

The Environment

The government is committed to enhancing the quality of the environment. Priorities in 2014 included improving air quality, implementing a solid waste management policy, improving harbour water quality, promoting energy efficiency and conservation, and combating 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. Over 500 square kilometres of 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, including the air quality. 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. Stepping up action to improve air quality as well as water quality in Victoria Harbour, managing municipal solid waste better through sustainable use of resources, promoting energy efficiency and strengthening regional co-operation 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 22 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 2014-15 was budgeted at \$16.1 billion, or about 3.7 per cent of total public expenditure.

Sustainable Development

The Council for Sustainable Development, appointed by the Chief Executive, promotes sustainable development in Hong Kong. The Sustainable Development Fund provides grants to organisations and individuals to carry out work related to sustainable development. Since 2003, 63 projects have been approved (and 51 of those completed), involving grants of over \$63 million.

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.

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 promote sustainable development.

Cross-boundary Co-operation

Since environmental pollution transcends administrative boundaries, Hong Kong works together with Guangdong and the Macao SAR on environmental matters. In September 2014, Hong Kong, Guangdong and Macao signed a Co-operation Agreement on Regional Air Pollution Control and Prevention. At the same time, the regional air quality monitoring network was enhanced, with inclusion of a monitoring station in Macao and the number of air monitoring stations increased from 16 to 23. Results from the regional air quality monitoring network show that there has been a substantial reduction in the average annual concentration of most pollutants in the region in recent years. From 2006 to 2013, the average annual concentrations of sulphur dioxide, nitrogen dioxide and respirable suspended particulates decreased by 62 per cent, 13 per cent and 15 per cent respectively. To further improve regional air quality, the Hong Kong and Guangdong governments in November 2012 endorsed the emission reduction targets/ranges for the Pearl River Delta region for up to 2020.

They also commenced a joint regional study to understand fine suspended particulates (PM2.5) pollution characteristics, which will assist in the formulation of appropriate and effective policies to combat PM2.5 pollution in the Pearl River Delta (PRD) region. This first regional air quality study under the newly signed co-operation agreement will be completed in 2017.

The Cleaner Production Partnership Programme encourages and assists Hong Kong-owned factories in Guangdong to adopt cleaner production technologies and practices. By the end of 2014, over 2,400 funding applications had been approved since the programme's launch in 2008. In addition, the Hong Kong–Guangdong Cleaner Production Partners Recognition Scheme recognises efforts to pursue cleaner production. As at the end of 2014, 216 enterprises were holding commendations. In November 2014, the two governments also signed an agreement to strengthen co-operation in promoting cleaner production to enterprises in the region.

Hong Kong and Shenzhen are implementing joint programmes to protect the water quality of the adjoining waters, including Deep Bay and Mirs Bay. The second review of the joint programmes for Deep Bay continues to gauge their effectiveness and to draw up necessary additional mitigation measures. Meanwhile, Hong Kong and Guangdong have assessed the pollution load-carrying capacity of the Pearl River Estuary to provide a scientific basis for water quality management of the estuary.

Physical Characteristics, Flora and Fauna

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 reveals 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-cut platforms, sea stacks, notches and blowholes.

While most of the hexagonal volcanic rock columns in other regions of the world are composed of basalt lava, those in Sai Kung are made up of 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.

Fauna

Terrestrial

Hong Kong's climate and physical environment provide a wide range of habitats and support for a rich and varied fauna which includes over 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 Tusktail, Hong Kong Clubtail 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 mangroves provide a rich habitat for migratory and resident birds, particularly waterbirds. Some 390 species of birds have been observed in this area. Thirty-seven 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

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. They 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.

Conservation and Biodiversity

Legislation and 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 designated as 'Restricted Areas': the Mai Po Marshes; the Yim Tso Ha Egrettry; 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.

UN Convention on Biological Diversity

The United Nations Convention on Biological Diversity (UNCBD) (extended to Hong Kong in 2011) aims to conserve biodiversity, ensure the sustainable use of its components, and ensure the fair and equitable sharing of benefits deriving from the use of genetic resources. To contribute to global objectives under the UNBCD's Strategic Plan for Biodiversity 2011-2020, the government is now developing a Biodiversity Strategy and Action Plan to step up conservation efforts and support Hong Kong's sustainable development.

The Cartagena Protocol on Biosafety, adopted under the UNCBD, aims to ensure the safe handling, transport and use of genetically modified organisms resulting from biotechnology that may have adverse effects on biodiversity. Hong Kong implements the protocol through enforcement of the Genetically Modified Organism (Control of Release) Ordinance.

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 high winds, heavy rain and sometimes storm surges.

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 2014, the weather in Hong Kong was generally warmer than usual. In particular, June, July and September had the highest monthly mean temperatures since 1884. The annual mean temperature for 2014 was 23.5 degrees, the ninth highest on record. The year was also wet and thundery, with total rainfall about 10 per cent higher than normal. There were 59 thunderstorm days during the year, the most since records began in 1947. The Red and Black Rainstorm Warning Signals issued on 30 March were the earliest in a year since the warning system's introduction in 1992. Intense thunderstorms that day also brought widespread hail and severe squalls to the territory. Tropical cyclone warning signals were issued on four occasions in 2014, including the passage of Typhoon Kalmaegi in September when the No 8 Gale or Storm Signal was issued.

Climate Change

Impact on Hong Kong

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

In 2014, the government continued a three-year programme begun in 2012 to conduct energy-cum-carbon audits on a total of 120 government buildings and public facilities to identify carbon reduction measures. To encourage private sector companies to adopt regular carbon auditing, the government also launched the Carbon Footprint Repository in December 2014, and 64 listed companies disclosed their carbon management experience and practices to the public through this government website.

Carbon Intensity Reduction Target

In 2010, the government set a target by 2020 of reducing carbon intensity by 50 to 60 per cent from its 2005 level. The government has focused on the power and transport sectors, which are the major contributors of local emissions, and launched a three-month public consultation in March 2014 on the future fuel mix for electricity generation to reduce greenhouse gas emissions. The government is now analysing the views expressed.

Energy

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, 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. 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. 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.

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.

Regulations under the Electricity Ordinance govern 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.

Other Fuels

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 1.8 million town gas and 0.46 million LPG customers respectively in the domestic, commercial and industrial sectors, of which town gas and LPG respectively accounted for 87.2 and 12.8 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 mainly by sea and stored at five terminals on Tsing Yi Island before being distributed to customers including 65 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).

Energy Saving

Energy Efficiency

Energy consumption is closely related to greenhouse gas emissions. Improving energy efficiency helps combat global climate change. The total energy consumption at end-use level in Hong Kong in 2012 was 287,970 TJ, with the commercial, transport, residential and industrial sectors consuming 42 per cent, 32 per cent, 21 per cent and 5 per cent 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 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. New grading standards announced in October 2014 for room air conditioners, refrigerating appliances and washing machines will be implemented in November 2015, saving annually an estimated 300 million kilowatt-hours in electricity consumption and \$300 million in electricity expenses.

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. Phases I and II have been completed while Phase III (Package A) is under construction.

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 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 are conducting feasibility studies for off-shore wind farm projects.

Energy Efficient Buildings

As buildings account for about 90 per cent of electricity consumed, promoting their efficient use of energy is instrumental in reducing greenhouse gas emissions. New buildings and existing buildings undergoing major retrofitting works are required to comply with the Building Energy Code mandated under the Buildings Energy Efficiency Ordinance implemented in 2012. It stipulates the minimum energy efficiency standards for major building services installations including air-conditioning, electrical installations, lighting, and lift and escalator installations. Commercial buildings are also required to conduct energy audits at least every 10 years. For new buildings, the implementation of the ordinance in the first 10 years is expected to save 2.8 billion kilowatt-hours of electricity and hence cut about 1.96 million tonnes of carbon dioxide emissions.

Pollution Prevention

Air Pollution

The EPD has taken action to reduce emissions from local air pollution sources to improve air quality. Between 1997 and 2012, emissions of sulphur dioxide (SO₂), nitrogen oxides (NO_x), respirable suspended particulates (RSP) and volatile organic compounds (VOC) in the territory have dropped by 23 per cent to 60 per cent.

From 2005 to 2014 (preliminary data), the ambient concentrations of SO₂, RSP and PM_{2.5} dropped by 50 per cent, 22 per cent and 29 per cent respectively and roadside concentrations fell by 59 per cent, 33 per cent and 42 per cent respectively. However, ozone increased by 31 per cent, reflecting worsening regional photochemical smog, and roadside NO₂ increased by six per cent due to excess vehicle emissions and increased regional background ozone.

New Air Quality Objectives (AQOs) took effect from 1 January 2014, benchmarked against the World Health Organisation's Air Quality Guidelines, and broadly comparable to the air quality standards adopted by the European Union and the United States. The government will review the AQOs at least once every five years and implement measures under the Clean Air Plan to broadly achieve the AQOs by 2020.

The Air Quality Health Index (AQHI) launched on 30 December 2013 provides real-time information about short-term 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.

Land Transport

Vehicle emissions are the major source of roadside air pollution. The government's policy is to apply the most stringent practicable motor vehicle fuel and emission standards. All newly registered vehicles are required to comply with the Euro V standards.

Nearly all of Hong Kong's taxis and over 67 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. On 1 March 2014 an incentive-cum-regulatory scheme was launched to progressively phase out by the end of 2019 some 82,000 pre-Euro IV diesel commercial vehicles, with \$11.4 billion available as ex-gratia payments for affected vehicle owners. The government has limited the service life of diesel commercial vehicles registered from 1 February 2014 to 15 years.

To promote the use of electric vehicles (EV) in Hong Kong the First Registration Tax for EVs is waived till March 2017. Various EV models have been launched in the Hong Kong market and there are more than 1,100 charging points available for public use including some 30 quick and over 150 medium charging points.

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 2014, 7,020 smoky vehicles were reported, about 88 per cent fewer than in 1999. A one-off subsidy to petrol/LPG taxi and light bus owners to replace catalytic converters and oxygen sensors ended in April. Since 1 September, the government has deployed mobile roadside remote sensing equipment to detect LPG and petrol vehicles with excessive emissions.

To promote mass transit systems that are pollution-free at street level, the government gives priority to rail over road and encourages innovation wherever practical.

Marine transport

Marine vessels are 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 regulating 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 plans to mandate this practice in 2015. Legislation in April 2014 tightened the sulphur limit on local marine light diesel from 0.5 per cent to 0.05 per cent.

Power generation

Power plants are a major source of local emissions. To improve local and regional air quality, the government has progressively tightened the statutory emission caps on the power sector and encouraged the power companies to use cleaner fuels and to retrofit their major coal-fired electricity generation units with advanced emission reduction devices. In December 2014 the emission caps for the three key pollutants (SO₂, NO_x and RSP) were tightened from 2019 onwards by 40 to 63 per cent of the 2010 levels.

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

As in most major cities, noise is an issue in Hong Kong and more than one million people are affected by 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. 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, all newly registered vehicles must comply with the 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.

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.

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.

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.

Waste Management

Waste Statistics

Over the past 30 years, Hong Kong's municipal solid waste (MSW) has increased by nearly 80 per cent while the population has grown by 36 per cent and Gross Domestic Product (GDP) has quadrupled. Over the past five years from 2010 to 2014, the MSW disposed of at landfill annually was within the range of 3.28 to 3.57 million tonnes and the daily per capita disposal rate was between 1.27 and 1.35 kilogrammes. Food waste accounted for around 37 per cent of MSW on average over the past five years.

Hong Kong also produced substantial quantities of construction waste, with an annual quantity within the range of, 1.22 to 1.44 million tonnes disposed of at landfill over the past five years, an average 45 per cent drop on the 2.39 million tonnes in 2005 before the implementation of the Construction Waste Charging Scheme in 2006.

Waste Reduction

Waste reduction and recovery play an important role in waste management. The Source Separation of Waste Programme provides waste separation facilities where people live and work and covers over 80 per cent of the population.

Waste-to-Resources Plan and Food Waste & Yard Waste Plan

The government's 'Hong Kong Blueprint for Sustainable Use of Resources 2013-2022' maps out the strategy, policies and plans for waste management to tackle the 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 MSW disposal rate to 0.8 kg or less by 2022.

In February 2014, the government unveiled 'A Food Waste & Yard Waste Plan for Hong Kong 2014-2022' mapping out a comprehensive strategy, targets, policies and action plans to manage food waste and yard waste. The government aims to reduce food waste disposal to landfills by 40 per cent by 2022 and sets out four strategies to tackle food waste: reduction at source; reuse and donation; recyclable collection; and turning food waste into energy.

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 quantity-based MSW charging is effective in reducing waste. Following public consultation, the Council for Sustainable Development (SDC) submitted its proposals for quantity-based MSW charging to the government in December 2014. In April, the government launched a pilot MSW charging scheme in seven housing estates to obtain practical experience and further views from the community. A pilot scheme for rural villages was also launched in December.

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. Legislation has been enacted to extend the Environmental Levy Scheme on Plastic Shopping Bags to cover all retailers with full implementation effective from 1 April 2015. The government is also proceeding with new PRSs on waste electrical and electronic equipment (WEEE) and glass beverage bottles and has sought funding approval from the Legislative Council to develop a WEEE treatment facility and expand the collection network for glass bottles. Meanwhile, the EPD will continue to promote and support trade-funded voluntary recycling programmes.

The government is progressively setting up a Community Green Station (CGS) in each of the 18 districts and the EPD will appoint a non-profit-making organisation by way of open tender to operate and provide funding for each CGS. The first CGS will start operation in Sha Tin in early 2015.

Food Wise Hong Kong Campaign

The government's Food Wise Hong Kong Campaign, rolled out in 2013, seeks to drive behavioural change and encourage the community, from individuals to households to commercial and industrial operators, to avoid and reduce food waste at source.

Surplus Food Donation

The government has increased support to non-governmental organisations (NGOs) in collecting edible surplus or 'close-to-expiry' foods from supermarkets, wet markets, restaurants, clubs and hotels for donation to the needy in the community. NGOs can apply for funding from the Environment and Conservation Fund for projects to reduce food waste.

Waste Recycling

The EPD actively supports the recycling trade and has stepped up publicity efforts to educate the public to reduce waste at source, separate waste properly to prevent contamination of recyclables, improve the quality of recyclables collected and lessen the burden of subsequent treatment.

In each of the last five years, the MSW recovery rate of paper waste was between 61 per cent and 65 per cent and of metal waste between 87 per cent and 93 per cent. Over the same period, the MSW recovery rate of plastics waste dropped from 71 per cent to 26 per cent.

Over 90 per cent of recyclable MSW is exported for recycling outside Hong Kong every year, with plastics, paper and metals contributing over 90 per cent 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.

Between 2009 and 2013, the overall recovery rate of solid wastes in Hong Kong, including MSW and construction waste, was between 78 per cent and 85 per cent each year, with an annual average of 21 million tonnes recovered, 37 per cent higher than the annual average of 15 million tonnes between 2004 and 2008.

Recycling Fund

The Chief Executive announced in the 2014 Policy Address that the government had earmarked \$1 billion to launch a Recycling Fund to promote the sustainable development of the recycling industry in Hong Kong. The Recycling Fund aims to support projects that raise the quantity and quality of recyclables recovered, thus reducing landfill disposal, and to support projects that promote markets for recycled products and enhance the recycling industry's overall capability, capacity and skills.

Waste Treatment and Disposal Infrastructure

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 2.38 million tonnes of MSW in 2014. At present, about 80 per cent of Hong Kong's domestic waste is delivered via this network to landfills.

Landfills

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

In 2014, 3.57 million tonnes of MSW were disposed of. About 66 per cent was domestic waste and the remainder was commercial and industrial waste. On average, each person in Hong Kong disposed of about 1.35 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.

Planned Infrastructure

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) to be built at an artificial island near Shek Kwu Chau 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 and the Outline Zoning Plan for the IWMF have been approved. The IWMF is scheduled for commissioning in 2022-23. In addition, Hong Kong also plans to build a network of five or six organic waste treatment facilities (OWTFs) that will use biological treatment technologies to turn source-separated food waste into useful resources such as biogas, with compost as a by-product. 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 substantially completed, and progressive commissioning started in late 2013. It will adopt advanced incineration technology to treat sewage sludge generated from sewage treatment works and has a maximum treatment capacity of 2,000 tonnes per day. The facility is equipped with a waste-to-energy installation and any surplus electricity generated from sludge incineration will be exported to the public power grid.

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 2014, a daily average of 24 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.

Construction Waste

The construction industry generated 25.4 million tonnes of construction waste in 2014. Of that, about 94 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.

Marine Refuse

Clearing marine refuse, including refuse that has been washed ashore, involves several government departments: the Agriculture, Fisheries and Conservation Department; the Food and Environmental Hygiene Department; the Leisure and Cultural Services Department; and the Marine Department. Some of the work is outsourced to service providers. The Marine Department deploys a fleet of about 70 contractors' vessels to collect floating refuse and refuse from vessels. Nearly 15,238 tonnes of waste from marine waters and coastal areas of Hong Kong and 4,352 tonnes of refuse from vessels were collected in 2014. 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 continued the Marine Refuse Study to investigate 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 Day in July, with the theme of 'Protect our coast Leave no trace', emphasised the importance of reducing marine refuse and keeping the shorelines clean.

Livestock Waste

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 20,829 tonnes of waste in 2014.

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.

Sewage Treatment and Disposal

Victoria Harbour and HATS

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.

The Harbour Area Treatment Scheme (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 is scheduled for commissioning in 2015. Since commissioning in 2010, the Advance Disinfection Facilities have reduced sewage pathogens in the Western Harbour and at the 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 previously closed beaches so that they now comply with the Water Quality Objective for bathing beaches and have been re-opened. The government plans to commission a consultancy study on further enhancing the quality of Victoria Harbour's coastal waters.

Apart from HATS, the government has spent a further \$27 billion on other sewerage schemes since 1991 and will spend another \$15 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, over 8,000 village houses have made connections to the public sewers.

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.

In 2014, the government commenced preliminary works for a consultancy study on providing public sewerage to villages in the West Kowloon and Tsuen Wan areas.

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.

Water Quality

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 HATS Stage 1 went into operation in 2001, there has been a marked improvement. The dissolved oxygen level in the harbour water has increased, while pollutants like ammonia and faecal bacteria have decreased. 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 monitored in the 'good' and 'excellent' categories increased from 34 per cent in 1986 to 85 per cent in 2014, 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 2014.

Marine water quality objectives under the Water Pollution Control Ordinance apply to the 10 water control zones. The government is considering preliminary proposals to revise these objectives.

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 2014.

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 2014
Good	Up to 24	Undetectable	23
Fair	25 to 180	10 or less	18
Poor	181 to 610	11 to 15	0
Very Poor	More than 610	More than 15	0

Beach water quality gradings 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.

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 2014, EPD inspectors made over 59,500 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 412 prosecutions and about \$3.3 million in fines.

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 2014, the EPD handled 117 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.

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.

Weather Forecast and Information Services

Weather information is delivered to the public through the media, the observatory website, the mobile application 'MyObservatory', social media platforms, and the Dial-a-Weather telephone service. The observatory also produces free TV weather programmes regularly and an educational programme, 'Cool Met Stuff', for Hong Kong's major TV networks and various media. Users of personal computers can obtain the latest weather information using the 'Weather Wizard' software and can customise the information they receive via the observatory's personalised website. In 2014, the observatory's online information service (including its mobile application) registered more than 72 billion page views, a record high.

In 2014, the observatory extended the weather forecast range from seven days to nine days and enhanced the 'Automatic Regional Weather Forecast in Hong Kong' webpage, providing nine-day forecasts of hourly air temperature, relative humidity, wind direction and wind speed at various locations in Hong Kong and the probability of precipitation over the territory. The observatory also launched a new 'Hot Weather Special Advisory' service and provided a trial Hong Kong Heat Index on the observatory website for monitoring hot weather conditions.

The observatory issues weather forecasts and warnings to the shipping, aviation, industrial and engineering sectors. To enhance aviation weather services and safety for Hong Kong International Airport and the Hong Kong Flight Information Region, a new Terminal Doppler Weather Radar (TDWR) was installed at Brothers Point in Tuen Mun in 2014 to detect windshear. The existing TDWR at Tai Lam Chung will turn into a backup to ensure uninterrupted service. The observatory advises government departments and the engineering community on physical oceanographic matters, provides forecasts of wind, weather, wave and swells for fishermen and mariners, issues warnings or information bulletins on storm surges caused by tropical cyclones, and publishes annually the Hong Kong Tide Table.

Climate Services and Climate Change Related 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 by the United Nations Intergovernment Panel on Climate Change. The observatory also engages with partners and stakeholders in the development of climate services. For example, it collaborates with a utility company to project electricity consumption in the next seven days to promote energy saving, based on the observatory's weather forecast.

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, work with other relevant government departments to provide decision makers with an assessment of radiological consequences, and advise on actions to take. Relevant information on radiation levels and the latest developments would be provided to the public through various channels. The observatory continues to enhance radiation monitoring and assessment capabilities through collaboration with its Mainland and international counterparts.

Geophysical Services

The observatory monitors earthquakes and tsunamis in the vicinity of Hong Kong and around the world. It provides information on earthquakes and warnings of tsunamis through its website, 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 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. In October, the observatory organised a joint webcast of the total lunar eclipse with the Hong Kong Space Museum, the Ho Koon Nature Education cum Astronomical Centre and the Po Leung Kuk Ngan Po Ling College.

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 telephone service, local radio stations, web clocks and the internet network time service. The internet service handled around 10.3 billion time checks in 2014.

International and Regional Co-operation

In November, the observatory signed the 'Co-operation Agreement in Meteorological Science and Technology' with the Guangdong Meteorological Bureau to enhance collaboration in areas such as numerical weather prediction, weather forecast and warning, climate change study and atmospheric measurements.

In 2014, the World Weather Information Service (WWIS) website operated by the observatory on behalf of the World Meteorological Organisation was upgraded and the Data Collection or Production Centre for WWIS was also officially launched.

Public Education

To promote public awareness of hazardous weather and climate change, the observatory carries out a broad range of educational and outreach activities. In 2014, these included

producing a TV documentary with Radio Television Hong Kong on climate change; supporting HongKong Post to issue a series of stamps on weather phenomena; holding briefing sessions, seminars and talks on subjects ranging from climate change to energy efficiency and conservation; and producing internet videos on climate change.

Volunteers from 'Friends of the Observatory' which has over 11,000 members support the observatory's annual open day and conduct public tours of the observatory on Saturdays. In addition, the observatory's Community Weather Information Network, developed in collaboration with Hong Kong Polytechnic University, encourages the public to participate in weather observation and share their experiences through its Community Weather Observing Scheme. Some of the resulting weather and cloud photos collected in 2014 were used to produce the observatory's 2015 calendar.

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 2014, 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 laboratory also offers analytical services for chemicals regulated under the Stockholm Convention on Persistent Organic Pollutants to help government departments advance 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

Harbour Area Treatment Scheme (HATS): www.cleanharbour.gov.hk

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

Hong Kong Observatory Mobile Web Services: m.weather.gov.hk

Hong Kong Observatory Personalised Website: my.weather.gov.hk

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

MyWorldWeather: worldweather.wmo.int/myworldweather

Sustainable Development Division: www.susdev.gov.hk

World Weather Information Service: worldweather.wmo.int