

Chapter 18

Environment and Ecology

The newly set up Environment and Ecology Bureau has enlarged the policy functions of the former Environment Bureau to consolidate the work related to environmental protection, conservation of natural ecology, environmental hygiene, food safety, agriculture and fisheries, and animal welfare to achieve synergy in enhancing the overall environment of Hong Kong.

In July 2022, the government set up the District Matters Coordination Task Force, led by the Deputy Chief Secretary for Administration, to steer bureaus and departments on stepping up efforts to enhance the overall environmental hygiene and cityscape. As major supporting parties of the task force, the bureau and the departments under its charge strengthened the work on street management and hygiene, in particular in respect of street cleanliness, shopfront extension problems and rodent infestations, bringing about notable improvements to the cityscape. For stronger deterrence and a sustained impact, the bureau also launched a public consultation in December on raising the fixed penalty for major public cleanliness and obstruction offences.

Under Hong Kong's Climate Action Plan 2050, the government is working towards the target to achieve carbon neutrality before 2050 and reduce carbon emissions by half before 2035 compared with the 2005 level. It has also pledged to cease using coal for daily electricity generation by 2035.

In 2022, more than half of the newly registered private cars were electric vehicles. As stated in the climate action plan, the government will cease new registration of fuel propelled and hybrid private cars in 2035 or earlier. To promote the use of electric vehicles, more than 1,000 medium chargers were installed in government car parks for public use during the year.

Legislative amendments were introduced in October to expand the scope of the Mandatory Energy Efficiency Labelling Scheme to include more household appliances, increasing the scheme's total coverage of energy consumption in the residential sector from about 50 per cent to about 80 per cent.

During the year, the community recycling network Green@Community was further expanded to a total of 11 recycling stations, 32 recycling stores and more than 120 mobile recycling spots collecting recyclables across the territory. The enhanced Plastic Shopping Bag Charging Scheme took effect in December, with the minimum charging level per plastic shopping bag increased from 50 cents to \$1 and control on exemptions tightened.

During the COVID-19 pandemic, the Environmental Protection Department applied sewage surveillance testing extensively to track hidden cases in the community. This led to 306 restriction-testing declaration operations, with 390,027 higher-risk individuals tested and 26,757 confirmed cases identified for follow-up medical treatment.

At the peak of the epidemic in early 2022, the bureau maintained a steady supply of fresh produce with the support of Mainland authorities despite disruptions in cross-boundary logistics. During the year, food control facilities at the Hong Kong-Zhuhai-Macao Bridge was also expanded to cover more food types being imported to Hong Kong.

The Environment and Ecology Bureau oversees policies on environmental protection, conservation of natural ecology, climate actions, environmental hygiene, food safety, agriculture and fisheries, and animal welfare. It is supported by the Environmental Protection Department (EPD), Hong Kong Observatory (HKO), Food and Environmental Hygiene Department (FEHD), Agriculture, Fisheries and Conservation Department (AFCD) and Government Laboratory in executing these policies.

The EPD is responsible for protecting the environment, including nature conservation. It executes environmental policies; vets environmental planning and assessment studies; enforces and reviews environmental laws; plans and develops waste disposal facilities; promotes environmental management, auditing and reporting; and raises environmental awareness in the community.

The Hong Kong Observatory provides meteorological, climatological, radiation monitoring, oceanographic, geophysical, astronomical and time services.

The FEHD ensures that food sold in Hong Kong is safe and fit for consumption and that a clean and hygienic living environment is maintained.

The AFCD implements policies supporting the agricultural and fisheries industries; provides farmers and fishermen with infrastructural and technical support; oversees quarantine and animal welfare matters; conserves flora, fauna and natural habitats; and manages country parks and special areas.

The Government Laboratory provides analytical and advisory services to support the enforcement of environmental protection legislation, implementation of environmental programmes and routine food surveillance by the FEHD's Centre for Food Safety.

Environmental Protection

Environmental protection is a major priority for the government. Improving air quality and harbour water quality, managing municipal solid waste better through sustainable use of resources and promoting energy efficiency are important for improving the quality of life.

Government spending on the environment in 2021-22 was budgeted at \$23 billion, or about 3 per cent of total public expenditure.

The bureau and the EPD work with the government-appointed Environmental Campaign Committee to encourage the public to contribute to a better environment through campaigns and community programmes. The department's environmental resource and education centre provides the public with easy access to environmental information.

The government's Environment and Conservation Fund promotes behavioural and lifestyle changes by supporting educational, research and other projects on environmental protection and conservation.

The \$400 million Green Tech Fund, set up in 2020, provides more focused funding support to research and development (R&D) projects that help Hong Kong decarbonise and enhance environmental protection. Since its launch, 22 projects from local universities, public research institutes and private companies have been approved, involving total grants of about \$100 million.

Legislation and Environmental Auditing

Eleven ordinances address environmental protection: the Waste Disposal Ordinance, Water Pollution Control Ordinance, Air Pollution Control Ordinance, Noise Control Ordinance, Ozone Layer Protection Ordinance, Dumping at Sea Ordinance, Environmental Impact Assessment Ordinance, Hazardous Chemicals Control Ordinance, Product Eco-responsibility Ordinance, Motor Vehicle Idling (Fixed Penalty) Ordinance and Mercury Control Ordinance.

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. Its Compliance Assistance Centre responds to enquiries from businesses on environmental compliance, pollution prevention and environmental management. Departmental inspectors conduct site visits to enforce controls on air, noise, waste and water pollution and deal with complaints about pollution, resulting in 743 convictions and \$3.69 million in fines in 2022.

Major development projects undergo environmental monitoring and auditing to validate assumptions made during the planning stage and to monitor the effectiveness of mitigation measures, so as to ensure the project meets the environmental performance promised in its environmental impact assessment. These projects are required under their environmental permits to publish the monitoring data and auditing results on dedicated websites or the Environmental Impact Assessment Ordinance website. In 2022, the department handled 115 monitoring and auditing programmes.

Sustainable Development

The bureau promotes sustainable development in the government and the community. All government bureaus and departments must conduct sustainability assessments for their major initiatives and present the implications to the Policy Committee and Executive Council.

The Sustainable Development Fund provides grants for projects that enhance public awareness of sustainable development and encourage sustainable practices. Since 2003, 82 projects have been approved, involving grants totalling about \$85 million.

The government's Sustainable Development School Outreach Programme offers dramas, seminars, workshops and field trips to secondary and primary school students and attendees of the Elder Academy to enhance their understanding of sustainable development. The latest round of programmes under the theme of 'Sustainable Ecology' has reached more than 120,000 participants.

The Council for Sustainable Development, appointed by the Chief Executive, promotes sustainable development in Hong Kong. In April, the council submitted to the government a public engagement report with recommendations on the control of single-use plastics.

Working with the Education Bureau, the council launched an e-learning platform on long-term decarbonisation for senior secondary school students in 2021 to enhance their knowledge about low-carbon living. The platform was updated in October 2022 to provide new learning and teaching materials. It has attracted more than 70,000 visitors.

Cross-boundary Cooperation

Hong Kong collaborates with Guangdong and Macao on environmental matters. The Hong Kong Special Administrative Region (HKSAR) and Guangdong governments work together to improve regional air quality, combat regional ozone problems and forecast air quality.

The Guangdong-Hong Kong-Macao Pearl River Delta Regional Air Quality Monitoring Network comprises 23 air monitoring stations. Results from the network have shown substantial reductions in most pollutants in recent years. From 2012 to 2021, the average annual concentrations of sulphur dioxide, nitrogen dioxide and respirable suspended particulates decreased 59 per cent, 29 per cent and 29 per cent respectively. The concentration of fine suspended particulates has decreased 28 per cent since the pollutant was first monitored in 2015. The ozone level increased 20 per cent over the past 10 years, indicating regional photochemical pollution must be reduced.

The Cleaner Production Partnership Programme helps Hong Kong-owned factories in Hong Kong and Guangdong adopt cleaner production technologies and practices to reduce air pollutant emissions, effluent discharge and carbon dioxide emissions while saving energy and production costs. From June 2020 to end-2022, about 500 projects had been approved, involving over \$100 million in funding. The programme has been extended to March 2025.

Hong Kong and Shenzhen are implementing joint action programmes to protect the quality of adjoining waters. The water quality in Deep Bay has shown noticeable improvement, while that in Mirs Bay has remained consistently good. Hong Kong and Guangdong are also pursuing a joint water quality management plan to protect the water quality of the Pearl River 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 about 400 million years ago. Between 360 and 300 million years ago, the region was occasionally inundated by a shallow sea, during which limestones (now marble) and siltstones accumulated. From 170 to 140 million years ago, violent eruptions from several volcanic centres deposited thick ash layers.

At deeper levels, molten magma intruded and slowly crystallised to form granite. Volcanism ended with a colossal eruption from the High Island Supervolcano centred in southeastern Hong Kong. Layered rocks 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. During the last 2.6 million years, several major glaciations occurred, causing successive lowering of the global sea level. Widespread river floodplains surrounded Hong Kong, and were later covered by marine mud when the sea level rose during interglacial periods.

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.

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. Hong Kong has a rich flora with about 3,300 species of vascular plants, of which 2,100 are native to the city.

The major types of vegetation cover 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.

The government has made continual afforestation efforts with conservation measures. Besides greening and beautifying the countryside, woodlands are important habitats for wildlife and are essential to protect water catchments from soil erosion.

Fauna

Terrestrial

The climate and physical environment provide a wide range of habitats and support for a rich and varied fauna that includes over 570 species of birds, 55 species of terrestrial mammals, 25 species of amphibians, 90 species of reptiles, 194 species of freshwater fish, 245 species of butterflies and 130 species of dragonflies.

Among the rich terrestrial biodiversity, some species, such as the Bogadek's burrowing lizard, have been recorded only in Hong Kong. The territory is also home to a number of globally threatened species, such as the big-headed turtle, yellow-breasted bunting, short-legged toad, Chinese pangolin and Chinese tiger dragonfly.

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 is listed as a Wetland of International Importance under the Ramsar Convention. About 1,500 hectares of inter-tidal mudflats, fish ponds, tidal shrimp ponds, marshes, reed beds and mangroves provide a rich habitat for migratory and resident birds, particularly water birds. Around 440 species of birds have been observed in this area. About 50 species are considered globally threatened or near threatened, including the black-faced spoonbill, Baer's pochard, Nordmann's greenshank and spoon-billed sandpiper. The AFCD implements a wetland conservation and management plan to conserve the ecological value of the area.

Traditional *fung shui* woods near old villages and temples and secondary forests provide important habitats for many woodland birds. Warblers, flycatchers, robins, thrushes, bulbuls and tits are among the birds that have been sighted.

Areas around the Kowloon reservoirs are inhabited by monkeys descended from individuals released there in the early 20th century. These monkeys include the rhesus macaque and hybrids of the rhesus macaque and long-tailed macaque. Some have migrated to the forested areas of Shing Mun Reservoir and Tai Po Kau. The feeding of monkeys is prohibited, to make them forage for natural food in the countryside.

Other mammals that are very common in the countryside include the red muntjac and East Asian porcupine, while the leopard cat, small-toothed ferret badger and small Indian civet are less commonly seen. Cave-dwelling bats such as the greater bent-winged bat and Chinese horseshoe bat are found in caves and water tunnels, while the short-nosed fruit bat enjoys roosting under the Chinese fan palm. Sightings of rare species, such as the Eurasian otter and crab-eating mongoose, are reported occasionally.

The territory is home to 115 species of amphibians and reptiles, of which the Hong Kong cascade frog, Hong Kong newt, Romer's tree frog and Burmese python are protected under the Wild Animals Protection Ordinance. Most of the 53 species of snakes are non-venomous, and reports of people being bitten by highly venomous snakes are rare. Among the five species of sea turtles recorded in Hong Kong waters, only the green turtle is known to be breeding locally.

Marine

Hong Kong's subtropical marine environment supports species found in both tropical and temperate climates and local waters contain a wide diversity of fish, crustaceans, molluscs and other marine life. 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 contributes to the high 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 local 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 better known of the two. It prefers an estuarine environment and inhabits the western waters, while the Indo-Pacific finless porpoise lives in the eastern and southern parts, where the waters are predominantly oceanic.

The government's Marine Parks programme is important in protecting and conserving sites of special ecological and conservation value. In addition, artificial reefs are deployed in suitable waters to improve inshore fishery resources and biodiversity.

Conservation and Biodiversity

Legislation and Conservation

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

Seven ordinances address conservation and biodiversity: the Forests and Countryside Ordinance, Wild Animals Protection Ordinance, Protection of Endangered Species of Animals and Plants Ordinance, Country Parks Ordinance, Marine Parks Ordinance, Fisheries Protection Ordinance, and Genetically Modified Organisms (Control of Release) Ordinance.

United Nations Convention on Biological Diversity

The United Nations Convention on Biological Diversity, which covers Hong Kong, 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. The government has been implementing the Hong Kong Biodiversity Strategy and Action Plan since 2016 to support the implementation of the convention and enhance the city's biodiversity conservation and sustainable development.

The Cartagena Protocol on Biosafety, adopted under the convention, seeks to ensure the safe transfer, handling and use of genetically modified organisms that may affect biodiversity adversely. Hong Kong implements the protocol through the Genetically Modified Organisms (Control of Release) Ordinance.

Protected Areas

The AFCD manages country parks, special areas including Hong Kong Wetland Park, marine parks, the marine reserve and Hong Kong Unesco Global Geopark.

About 40 per cent of Hong Kong's total land area is designated as country parks and special areas for conservation and recreation. There are 24 country parks and 22 special areas covering 44,312 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, litter collection, the provision of educational and recreational facilities, and the promotion of a better understanding of the countryside.

There are seven marine parks, including the South Lantau Marine Park designated in June, and one marine reserve, covering about 6,100 hectares of scenic coastal areas, seascapes and important biological habitats. The marine reserve is dedicated to conservation, education and scientific studies.

Fishing in some marine parks is regulated through a permit system and banned in the other parks and marine reserve. Publicity and educational activities are organised for students and other 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. Sixty-seven sites are listed on the SSSI Register.

Hong Kong Wetland Park

The 61-hectare Hong Kong Wetland Park stretches from the northern part of Tin Shui Wai to the southern tip of the Mai Po Inner Deep Bay Ramsar Site. It is a special area designated under the Country Parks Ordinance. The park promotes wetland conservation, education and nature-based tourism, and gives visitors the opportunity to appreciate wetlands and local wildlife in an open and natural setting.

Hong Kong Unesco Global Geopark

Extending from Sai Kung to the northeastern New Territories is the Hong Kong Unesco Global Geopark. The geopark comprises spectacular hexagonal volcanic rock columns of a size and composition rarely found elsewhere in the world and was selected as one of the first 100 International Union of Geological Sciences Geological Heritage Sites. There are also sedimentary rocks that are 400 million years old and of great geological and educational interest.

The Volcano Discovery Centre at Sai Kung town centre is an ideal starting point to visit the geopark. Visitors can also explore the Story Rooms at geopark communities to learn more about the history and intangible cultural heritage of these villages.

Countryside Conservation

The Countryside Conservation Funding Scheme provides funding to non-profit-making organisations for implementing conservation and revitalisation projects in countryside areas, including natural environment and habitats, non-graded built heritage and cultural and historic assets. Since its launch, the scheme had approved 27 projects with total funding of about \$165 million.

To support eco-tourism, better serve visitors and help revitalise desolate villages, the bureau's Countryside Conservation Office works with relevant bureaus and departments to develop licensing requirements and procedural guidelines designed especially for guesthouses and catering businesses in countryside areas, reflecting the special nature and restrictions of rural settings.

Climate

Hong Kong has a subtropical climate. January and February are cloudier with cold spells, while 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 occur 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, and may on occasion be relatively cold at night and in the early morning.

The Year's Weather

It was one of the sixth-warmest years in Hong Kong since records began in 1884, with an annual mean temperature of 23.9 degrees Celsius, 0.4 degrees above normal. With the mean temperature reaching 30.3 degrees, July was the hottest month on record in Hong Kong. The autumn mean temperature of 26.4 degrees for September to November was also the warmest on record. The total annual rainfall of 2,205.4mm was about 9 per cent below normal.

Six tropical cyclones affected the territory in 2022. The No 8 Gale or Storm Signal was issued during the passage of Chaba, Ma-on and Nalgae.

Climate Change

Carbon Neutrality

Hong Kong's Climate Action Plan 2050, announced in 2021, sets out four major strategies and targets – net-zero electricity generation, energy saving and green buildings, green transport and waste reduction – to reduce carbon emissions by half before 2035 compared with the 2005 level, and to achieve carbon neutrality before 2050.

The government will set up a new Office of Climate Change and Carbon Neutrality to strengthen coordination and promote deep decarbonisation. The Council for Sustainable Development will also be reorganised to become the Council for Carbon Neutrality and Sustainable Development to offer advice on decarbonisation strategies.

Meteorological and Geophysical Services

Weather Forecasting and Information Services

The Hong Kong Observatory provides weather information through a variety of channels, including the media, social media, its website, mobile application MyObservatory, and the Dial-a-Weather telephone service. It also produces regular weather television programmes and an educational series, *Cool Met Stuff*.

The mobile application MyObservatory was updated with a new home screen design, enabling users to get rainfall and weather at various districts more conveniently. The Observatory also won the Smart Living (Smart Lifestyle) Silver Award at the Hong Kong ICT Awards 2022 with MyObservatory.

In 2022, the Observatory launched a special alert on prolonged heat, warning the public to take precautionary measures appropriate to the prolonged effect of very hot weather. It also enhanced its monitoring and forecasting of the combined effect caused by tropical cyclones and prolonged rainstorms.

The Observatory issues weather forecasts and warnings and offers professional advice to government departments and the aviation, shipping, engineering and other sectors. It provides aviation weather services to the airport and the Hong Kong Flight Information Region; offers flight crew the latest inflight weather information through its mobile application MyFlightWx; and issues forecasts of wind, weather, waves and swells for the marine community and container terminals.

From the end of June, the Observatory sent Aeronautical Meteorological Advisers to station at the airport's new Integrated Airport Centre to provide briefings and consultation services concerning high-impact weather. It also enhanced instruments and systems to support the opening of the third runway. As the Backup Centre of the Asian Aviation Meteorological Centre, the Observatory regularly takes over from the main centre in Beijing to provide en-route hazardous weather warning services for the Asia-Pacific region.

Climate Services and Studies

The Observatory provides government departments and those involved in disaster prevention and risk reduction with climatological information and predictions. It conducts research on past trends and projections of temperature, rainfall, sea level and extreme weather in Hong Kong and provides the latest climate change information and scientific input to government departments in support of initiatives to combat climate change.

In 2022, the Observatory updated the climate projections for Hong Kong based on data released by the *Sixth Assessment Report* of the United Nations Intergovernmental Panel on Climate Change.

Radiation Monitoring and Assessment

The Observatory monitors ambient radiation levels in Hong Kong and measures the amount of radioactivity in environmental samples. It enhances its monitoring and assessment capabilities through collaboration with Mainland and international counterparts. In the unlikely event of a nuclear incident, the Observatory would step up radiation monitoring, provide decision makers with assessments of radiological consequences and advice on actions to take, and provide information on radiation levels and developments to the public through various channels. In 2022, new emergency communication facilities of the Monitoring and Assessment Centre were put into operation and the nuclear accident consequence assessment system was enhanced to improve emergency response capabilities.

Geophysical Services

The Observatory monitors earthquakes and tsunamis in the vicinity of Hong Kong and round the world. It provides earthquake information and tsunami warnings via different channels. In 2022, the Observatory recorded eight locally felt earthquake tremors, and the earthquake of magnitude 4.1 which occurred on 14 March near the coast of southeastern China received the most public reports. The Backup South China Sea Tsunami Advisory Centre (Hong Kong) was set up at the Observatory headquarters and put into operational trial on 29 March.

Time Services

As Hong Kong's official timekeeper, the Observatory maintains a time standard accurate to within one-hundred-millionth of a second per day and contributes to the determination of Coordinated Universal Time by the International Bureau of Weights and Measures. The public can check the time through the Observatory's online time service, web clock, Dial-a-Weather and radio stations. The Observatory's internet time service drew a record high of about 100 billion visits in 2022.

Cooperation with Other Meteorological Services

In 2022, the Observatory participated in separate sessions of two commissions under the World Meteorological Organisation to provide advice on technical policies.

Public Education and Engagement

The Observatory promotes public awareness of hazardous weather, climate change and radiation. During the year, it launched an online video course on tropical cyclones and an e-book titled *Decoding Radiation*.

The Observatory held its open day in November, in hybrid formats for the first time, to showcase its work and raise awareness of extreme weather under climate change.

It conducts school and online talks on climate change and radiation, and disseminates information and international research findings on global climate change. In 2022, it launched educational videos on the latest developments in climate change and organised a climate science webinar. The Observatory engages students and young people through various outreach events including the 'Science in Public Service' campaign, 'Gamma-Go' workshops and activities related to the Community Weather Information Network.

Energy

The government's energy policy is to provide a reliable supply of energy at reasonable prices and promote its economical and safe use, while minimising the environmental impact of energy production and usage.

Electricity

The Hongkong Electric Company Limited (HK Electric) supplies electricity to Hong Kong Island and the neighbouring islands of Ap Lei Chau and Lamma. 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, with the current ones signed in 2017. These require the companies to seek the government's approval for certain aspects of their development plans, including projected basic tariff levels, to ensure the continued supply of reliable, safe and efficient electricity at reasonable prices. The agreements do not give the companies any exclusive rights to supply electricity. They are not franchises, nor do they define a supply area for either company or exclude newcomers to the market. The companies receive a return on their average net fixed assets at the permitted rate of return specified in the agreements.

HK Electric has a total installed capacity of 3,402 megawatts at its Lamma Power Station. CLP Power receives its electricity supply from the Castle Peak Power Company Limited's power stations at Black Point (3,250MW), Castle Peak (4,108MW), Penny's Bay (300MW) and West New Territories Landfill (10MW).

Each company owns its respective transmission and distribution systems. The two transmission systems are connected by a cross-harbour link, which provides emergency backup and some sharing of generating capacity reserves between the two systems. The link has a total capacity of 720 megavoltamperes.

CLP Power's transmission system is also connected to the Guangdong electricity network which allows electricity exports and imports to and from the province. The company imports about 70 per cent of the power generated by the Daya Bay nuclear power station, which has two 984MW pressurised water reactors. In addition, from 2014 to 2023 it imports on a temporary basis another 10 per cent of Daya Bay's electricity.

CLP Power also has the right to use up to half of the 1,200MW capacity of the Guangzhou Pumped Storage Power Station phase 1 at Conghua. It stores off-peak electricity from Castle Peak Power's stations and the Daya Bay station in the Conghua plant, which generates hydroelectricity to meet Hong Kong's demand during peak periods.

Electricity generation is the largest contributor to carbon emissions in Hong Kong. Coal currently makes up about a quarter of Hong Kong's fuel mix for electricity generation, down from about half in 2015. Under Hong Kong's Climate Action Plan 2050, the government has pledged to cease using coal for daily electricity generation by 2035 and the target is to achieve net-zero electricity generation.

Other Fuels

Town gas and liquefied petroleum gas (LPG) are the main types of fuel gas used for domestic, commercial and industrial purposes. Hong Kong has 2.3 million gas customers in the domestic, commercial and industrial sectors, and town gas and LPG respectively accounted for 89 and 11 per cent of the total fuel gas sold in these sectors in terms of heating values in 2022.

Town gas is manufactured at plants in Tai Po and Ma Tau Kok, which have daily throughput capacities of about 10 million and 2.6 million cubic metres respectively. It is channelled to customers via a pipe network of about 3,700km.

LPG is imported into Hong Kong mainly by sea and stored at five terminals in Tsing Yi before being distributed to customers, including 70 auto-LPG filling stations.

Natural gas is imported from the Mainland via submarine pipelines to Black Point Power Station and Lamma Power Station for electricity generation, and to the Tai Po plant, and onward from Tai Po to the Ma Tau Kok plant via underground pipelines, for the production of town gas. Separately, CLP Power draws natural gas from the Mainland's Second West-East Natural Gas Pipeline through the submarine Hong Kong Branch Line facilities.

Renewable Energy

As pledged in the climate action plan, the government will drive the development of renewable energy, aiming to increase its share in the fuel mix for electricity generation to 7.5-10 per cent by 2035 and to 15 per cent thereafter through facilitating local public and private renewable energy projects and developing more advanced waste-to-energy facilities.

For the public sector, the government leads in developing renewable energy, including large-scale projects in reservoirs, restored landfills and water bodies. Building on the pilot projects of floating solar energy generation systems at Shek Pik Reservoir, Plover Cove Reservoir and Tai Lam Chung Reservoir, each with a capacity of 100 kilowatts, the government is planning a large-scale floating solar farm at Plover Cove Reservoir with a generating capacity of 5MW and the introduction of highly efficient storage battery technology, on a pilot basis, to better utilise the electricity generated at reservoirs.

To assess the feasibility of generating solar energy at restored landfills, a pilot solar farm project with a capacity of 1MW is being implemented at the South East New Territories Landfill in Tseung Kwan O while the construction of another medium-scale solar energy generating system with a generating capacity of 150kW at Jordan Valley Landfill is under way. The government is also exploring the feasibility of installing larger-scale floating or other types of solar energy generation systems in water channels through two pilots in Shing Mun River and San Tin Polder.

The government has developed advanced waste-to-energy facilities at O • Park1 (Organic Resources Recovery Centre Phase 1) and T • Park (Sludge Treatment Facility), which generate surplus electricity from organic waste and sludge respectively.

Aside from large-scale renewable energy systems, the government has earmarked \$3 billion to install small-scale systems at government premises since 2017-18, with more than \$1.8 billion approved for about 170 projects which can generate about 25 million kWh of electricity per annum.

As for the private sector, the Feed-in Tariff scheme provides financial incentives for the installation of private renewable energy systems. Between 2018 and 2022, the two power companies approved over 21,000 applications. Systems already approved could generate about 340 million kWh of electricity each year.

Solar energy generation systems have been installed at more than 350 schools and non-governmental welfare organisations under the government's support scheme, Solar Harvest. Other measures to assist the development of renewable energy by the private sector include facilitating the installation of solar energy generation systems in open car parks, relaxing restrictions on installing solar systems in New Territories Exempted Houses and legislative amendments relevant to Feed-in Tariff payments.

Both power companies use renewable energy. HK Electric operates an 800kW wind turbine on Lamma and a 1MW thin film solar energy generation system at Lamma Power Station, while CLP Power runs a 200kW renewable energy generation system of solar panels and wind turbines on Town Island in Sai Kung and a 10MW landfill gas power generation system at West New Territories Landfill.

Energy Saving

Energy consumption is related closely to greenhouse gas emissions. Improving energy efficiency helps combat global climate change. End-users consumed 272,490 terajoules in 2020,

with the commercial, transport, residential and industrial sectors taking up 42, 29, 24 and 4 per cent respectively.

The Energy Saving Plan for Hong Kong's Built Environment 2015~2025+ sets a target of reducing energy intensity by 40 per cent by 2025, and outlines the policy, strategies and key actions to achieve that target. By end-2020, the city had lowered its energy intensity by more than 30 per cent.

The Electrical and Mechanical Services Department's Energy Efficiency Office promotes efficient use of energy through legislation and public education. Its Mandatory Energy Efficiency Labelling Scheme requires prescribed products to bear energy labels informing consumers of the products' energy efficiency performance. The scheme, now in its third phase, regulates eight types of household electrical appliances. The bureau is working on legislative amendments to expand the scope to include more appliances, such as light-emitting diode lamps, gas cookers and gas instantaneous water heaters, increasing the coverage of energy consumption in the residential sector from about 50 per cent to 80 per cent.

The E&M InnoPortal promotes energy-related innovation and technology. It lists the service needs of various government departments, public organisations and the trade. Universities and start-ups can propose solutions to meet these service needs. At end-2022, the portal had collected more than 420 service needs and over 1,050 suggested solutions. More than 160 field trials have started, with 40 of these related to energy efficiency and renewable energy.

District cooling systems can save electricity by up to 35 per cent compared with traditional central air-conditioning systems in individual buildings. They will be increasingly incorporated in new development areas to reduce energy consumption. The district cooling systems in the Kai Tak Development will be completed in phases, providing chilled water to non-domestic developments in the area for air-conditioning. Buildings served by these systems include the Kai Tak Cruise Terminal, Trade and Industry Tower, Hong Kong Children's Hospital, schools and shopping centres. The government is also constructing district cooling systems at Tung Chung New Town Extension (East) and Kwu Tung North New Development Area.

Energy-efficient Buildings

Buildings account for about 90 per cent of the electricity consumed, so promoting their efficient use of energy is paramount to reducing carbon emissions. The Building Energy Code under the Buildings Energy Efficiency Ordinance stipulates the minimum energy efficiency standards for four major types of building services installations, namely air conditioning, electrical installations, lifts and escalators, and lighting installations. The ordinance also requires commercial buildings to conduct energy audits every 10 years in accordance with the Energy Audit Code. The codes are reviewed every three years and the latest editions were gazetted in end-2021, improving the energy efficiency standards by more than 15 per cent compared with 2015.

The government's earlier target of reducing electricity consumption by 5 per cent from 2015-16 to 2019-20 was met one year ahead of schedule, with a final saving of 7.8 per cent. The government aims to further improve the overall energy performance in government buildings and infrastructure by 6 per cent by 2024-25.

For private buildings, the capital cost of buying renewable-energy installations and building energy-efficient installations is tax deductible.

Retro-commissioning is a cost-effective and useful means of saving energy in existing buildings. The Electrical and Mechanical Services Department organises seminars to help building owners and relevant trades carry out retro-commissioning. Since 2019, \$215 million has been earmarked to retro-commission government buildings. About 200 government buildings had participated as at end-2022.

Under the current Scheme of Control Agreements, the power companies will promote energy efficiency and conservation. Each company manages its own energy-efficiency fund to support the retrofitting and retro-commissioning of private buildings.

Pollution Prevention

Air Pollution

The government has been implementing measures to reduce air pollutant emissions from local electricity generation, vehicles and vessels. Between 2010 and 2020, emissions of sulphur dioxide (SO₂), nitrogen oxides (NO_x), respirable suspended particulates (RSP), fine suspended particulates (FSP), carbon monoxide and volatile organic compounds dropped by between 32 per cent and 86 per cent.

New air quality objectives (AQOs) which took effect on 1 January tightened the 24-hour AQO for SO₂, and the annual and 24-hour AQOs for FSP. In 2022, the ambient concentrations of major air pollutants broadly complied with the new objectives.

From 2013 to 2022, ambient concentrations of RSP, FSP, nitrogen dioxide (NO₂) and SO₂ dropped 51 per cent, 55 per cent, 43 per cent and 62 per cent respectively, while roadside concentrations of the same fell 49 per cent, 51 per cent, 47 per cent and 64 per cent respectively. Regional ozone background, however, remained relatively high, indicating that the regional photochemical smog problem remains challenging. The EPD is collaborating with the Guangdong and Macao governments on a three-year joint regional ozone study to tackle the problem.

Land Transport

Vehicle emissions are the major source of roadside air pollution. The government's policy is to apply the most stringent motor vehicle fuel and emission standards practicable. Nearly all taxis and about 80 per cent of public light buses run on LPG. Further to the phasing out of about 82,000 pre-Euro IV diesel commercial vehicles, an incentive-and-regulatory programme has been implemented to phase out some 40,000 Euro IV diesel commercial vehicles by 2027.

Controls are in place to curb excessive smoke from diesel vehicles and excessive emissions from petrol and LPG vehicles due to poor maintenance. During the year, 540 diesel vehicles with excessive smoke were reported and 1,935 petrol and LPG vehicles with excessive emissions were identified by roadside remote sensors. Such vehicles must pass a chassis dynamometer emission test within 12 days to prove the problem has been rectified.

The government is implementing measures in the Hong Kong Roadmap on Popularisation of Electric Vehicles, announced in 2021, to promote the use of electric vehicles (EVs). The key measures include ceasing new registration of fuel-propelled and hybrid private cars in 2035 or earlier, promoting trials for electric public transport and commercial vehicles, expanding and promoting the EV charging network, training for technicians and mechanics on EV maintenance, formulating a producer responsibility scheme for retired EV batteries, and establishing a task force to examine the high-end development of new decarbonisation technologies globally.

At year end, the number of EVs, including government and special-purpose vehicles, was more than 47,400 – a 70 per cent increase on 2021 – while 5,435 public chargers were available, including 998 quick and 2,983 medium chargers. To encourage people to switch to EVs, the EV-charging at Home Subsidy Scheme was introduced in 2020 to promote the installation of EV charging-enabling infrastructure in car parks of existing private residential buildings. The government had received more than 650 applications covering over 133,000 parking spaces by end-2022.

The trial and application of green commercial transport technologies is subsidised under the New Energy Transport Fund. Around 290 trials have been approved since the fund's inception, with subsidies totalling about \$253 million.

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

Marine Transport

Marine vessels are a major air pollutant emission source in Hong Kong. The government caps the sulphur content in locally supplied marine light diesel at 0.05 per cent. All vessels in Hong Kong waters are required to use compliant fuel, such as fuel with sulphur content not exceeding 0.5 per cent and liquefied natural gas.

Power Generation

Power plants are a major source of local emissions. The government tightens statutory emission caps on the power sector progressively and encourages the power companies to further develop and utilise more zero-carbon energy to reduce air pollutant and emissions.

Indoor Air Quality

The government's voluntary Indoor Air Quality Certification Scheme for Offices and Public Places encourages property owners and management companies to enhance indoor air quality at their premises.

Ozone Layer Protection

The Montreal Protocol for controlling substances that deplete the ozone layer applies to Hong Kong. The Ozone Layer Protection Ordinance prohibits the manufacture of these substances and their import for local consumption. The import of hydrochlorofluorocarbons for local consumption has been banned since 2020, with only a small amount permitted to service refrigeration and air-conditioning equipment until 2029.

Non-road Mobile Machinery

Non-road mobile machinery newly supplied for use in Hong Kong is required to meet statutory emission requirements, namely the Euro Stage IIIA emission standard for machines such as crawler cranes, air compressors and excavators. The statutory emission standards for newly approved non-road vehicles have been tightened in phases since 2019 to Euro VI, which is in line with the emission standards for newly registered road vehicles. All machinery to be used in specified activities or locations, such as Hong Kong International Airport, container terminals and construction sites, must bear EPD-issued labels.

Noise Pollution

Construction Noise

The department controls noise from general construction works between 7pm and 7am and at all times on public holidays through construction noise permits. These permits strictly restrict the use of equipment and the conduct of noisy manual activities in built-up areas. Percussive piling is prohibited at night and on public holidays, and requires a permit during the day on non-public holidays. The use of noisy diesel, steam and pneumatic piling hammers is generally banned, while hand-held percussive breakers and air compressors used in construction must meet strict noise standards and be issued with noise emission labels. Apart from these legal controls, the department also promotes quiet construction equipment and techniques to the construction industry.

Quiet Renovation

To mitigate noise nuisance from domestic renovation, the EPD launched a two-year quiet renovation pilot scheme in 2021 to provide administrative and technical support through property management organisations. The scheme assists these organisations to formulate quiet renovation house rules, and provides free rental of quiet renovation equipment to renovation companies or qualified workers. As of end-2022, the scheme had been introduced to more than 900 trade practitioners.

Road Traffic Noise

To mitigate the impact of traffic noise on residents, proponents of development projects are required to assess traffic noise impact when planning new roads and residential developments, provide direct mitigation measures such as noise barriers and low-noise road surfacing for new roads, and adopt innovative noise mitigation designs such as acoustic balconies and windows. All newly registered vehicles must comply with internationally recognised noise standards. As regards existing roads, the government installs noise barriers and lays low-noise road surfacing materials, with 128 road sections enhanced through these efforts as at end-2022. About 150 new residential development projects, involving 40,000 units, had adopted innovative noise mitigation designs by the end of the year.

Noise from Industrial or Commercial Activities

The EPD serves noise abatement notices requiring the owners or occupants of premises causing excessive noise from industrial or commercial activities to tone down within a given period.

Railway Noise

In planning new railway projects, the MTR Corporation Limited must comply with a statutory environmental impact assessment. The department will request the company to make improvements if noise emitted from existing railways exceeds the relevant standards.

Aircraft Noise

The Hong Kong Planning Standards and Guidelines restricts new residential developments from being built in areas with aircraft noise levels exceeding the planning standard. The impact of aircraft noise on residents in the vicinity of flight paths at the airport should also be within the planning standards.

Waste Management

Waste Statistics

Over the past five years, the municipal solid waste dumped at landfills has increased 6 per cent, while the mid-year population has grown 0.3 per cent. In 2021, the daily per capita disposal rate was 1.53 kilograms. About 60 per cent of 4.15 million tonnes dumped at landfills was domestic waste, and the remainder was commercial and industrial waste. Food waste accounted for 30 per cent of the total municipal solid waste.

During the same five-year period, the amount of overall construction waste disposed of at landfills has dropped by 13 per cent. In 2021, the overall construction waste disposed of at landfills was 1.33 million tonnes.

Waste Reduction

The Waste Blueprint for Hong Kong 2035 outlines the strategies, goals and measures for waste management up to 2035. The government works with the industry and the community to move towards two main goals. The medium-term goal is to reduce the per capita municipal solid waste disposal rate by 40 to 45 per cent and raise the recovery rate to about 55 per cent by implementing municipal solid waste charging, alongside other policies and legislation, while the long-term goal is to move away from the reliance on landfills for direct waste disposal by developing adequate waste-to-energy facilities. To achieve the goals, the government will promote six major areas of action: waste reduction, waste separation, resources circulation, industry support, innovation and cooperation, and education and publicity.

Municipal solid waste charging is central to the government's waste reduction strategy which aims to provide incentives to the public and enterprises to practise waste reduction at source and clean recycling, thereby reducing overall waste disposal. The Waste Disposal (Charging for Municipal Solid Waste) (Amendment) Bill was passed in August 2021. The preparatory period of 18 months as a basic arrangement has commenced to enable the government, stakeholders and the public to prepare for the implementation of municipal solid waste charging.

From the 2019-20 financial year, the government has been providing additional recurrent resources to strengthen support for waste reduction and recycling. When municipal solid waste charging is implemented, the additional provision will increase to no less than \$800 million every year.

Various producer responsibility schemes (PRs) have been introduced to reduce waste at source and facilitate the development of a circular economy, including the Plastic Shopping Bag Charging Scheme and PRs on waste electrical and electronic equipment (WEEE) and glass beverage containers. In 2022, over 22,100 tonnes of WEEE and more than 19,000 tonnes of waste glass containers were collected and treated.

Waste Recycling

The government supports the recycling industry and educates the public to reduce and separate waste at sources, so as to improve the quality of the recyclables collected and to streamline the subsequent treatment process.

The government launched a larger scale food waste collection service in 2021, aiming to collect 250 tonnes of food waste per day by 2022. The first contract covering Hong Kong Island and the Islands District began in September 2021, and the second covering Kowloon, Kwai Tsing, Tsuen Wan and Tseung Kwan O began in February 2022.

The government extended a pilot scheme on waste plastics collection and recycling from three districts to nine districts progressively since March. The service covers about half of the population and the total collection amount is expected to be 5,000 tonnes per year.

The Programme on Source Separation of Waste covers over 80 per cent of the population. Residents can contribute recyclable items to waste separation facilities close to their homes and workplaces.

Community participation is encouraged through district-based education and recycling support. The community recycling network Green@Community promotes waste reduction and recycling, and provides local collection points for recyclables of low commercial value. In 2022, 10 more recycling stores began operation, taking the city's total to 32. There are also 11 recycling stations and over 120 mobile recycling spots operating on a weekly schedule at fixed locations. The Green Outreach team, which provides on-site assistance and support on recycling to property management companies and residents, has extended its coverage to the entire territory.

Between 2017 and 2021, the annual average recovery rates of paper, metal and plastics in municipal solid waste were 39 per cent, 90 per cent and 10 per cent respectively.

During the same period, an average of 78 per cent of solid waste, including municipal solid waste and overall construction waste, was recovered each year, working out to an annual average of 19 million tonnes recovered.

EcoPark

More than 80 per cent of recyclable municipal solid waste is delivered outside Hong Kong for recycling every year, with plastics, paper and metals contributing more than 90 per cent of the recovered waste. The 20-hectare EcoPark in Tuen Mun promotes development of the recycling industry by providing long-term land at affordable rents to encourage investment in advanced technologies and value-added recycling processes. Private recyclers in EcoPark recycle cooking

oil, scrap metal, wood, WEEE, plastics, construction materials, glass, rubber tyres, batteries and paper.

Recycling Fund

The \$2 billion Recycling Fund supports the recycling industry to enhance operational capabilities and efficiency, and the application of technology. As of end-2022, about \$750 million had been approved.

Waste Treatment and Disposal

Refuse Transfer Stations

Municipal solid waste is mainly collected by refuse collection vehicles and delivered to refuse transfer stations for compression, then packed into specially designed containers and taken to strategic landfills by sea or land. In 2022, the network handled 3.13 million tonnes of such waste, which translates to 77 per cent of Hong Kong's total.

Landfills

Hong Kong has three strategic landfills, which serve as the final disposal sites for most of the solid waste. The design and operation of these landfills adopt different measures to reduce the impact on the environment. With the South East New Territories Landfill accepting only construction waste, all municipal solid waste is disposed of at the North East New Territories Landfill and Western New Territories Landfill.

All three landfills need to be extended to ensure an uninterrupted waste disposal service. The initial work of the South East New Territories Landfill Extension has been completed, and it has received construction waste since November 2021. The contract for the North East New Territories Landfill Extension project was awarded in early 2022, and the site formation and construction works began in November. The tendering exercise for the West New Territories Landfill Extension project is in progress.

Through different waste reduction and recycling initiatives, the municipal solid waste charging scheme and the development of other infrastructure and waste-to-energy facilities, the aim is to achieve zero landfill by 2035, meaning reliance on landfills for the disposal of municipal solid waste can be eradicated.

Hong Kong has 13 restored landfills. The government promotes the development of restored landfills into recreational or nature conservation facilities. In 2022, land in Shuen Wan Restored Landfill was granted to a developer to build a private golf course in exchange for the surrender of ecologically important land in Sha Lo Tung to the government.

Planned Infrastructure

To move away from reliance on landfills for municipal solid waste disposal by around 2035, the government will develop a network of advanced modern waste-to-energy incinerators. The EPD is building the first such incinerator, I • Park1, near Shek Kwu Chau, targeted for commissioning in 2025; and planning the development of a second, I • Park2, in Tuen Mun.

A network of organic resources recovery centres, using biological technology to turn food waste into useful resources, is being built. The first such facility, O • Park1, opened in 2018 with a capacity of 200 tonnes daily. It treated 46,000 tonnes of food waste, generated 11.4 million kWh of electricity and produced 2,600 tonnes of compost in 2022. O • Park2, with a capacity of 300 tonnes daily, is under construction for commissioning in 2024.

The anaerobic co-digestion trial scheme launched in 2019 at the Tai Po Sewage Treatment Works can process about 50 tonnes of food waste a day. The trial will be extended to the Sha Tin Sewage Treatment Works for commissioning in the second half of 2023, with a similar treatment capacity.

Another recycling centre, Y • Park, in Tuen Mun began operation in 2021, turning suitable yard waste into products such as wood chips and wooden boards. Y • Park's handling capacity was about 11,000 tonnes, or an average of about 30 tonnes per day, in the first year and will increase to an annual average of around 22,000 tonnes. A pilot biochar production plant is under construction in EcoPark for converting woody waste into biochar. The plant is expected to process around 6,000 tonnes of woody waste and produce about 1,200 tonnes of biochar a year.

Chemical, Clinical and Special Waste

All chemical and clinical waste producers are required to pack, label and store their chemical and clinical waste properly before disposal at licensed treatment facilities. A trip ticket system tracks the waste movement from its origin to the final disposal point. The Chemical Waste Treatment Centre in Tsing Yi treated a daily average of 21.5 tonnes of chemical waste and 13.3 tonnes of clinical waste in 2022. Waste producers using its services pay part of the treatment cost.

The government's policy is to return radioactive waste to the original suppliers as much as possible, hence only some low-level radioactive waste needs to be transferred to a dedicated facility on Siu A Chau, an uninhabited island southwest of Lantau, for long-term storage. The facility is purpose-built to meet stringent international standards for the safe storage of low-level radioactive waste.

T • Park, a sludge treatment facility in Tuen Mun, employs an advanced treatment process to treat up to 2,000 tonnes per day of sludge generated from sewage treatment. It has waste-to-energy facilities to convert the incineration heat to sufficient electricity to power the entire facility and exports the surplus to the public power grid. The facility treated about 390,000 tonnes of sewage sludge and exported 13 million kWh of electricity in 2022. Its environmental education centre has attracted over 300,000 visitors since opening in 2016.

Construction Waste

The Construction Waste Disposal Charging Scheme provides economic incentives to reduce construction waste, recover and reuse inert materials, and reduce their disposal at landfills. An annual average of 19 million tonnes of overall construction waste was generated from 2017 to 2021. The reuse rate was 93 per cent in 2021, having remained above 90 per cent in recent years.

Marine and Shoreline Refuse

Marine refuse in Hong Kong waters is cleared by the Marine Department, which deploys about 42 vessels to scavenge for floating refuse and collect domestic refuse from vessels in the anchorages and typhoon shelters. In 2022, the department collected about 2,700 tonnes of such refuse.

Shoreline refuse is cleared by the AFCD, FEHD, Leisure and Cultural Services Department and other government bodies.

The Inter-departmental Working Group on Marine Environmental Management coordinates the efforts of different departments in handling marine refuse and marine environmental incidents.

The government also leverages community efforts to protect the marine environment through the Clean Shorelines Liaison Platform. Since 2015, over 3,200 participants from schools, non-profit-making organisations and commercial companies have been engaged in the Shorelines Cleanup Day programme through the platform. There have also been more than 2,500 coastal clean-up activities carried out by voluntary groups and activists in the past seven years.

Hong Kong cooperates with Guangdong through a notification and alert system on marine refuse. Notifications on any potential surge of marine refuse in Hong Kong, the Pearl River Estuary and its neighbouring waters are issued by the Hong Kong-Guangdong Marine Environmental Management Special Panel to facilitate follow-up actions.

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 27,500 tonnes of waste in 2022.

Sewage Treatment and Disposal

The public sewerage system covers the entire urban area and serves over 93 per cent of the whole population. It collects about 2.8 million cubic metres of waste water daily, over 99 per cent of which receives chemical or higher levels of treatment before being discharged.

Victoria Harbour and Harbour Area Treatment Scheme

Under the Harbour Area Treatment Scheme, all sewage from both sides of Victoria Harbour is intercepted and conveyed through a network of deep tunnels to the Stonecutters Island Sewage Treatment Works for treatment and disinfection before discharge. This has improved the overall water quality in the harbour significantly.

The government also implements other measures to alleviate pollution caused by the discharge of residual pollutants through the storm water systems. These include rectifying misconnected sewers, installing dry-weather flow interceptors in some storm water culverts and rehabilitating ageing sewers.

Sewage Disposal in Rural Areas

As at end-2022, more than 17,000 village houses had been connected to public sewers. Eligible households can apply for loans and grants to help them connect their buildings to public sewers.

Sewage Charges

All water users who discharge sewage into a communal drain or sewer pay a charge of \$2.92 per cubic metre of water supplied, with each domestic account exempt from paying for the first 12 cubic metres per four-month consumption period. Twenty trades whose effluent strength is higher than that of domestic sewage pay a trade effluent surcharge reflecting the additional cost of treating their stronger effluent. These charges are used to recover the operating and maintenance costs of sewage collection, treatment and disposal facilities, whose construction is government-funded.

Water Quality

The water quality of Victoria Harbour has improved markedly under the Harbour Area Treatment Scheme. In 2022, the harbour's overall compliance with the statutory water quality objectives was 93 per cent.

By controlling pollution at source, river water quality has also improved. During the year, 84 per cent of the river monitoring stations were categorised as 'good' or 'excellent', while only 6 per cent belonged to the 'bad' category.

Bathing Beaches

Beach water quality is assessed through an established system which ranks a beach according to the level of the *Escherichia coli* bacteria in its water, to reflect the corresponding swimming-associated health risks. As of 2022, all 42 gazetted beaches had complied with the statutory bacteriological water quality objective for bathing waters for 13 consecutive years, among which 27 beaches were ranked as 'good' and the remaining 15 were ranked as 'fair'. No beaches fell into the 'poor' or 'very poor' categories.

Licensing of Food Premises and Other Trades

The FEHD is the licensing authority for food businesses. It issues licences for food businesses and permits for the sale of restricted foods. It also issues permits for karaoke establishments in licensed restaurants and licences for places of public entertainment, private swimming pools, commercial bathhouses, funeral parlours, undertakers of burials and offensive trades. It provides executive and secretarial support to the Liquor Licensing Board, an independent statutory body that issues liquor licences, including those for clubs.

During 2022, the department issued 7,719 full, provisional and temporary food business licences; 1,790 permits for the sale of restricted foods, including 621 online restricted food permits; 1,892 licences for places of public entertainment; 31 licences for other trades; 1,165 liquor and club liquor licences; and 12 permits for karaoke establishments in licensed restaurants.

Food Safety

The Centre for Food Safety ensures that the food sold in Hong Kong is safe and fit for consumption. It tested about 63,800 samples of food at import, wholesale and retail levels for chemical, microbiological and radiological examination in 2022. The overall satisfaction rate of these tests was 99.8 per cent.

During the year, the Man Kam To Animal Inspection Station inspected 26,085 vehicles carrying live food animals including pigs, cattle and goats, and examined 976,985 live food animals.

The bureau and the centre, making reference to the food safety standards of the Codex Alimentarius Commission and other economies, and taking into account local dietary practices and risk assessment results, review and update Hong Kong's food safety standards and regulatory arrangements. In 2022, the bureau and the centre reviewed the food safety legislation relating to veterinary drug residues.

Public Markets and Cooked Food Markets

The FEHD operates 96 public markets, including 23 free-standing cooked food markets. There are some 13,500 stalls mainly selling fresh provisions, cooked food, light refreshments and household items. As at end-2022, the overall occupancy rate at these markets was 86 per cent.

Seven new public market projects are at different stages of planning. They are the development of new public markets in Tin Shui Wai, Tung Chung Town Centre, Tseung Kwan O, Kwu Tung North New Development Area, Tung Chung New Town Extension and Hung Shui Kiu/Ha Tsuen New Development Area, as well as the establishment of a temporary market in Tung Chung Town Centre.

The FEHD is taking forward the pioneering project of the Market Modernisation Programme – the overhaul of Aberdeen Market. The work is expected to be completed by the first quarter of 2023. The department is also carrying out the preparatory and consultation work for the proposed overhaul works for five other markets. In addition, the FEHD has carried out minor refurbishment or improvement works in 16 markets, of which 14 have been completed.

Hawkers

The FEHD regulates hawking in Hong Kong. As at end-2022, there were 5,200 licensed fixed-pitch hawkers and 304 licensed itinerant hawkers.

In 2022, the department rolled out 105 vacant fixed hawker pitches for selection by eligible applicants. The selection was completed in November and 84 new hawker licences were issued by end-2022.

Shopfront Extension

During the year, the FEHD and police conducted joint operations against shopfront extensions in all districts, under a new strategy to step up tackling street obstruction caused by goods. Offenders not only faced prosecution, but also the removal of any obstructive items, increasing

the cost of non-compliance. By end-2022, there had been a total of 662 joint enforcement operations.

Slaughterhouses

The FEHD oversees the hygiene standards of licensed slaughterhouses in Sheung Shui and Tsuen Wan. Meat supplied by the slaughterhouses has to pass inspection before delivery to markets.

During the year, 26,085 truck movement permits for imported livestock and 8,807 admission forms for local pigs were handled at the slaughterhouses, 29,996 samples were taken from food animals for testing of veterinary drug residues, and 1,084,037 pigs, 11,839 head of cattle and 1,260 goats were slaughtered.

Public Cleansing Services

The District Matters Coordination Task Force, led by the Deputy Chief Secretary for Administration, was established in July to steer bureaus and departments to enhance the overall environmental hygiene and cityscape. The task force launched the Government Programme on Tackling Hygiene Black Spots in August and the FEHD stepped up cleansing work at 198 black spots.

The FEHD takes enforcement action against littering, spitting and other unhygienic practices in public. In 2022, some 46,500 fixed penalty notices were issued. To support enforcement against fly-tippers, internet protocol cameras have been installed at 405 illegal refuse dumping black spots and hygiene conditions have improved.

The FEHD provides street cleansing, household waste collection and public toilet services. All streets are swept one to eight times a day and are washed regularly, from daily to fortnightly or whenever the need arises, depending on the conditions of individual locations. The department also deploys mechanical sweepers to sweep flyovers and highways.

Household waste is collected all year round. In 2022, about 6,120 tonnes of household waste were collected daily by the department and its contractors, of which 79 per cent was collected by the latter. As well as managing public refuse collection points, the FEHD has been enhancing the hardware of refuse collection facilities in rural areas. By end-2022, fully enclosed refuse collection facilities with new designs, such as solar-powered mobile refuse compactors and aluminium refuse collection points, had been installed at 150 locations.

The department manages some 800 public toilets and toilet attendant services are provided at heavily used public toilets. The FEHD has been developing a smart toilet system at public toilets with the support of the Electrical and Mechanical Services Department. By end-2022, 12 public toilets had been installed with smart devices for trial. The department is also implementing the Enhanced Public Toilet Refurbishment Programme. In 2022, 48 public toilets were refurbished, of which six were at major tourist spots.

In connection with a review on existing statutory powers and penalties regarding environmental hygiene, the bureau launched a public consultation in December to gauge views on the proposals to increase the fixed penalty level of public cleanliness and obstruction offences.

Abatement of Sanitary Nuisances

The FEHD issues nuisance notices requiring those responsible to stop sanitary nuisances arising from refuse accumulation, dripping air conditioners and water seepage on private premises. In 2022, it issued 7,334 such notices and secured 211 convictions against those who failed to comply with the notices.

Pest Control

Preventing vector-borne diseases is one of the FEHD's important tasks. In 2022, the department's anti-mosquito teams conducted 825,930 inspections of potential mosquito breeding spots and eliminated 72,252 breeding places. No local case of dengue fever was recorded during the year.

In addition to conducting regular territory-wide operations to tackle rodent infestation, the FEHD is piloting new rodent control strategies, which include forming overnight rodent control roving teams since July and applying new technologies, tools and baits, such as T-shaped bait boxes. The number of live rodents caught by the department in the second half of 2022 was 27,728, about 50 per cent more than the 18,459 caught in the corresponding period in 2021.

In December, the bureau launched the Cross-sectoral Territory-wide Anti-rodent Action to engage different sectors of the community in strengthening anti-rodent work in collaboration with the government.

Cemeteries, Crematoria and Columbaria

The FEHD manages six government crematoria, 10 public cemeteries, 13 gardens of remembrance, 11 public columbaria, two facilities for keeping abortuses and one abortuses cremation facility, and monitors the management of 27 private cemeteries. The department also promotes green burial and seeks to provide a steady supply of public niches, allocating about 22,000 niches in 2022.

Under the Private Columbaria Ordinance, a specified instrument, namely a licence, an exemption or a temporary suspension of liability, must be obtained to operate a private columbarium. The Private Columbaria Licensing Board regulates the operation and management of private columbaria, and handles applications for specified instruments. As at end-2022, it had approved nine licence applications and two exemption applications; given approvals in principle for three licence applications, two exemption applications and 66 temporary suspension of liability applications; and refused applications for specified instruments from 32 private columbaria. During the year, the FEHD carried out about 350 inspections of private columbaria and investigated about 50 cases of suspected contravention of the ordinance.

Guarding against African Swine Fever

While African swine fever is not a zoonotic disease and poses no food safety risk, it can cause widespread deaths among pigs within a short time. Biosecurity is enhanced at pig farms, boundary checkpoints and slaughterhouses to minimise the transmission risk of the disease.

A surveillance programme launched by the AFCD in collaboration with the FEHD in 2019 monitors epidemiology of African swine fever in the local wild pig population. By end-2022, the AFCD had tested 97 wild pig carcasses and 305 wild pig blood samples for African swine fever, and found six carcasses carrying the virus.

The AFCD has strengthened the regulation of local pig-carrying trucks, restricting them to only carrying live pigs from a single licensed pig farm to the slaughterhouse per trip to reduce the risk of cross-contamination, and stipulating spillage and leakage prevention standards to minimise the spread of diseases through pig waste. The department has commissioned contractors to thoroughly cleanse and disinfect all local pig-carrying trucks every time they leave the slaughterhouses.

Measures against Avian Influenza

Government measures to keep avian influenza at bay include stringent monitoring of the poultry supply chain from farm to retail levels, compulsory vaccination of chickens against the H5 and H7 avian influenza viruses and the close surveillance of imported and local birds.

Since the constant mutations of the virus affect the efficacy of existing vaccines, the AFCD introduced a new trivalent H5 and H7 avian influenza vaccine for local poultry farms in 2022 to enhance the protectiveness against variant viruses. The department also conducts stringent surveillance of local and imported birds to minimise the introduction and transmission risk of the virus in local poultry farms and to ensure a stable poultry supply.

Samples are collected regularly for testing from poultry farms, wholesale markets and retail outlets; from birds kept in recreation parks and pet shops; and from wild birds in wetlands and elsewhere. The government provides a round-the-clock service for the collection of sick and dead wild birds and poultry. In 2022, the AFCD collected 8,153 wild bird and poultry carcasses and found three of them carrying the highly pathogenic H5 virus.

Other preventive measures include inspecting live poultry retail outlets to ensure compliance with special licensing or tenancy conditions on avian influenza control; maintaining the hygiene of market stalls and ventilation systems; conducting inspections, washing and disinfection of public places where wild birds gather; and taking stringent enforcement action against the feeding of wild birds in public places.

The measures are effective in preventing human infection of avian influenza, as evidenced by the total absence of locally infected human case of the H5 or H7 viruses since the first avian influenza outbreak in Hong Kong in 1997.

Antimicrobial Resistance

In November, the government launched the Hong Kong Strategy and Action Plan on Antimicrobial Resistance (2023-2027), the second action plan mapping out response strategies to tackle antimicrobial resistance for the next five years. The plan details AFCD measures in the food animal production sector, including livestock and fish, to alleviate the development of antimicrobial resistance and safeguard animal and public health.

The AFCD inspects food animal farms to collect data and samples to evaluate antimicrobial usage, as well as biological samples for bacterial culture and antimicrobial sensitivity testing on a regular basis. The data helps the department identify control points and devise appropriate control measures.

Control of Animal Diseases

As Hong Kong's inspection and quarantine authority for animals, the AFCD regulates cross-boundary animal movements to prevent animal diseases from entering the territory. The department also assesses the risk of disease in imported animals and animal products on the basis of their species, the intended use and the disease status of the place of origin, and formulates quarantine measures to control the import of animals and animal products.

In 2022, about 4,300 lot-based permits were issued for animal imports, which included dogs, cats, horses, birds, zoo animals and live food animals such as pigs and cattle.

Quarantine Detector Dog Programme

The Quarantine Detector Dog Programme helps combat the illegal import of animals. The dogs are trained to detect live animals and animal products hidden in luggage at land boundary control points, Hong Kong International Airport and the airport's Air Mail Centre. In 2022, more than 3,400 travellers, 330 vehicles and 6,900 parcels and pieces of luggage were screened.

Animal Welfare and Management

The government's approach towards animal welfare and management includes strengthening public education, controlling animal trading properly, working closely with animal welfare organisations, managing stray animals, and handling and preventing acts of animal cruelty.

The AFCD encourages the public to care for and respect animals. It promotes responsible pet ownership and animal welfare through educational talks, roving exhibitions, dog training courses and advertisements on different platforms.

The department partners with 17 animal welfare organisations to rehome dogs, cats, rabbits, birds and reptiles. It provides free desexing for the rehomed animals, and subvents these organisations in carrying out animal welfare and management projects.

Under a cooperation mechanism established among the police, AFCD and Society for the Prevention of Cruelty to Animals (SPCA), the police may invite AFCD and SPCA officers to provide professional advice and assistance at the scene of an animal cruelty case. The AFCD and

SPCA also give talks on the multi-agency approach for investigating animal cruelty cases to enhance frontline police officers' professional knowledge in handling such cases.

The AFCD inspects licensed pet shops to ensure compliance with the licensing conditions. Pet shops are required to obtain dogs for sale only from approved sources. Dog breeders and sellers are regulated under the Public Health (Animals and Birds) (Trading and Breeding) Regulations.

Food Supply

The Mainland is Hong Kong's main source of fresh food and the government closely monitors the logistics of food supply to the city. At the peak of the COVID-19 epidemic in early 2022, supply was temporarily disrupted when a number of cross-boundary truck drivers tested positive for the virus. With the support of the Mainland authorities, fresh food supply quickly resumed to normal. During the year, more types of fresh food were allowed to be imported through the food control facilities at the Hong Kong-Zhuhai-Macao Bridge.

Primary Production

Hong Kong's agricultural and fisheries industries are relatively small in scale. The government helps improve their output quality, productivity and competitiveness. The two industries combined employed some 17,900 people directly and produced \$3.65 billion of output during the year. Live poultry accounted for 100 per cent of local consumption; cut flowers, 38 per cent; seafood, 17 per cent; live pigs, 11 per cent; freshwater fish, 5 per cent; and vegetables, 1.9 per cent.

Agricultural Industry

The agricultural industry focuses mainly on producing quality fresh food crops through intensive land use. Most farming is in the New Territories and for growing crops, comprising mainly vegetables and cut flowers, with a combined output in 2022 valued at about \$414 million. The principal food animals reared are pigs and poultry, which respectively yielded earnings of about \$518 million and about \$419 million, inclusive of eggs.

The AFCD encourages crop farmers to tap niche markets and sharpen their competitiveness by cultivating safe and quality vegetables. To promote organic farming, the department provides organic farming support to 342 farms occupying 101 hectares of land. It also promotes the use of smart greenhouse technology for intensive high-value crop production.

The department manages a voluntary Accredited Farm Scheme jointly with a statutory body, the Vegetable Marketing Organisation (VMO), to provide a stable supply of quality and safe vegetables. A total of 315 farms in Hong Kong, Guangdong Province and Ningxia Autonomous Region, occupying 2,573 hectares of land, are accredited under the scheme.

The Controlled Environment Hydroponic Research and Development Centre, a joint set-up between the AFCD and VMO at Cheung Sha Wan Wholesale Vegetable Market, studies the application of state-of-the-art hydroponic cultivation techniques to the agricultural sector to enhance the output of local vegetable production.

Leisure farms are popular places for recreation. The department works with the agricultural sector to provide updated information about these farms on a mobile application, Hong Kong Leisure Farms.

Under the New Agriculture Policy, the government promotes the modernisation and sustainable development of local agriculture. The \$500 million Sustainable Agricultural Development Fund aims to enhance the industry's overall competitiveness. To further assist local farmers to adopt advanced technology and intensify production, the government injected an additional \$500 million into the fund in December, expanded its coverage and enhanced the funding arrangement. The first phase of an agricultural park at Kwu Tung South commenced operation at the end of 2022.

Fisheries Industry

Fresh fish is one of Hong Kong's most important primary products. In 2022, the amount of fish caught and fish reared in ponds and floating cages at sea totalled about 79,960 tonnes, with a value of \$2.3 billion.

As at the year end, some 6,139 vessels were licensed as fishing vessels under the Merchant Shipping (Local Vessels) (Certification and Licensing) Regulation. These included larger vessels operating mainly in the South China Sea and smaller vessels in local waters. There were about 10,320 local fishermen in the industry, with a quota of 4,785 Mainland deckhands. The total catch weighed about 77,200 tonnes, with an estimated wholesale value of \$2.2 billion, and provided some 32,000 tonnes of fish for local consumption.

As at the year end, 913 AFCD-licensed mariculturists were operating in 26 designated fish culture zones. They supplied consumers with some 590 tonnes of live marine fish valued at \$60 million during the year.

Freshwater and brackish water fish are reared in fish ponds located mainly in the northwestern New Territories. In 2022, pond fish culture yielded some 2,070 tonnes of fish, valued at \$55 million.

The AFCD combats illegal fishing practices, including trawling, to ensure the sustainable development of the industry and to conserve fisheries resources. In 2022, there were two convicted cases of illegal fishing.

The department helps the industry cope with challenges, including providing credit facilities to fishermen, owners of fish-collecting vessels and fish farmers for sustainable development and general productive purposes. It offers free training courses to fishermen. The \$500 million Sustainable Fisheries Development Fund helps fishermen adopt sustainable and high value-added methods of operation, and subsidises programmes and research to enhance the industry's competitiveness. The government injected an additional \$500 million into the fund in December, expanded its coverage and enhanced the funding arrangement.

The voluntary Accredited Fish Farm Scheme tags fish from 158 participating farms for easy recognition. More than 65,000kg of accredited fish were sold under the scheme in 2022.

To help the industry adopt modern and sustainable aquaculture, the AFCD has established a demonstration mariculture farm as a training centre at the Tung Lung Chau fish culture zone. The centre provides practical training using the latest equipment to help fish farmers learn new aquaculture techniques.

The AFCD plans to designate new fish culture zones at Wong Chuk Kok Hoi, Outer Tap Mun, Mirs Bay and Po Toi (Southeast), and has submitted the relevant environmental impact assessment reports to the EPD for approval.

To meet public demand for recreational fishing and to help mariculturists diversify their business, 71 mariculturists in 11 fish culture zones have the department's approval to operate recreational fishing businesses on licensed fish culture rafts.

The AFCD monitors red tides and issues red tide alerts through support groups at the fish culture zones and via its website, press releases and text messages. Seven red tides were recorded in Hong Kong waters in 2022.

Wholesale Markets

Fresh food produce is sold in wholesale markets managed by the AFCD, VMO, Fish Marketing Organisation (FMO) and private sector. In 2022, government wholesale markets, namely the Western Wholesale Food Market, Cheung Sha Wan Wholesale Food Market, Cheung Sha Wan Temporary Wholesale Poultry Market and North District Temporary Wholesale Market for Agricultural Products, handled 217,127 tonnes of vegetables, 65,529 tonnes of fruits, 68,822 tonnes of eggs, 33,477 tonnes of freshwater fish and fishery products and 7,387 tonnes of poultry, with a combined value of \$6.62 billion.

The VMO provides farmers and traders with wholesale marketing services, including trading facilities, accounting and transport services. In 2022, 58,312 tonnes of vegetables valued at \$568 million were sold through the VMO.

The FMO provides wholesale marketing services at its seven wholesale markets. In 2022, some 35,672 tonnes of marine fish valued at \$3 billion were sold through the FMO. The organisation also develops fishery products at its processing centre to promote the quality of local products. The FMO and VMO have collaborated to launch the Local Fresh app for customers to purchase local agricultural and fishery products online, and operate a store promoting premium local fishery products.

Websites

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

Centre for Food Safety: www.cfs.gov.hk

Climate Ready: www.climateready.gov.hk

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

Environment and Ecology Bureau: www.eeb.gov.hk

Environmental Protection Department: www.epd.gov.hk

Food and Environmental Hygiene Department: www.fehd.gov.hk

Government Laboratory: www.govtlab.gov.hk

Hong Kong Observatory: www.hko.gov.hk

Hong Kong Observatory *Cool Met Stuff* channel: url.hko.hk/cms

Internet Memorial Service: www.memorial.gov.hk

Low Carbon Living Calculator: www.carboncalculator.gov.hk

MyObservatory mobile application: www.hko.gov.hk/en/myobservatory.htm

'Science in Public Service' campaign: www.science.gov.hk