya Bay Contingency Plan in April. In the unlikely event of a nuclear accident, the observatory will step up radiation monitoring immediately, assess the radiological consequences with other concerned departments and provide advice to policy bureaux on the actions to take. The public will also be provided with relevant information on radiation and is kept abreast of the developments through various channels.

Climate Services

The observatory provides a wide range of climatological information and climate prediction services to meet the needs of the general public and different sectors of society. It provides updates of climatic phenomena such as the El Nino, issues an annual outlook on rainfall and tropical cyclones, and predicts seasonal temperature and rainfall. It conducts research on past trends and future projections of temperature, rainfall, sea level and extreme conditions. In 2012, the observatory launched a new webpage on climatology for festivals and special days.

Oceanographic Services

The observatory produces an annual Hong Kong tide table, provides forecasts of wind, weather, wave and swells for fishermen and mariners, and issues warnings or information bulletins about storm surges and tsunamis. It advises Government departments and the engineering community on physical oceanographic matters.

Geophysical Services

The observatory monitors earthquakes in the vicinity of Hong Kong and around the world. It posts information about these occurrences on its website for the public, through the media and other social media platforms, as well as through SMS and emails for special users.

Astronomical Services

The observatory provides information about astronomical occurrences such as solar and lunar eclipses. It also publishes astronomical almanacs, including the traditional Chinese calendar and various types of astronomical and geophysical information. In June, the observatory co-operated with the Hong Kong Space Museum to webcast a rare astronomical event, the transit of Venus across the face of the sun, attracting over 1.98 million page visits.

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 its Dial-a-Weather System, local radio stations, web clocks and the internet network time service, with the latter handling about 4.3 billion checks in 2012, about three times that in 2011.

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), 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. The 'Community Weather Observing Scheme', a new initiative of Co-WIN, was launched in 2012, providing a new platform for sharing weather reports posted by members of the public via personal computers or mobile phones.

Websites

Environment Bureau: www.enb.gov.hk

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

Environmental Protection Department: www.epd.gov.hk

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

Sustainable Development Division: www.susdev.gov.hk

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

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

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

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

MyWorldWeather: worldweather.wmo.int/myworldweather