Hong Kong Housing Authority

ENVIRONMENTAL REPORT 2020/21

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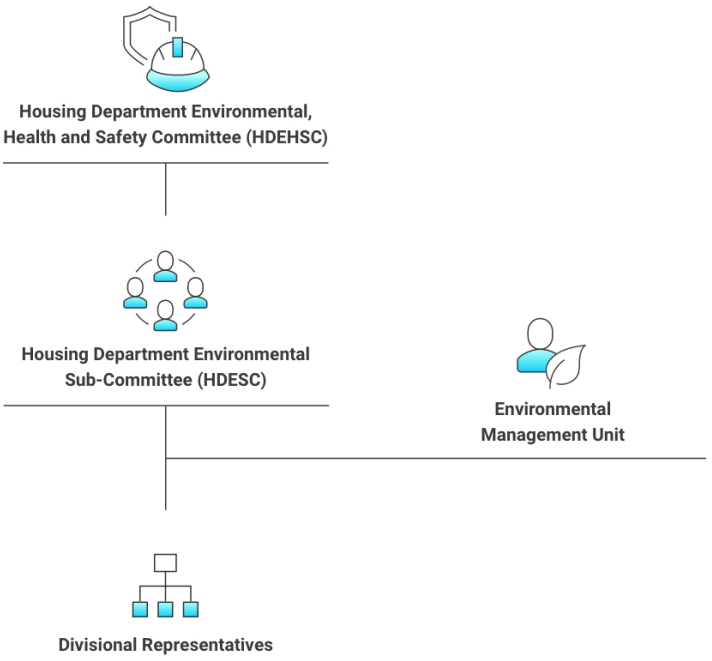
INTRODUCTION

The Hong Kong Housing Authority (HA) is committed to minimising our environmental footprints and building resilience to the potential impact of climate change for our new and existing housing estates and our offices. The HA Environmental Report 2020/21 (the “Report”) presents the HA’s environmental initiatives and performance achieved from 1 April 2020 to 31 March 2021 (unless otherwise mentioned in the Report), as well as its environmental management structure.

ENVIRONMENTAL MANAGEMENT

ENVIRONMENTAL MANAGEMENT STRUCTURE

The Housing Department Environmental, Health and Safety Committee (HDEHSC) is tasked with the development and formulation of policy direction on environmental, health, safety and sustainability aspects within the HD. The Housing Department Environmental Sub-Committee (HDESC) is to oversee the progress and performance of environmental initiatives and action plans, with support from the Environmental Management Unit.



MANAGEMENT APPROACHES AND POLICIES

To govern our operations with clear direction on sustainability commitment and approaches, we have formulated the Environmental Policy, Environmentally Responsible Procurement Policy, and Energy Policies, and adopted a series of environmental principles, which have been communicated to and are supported by our stakeholders, including our staff, service providers, material suppliers and contractors. For the full version of these Policies, please refer to our **HA/HD website**.

Environmental Policy

Environmentally Responsible Procurement Policy

Energy Policy of Development and Construction Division

Energy Policy of Estate Management Division

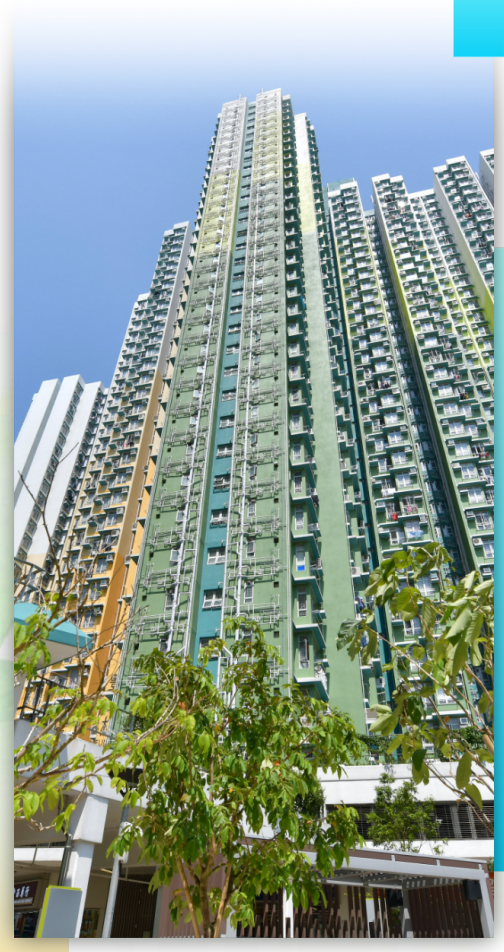
Certified Standard

In addition to formulating and implementing the policies at the departmental/divisional level, individual divisions and units have obtained various certifications on management systems to align with international practices. For the list of certified standard, please refer to **HA/HD website**.

Environmental Targets

In 2020/21, we have set 40 environmental targets to promote sustainable development. These environmental targets cover six aspects, including energy efficiency, water conservation, greening, waste management, control of hazardous materials, as well as enhancement of environmental awareness and participation in environmental protection initiatives. For details, please refer to the chapter "**Targets and Outlook**".

ENVIRONMENTAL PERFORMANCE



INITIATIVES IN PLANNING AND CONSTRUCTION OF NEW PUBLIC HOUSING

GREEN DESIGN AND CONSTRUCTION

The HA strives to make our housing more resilient and sustainable in the face of environmental challenges. We have been developing sustainable buildings, enabling us to respond timely to the global need for climate change mitigation.

We design and develop our public housing with climate-resilient elements in accordance with industry recognised standards such as the Urban Design Guidelines issued by the Planning Department, which intend to reduce the effects of climate change, such as mitigating the urban heat island effect.

One of these elements is the Zero Irrigation System (ZIS), which was developed in 2013 to reduce water consumption by reusing rainwater for irrigation. The ZIS consists of three sub-systems: a Rainwater Harvesting System that collects and stores excess rainwater in retention boxes under planting areas; a Sustainable Urban Drainage System that reduces storm water runoff into the sewer system; and a Sub-soil Irrigation System that passively delivers water from the retention boxes to the vegetation above. We aim at implementing ZIS in all new public housing estates, contributing to water conservation.

Zero Irrigation System

All planters at Wui Chi House, Tung Wui Estate adopt the ZIS

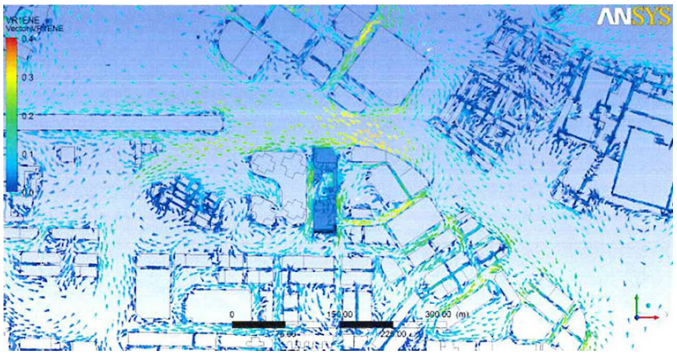
All planters at Wui Chi House, Tung Wui Estate adopt the ZIS

All planters at Wui Chi House, Tung Wui Estate adopt the ZIS

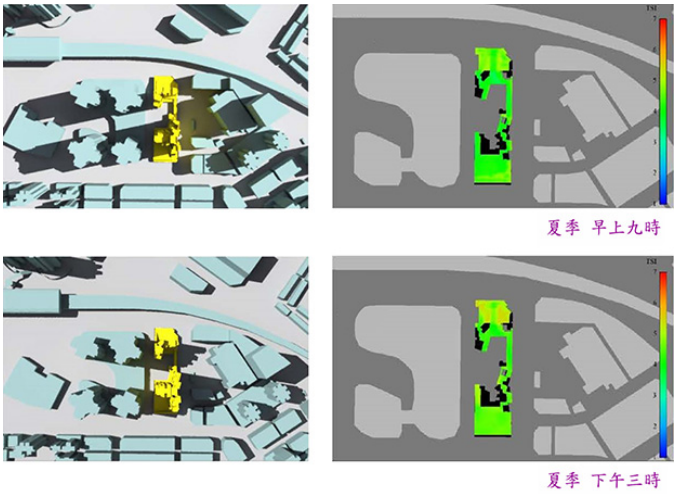
Trial study of modular type ZIS and recycled glass cullet was conducted at Wing Tai Road

Conducting Micro-climate Studies and Air Ventilation Assessment

Since 2004, we have been conducting Air Ventilation Assessment (AVA) and micro-climate studies in our design of new public housing developments to assess their impact on the neighbourhood environment using design tools such as computational fluid dynamic model and wind tunnel testing. Through these studies, we can optimise the environmental performance of our new developments in respect of wind environment, natural ventilation to buildings, daylight penetration, thermal comfort and air pollutants emission. We also extended the application of micro-climate studies in supporting BEAM Plus New Building certification with a view to enhancing the sustainability rating of our new public housing developments and creating a green, energy efficient and healthy living environment for our residents.



Long Ching Estate's micro-climate studies and Air Ventilation Assessments



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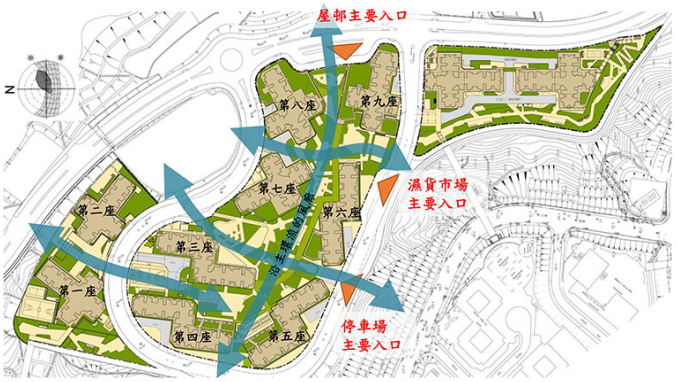


Long Ching Estate's micro-climate studies and Air Ventilation Assessments

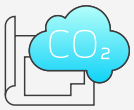
Conducted micro-climate studies in **35** on-going projects

Carried out Air Ventilation Assessments in **34** on-going projects

Adopting Low Carbon Building Design

We apply the Carbon Emission Estimation (CEE) method to estimate carbon dioxide emissions from buildings throughout their expected 100-year life cycle. This methodology enables the establishment of the benchmarks of emission level for a housing block and a housing estate throughout the project cycle stages to facilitate comparison and to set achievable goals for improvements. CEE includes an estimate of carbon dioxide emissions generated by materials consumed during construction, materials for structures, the operation of communal building services installations as well as demolition activities, and the off-sets from renewable energy application and tree-planting.

Carbon Emission Estimation



Conducted CEE for **12** projects

15.77% reduction in estimated carbon emission since the roll-out of CEE

Utilising Green Materials and Products

We have increased our utilisation of green materials such as Ground Granular Blast Furnace Slag (GGBS). As part of our current building contracts, we require that 35% of the cement used to produce precast facades and stairs be replaced by GGBS. We are also investigating the feasibility of using GGBS to build precast hard paving, partition walls and refuse chutes.

We have also adopted other green materials in our new works projects, such as:

- Using synthetic macro-fibre reinforcement in on-grade slabs in new works projects where applicable;
- Using recycled materials in new works projects to reduce the use of raw materials and embodied carbon; and
- Implementing the mandatory use of B5 bio-diesel as fuel for all non-road based construction machinery on site.

In addition, current specification clauses for all our new works projects are aligned with the latest BEAM Plus assessment criteria, BEAM Plus for New Building version 2.0. We will stay updated on the HKGBC Green Product Accreditation & Standards Scheme to revise our green materials and products guides where applicable.

Environmentally Friendly Construction Practices

We have developed various standards to better manage our innovative and environmentally friendly practices during the construction stage, such as:

- Using Forest Stewardship Council (FSC) timber for temporary work;
- Adopting semi-precast slab with pre-installed service conduits in corridor at typical floor in suitable new works projects;
- Widening the use of precast concrete components including volumetric precast elements;
- Adopting re-usable modular hoarding with bolt-and-nut fixing in suitable new works projects; and
- Using hard paved construction at all piling and building construction sites.

Modular Integrated Construction (MiC) refers to the manufacture of free-standing integrated modules (completed with finishes, fixtures and fittings) in a prefabrication factory, which are then transported to the site for installation. In 2020, we completed a MiC mock-up project to test out HA's engineering design modules in the areas of installation, buildability, safety, quality assurance, etc. In addition, the HA has selected three public housing development projects for adoption of MiC at Tung Chung Area 99, Tak Tin Street in Kwun Tong and Anderson Road Quarry Sites R2-6 and R2-7. Looking ahead, the HA will actively identify other projects suitable for adopting MiC.

Precast concrete construction

The HA has established a guideline for "Implementation of Precast Construction at Roof of Domestic Block" and implemented the use of precast acoustic balconies in the latest Modular Flat Design. Precast concrete components have been used in common areas, such as structural walls with concealed conduits and lift shafts with pre-installed lift guide rails.

In addition, as stipulated in all building, demolition, piling and civil engineering contracts, contractors are required to implement green construction measures on site, requiring them to:

- Implement environmental management plans on site
- Use generators with Quality Powered Mechanical Equipment (QPME) labels
- Adopt hard paved construction
- Install water recycling facilities
- Provide solar hot water heaters in workers' shower area
- Use Radio-frequency identification (RFID) to track construction waste disposal
- Provide food waste composting facilities
- Greening on site; and
- Use Non-Road Mobile Machinery (NRMM) including excavators, crawlers, air compressors, and generators in full compliance with the Government requirement

Environmental Data Visualisation – Building Information Modelling (BIM)

This year, we continued to update our BIM standards and modelling guidelines, produce new templates for different projects, and expand our BIM object libraries. In addition, we have started to require contractors to provide four-dimensional (4D) videos as part of complex building tenders and foundation tenders. Developed by our in-house experts, our BIM-enabled Systematic Approach to Foundation Design (BIM-SAFD) is especially useful for 3D visualisation of complex underground geological conditions, and can also be used for producing plans, creating schedules for statutory submissions, and measuring quantities for tender documentation.

Building Information Modelling

Besides, we have increased the budget and days for BIM training. We are also producing BIM training videos for staff to learn at their own pace. In the future, we plan to explore innovative BIM applications that can be integrated with new technologies, such as the 5th generation mobile network (5G), reality capture, generative design and off-site prefabrication.

Green Building Recognition

The Building Environmental Assessment Method Plus for New Buildings (BEAM Plus NB) offers us with a lifecycle assessment of our new buildings' environmental attributes. All new buildings are designed to meet BEAM Plus assessment criteria, aiming for gold rating standard or above. We are delighted that all our certification results under BEAM Plus NB (Version 1.2) for 2020/21 met this standard, as presented in the table.

Project & Rating (Provisional Assessment) – Gold

- PRH Development at Queen's Hill Site 1 Phase 2, Fanling
- PRH Redevelopment at Pak Tin Estate (Phases 7, 8 & 11)
- Public Housing Development at Tuen Mun Area 29 West
- PRH Development at Lai Cho Road, Kwai Chung
- Public Housing Development at Fanling Area 36 Phase 4
- Public Housing Development at Ching Hong Road North, Tsing Yi, Phase 1, Phase 2
- Public Housing Development at Anderson Road Quarry Site RS-1
- Subsidised Sale Flats Development at Ko Shan Road
- Public Housing Development at Java Road, North Point

Project & Rating (Final Assessment)

• Long Shin Estate, Yuen Long	Platinum
• On Tai Estate, Kwun Tong	Platinum
• Mun Tung Estate, Tung Chung	Gold
• Ping Yan Court, Yuen Long	Gold
• Ngan Wai Court, Mui Wo	Gold
• Ngan Ho Court, Mui Wo	Gold
• Hoi Ying Estate, Sham Shui Po	Gold
• Choi Hing Court, Kwun Tong	Gold
• Kai Long Court, Kowloon City	Gold

Average Energy Consumption

of building services installations in communal areas was **21.75 kWh/m^2/Annum**

Renewable Energy

Since 2011, we have been installing grid-connected photovoltaic (PV) systems in new public housing projects and participating in electricity supply companies' feed-in tariff programmes. Currently, our PV systems are designed to supply 1.5 to 2.5 percent of the building's total electricity demand.

PV Systems (as of March 2021)

Installed in **123** domestic blocks, with a total system capacity of **1,100 kW**

Promoting Electric Vehicles

The HA has installed electric vehicles (EV) charging facilities in all new estate car parks to support the Government's Roadmap on Popularisation of Electric Vehicles. In our new indoor private car parks, 30% of parking spaces are equipped with EV chargers, while the remaining 70% are provided with EV charging-enabling facilities for future EV chargers installation.

EV charging facilities at Choi Hing Court, Kwun Tong

EV charging facilities at Choi Hing Court, Kwun Tong

Energy Efficiency in Buildings

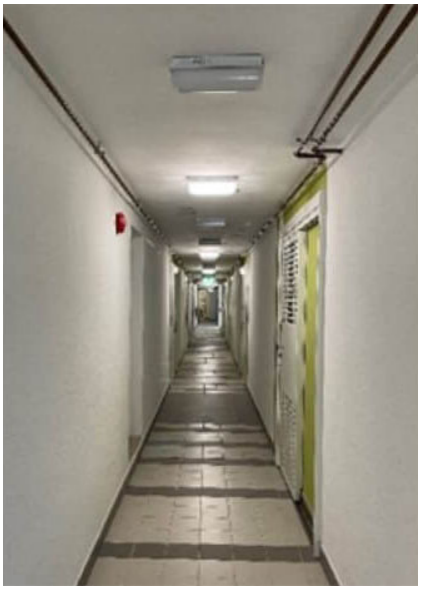
The Buildings Department issued “Guidelines on the Design and Construction Requirement for Energy Efficiency of Residential Buildings” (the Guidelines) in 2014. Following the Guidelines, we continue to improve natural ventilation and environmental performance in our new buildings.

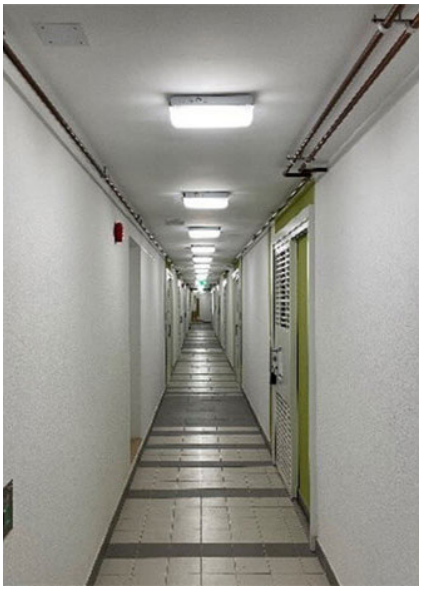
We also follow the Electrical and Mechanical Services Department (EMSD) Building Energy Codes for new building projects to meet energy efficiency requirements. We have received Certificates of Compliance Registration from EMSD to show our compliance with the Building Energy Efficiency Ordinance.

We continued to implement the following energy saving measures, including:

- Two-level lighting system for barrier free access in domestic and non-domestic blocks of new works projects;
- Energy efficient LED bulkhead lights, LED Exit signs and Directional signs in all new works projects;
- Energy efficient gearless lifts in domestic blocks at new works projects and adopt permanent magnet synchronous motors for the gearless lifts as they become readily available in the market;
- Regenerative power for lift systems using motors with power rating of 8kW or above in new works projects; and
- Smart meters and information display systems in the main entrance lobbies of new housing blocks to allow tenants to view their own or neighbouring blocks’ monthly electricity, gas and fresh water consumption.

Two-level lighting system


Two-level lighting system


Two-level lighting system

Our energy management measures have been regularly reviewed. We are committed to designing new projects in accordance with the Buildings Department's Practice Note on Residential Thermal Transfer Values.

WATER CONSERVATION

Fresh water is used in new building construction, daily washing, flushing, and irrigation. We have adopted several measures in our new projects, such as using 6-litre dual flush water-closet suites in domestic premises to fulfil the water efficiency grading. We support the government's water conservation campaign by assisting and facilitating WSD's promotional booths at public rental housing estates to help interested households to register and arrange installation of flow controllers for water taps.

MITIGATING ENVIRONMENTAL IMPACTS

Estate Ecology


Landscape design and tree conservation of public housing

At Fanling Area 49 (Fai Ming Estate), we carried out an ecological survey and assessment in April 2010. The watercourse and the secondary woodland were found to be of relatively high ecological value with species of conservation concern. Butterfly community in the study area was found to be relatively diverse (78 species recorded, 30% of total recorded in Hong Kong). During design and construction stage, project team collaborated with ecologists paying extra effort from master layout plan down to landscape design and selection of appropriate planting species, etc. Also, throughout the whole construction period, a regular monitoring system was imposed to review if the mitigation measures were executed effectively. The final monitoring result recorded at end of March 2020 (completion of development) noted that the native species were 3 times more than that in 2014 (commencement of development). Diversity of butterfly families were also successfully restored in the Ecological Transition Zone (ETZ) within the estate. Indeed, it was reviewed that the whole design consideration and monitoring system were successfully implemented at ecological garden with distinguished results.

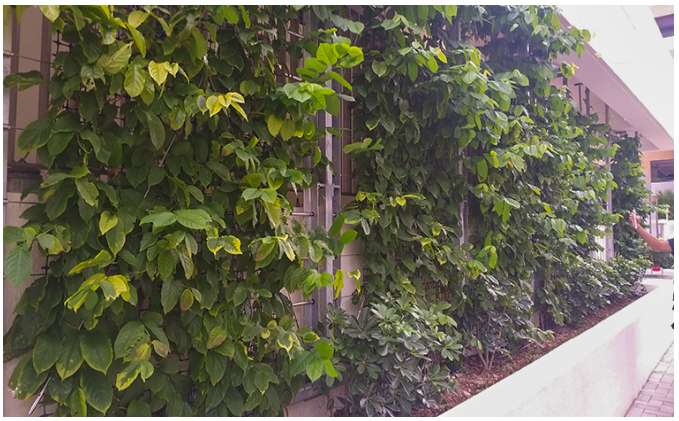
We provide new vegetation and encourage greening in new public housing to apply balanced ecological planning and design concepts. The greening ratio for all new public housing will be at least 20%, with a goal of 30% for large sites over two hectares, and a tree planting ratio of not less than 1 tree per 15 flats.

Meanwhile, we adopt a prefabricated modular method to make ground and podium tree planting faster and easier. Besides, we currently study the usage of pre-grown vertical green panels to increase green coverage and provide “instant greening” effects.

Fai Ming Estate

Fai Ming Estate

Yue Chun House, Yue Wan Estate



Yue Chun House, Yue Wan Estate

To optimise the use of resources, felled trees are recycled at some of our developments. We set up on-site shredding and composting to reuse fallen trees as mulch. Some trees are chipped and composted with food and garden trash.

We continue to engage the local community in our greening efforts. Tenants are invited to join our Action Seedling programme to plant trees at our designated planting area.

Noise Control

Buildings near roads will be affected by traffic noise. We used acoustic windows, acoustic balconies, architectural fins and noise barriers in buildings to meet site-specific requirements. The second generation of precast acoustic balconies include a sliding screen in front of the balcony doors, noise-absorbing material in the balcony wall and ceiling, and inclined panels along the parapet. These designs effectively reduce traffic noise and improve residents' quality of life.

Second generation of acoustic balcony

Second generation of acoustic balcony

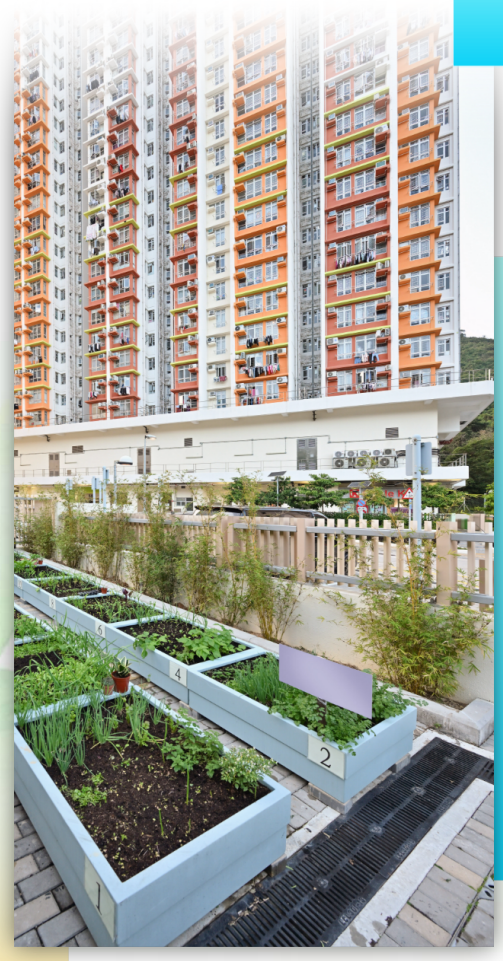
Air Quality Management

To remove air pollutants, filters are installed in our contractors' plants and machines. The HA also phased out 4 types of Exempted Non-Road Mobile Machinery in our construction sites with estimated value over $200 million in line with the Development Bureau's implementation plan.

Risk Assessment

The HA conducts a risk assessment to ISO 31000 Risk Management System standard for all new buildings. About 2,300 building materials used in architectural, structural and geotechnical engineering were assessed to ensure quality control.

ENVIRONMENTAL PERFORMANCE



- Initiatives in Planning and Construction of New Public Housing
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- Case Study: Carbon Reduction in New Developments

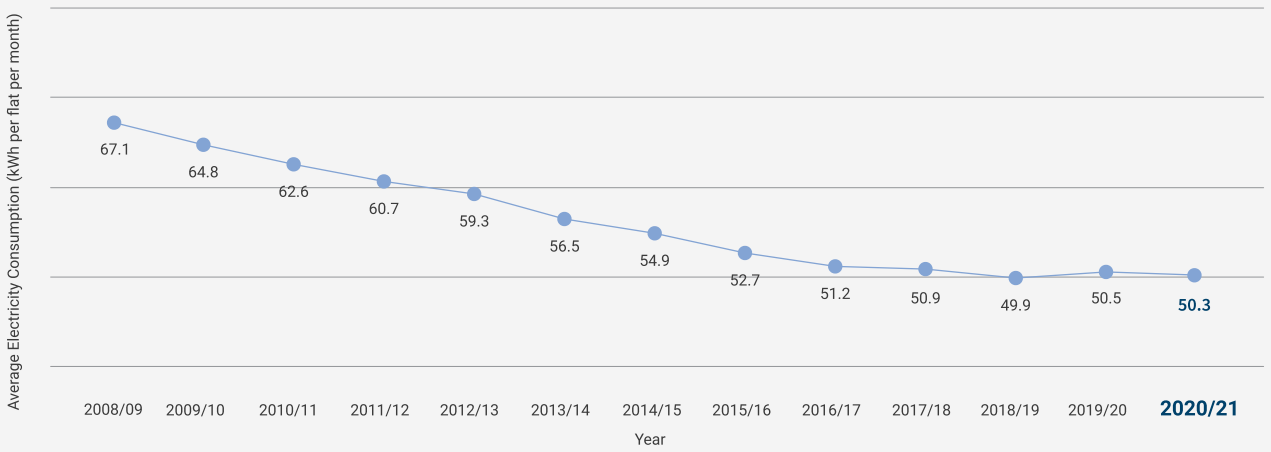
INITIATIVES IN EXISTING HOUSING ESTATES

ENERGY CONSERVATION AND CARBON MANAGEMENT

We continued to maintain the ISO 14001 certification for Environmental Management System for all public rental housing (PRH) estates. An internal audit was completed in the first quarter of 2021 whereas the external Surveillance Audit for PRH estates was carried out in May 2021.

We also continued to maintain ISO 50001 certification for Energy Management System (EnMS) in the communal areas of all PRH domestic blocks. Moreover, we continued carbon emission monitoring and efficiency review through our Carbon Audit exercise in 14 typical domestic block types. With effective implementation of the EnMS, existing estates' communal electricity consumption has remained at 50.3 kWh per flat per month.

Electricity Consumption in the Public Areas of Estates



Carbon Footprint of 14 Typical Housing Blocks

Decreased by **20%** against 2011/12 on average

The HA is studying the feasibility of installing solar PV systems on the rooftops of residential buildings in existing PRH estates. A pilot project on grid-connected PV system in a domestic block in Lee On Estate was put into operation in June 2020, in conjunction with the re-roofing works. We will continue to explore different types of solar PV panels for application in existing PRH estates.

The HA installed standard and medium Electric Vehicle (EV) chargers at private car parking spaces in our existing carparks subject to demand and technical feasibility. Besides, we provide EV charging facilities in the carparks of new public housing developments in accordance with the latest planning guidelines. As of the end March 2021, we provided EV charging facilities at about 400 hourly private car parking spaces and about 1,000 monthly private car parking spaces in HA's carparks.

WASTE MANAGEMENT

The HA has been working closely with the Environmental Protection Department (EPD) in launching waste reduction programmes. Starting from February 2021, the HA and the EPD launched a one-year pilot scheme under which reverse vending machines (RVM) for recycling plastic beverage bottles have been placed in three PRH estates. The pilot scheme has been positively received by residents, and we are now selecting other suitable PRH estates for inclusion in a second and larger-scale pilot scheme.

To prepare for the upcoming Municipal Solid Waste (MSW) charging scheme, we also collaborated with EPD to promote waste reduction and clean recycling in 40 PRH estates ahead of the Phase 2 MSW charging trial. Promotional posters, banners and easy racks were displayed, and online competitions and mini-games were set up.

Greening Activities and Waste Recycling Facilities in Public Rental Housing Estates

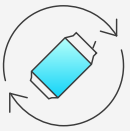
Member of the public using the RVM installed at Lei Muk Shue Estate to return plastic beverage bottles for recycling.

Promotional posters were displayed at notice board of green station in Wan Tsui Estate.

In 2018, in collaboration with EPD and the Food and Environmental Hygiene Department (FEHD) a pilot scheme has been launched to collect source-separated food waste from nine HA wet markets and shopping centres. Since July 2020, nine more HA wet markets and shopping centres have joined the Phase 2 pilot programme.

To promote waste separation at source and environmental management initiatives, HA collected various recyclable materials in all PRH estates:

26,196
tonnes of paper recycled



2,118
tonnes of aluminium cans recycled

2,256
tonnes of plastic bottles recycled

751
tonnes of used clothes recycled

539
tonnes of glass bottles recycled

11
tonnes (38,100 boxes) of mooncake boxes recycled

5,300
potted citrus plants recovered for replanting after Lunar New Year

0.65
kg/person/day average domestic waste production

WATER CONSERVATION

The HA values water conservation. We launched several water conserving initiatives in our commercial properties. For example, we installed Reclaim Water Harvesting System to filter and reuse condensate water for irrigating landscape.

GREENING AND TREE MANAGEMENT

Greening

This year, we enhanced the existing greenery at 20 PRH estates by introducing new varieties of plants to match the local landscape and condition. We also organised greening activities for residents at 20 estates to promote community participation in the greening of PRH estates.

Landscape Improvement Programme

Aging plants removed and greenery revitalised for residents' enjoyment in Tin Chak Estate

^ Before

> After

Provision of access and replanting to improve erosion and avoid jay walking in Tin Yan Estate

^ Before

> After

Community Participation Programme

Strengthening Tree Management

The HA has been using a centralised electronic tree database with Geographic Information System (GIS) to maintain the latest tree data. A computerised Enterprise Tree Management System operated in a web-based platform and mobile device application has also been in place since 2016 to keep tree inventory and conduct tree risk assessment. This year, in addition to our regular tree inspection work, we had recruited some 690 Estate Tree Ambassadors from tenants to help monitor trees and organised tree planting days in 10 PRH estates.

ASBESTOS ABATEMENT

We continue to alert the public and tenants of asbestos in some of our old estates by distributing pamphlets, updating the Asbestos Containing Materials (ACM) record in the HA/HD website and labelling on all ACM. To ensure proper monitoring, half-yearly common area and annual in-flat inspections are conducted by a Registered Asbestos Consultant.

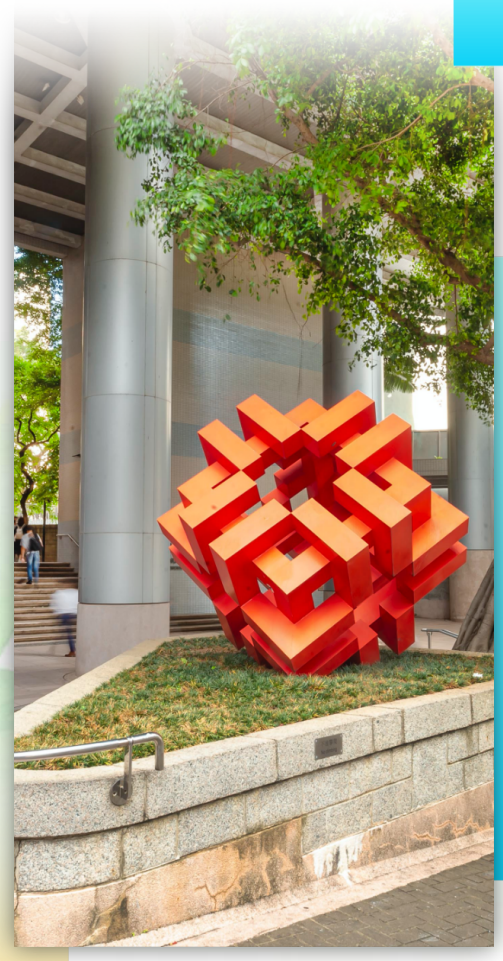
ORGANISING GREEN ACTIVITIES

To promote greening in PRH estates, we organised tree planting days in 10 estates and community garden programmes in 10 estates. Green publicity and public education are also delivered to residents through various channels, such as Facebook, Housing Channel, display of posters and banners.

Tree Planting Day

Community Garden Programme

ENVIRONMENTAL PERFORMANCE



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INITIATIVES IN OFFICE AT WORK

ENERGY SAVING AND CARBON MANAGEMENT

Electricity Saving

Saved **15.4%** in 2020/21

Far exceeding our target of 5.5% against base year 2013/14

WASTE MANAGEMENT

Paper Consumption

Reduced by **11.3%** in 2020/21

Far exceeding our target of 3.5% against base year 2013/14

WATER CONSERVATION

Water Consumption in HA Headquarters (HAHQ)

Lowered by **18.3%** in 2020/21

Far exceeding our target of 2.5% against base year 2015/16

ENVIRONMENTAL PERFORMANCE

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CASE STUDY: CARBON REDUCTION IN NEW DEVELOPMENTS

The HA aims to design, construct and manage housing developments that contribute to the Hong Kong government's policy to reduce carbon emissions and to achieve carbon neutrality before 2050. We aim to obtain BEAM Plus certification for all our new developments achieving gold rating standard or above.

Carbon Reduction Initiatives in New Development Projects - On Tai Estate and Hoi Ying Estate

By adopting green and low-carbon measures throughout the building development cycle, HA is able to reduce both embodied and operational carbon emissions. Exemplary developments are On Tai Estate and Hoi Ying Estate which have been awarded Final Platinum and Gold in BEAM Plus respectively in 2020/21.

PLANNING AND DESIGN STAGE

We have adopted the concept of “Sustainable Community for Green and Healthy Living” in the design and planning stage for new projects. Careful consideration of surrounding conditions is in place to meet Urban Design Guidelines in Hong Kong Planning Standards and Guidelines (HKPSGs). Simulations for microclimate and air ventilation assessments are carried out to optimise utilisation of existing wind environment and natural sunlight. We also adopt passive design to save energy, including the consideration on master layout plan, building orientation and selection of appropriate materials for buildings envelope.

- Provision of greenery and trees on site will also contribute to mitigate the urban heat island effect as well as to reduce carbon emission. On Tai Estate has provided more than 30% of greenery including vertical greenery, at-grade planting, green roof, etc. to expand urban greenery.

- For at-grade planting, we researched into the application of Structural Soil and formulated the chemical mix at On Tai Estate to provide adequate soil volumes for tree roots located underneath pavements, allowing the roots to grow deeper into the base course while pavements are adequately compacted and remain stable. The roots are therefore less likely to heave and crack pavement compared to conventional tree pits.

- During planning stage, detailed micro-climate studies were conducted for On Tai Estate to adjust the disposition of buildings in regard to the prevailing weather and site conditions. A healthier and more comfortable living environment was then created for the residents.

At Hoi Ying Estate, apart from over 20% of greenery provision, a public open space between the estate and the adjacent Hoi Lok Court not only provides abundance of greening, but also serves as a breezeway to enhance air ventilation of the southern part of Sham Shui Po District, reducing the impact of urban heat island effect, as well as enhancing the connectivity towards waterfront.

On Tai Estate was designed with green spine and wind corridors. Openings are provided at the upper podium above the car park to enhance breezeways to save energy from mechanical ventilation in the carpark. Stepped plantings are implemented to maximise tree planting space for enhancing the green environment.

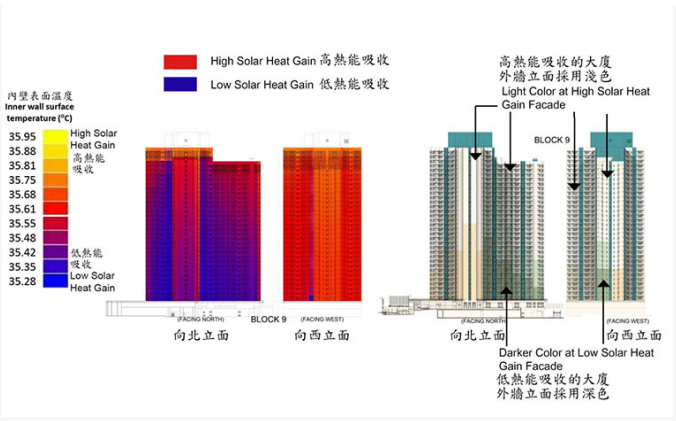
CONSTRUCTION STAGE

During construction stage, the HA adopts Building Information Modeling (BIM) to allow more accurate coordination and planning resources. For material selection, we strive to use timber products from sustainable sources to minimise impact to the natural environment, incorporating renewable materials into building construction. We also use non-Chlorofluorocarbons (CFC) based refrigerants and non-ozone-depleting substances in thermal insulation materials to lower the embodied carbon of our buildings.

The use of precast elements has been incorporated in our building construction methods for many years. Prefabricated components and precast elements such as semi-precast slabs, volumetric precast bathrooms, precast facades and staircases are used extensively to improve construction efficiency and reduce wastage. Precast roof parapets, water tanks, tie beams, refuse chutes, manholes and fence wall are being applied in our new projects as appropriate. The use of prefabrication also improves quality and reduces long term maintenance.

Where applicable, the external facade colour of our new buildings are also selected to minimise heat absorption and aiming to keep building temperatures lower. At On Tai Estate, the colouring pattern was designed according to the thermal study which minimises the solar heat gain from the building facade.

Precast elements during building construction



Thermal study for external facade colour at On Tai Estate

OPERATION STAGE

To ensure our buildings operate sustainably and continue to contribute to carbon reduction efforts, we pay attention to managing building energy consumption using various innovative designs and installations. Where suitable, we install photovoltaic systems at the upper roofs of domestic blocks. The electricity generated from these photovoltaic panels will supply to the common facilities so as to reduce electricity demand and also indirectly reduce greenhouse gas emissions from the power plant. Besides outdoor installations, energy saving initiatives are also implemented inside the buildings. Two-level lighting control system has been deployed in the public corridor of each floor of the domestic blocks. Proper lighting control with the aid of motion sensors, photocell sensors, timer control switches and on-demand switches have also been adopted to reduce energy use.

To better utilise natural light to reduce energy use, a total 30 solar light tubes are installed at On Tai Estate for lighting up wet market and car park by reflecting and distributing natural light to the designated areas for optimal utilization of natural resources.

In addition, water-saving initiatives are widely applied in new development projects including the use of low water flow and flush sanitary fittings and fitments to achieve potable water saving and sewage volume reduction. Zero Irrigation System on planting trees on top of shrubs and groundcovers is adopted to reduce the consumption of potable water. Besides, we also make use of twin tank system to provide an uninterrupted fresh and flush water supply to residents and reduce water wastage during maintenance or cleaning.

To better utilise natural light to reduce energy use, a total 30 solar light tubes are installed at On Tai Estate for lighting up wet market and car park.

Zero Irrigation System in the stepped planters are adopted to reduce the consumption of potable water.

To promote a green and healthy living style, electric vehicle charging facilities in carparks are provided to promote the use of electric vehicle. Community farms in new projects also encourage the tenants to participate in greening activities at community level. For example, the community farm at Hoi Ying Estate aims at arousing tenants' awareness in greening and environmental protection through participating in gardening activities.

Community farm at Hoi Ying Estate

PV Panels at Hoi Ying Estate

Key statistics of the two estates are provided in the table below. HA will continue to develop low-carbon projects throughout the building lifecycle with the support of its supply chain partners.

	On Tai Estate	Hoi Ying Estate
District	Kwun Tong	Sham Shui Po
Number of blocks	11	2
Number of flats	8,561	1,319
Number of residents	25,100 (approx.)	3,600 (approx.)
BEAM Plus NB (Version 1.2) Final Assessment	Platinum (2020/21)	Gold (2020/21)

TARGETS AND OUTLOOK

- Environmental Awareness and Participation
- Energy Efficiency
- Greening and Landscaping
- Hazardous Material Management
- Waste Management and 4Rs
- Water Conservation

In 2020/21, the Hong Kong Housing Authority (HA) set 40 environmental targets, 37 of them were fully met, while the remaining 3 were close to the targets. Details of our targets achieved in 2020/21 and the targets set for 2021/22 are shown as follows:

ENVIRONMENTAL AWARENESS AND PARTICIPATION

	Targets for 2020/21	2020/21 progress	Targets for 2021/22
1	Review and monitor environmental awareness in public rental housing (PRH) by conducting surveys biennially.	Fully met	To be maintained
2	Monitor environmental awareness of the HA staff and enhance general awareness by reviewing and implementing training and publicity strategies.	Fully met	To be maintained
3	Collaborate with green groups to conduct environmental awareness programmes in PRH.	Fully met	To be maintained
4	Enhance the environmental performance of contractors on site through environmental management plan and use of environmentally sound construction method.	Fully met	To be maintained
5	Promote PRH tenants' awareness and participation related to waste separation at source, waste reduction and green management initiatives through various publicity channels such as estate newsletters and activities, broadcasting of rolling text or video in Housing Channel and other joint activities with green groups.	Fully met	To be maintained
6	Promote environmental message to HA staff by displaying environmental issues at HAHQ Green Corner.	Fully met	To be maintained
7	Enhance staff environmental awareness and knowledge by organising seminars related to Waste Management Plan, legislation updates, general seminars on environmental issues and campaigns to promote environmental protection.	Fully met	To be maintained
8	Enhance community awareness of environmental protection by organising programmes to promote environmental protection messages.	Fully met	To be maintained

ENERGY EFFICIENCY

	Targets for 2020/21	2020/21 progress	Targets for 2021/22
9	Reduce the electricity consumption of building services installations in communal areas of new domestic blocks.	Fully met	To be maintained
10	Adopt green design for building services equipment by conducting carbon emission estimation for projects with domestic blocks and energy estimation of domestic blocks for projects at detailed design stage.	Fully met	To be maintained
11	Explore, study and adopt the application of more energy efficient equipment, including • mass application of LED bulkhead lightings at the communal areas of all newly designed domestic blocks; • implementation of environmental lighting controls using motion-sensors and push buttons at the communal areas of all domestic blocks; and • implementation of gearless lift and regenerative power for lift with a capacity of 8kW or above in all new projects under design.	Fully met	To be maintained
12	Conduct Carbon Audit in the 14 PRH blocks representing the majority of PRH block types for monitoring and benchmarking purpose, and investigate measures for energy reduction when the building carbon emission is found exceeding the baseline figure.	Fully met	To be maintained
13	Perform various initiatives to reduce 5.5% electricity consumption compared to 2013/14 for HA office premises under comparable operating conditions.	Fully met	0.5% lower than the consumption of 2018/19

GREENING AND LANDSCAPING

	Targets for 2020/21	2020/21 progress	Targets for 2021/22
14	Provide green treatment to newly formed slopes such as hydroseeding, planting or other appropriate green treatments to soil, rock and other slope surfaces.	Fully met	To be maintained
15	Add new vegetation and promote greening in new public housing by • planting trees in all new public housing targeting at minimum one tree per 15 flats and conduct annual tree survey to ensure all new public housing meet the target; and • achieving an overall target of 30% green coverage and at least 20% for public housing developments at planning, design and implementation stage.	Fully met	To be maintained
16	Improve the slope appearance in existing PRH estates by providing green treatment to hard surfaced slopes and improving the existing vegetated slopes; and improve Chunam surfaces through hydroseeding, stone pitching and toe planters.	Fully met	To be maintained
17	Promote local residents and the community to participate in early plant raising for new housing estates.	Fully met	To be maintained
18	Promote community involvement in greening of the new PRH estates by introducing communal planting areas/community farms in master landscape layout plan at design stage and encourage PRH residents to participate in gardening and planting works within their own estates for recreation and education purposes.	Fully met	To be maintained
19	Re-landscape and upgrade the existing landscape facilities in the selected PRH estates by planting more trees and flowers through Landscape Improvement Programme.	Fully met	To be maintained
20	Promote community participation and increase tenants' awareness in greening of PRH estates, through organising greening activities in the estates, such as community garden programme, community greening participation programme and tree planting days.	Fully met	To be maintained
21	Promote staff/ tenant's involvement in greening activities.	Fully met	To be maintained

HAZARDOUS MATERIAL MANAGEMENT

	Targets for 2020/21	2020/21 progress	Targets for 2021/22
22	Abate the existing asbestos containing materials in the HA construction sites by implementing proper asbestos removal works in demolition.	Fully met	To be maintained
23	Implement asbestos abatement programme in PRH estates by • promulgating and enhancing publicity of locations and proper handling of Asbestos Containing Materials (ACM); • enhancing regular monitoring system on ACM; • formulating the asbestos abatement programme; • arranging regular training seminars or briefings; and • reminding project team to take proper mitigation measures.	Partially met[1]	To be maintained
24	Control hazardous materials to minimise harm to environment by collecting all disposed mercury-containing lamps in HAHQ for special waste treatment.	Fully met	To be maintained

[1] The in-flat inspection under "regular monitoring system on ACM" had once been suspended due to the COVID-19 pandemic. As at 31 May 2021, 99.05% of the concerned flats had been inspected.

WASTE MANAGEMENT AND 4Rs[2]

	Targets for 2020/21	2020/21 progress	Targets for 2021/22
25	All softwood and at least 50% of all timber used for all types of timber doors in the new public housing developments shall be from sustainable sources in compliance with BEAM Plus (New Building) requirement.	Fully met	To be maintained
26	Use timber from sustainable sources for temporary works during construction.	Fully met	To be maintained
27	Enhance the use of "green" materials and components.	Fully met	To be maintained
28	Arrange publicity activities in PRH estates to promote recycling of domestic waste for paper by not less than 27,000 tonnes.	Close to the target[3]	To be maintained
29	Arrange publicity activities in PRH estates to promote recycling of domestic waste for aluminium cans by not less than 1,400 tonnes.	Fully met	To be maintained
30	Arrange publicity activities in PRH estates to promote recycling of domestic waste for plastic bottles by not less than 1,800 tonnes.	Fully met	To be maintained
31	Promote recovery of domestic waste for used clothes by allowing charity organisations to collect used clothing and to promote used clothes recovery by not less than 850 tonnes in PRH estates.	Close to the target[4]	not less than 650 tonne
32	Promote recovery of glass bottles for recycling by arranging joint publicity activities with green groups in PRH estates.	Fully met	To be maintained
33	Promote recovery of rechargeable batteries by arranging publicity activities in PRH estates.	Fully met	To be maintained
34	Reduce domestic waste by promoting waste reduction through various publicity campaigns such as EMAC newsletters and activities, and other joint activities with green groups.	Fully met	To be maintained
35	Promote waste separation at source and green management initiatives by • implementing source separation of domestic waste programme in all estates; and • setting up collection point in the PRH estates for collecting domestic recyclable from tenants with incentives such as cash or household sundries for exchange.	Fully met	To be maintained

	Targets for 2020/21	2020/21 progress	Targets for 2021/22
36	Use environment-friendly paper for printing of all publicity materials.	Fully met	To be maintained
37	Perform various initiatives to reduce 3.5% A3 and A4 paper consumption compared to 2013/14 in all HA offices under comparable operating conditions.	Fully met	To reduce 4.0% compared to 2013/14
38	Perform various initiatives to encourage paper recycling for not less than 37 kg per staff.	Fully met	To be maintained

[2] 4Rs include Reduce, Reuse, Recycle and Replace.

[3] The drop in waste paper recovered was due to a combination of factors. These include changes in many residents' reading habit whereby they read printed newspapers less frequently; suspension of most of the promotional activities under the COVID-19 epidemic situation last year; and availability of more collection points currently in the community, etc.

[4] Apart from the suspension of most of the promotional activities under the COVID-19 epidemic situation, the drop in used clothes recovered was due to residents' increasing awareness of environmental protection and that more collection points are now available in the community, etc.

WATER CONSERVATION

	Targets for 2020/21	2020/21 progress	Targets for 2021/22
39	Reduce irrigation water consumption by providing Zero Irrigation Systems (ZIS) or other types of root-zone irrigation systems in all new building projects.	Fully met	To be maintained
40	Perform various initiatives to reduce 2.5% water consumption compared to 2015/16 for HAHQ under comparable operating conditions.	Fully met	To reduce 2.75% compared to 2015/16

SUMMARY OF STATISTICS

ENERGY CONSUMPTION

	Energy Consumed
Energy Consumption in Existing Housing Estates (kWh)	
Electricity consumption in public areas of estates	455,129,439
Average electricity consumption in public areas of estates (per flat/month)	50.3
Renewable energy generated from PV panels	1,066,404
Energy Consumption in HA Office Premises (kWh)	
Electricity consumption in office premises	33,407,921
Average electricity consumption in office premises (per staff)	3,391.49
Energy Consumption by Construction Contractors (GJ)	
Diesel consumption for construction activities	1,020,527
Diesel consumption for transportation of construction waste	54,534
Electricity consumption for construction activities	58,176
Gasoline consumption for contract cars	9,441

GREENHOUSE GAS (GHG) EMISSIONS[1]

	2016/17	2017/18	2018/19	2019/20	2020/21
GHG Emission Intensity in Existing Housing Domestic Blocks (tonnes CO_2e/m^2)					
Average of domestic block types	0.025	0.025	0.024	0.024	0.024
GHG Emission Intensity in HA Office Premises (tonnes CO_2e/m^2) [2]					
Block 3 of HAHQ	0.123	0.112	0.107	0.113	0.110
Lok Fu Customer Service Centre	0.144	0.140	0.136	0.139	0.138

1 Territory wide default GHG emission factors (0.7) were used based on the Guidelines to Account for and Report on Greenhouse Gas Emissions and Removals for buildings (Commercial, Residential or Institutional Purpose) in Hong Kong issued by the Environmental Protection Department, HKSAR in February 2010.

2 Greenhouse gas emissions figures are disclosed based on finalised carbon audit reports. Latest available reports cover period from 1 August 2020 to 31 July 2021.

MATERIALS CONSUMPTION

	Materials Consumed
Materials Consumption in HA Office Premises	
Paper consumption in office premises (reams/staff)	13.21

WATER MANAGEMENT

	Water Consumed	Water Recycled
Water Consumption in New Works Projects (m^3)		
New works projects	1,512,780	272,851
Water Consumption in Existing Housing Estates (m^3)		
Public areas of estates	3,733,141	-
Water Consumption in HA Office Premises (m^3)		
HAHQ	10,817	-
HAHQ (per staff)	2.68	-

WASTE MANAGEMENT

	Handling Method		
	Recycled	**Public fill**	**Landfill**
Amount Handled in New Works Projects (tonnes)			
Hazardous waste	20.69	-	0.27
Non-hazardous waste	180,486	1,591,049	109,401
Total waste for new works projects			1,880,956.96
Amount Handled in Existing Housing Estates (tonnes)			
Non-hazardous waste			
Paper	26,196	-	-
Plastic bottles	2,256	-	-
Aluminium cans	2,118	-	-
Used clothes	751	-	-
Glass bottles	539	-	-
Mooncake boxes	11	-	-
Amount Handled in HAHQ (tonnes)			
Hazardous waste			
Toner cartridges	5	-	-
Fluorescent lamps and tubes	4	-	-
Non-hazardous waste			
General waste	-	-	125
Paper	163	-	-