



HONG KONG REPORT

On the State of Sustainable
Built Environment

2017



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Built Environment

2017 

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KEY MESSAGES



Message from Chief Executive, Hong Kong Special Administrative Region



Hon. C Y Leung, GBM, GBS, JP
Chief Executive, Hong Kong Special Administrative Region

I am pleased to see the publication of the *Hong Kong Report on the State of Sustainable Built Environment 2017*. The report, published every three years, presents the current state of Hong Kong's built environment.

The 2017 Hong Kong Report carries the theme 'Transforming Our Built Environment through Innovation and Integration: Putting Ideas into Action', in keeping with the theme of the World Sustainable Built Environment Conference, 5-7 June, in Hong Kong.

The report details the joint efforts of the Hong Kong Government, together with industry and the community, in pursuing a sustainable built environment in our compact city of more than seven million people. Hong Kong has been working towards a high-density, low-carbon community since 1997, when the Government commissioned the 'Study on Sustainable Development for the 21st Century in Hong Kong'.

While the Government has taken the lead in adopting energy-saving and green-building design, community engagement is highlighted in a new, dedicated section of the report. It features projects ranging from community green stations to mobile apps. A sustainable built environment also requires

community involvement in a wide range of projects, large and small, from the adoption of building automation controls to the development of a master plan for a pilot smart city in Hong Kong's Kowloon East district.

Looking to the future, 195 countries, including China, have agreed to combat climate change and fulfil the 2°C target under the Paris Agreement. The Agreement, I am pleased to note, applies to Hong Kong, a Special Administrative Region of China. With buildings accounting for 60% of our carbon emissions, achieving a sustainable built environment forms a crucial aspect of our climate change strategy. I look forward to continuing our sustainable building reform, to showing the world how high-density Hong Kong can achieve low-carbon living, with all the advantages it brings to business and community.

A handwritten signature in black ink, appearing to be 'CY Leung', written on a light-colored background.

Hon. C Y Leung, GBM, GBS, JP
Chief Executive
Hong Kong Special Administrative Region

Message from Secretary for Development, HKSAR Government



Mr Eric Ma Siu-cheung, JP
Secretary for Development, HKSAR Government

Around 20% of global greenhouse gas emissions are building-related. The importance of green building has been well recognised in the global campaign against climate change. The Government of the Hong Kong Special Administrative Region in collaboration with the multi-disciplinary construction professionals has been driving the green building movement with the vision to build Hong Kong into a low-carbon smart city with green lifestyle.

This Hong Kong Report contains a collection of our insights, integrated efforts and achievements to spearhead the green building movement by pursuing sustainable built environment in this high-density city. This ascension of the movement capitalises on the synergy of building clusters and the distinctive environment of Hong Kong to optimise the cost-effectiveness of sustainability measures in decarbonising the high-rise buildings for further reducing greenhouse gas emissions and upgrading people's health and quality of life.

The Government has been striving to lead by example to adopt new green building features and technologies in public projects

and launching related policies. The staunch support of the industry and the community provides the necessary synergy for achieving our common goal. The integrated efforts are riding on our three-dimensional approach, namely 'Participation, Penetration and Process' for systematic and holistic implementation. The numerous public and private sector projects included in the report showcased our achievements over the years. They presented to us how thoughtful planning and design for sustainable development has been put into action and the sustainability features have been brought into real life.

We are very pleased to see the collaborative and valuable support for the World Sustainable Built Environment 2017 hosted by Hong Kong. We look forward to more international collaborations to embrace green building movement against climate change in future.

A handwritten signature in black ink, appearing to read 'Eric Ma', written over a light grey background.

Mr Eric Ma Siu-cheung, JP
Secretary for Development
HKSAR Government

Message from Secretary for the Environment, HKSAR Government



Mr Wong Kam-sing, GBS, JP
Secretary for the Environment, HKSAR Government

It is our great honour to be the host city of the World Sustainable Built Environment Conference 2017 (WSBE17). As a vibrant and compact world city where about 90% of the population lives in high-rise buildings, Hong Kong offers a unique setting for policy makers, experts, practitioners and other stakeholders to put our heads together to map the way forward to foster a more sustainable built environment for our future generations.

With the theme 'Transforming Our Built Environment through Innovation and Integration: Putting Ideas into Action', WSBE17 Hong Kong provides a global platform for developing and honing innovative ideas and policies for sustainable built environment of tomorrow. Here in Hong Kong, the penchant for sustainable built environment is not only shared by the some 1,800 delegates coming from 50 countries. Many business leaders in Hong Kong are also increasingly looking to innovative sustainable building ideas and practices as they seek to tackle the challenges of climate change and embrace energy saving in buildings.

In January this year, the Hong Kong SAR Government published the *Hong Kong's Climate Change Action Plan 2030+* which sets out the ambitious target to reduce Hong

Kong's carbon intensity by 65-70% by 2030 compared with the 2005 level. While the Government can make policies and commit to action plans to meet carbon reduction targets, we also need our people to be engaged. To partner with our stakeholders to develop a credible low-carbon pathway for the future, the Environment Bureau has created a dialogue platform, starting with the senior management of Hong Kong major property development companies and energy suppliers, followed by the hotel sector and others stakeholders under the '4T' framework, namely 'target', 'timeline', 'transparency' and 'together'. The partnership includes setting energy saving targets and timelines that would eventually dovetail with that of the Paris Agreement reporting timelines, as well as the sharing of practices and experiences on sustainable built environment and energy efficiency. This partnership is in its early days and we believe it has the potential to strengthen Hong Kong's capacity for energy saving and environmental sustainability in future.

We have outlined some of the key policy measures to promote sustainable built environment in Hong Kong in this 2017 report. In line with the '4T' spirit, this report can add transparency to the sustainable

building achievement in Hong Kong and contribute to the co-learning of experiences among the WSBE17 delegates.

I hope this overview of our efforts to promote sustainable built environment in Hong Kong can help stimulate further innovative ideas and practices to bring sustainable building development to new heights. May I also take this opportunity to express my gratitude to the Hong Kong Green Building Council for its unwavering support for promoting sustainable built environment in Hong Kong, and wish the WSBE17 every success.

A handwritten signature in purple ink, appearing to read 'Wong Kam-sing'. The signature is stylized and fluid.

Mr Wong Kam-sing, GBS, JP
Secretary for the Environment
HKSAR Government

Message from Secretary for Transport and Housing



*Prof. Anthony Cheung Bing-leung, GBS, JP
Secretary for Transport and Housing, HKSAR Government*

Hong Kong is one of the most densely populated cities in the world. We have to utilise our scarce land resources in an optimal and sustainable manner to satisfy the diverse needs of a vibrant and thriving society. Based on the latest projection under the Government's Long Term Housing Strategy, the total housing supply target is set at 460,000 units for the ten-year period from 2017/18 to 2026/27. The ambitious programme ahead bears a sizable carbon footprint and it is indeed a challenging task to accomplish it sustainably.

Driven by the vision to provide a better living environment for our citizens, the Government and the Hong Kong Housing Authority have been actively exploring new and innovative means towards housing and related developments and rolling out continuous improvement in various aspects without compromising the long-term sustainability of our environment.

The 2017 Report showcases a wide range of exemplary housing projects, both private and public, that walk an extra mile to realise the green building vision. Notable measures include more innovative use of resources, re-use of recycled or upcycled building materials, advancement in construction technologies

such as precasting and adaptation of BIM, adoption of passive design to optimise natural lighting and ventilation, integrated building management and energy saving innovations. The Hong Kong experience has proved that building green in a high-rise, high-density city is workable. Of course we must not stop here as more can be done to raise our standards.

It is indeed Hong Kong's great honour to be the host city of the World Sustainable Built Environment Conference 2017 (WSBE17 Hong Kong) to provide a global platform for green building leaders to share experience and exchange views on how to 'Transform Our Built Environment through Innovation and Integration', and in collaboration with other world cities, to 'Put Ideas into Action' for a greener Earth. We look forward to your active support and participation in WSBE17 Hong Kong in our collective mission to take forward building development, environmental protection and socio-economic development alongside each other harmoniously to create a liveable and sustainable environment for all.

A handwritten signature in black ink, appearing to read 'Anthony Cheung', written in a cursive style.

Prof. Anthony Cheung Bing-leung, GBS, JP
Secretary for Transport and Housing
HKSAR Government

Messages from Chairman of Construction Industry Council and Chairman of Hong Kong Green Building Council



2017 marks the 10th anniversary of the Construction Industry Council (CIC). It is most fitting to celebrate this special occasion by jointly hosting the WSBE17 Hong Kong with HKGBC, an organisation which we had founded and worked together to promote green and sustainable development of Hong Kong's construction industry since 2009.

We are proud to present the Hong Kong Report which records some of our achievements in the area of sustainability. We look forward to improving ourselves with the valuable exchange of knowledge and ideas at the WSBE17 Hong Kong for a better world.

A handwritten signature in black ink, appearing to read 'Chan Ka-kui'.

Sr Chan Ka-kui, BBS, JP
Chairman
Construction Industry Council



It is my sincere pleasure to share this Report with you. Since its establishment in 2009, the Hong Kong Green Building Council has dedicated itself to promoting green building development both at home and abroad. Our work in this respect covers a wide range of activities, and constantly engaging all stakeholders, including the industry, the Government and the general public.

In the pages of this report, you will find a selection of projects that showcase what is taking place here in Hong Kong. Particularly, the past few years have seen significant progress in terms of expanding the focus from a narrow view of building performance to a wider view of public engagement and community-wide success.

None of this would have been possible without the generous support of the Construction Industry Council. I offer my heartfelt thanks for its funding and support of our operations over the years, and for its valuable collaboration on many important initiatives. We look forward to sharing with you many more successes in future editions of this Hong Kong Report !

A handwritten signature in black ink, appearing to read 'Bay Wong'.

Sr Bay Wong
Chairman
Hong Kong Green Building Council

Messages from Chairman of WSBE17 Hong Kong Organising Committee and Chairman of Hong Kong Report Sub-committee



The successful organisation of WSBE17 Hong Kong was made possible by many people. In addition to the tireless work of the event organisers, we also saw a wide range of sectors from across society coming together to promote and celebrate Hong Kong's achievements in green building development. This report offers an insight on the work achieved to date, and more importantly, points the way towards the comprehensive issues that we all need to focus on in the coming years.

I heartily recommend that everyone, including industry stakeholders and the public, read this Hong Kong Report. In doing so, they will gain a new angle of appreciation on the many different sectors that are each playing an equally important role in transforming the local built environment in such a way that benefit everyone.

As you look through the pages that follow, you will see that this report is not an end destination, but rather a critical part of a life-long journey. It points the way to the many endeavours that are yet to come as we work with all stakeholders to create an even better living environment for everyone in Hong Kong. It is my earnest hope that it will move and inspire you to join us on that journey.

A handwritten signature in black ink, appearing to read 'Conrad Wong', written over a light grey background.

Ir Conrad Wong Tin-cheung, BBS, JP
Chairman
WSBE17 Hong Kong Organising Committee



I would like to express my sincere appreciation for the involvement and contribution of everyone on the Hong Kong Report Sub-committee. It was not an easy task to create a Report that could capture the many actions and diverse achievements of the Government, industry, academia and the public.

In particular, there are two special parts that differentiate this report from the 2014 version. Firstly, we have conducted an industry survey to better understand and map the market's response to green building. The data collected from this survey can be used as the baseline so that we can check whether Hong Kong can achieve continuous improvements in future. Secondly, this report also dedicates more attention to community engagement, which is a crucial factor in creating a successful sustainable built environment.

Thanks to the overwhelming support of all contributors, this report offers an informative and inspirational view of our progress to date, and shows that the future is rich with potential for even greater progress. There is still much to be done, but this report is a heartening reminder that together we can achieve great things.

A handwritten signature in black ink, appearing to read 'LM Chow', written over a light grey background.

Mr LM Chow
Chairman
Hong Kong Report Sub-committee

INTRODUCTION



INTRODUCTION

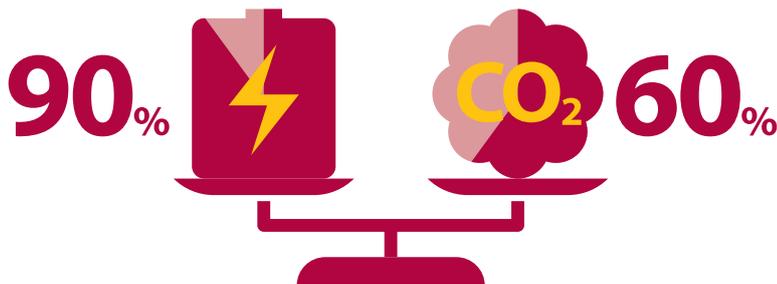


One of the world's most iconic cities, Hong Kong is famous for its unique subtropical built environment of high-rise, high density urban areas, juxtaposed with a large expanse of hilly and mountainous terrain. For many decades it has been one of the world's most densely populated places, with the majority of its more than 7.3 million residents living and working in urban skyscrapers.

Today, buildings, where much of our activities take place, account for some 90% of Hong Kong's total electricity consumption, compared to a global average of 40%. In turn, this high level of energy consumption by buildings accounts for 60% of the city's greenhouse gas emissions.

It is obvious, therefore, that buildings play a crucial role in achieving new energy savings in Hong Kong, and reducing greenhouse gas emissions. In recognition of this, creating a sustainable built environment (SBE) is an indispensable part of Hong Kong's master plan to combat climate change.

Significance of Buildings in Hong Kong



Our activities in buildings account for 90% electricity consumption or 60% carbon emissions

High Population Density



42,000+ buildings in private sector

Against this backdrop, the Government, industry stakeholders, academics and the broader community have all been putting tremendous effort into enhancing and accelerating the city's sustainable development in recent years. In particular, the past three years have seen Hong Kong's preparation for the World Sustainable Built Environment Conference 2017 Hong Kong (WSBE17 Hong Kong). This high-level global conference concludes the 2015-2017 cycle of the renowned SBE Conference Series. Themed 'Transforming Our Built Environment through Innovation and Integration: Putting Ideas into Action', this landmark conference brings together international experts to discuss how to sustainably transform the built environment, not only in the unique urban environment of Hong Kong, but in urban areas across the planet. The ideas and experiences shared at this world-class event will play an important role in achieving the 2°C target set at COP21.

Since 2008, the *Hong Kong Report on the State of Sustainable Built Environment* is also published every three years in parallel with the SBE Conference Series. This year, the report shares the theme of WSBE17 Hong Kong to showcase how Hong Kong is putting sustainability ideas into action. Through a series of case studies, it offers a fascinating insight into how Hong Kong is responding to the call for a more sustainable environment through innovative new practices and the integrated efforts of all stakeholders.

A three-dimensional approach to sustainability

In broad terms, Hong Kong's innovative and integrated efforts can be exemplified in three key aspects, namely Participation, Penetration and Process:



That's why, in addition to government policies, industry tools and exemplary industry projects, this report includes a dedicated section on community engagement to showcase the effort that Hong Kong is making in engaging the public in green building issues, and driving behavioural change to achieve a greener community.

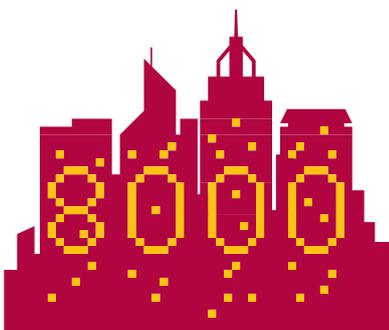
Penetration - from neighbourhoods to buildings to interiors

A sustainable built environment comprises much more than just buildings. In addition to the environmental performance of each building itself, it's vital to also place more emphasis on the building's occupants, namely how the building impacts on the health and wellbeing of those occupants, and the role that the building plays in the overall development of the surrounding neighbourhood.

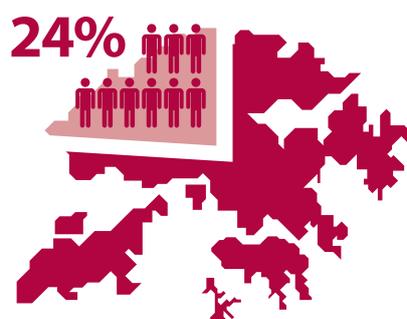
Participation - from government to industry stakeholders to the public

The Government and the construction industry have long been working together to identify and implement new sustainability measures, with the long-term goal of transforming Hong Kong to a sustainable built environment. However, that transformation cannot be successful without the participation of the public, who are the ultimate operators and users of the built environment.

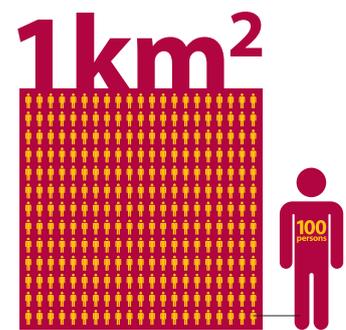
This report examines a careful selection of projects that showcase how Hong Kong is making great strides in its holistic approach to creating a sustainable built environment. Examples include projects of every scale, from the fitting out of an office unit, and the transformation of an existing building, to the construction of a new building, and even the master planning of a new district. Together they show how the SBE movement in Hong Kong has successfully penetrated projects of all types and scales.



8,000 high-rise buildings and skyscrapers



People live and work in 24% of Hong Kong's total area



Average population density of built-up areas 27,330 persons/km²

INTRODUCTION



Process – from research to planning to implementation

Addressing Hong Kong's unique SBE challenges is an ongoing process, and it starts with detailed research. In this report you will see a variety of research projects that are playing a key role in the development of greener materials and technologies, with findings that provide a solid foundation for the formulation of new plans and strategies. A number of these research and planning projects have already been put into practice, creating real change in construction practices and the built environment.

Report Highlights

Further highlights of this report include the following sections:

Government Policies

In recent years, the Hong Kong SAR Government has taken a proactive and holistic approach to creating a sustainable built environment. This section of the report introduces the latest policies and action plans covering the realms of planning, urban landscapes, water management, renewable energy, energy saving, climate change, and more.

Driving Hong Kong's Green Building Industry

Two key institutions, namely the Construction Industry Council (CIC) and the Hong Kong Green Building Council (HKGBC), are leading Hong Kong's green building movement. This section of the report summarises how the CIC and HKGBC are bringing together the Government, industry and academia, and encouraging professional exchange between Hong Kong and overseas experts, to drive green building development in all areas of Hong Kong.

Community Engagement

Citizens in Hong Kong are becoming more and more aware of how important it is to protect the environment. This awareness has turned into a strong desire for change, and a commitment to creating a better society. In this report, we have selected some of the many local initiatives that reveal how this trend is continually growing and gaining momentum.

Market Response

In many respects, the response of the construction industry to green building trends is what determines the sustainability of the overall market development. This report includes the results of a recent survey that examines the current market status and explores the way forward.

Public and Industry Projects

From refurbishing an office unit to transforming an existing building, from developing a new building to planning an entire district, this section includes a selection of projects of various scales and natures to show how both Hong Kong's public and private sectors are contributing to the creation of a sustainable built environment.

Research and Planning

Research and planning are key components in the development of innovative yet practical new SBE solutions, from highly efficient solar cells and greener construction practices to energy-efficient buildings and climate-resilient urban planning. This section of the report takes a closer look at the far-reaching research and planning works that are influencing Hong Kong's transformation to a sustainable built environment.



GOVERNMENT POLICIES



The Hong Kong Government is a steadfast supporter of the green building movement and is committed to building a sustainable future and ensuring that future generations can continue to thrive in a clean and green environment. Raising the environmental performance of buildings will have a huge impact on the sustainability of our environment and has been high on the Government's agenda. The Government's policy direction thus concerns ways of improving the overall built environment as well as the performance of individual buildings themselves.

GOVERNMENT POLICIES

Smart City in Kowloon East



Facilitating the transformation of Kowloon East (KE), in particular the already built-up areas, poses a great challenge. KE covers an area of about 488 hectares comprising two distinct settings, namely the 320-hectare former airport site, which is now undergoing comprehensively planned developments, and the 168-hectare built-up areas in the Kowloon Bay Business Area (KBBA) and the Kwun Tong Business Area (KTBA).

The Energizing Kowloon East Office (EKEO) of the Development Bureau has adopted a visionary, coordinated and integrated approach to transform KE into Hong Kong's second core business district (CBD2).

Enhancing Connectivity

For instance, it advocates the concept of

'Walkable KE' by formulating short, medium and long-term proposals to improve the pedestrian environment and traffic conditions in both Business Areas.

As of October 2016 it had completed 48 improvement schemes relating to pedestrian and traffic facilities. It has also collaborated with academic institutes, non-profit organisations, building owners, local and overseas artists, local industrialists and other government departments, to face-lift some back alleys so as to draw more pedestrians away from areas of busy traffic. This ongoing initiative continues to improve KE's back alleys.

In tandem, the EKEO is preparing to carry out medium-term improvement proposals, including the enhancement of pedestrian

links between Ngau Tau Kok MTR Station and the waterfront by subways, and between Kowloon Bay MTR Station and the future East Kowloon Cultural Centre and nearby residential areas by an additional footbridge link.

To enable the public to enjoy the benefits of improved connectivity as soon as possible, it is proactively steering and coordinating concerted efforts in the formulation of new policies. Under a pilot scheme announced in the Government's 2016 Policy Address, landowners of Kowloon Bay and Kwun Tong Business Areas are encouraged to provide pedestrian links based on the planned pedestrian network through a waiver of the land premium payable for the necessary lease modification.

Improving the Environment

The EKEO places strong emphasis on enhancing the environment through quality urban design, land use review/restructuring, and streetscape enhancement. The Kwun Tong Promenade, completed in May 2015, is an example of this. A comprehensive 'Energizing Hoi Bun Road - Green Operation' is now underway, with the EKEO coordinating the efforts of relevant works departments for prompt completion of greening and face-lifting works along Hoi Bun Road.

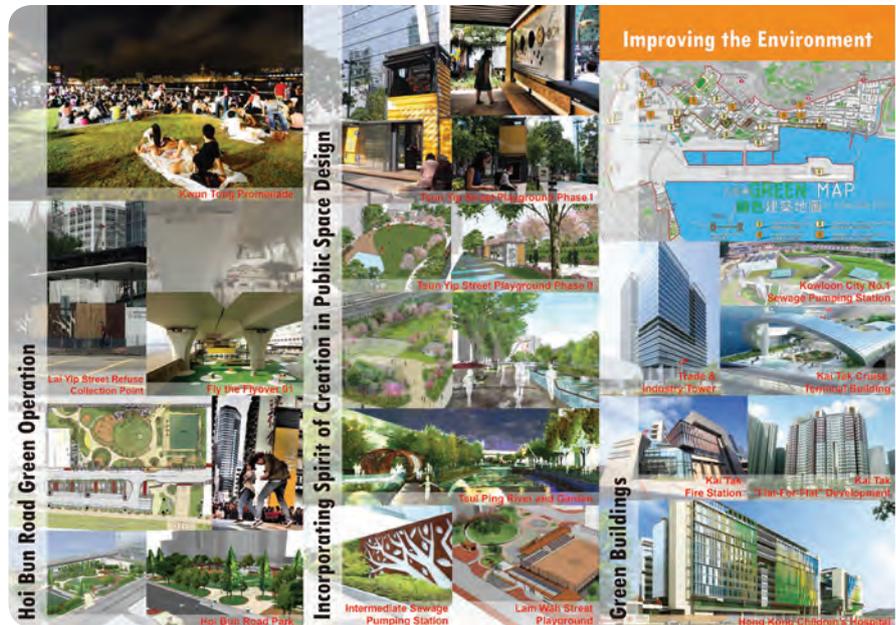
A piece of land beneath Kwun Tong Bypass has also been turned into an informal performance venue called 'Fly the Flyover 01' (FF01). Works to convert the adjacent sites (FF02 and FF03) into similar art, cultural and creative venues are in progress.



A study on the industrial culture of KE identified that the 'Spirit of Creation' is a theme that resonates in the area. In recognition of this strong industrial heritage, cultural elements have been incorporated into the design of the Tsun Yip Street Playground Phase 1 improvement, and will also be extended to the Phase 2 works currently under construction. Further park enhancement projects in the pipeline will continue to showcase KE's industrial culture, which in aggregate will give the entire district a distinctive identity.

In collaboration with the Drainage Services Department, EKEO is developing environmental, ecological and landscaping proposals to transform the existing King Yip Street nullah into Tsui Ping River. It has also restructured the land uses in the King Yip Street area. For instance, the existing Shing Yip Street Garden will be re-provided as the Tsui Ping River Garden on a site closer to the estuary, accentuating the scenery of KE's blue-green infrastructure.

To build a green CBD2, the EKEO has set standards for new land sale sites in KE since



2013 by requiring a higher greening ratio and attainment of BEAM Plus Provisional Gold rating or above. It has likewise advocated the adoption of low-carbon and green elements in government buildings. To date, KE already has 23 public and private buildings which have attained a BEAM Plus Gold or Platinum rating.



can contribute to the development of a Smart City. The EKEO will ride on these efforts to integrate further proposals that increase the overall benefits to the district.

Smart and green buildings are conducive to quality living and a better environment. As an initial step in pushing ahead the Smart City initiative in KE, the EKEO has stipulated the provisioning of smart water meter systems and electric vehicle charging facilities for all new land sale sites, as well as the supply of real-time parking vacancy information in commercial car parks at appropriate sites.

It likewise commissioned a consultancy study in February 2016 to formulate a framework strategy, set directions and prioritise various innovative proposals to address key issues. Proof of concept trials will be held to demonstrate the effectiveness of some of these innovative proposals. For those that are proven, the EKEO will consider their scalability and implementation mechanism with a view to facilitating the co-creation of KE into a vibrant, smart and sustainable CBD2.

Project Facilitation

The EKEO plays an important advisory and facilitation role for public and private sector development projects in KE. A holistic approach rather than infrastructure-led or wholesale redevelopment is being adopted to facilitate KE's organic growth whilst also respecting the local ecology and the needs of the more than 270,000 people working there. It remains committed to facilitating new building developments and conversion projects in the pipeline, as well as providing input on the preparation of land sale conditions for KE's future development into a major new hub.

GOVERNMENT POLICIES

Total Water Management Strategy



To address the threat to the water supply arising from challenges like population growth and climate change, the Government promulgated a Total Water Management (TWM) strategy back in 2008 which emphasises containing water demand growth by conservation while also developing new water resources. The Government has since been implementing various measures under the strategy and laid a solid foundation for sustainable water management.

Water conservation

Water conservation is the cornerstone of sustainable water usage. The Government is taking a multi-pronged approach to promote water conservation using both hardware and software measures.

For instance, the Government has been promoting water conservation to users

in domestic and non-domestic sectors through a number of vehicles, such as the Water Supplies Department's (WSD) Water Resources Education Centre, the 'Let's Save 10L Water' campaign, and the 'Cherish Water Campus' Integrated Education Programme, as well as best practice guidelines for major water-consuming trades including the catering and hotel industries. The Government has also been installing flow controllers at public rental housing estates, schools and government buildings. Further to the phased implementation of the Voluntary Water Efficiency Labelling Scheme (WELS), which launched in 2009 and now covers showers, water taps, washing machines, urinal equipment and flow controllers, the Government is planning to implement the mandatory use of designated products registered under WELS for all new buildings and existing buildings under major renovation.

Water Intelligent Network

Having achieved a significant reduction in water mains leakage through a 15-year replacement and rehabilitation programme for 3,000 km of aged water mains, the Government is now progressively establishing a Water Intelligent Network to continuously monitor network healthiness so as to achieve timely and appropriate interventions that reduce water loss throughout the water network.



New water resources

The Government has long adopted a three-pronged approach to Hong Kong's water supply, namely using seawater for flushing purposes, importing Dongjiang water from Guangdong Province, and collecting rainfall through natural catchment. However, with challenges arising from climate change and competing demands for Dongjiang water in neighbouring cities, the Government needs to take a responsible approach to diversify Hong Kong's supply sources and thereby enhance its water security for the decades to come. Apart from expanding the saltwater supply system, the Government has been exploiting alternative water resources less susceptible to climate change, including seawater desalination, reclaimed water, grey water reuse and rainwater harvesting.

As a coastal city, Hong Kong has abundant seawater resources. Taking advantage of this and of advancements in the related

technology, the Government has embarked on the design of a medium-sized seawater desalination plant at Tseung Kwan O, which will have an output capacity capable of meeting 5-10% of Hong Kong's freshwater demand.

The Government is targeting to supply reclaimed water to the north-eastern part of the New Territories in phases starting with Sheung Shui and Fanling. Studies on the financial and legal frameworks for the supply of reclaimed water are currently in progress.

In addition, the Government has developed technical specifications and water quality standards for grey water reuse and rainwater harvesting for non-potable uses. The Government plans to include grey water recycling and rainwater harvesting systems for non-potable uses in all suitable new public works projects.



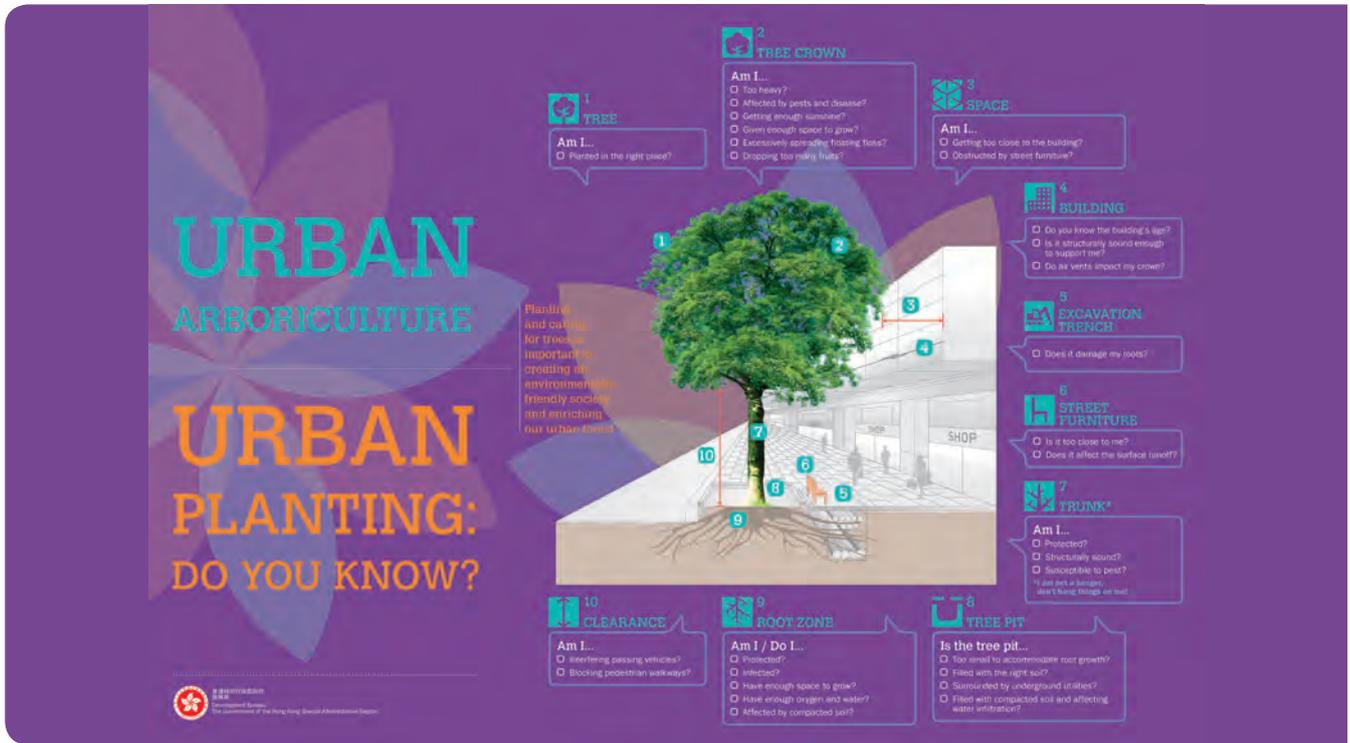
Moving ahead

Right now, a review of the TWM strategy is being conducted with an aim to ensure the sustainable use of precious water resources and the timely introduction of new initiatives to further strengthen Hong Kong's preparedness and adaptiveness against future uncertainties and challenges.

With the implementation of its TWM strategy and on-going initiatives, the Government is making good progress in evolving from the current three-pronged supply towards a six-pronged supply through the development of seawater desalination, reclaimed water and grey water reuse, and rainwater harvesting to enhance Hong Kong's water security, reliability and resilience.

GOVERNMENT POLICIES

Approach to Urban Landscapes



Use of Recycled and Green Materials in Public Works

The Government is taking the lead in making Hong Kong a green city through a number of measures, including the expansion of green procurement in public works. In this connection, the Environment Bureau has set up an Inter-departmental Working Group on Green Government Procurement. To encourage the wider use of green materials in public works projects, the Development Bureau has likewise set up a Sub-group on Green Procurement in Public Works Projects under the above Inter-departmental Working Group to identify and monitor the use of green materials in public works projects and to formulate guidelines, policies and strategies to promote their use.

Under the framework for procurement of recycled and green materials in public works projects, the Government's various works departments and the Housing Department have been using paving blocks with recycled glass (eco-pavers) as a standard requirement in road maintenance contracts and selected housing projects. Between 2010 and 2015, about 1,086,300 m² of eco-pavers were laid in both public works projects and housing projects, representing about 21,000 tonnes of recycled glass. Other uses of crushed glass

(i.e., glass cullet) are also being explored, such as for fill materials and for reclamation purposes in selected projects.

In 2008, the Highways Department mandated the use of up to 15% of Reclaimed Asphalt Pavement (RAP) in road maintenance contracts. The use of such reclaimed materials has progressively increased to 20% and 30% of the base course and wearing course respectively under all road maintenance contracts. In 2014, an estimated total of 128,000 tonnes of RAP were used.

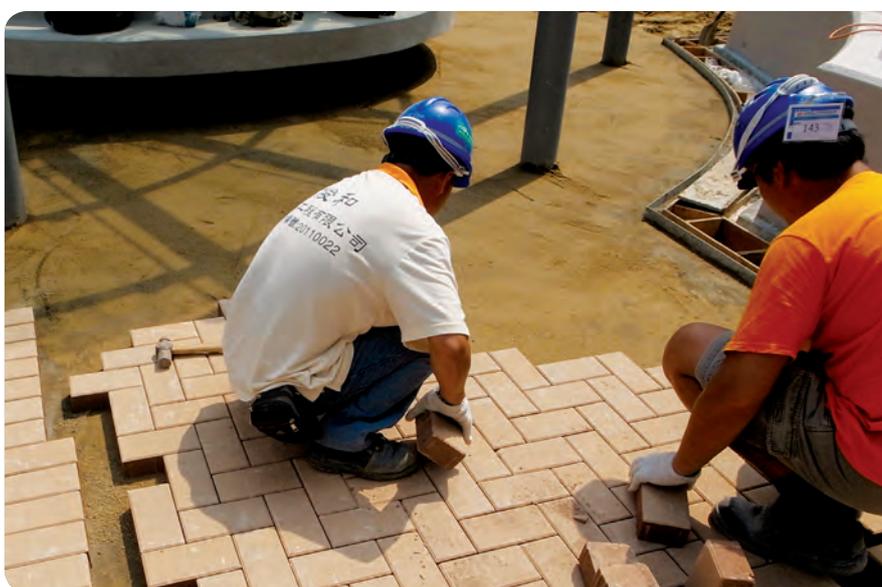
Ground Granulated Blast-furnace Slag (GGBS) is basically a by-product of the iron manufacturing industry. GGBS concrete offers much lower levels of embodied carbon than that of concrete made with pulverised fuel ash. In Hong Kong, GGBS concrete was successfully tried out during the construction of Tsing Ma Bridge and Stonecutters Bridge, at about a 60-70% cement replacement level. The Housing Department has also used GGBS in its precast concrete façades fabricated in the mainland China.

On-site activities including site offices and construction works are the largest



contributor to emissions in the construction process. With a view to encouraging the use of non-road mobile machinery (NRMM) to meet the emission requirements under the Environmental Protection Department's new legislation, and to accelerate the phasing out of non-compliant NRMM, the mandatory use of four types of NRMM approved under the legislation in new major capital works contracts was introduced on a progressive basis starting in 2015. To further reduce carbon emissions, all non-road-based construction machinery under new public works projects are now using B5 diesel, which is a blend of 95% Euro V diesel and 5% biodiesel.

Public works projects have also adopted the specifications for sustainable design and green features in site offices, with a view to promoting green site offices in new public works. The use of electric vehicles (EVs) in public works contracts has been adopted as far as practicable, as EVs have no tail-pipe emissions and can help improve roadside air quality. A total of 64 EVs have been in service under the Government's maintenance and capital works contracts since 2012.



GOVERNMENT POLICIES

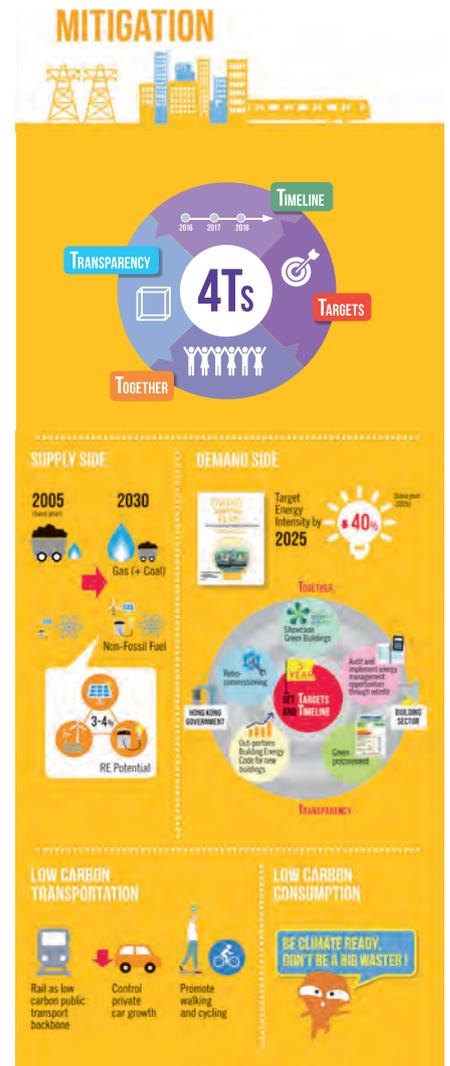
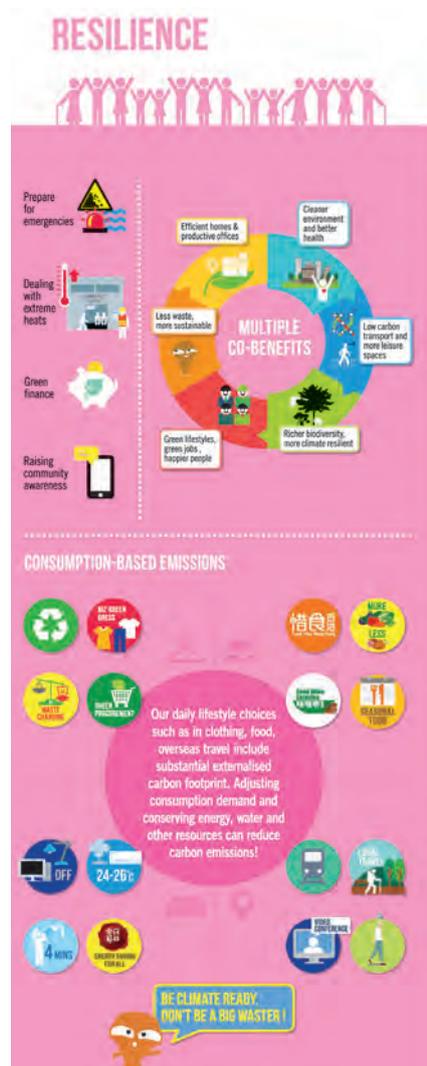
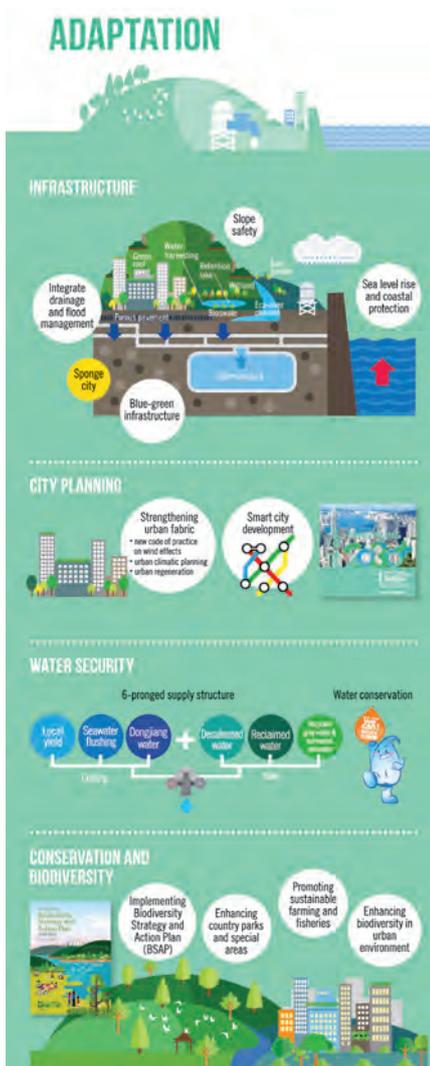
Tackling Climate Change through Green Buildings and Energy Conservation

In December 2015, 195 countries including China adopted the first-ever universal, legally binding global deal to combat climate change in Paris (the Paris Agreement). The Paris Agreement, which came into force in November 2016, applies to Hong Kong as well. In light of this development, the Steering Committee on Climate Change (SCCC), chaired by the Chief Secretary for Administration and comprising all 13 Policy Secretaries, has examined international experience in combating climate change and reviewed the scope for enhancing Hong Kong's mitigation, adaptation and resilience actions. Taking into account these findings together with views collected in 2016 from various stakeholders

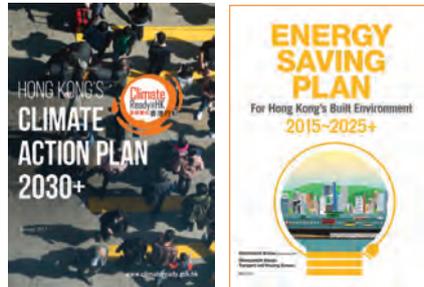
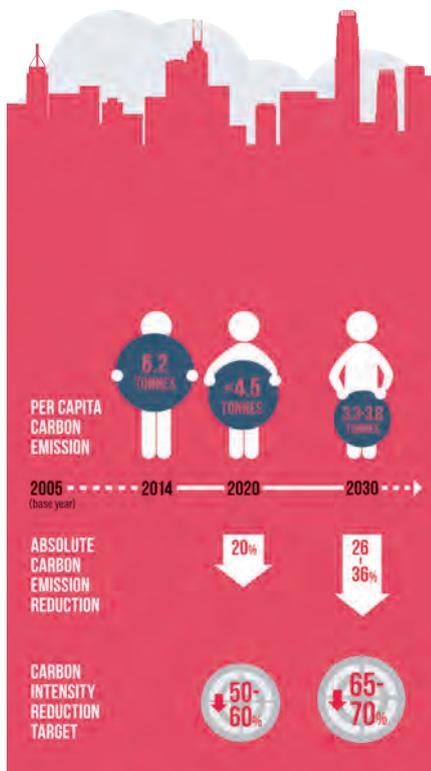
and the public on Hong Kong's long-term climate strategy, the SCCC recommended setting a target to reduce our carbon intensity by 65-70% by 2030 compared with the 2005 level, which is equivalent to an absolute reduction of 26-36%, resulting in a per capita emission of 3.3-3.8 tonnes in 2030. The SCCC also recommended a number of measures to achieve the target. The Chief Executive accepted the SCCC's recommendations, the gist of which were covered in his Policy Address on 18 January 2017.



The HKSAR Government released in January 2017 the *Hong Kong's Climate Action Plan 2030+*, an enhanced climate change work plan, setting out in greater detail the new target and key measures on mitigation, adaptation and resilience to combat climate change.



TARGET



As electricity generation accounts for almost 70% of Hong Kong's carbon emissions, we need to replace the majority of the coal-fired generation units which are due for retirement, and instead use cleaner energy sources. This approach will have a significant tariff impact. A consensus in society will be required for us to achieve our carbon reduction target for 2030. In addition, the Government will further promote energy saving and the development of renewable energy (RE).

Energy Saving

Hong Kong is a dynamic international financial centre with a population of 7.2 million, most of whom live and work in high-rise buildings. There are about 50,000 buildings in Hong Kong, about 8,000 of which are owned and managed by the Government. As electricity use in buildings accounts for about 90% of the total electricity consumption in Hong Kong, energy efficiency in buildings is the most critical means to continuously reduce carbon emissions.

The Government promulgated the *Energy Saving Plan for Hong Kong's Built Environment 2015~2025+* (ESP) in 2015, which sets a target of reducing Hong Kong's energy intensity by 40% by 2025. Achieving this target requires actions by the whole community. To promote energy saving in buildings, we have taken a number of steps on multiple fronts.

Government Leading by Example

The Government has been leading by example in green building labelling and energy saving. The Environment Bureau (ENB) and Development Bureau (DEVB) of the Government first published the joint circular on 'Green Government Building' to promote green government buildings in 2009. The joint circular was updated in 2015 to enhance the environmental performance framework of new and existing government buildings. It provides that all new government buildings of construction floor area above 5,000 m² with central air-conditioning or above 10,000 m² should aim to obtain the second highest grade (i.e. Gold rating) or above under the BEAM Plus as far as practicable. New government buildings, irrespective of size, which serve as landmarks or are of iconic nature (e.g. Kai Tak Cruise Terminal, the Energizing Kowloon East Site Office), should achieve the highest grade (i.e. Platinum rating).

PARIS AGREEMENT AND HONG KONG

FIGURE 2
TIMELINE 2017-2030



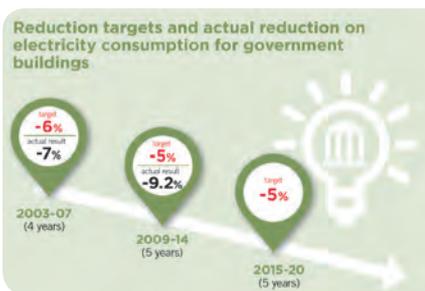
Hong Kong will need to review our climate change efforts every 5 years and align them with the submission timelines under the Paris Agreement. The timeline for review up to 2030 for Hong Kong is expected to be as follows:

GOVERNMENT POLICIES

Tackling Climate Change through Green Buildings and Energy Conservation



• Sing Yin Secondary School



To date, about 100 government building projects have been registered under BEAM Plus certification. Among the certified government building projects, 17 have achieved a Platinum rating and 14 of them have achieved a Gold rating. High ratings are also envisaged for the remaining ones yet to be certified.

In addition, the Government has developed demonstration projects to showcase state-of-the-art energy efficient designs and technologies, including Sing Yin Secondary School and the Trade and Industry Tower at Kai Tak Development. Sing Yin Secondary School was rated Platinum under HK-BEAM and won the Certificate of Merit by the Hong Kong Green Building Council (HKGBC) in 2013. It was also awarded '2013 Greenest School on Earth' by the US Green Building Council. As for the Trade and Industry Tower, it has achieved a Platinum rating in BEAM Plus Provisional Assessment.

The Hong Kong Housing Authority, which is the developer of public housing, has been incorporating green concepts into its projects for many years. It adopts a policy to get its new projects 'BEAM Plus Gold Ready' so that all new public housing production from 2015/16 achieve a performance equivalent to at least BEAM Plus Gold.

The Government has taken the lead to set specific electricity reduction targets for government buildings since 2003. We have already achieved an energy saving of over 15% over the past decade. On top of this, the Government has set the target of 5% saving in the electricity consumption of government buildings from 2015/16 to 2019/20 under comparable operating conditions in 2013/14.

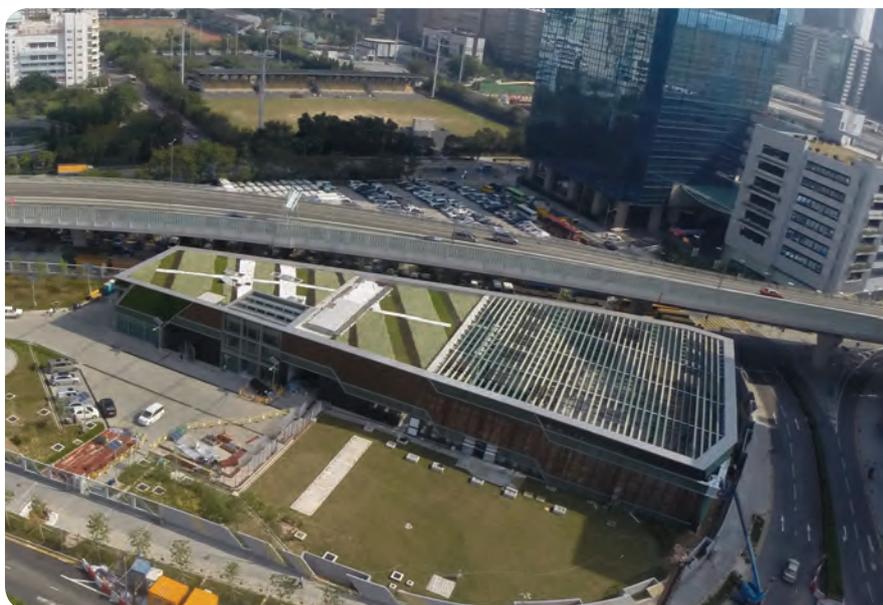
To achieve this target, a series of measures has been introduced, including the conduct of energy audits for about 350 major government buildings with comparatively high annual electricity consumption to identify energy management opportunities. At least HK\$500 million has been earmarked to gradually implement electricity saving projects identified in the energy audits in the next five years starting in Financial Year 2017/18. Bureaux and departments have been advised to strengthen energy saving efforts such as appointing green managers/wardens and adopting green housekeeping measures. All new government buildings should aim to outperform the Code of Practice for Energy Efficiency of Building Services Installation (Building Energy Code or BEC) by 3-10%.

Retro-commissioning is a cost-effective and useful means for energy saving in existing buildings. To promote retro-commissioning, the Electrical and Mechanical Services Department (EMSD) has conducted pilot studies in six government buildings. EMSD will publish technical guidelines in mid-2017 to assist building owners and relevant trades to conduct retro-commissioning. EMSD has also been working with the HKGBC to promote retro-commissioning to the private sector and a seminar for the relevant trades, property developers and property management companies was held in late January 2017.



Government Investing in Energy Efficient Infrastructure

Compared with traditional air-cooled air-conditioning systems and individual water-cooled air-conditioning systems, district cooling systems (DCS) consume 35% and 20% less electricity respectively. Other benefits of DCS include reduced heat island effects, avoidance of noise and vibration arising from the operation of heat rejection equipment and chillers of air-conditioning plants in buildings, and more flexible building design which allows more green features such as green roof and installation of renewable energy systems that can contribute to the development of distributed renewable energy.

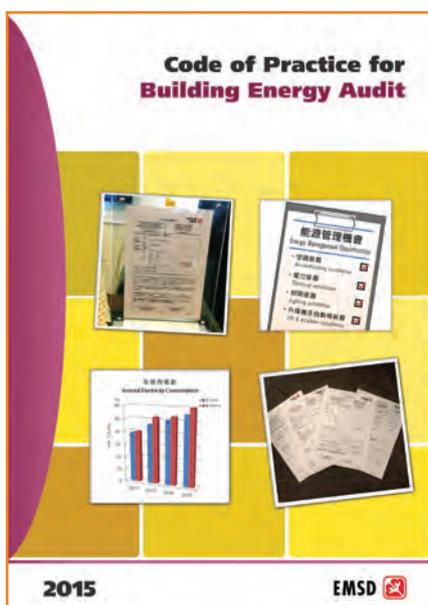


The Government is constructing the first-of-its-kind DCS at the Kai Tak Development (KTD) at an estimated total cost of more than HK\$4.9 billion. The maximum annual saving in electricity consumption upon completion of the entire DCS project is estimated to be 85 million kWh. DCS will also be considered for New Development Areas and Redevelopment Areas to further foster low-carbon development.

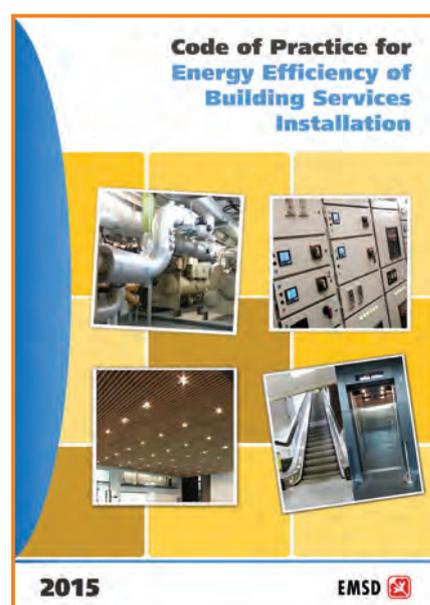
Promoting Energy Saving in the Private Sector

On the regulatory front, the Government has implemented the Buildings Energy Efficiency Ordinance (BEEO) which requires central building services installations in newly constructed buildings and buildings undergoing major renovation to meet the minimum energy efficiency standards stipulated in the BEC.

The BEC standards are reviewed every three years to reflect the development of international standards and latest technological advancement. These standards are expected to bring about an accumulative energy saving of 5 billion kWh by 2025,



equivalent to a reduction in greenhouse gas emissions of about 3.5 million tonnes. BEEO also requires owners of commercial buildings to carry out an energy audit of central building services installations every ten years.



The Buildings (Energy Efficiency) Regulation requires commercial and hotel buildings to meet the Overall Thermal Transfer Value (OTTV) standards to reduce energy consumption for air-conditioning. The Government further promulgated a new Residential Thermal Transfer Value (RTTV) standard for residential buildings which took effect in April 2015. All standards are subject to regular reviews.

GOVERNMENT POLICIES

Tackling Climate Change through Green Buildings and Energy Conservation

Our key focus going forward is existing buildings, since these represent the majority of buildings where the potential for energy saving is very significant. With 65% of the electricity being consumed by the commercial sector, which includes government and institutional buildings, this is where we must focus our early attention.

As pledged in the ESP, ENB has established a partnership with major stakeholders in the built environment under the 4T framework, namely target, timeline, transparency and togetherness. The partnership includes property developers, property management companies, hotels, utility companies, professional organisations, large corporations and public bodies. It is a voluntary platform to encourage stakeholders to operationalise the Paris Agreement and exchange energy saving practices and experiences.

We have encouraged the 4T partners to set their own energy saving targets and timelines and to share with us their energy saving measures. It was found that the estimated aggregate electricity saving of the 4T partners is about 5% in 2015-2020.

Through several rounds of gatherings and information exchange with the Government and each other, a broad consensus has been reached for the building sector to partner under the voluntary 4T framework to reduce electricity consumption on an on-going basis.

The partnership includes:

- Setting energy saving targets according to a timeline that would eventually dovetail with that of the Paris Agreement reporting timeline;
- Carrying out building energy audits and implementing recommendations;
- Conducting retro-commissioning periodically;

- Procuring green products that would help save energy;
- Out-performing the BEC for new buildings and major retrofits where possible;
- Applying for BEAM Plus rating or equivalent for new and existing buildings; and
- Joining the Energy Saving Charter.

Works Subsidy' to encourage property owners to use environmentally-friendly building materials and install energy saving facilities when carrying out building maintenance and repair works, with an aim to benefit more occupants living in unsatisfactory living conditions. The maximum subsidy amount for green items and related consultancy fee is HK\$600,000 per owners' corporation.



This 4T partnership will be on-going and we welcome more participation by stakeholders. ENB and EMSD will continue to work with the 4T partners on specific strategies to promote energy saving, such as the promotion of retro-commissioning which would also help stimulate an energy efficiency market for existing buildings.

The Government will continue to encourage building owners to make use of various existing tax concessions, loan schemes and funding schemes to procure energy saving installations. To encourage the business community to adopt environment-friendly machinery and equipment, the Government has since 2008 introduced a 100% profits tax deduction for capital expenditure on such equipment in the first year of purchase. For environmental protection installations mainly ancillary to buildings, the depreciation period has been shortened from the usual 25 years to five years as well. The Urban Renewal Authority has also introduced the Green Item Subsidy under the 'Common Area Repair

To encourage the public to take concrete actions to enhance building energy efficiency, the Government established a HK\$450 million Buildings Energy Efficiency Funding Schemes (BEEFS) in 2009 to subsidise buildings with owners' committees to conduct energy and carbon audits and to implement energy saving projects. BEEFS was completed in 2012 as scheduled. Over 6,400 buildings, or more than one seventh of the total building stock in Hong Kong, received subsidies under BEEFS. BEEFS also fostered the market for green building and energy saving and augmented the Government's efforts to promote green building in the private sector.



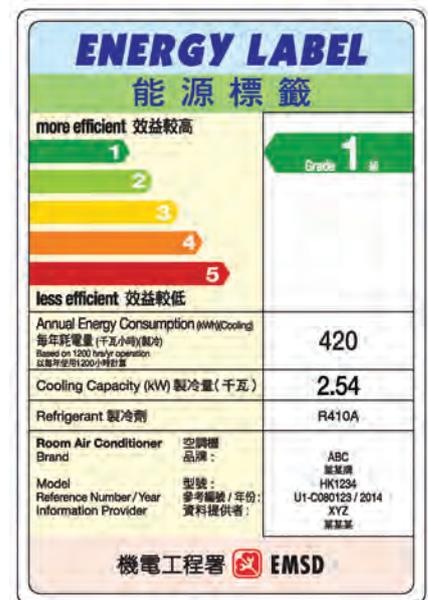
Hong Kong's two power companies launched in June 2014 two energy efficiency funds (EEFs) of HK\$100 million in total, i.e. Eco Building Fund of the CLP Power Hong Kong Limited and Smart Power Fund of the Hongkong Electric Company Limited. Both schemes aim to help residential building owners implement energy saving projects for communal areas of residential buildings by providing subsidies on a matching basis. Under the post-2018 Scheme of Control Agreements (SCAs) with the two power companies, existing incentive schemes in relation to promotion of energy efficiency and conservation (EE&C) will be expanded while new elements will be introduced. More funds will be available under the EEFs of the power companies to support the carrying out of retrofitting and retro-commissioning, including the implementation of building-based smart/IT technologies to enhance the energy efficiency of a wider coverage of buildings. The power companies will also plough back 65% of the incentives they earned from energy audit and EEFs-related work to further support other EE&C programmes, such as encouraging customers to upgrade their electrical appliances to more energy-efficient models, as well as other programmes to support green building initiatives, the use of renewable energy and disadvantaged groups.

Encouraging Behavioural Change

Introduced through the Energy Efficiency (Labelling of Products) Ordinance, the Mandatory Energy Efficiency Labelling Scheme (MEELS) requires energy labels to be shown on products supplied in Hong Kong to inform consumers of the products' energy efficiency performance. MEELS currently covers five types of prescribed products, namely room air conditioners (cooling function only), refrigerating appliances, compact fluorescent lamps, washing machines (washing capacity not exceeding 7kg), and dehumidifiers. The scope and grading standards of MEELS are regularly reviewed. The grading standards

of three types of products, namely room air conditioners, refrigerating appliances and washing machines, were upgraded in November 2015, bringing about an estimated annual saving of 300 million kWh in electricity consumption. The Government is working to expand the scope of MEELS to cover five more types of electrical products, namely televisions, washing machines (with a washing capacity of 7-10kg), room air conditioners (heating and cooling), electric storage water heaters and induction cookers. The total amount of energy saved from the expanded MEELS is expected to be more than 600 million kWh per annum.

Public education and publicity is also important to encourage behavioural change. In May 2017, ENB and EMSD jointly launched the Energy Saving for All 2017 Campaign to foster close partnership in all sectors to promote energy saving. The Campaign comprised the 'Energy Saving Charter 2017' under which over 3,300 signatories pledged to adopt behavioural change, and the new '4Ts Charter' which promotes energy saving by following the 4Ts of 'target', 'timeline', 'transparency' and 'together', i.e. setting a target with a timeline, ensuring transparency to track the energy saving result, and encouraging people to work together on the energy saving target. Over 1,000 premises have pledged to join the 4Ts Charter. The Campaign also comprised the 'Energy Saving Championship Scheme 2017'



which aims to give recognition to exemplary organisations with outstanding performance in the application, planning and promotion of energy saving.

In Hong Kong, local waste treatment accounts for about 5% of carbon emissions. The Government has pledged to develop a Community Green Station (CGS) in each of the 18 districts to enhance environmental education and to help collect different types of recyclables, especially those of low economic value such as glass beverage bottles and compact fluorescent lamps. Four CGS have been in operation so far and the full CGS network will be in place by 2019.



GOVERNMENT POLICIES

Tackling Climate Change through Green Buildings and Energy Conservation

Renewable Energy

Hong Kong does not have favourable conditions for large-scale commercialised Renewable Energy (RE) generation. It only has a land area of 1,106 km², much of which is hilly terrain. Our territorial waters are also limited. Nevertheless, we do have modest RE potential. Based on currently mature and commercially available technologies, our estimate is that Hong Kong has about 3-4% of realisable RE potential arising from wind, solar and waste-to-energy (WTE) that can be exploited between now and 2030. This estimate does not include options that have not yet been explored and possible nearer term technological advancement.

We will apply RE on a wider and larger scale in the immediate years ahead based on mature and commercially available technologies with the public sector taking the lead. The Government has earmarked HK\$200 million for the provision of RE installations in government buildings and venues, as well as community facilities, and set higher targets for government buildings in the use of RE:

- Upgrade the target of electricity consumption powered by RE in new schools and educational buildings from the existing 1% to 1.5%;
- Upgrade the RE target in new open space and public park projects from 15% of general public lighting to 25%;
- Require government buildings to allocate at least 10% of available roof space to incorporate RE technologies;
- Require existing government buildings undergoing major retrofitting and/or renovation to incorporate RE technologies wherever practicable; and
- Install display panels, where appropriate, to show the amount of RE generated at prominent locations in new schools and educational buildings, as well as open spaces and public parks to promote the concept of RE to the public.

Hong Kong is already on a committed path to turn waste into energy. The energy arising from sludge treatment is already used and landfill gas usage is being expanded. Currently, the largest WTE facility, T • PARK, commenced operation in April 2015. T • PARK was awarded a BEAM Plus Provisional Platinum rating. It reduces the volume of dewatered sewage sludge by 90% and the heat generated by the incineration process is used to generate electricity to meet on-site operational needs. By 2030, operating at maximum design throughput (2,000 tonnes of sludge per day) will enable surplus electricity to be exported to the power grid to meet the needs of up to 4,000 homes.

Apart from producing biogas from sewage sludge in four major sewage treatment works for supplying energy equivalent to some 32 GWh a year to help meet internal operational needs, we are also exploring the use of some existing sewage treatment facilities for food waste-sewage sludge anaerobic co-digestion as an additional part of the network for organic resource recovery treatment. We have started the preparation work for a co-digestion pilot plant at the Tai Po Sewage Treatment Works, which includes a food waste pre-treatment facility at the Shuen Wan Leachate Pre-treatment Plant next door to supply up to 50 tonnes per day of pre-treated food waste for co-digestion. The biogas produced will be converted into energy for internal usage at the sewage treatment works.

As for landfill gas (LFG), all the three existing strategic landfills (namely West New Territories Landfill, South East New Territories Landfill and North East New Territories Landfill) have been utilising LFG for electricity and thermal energy production for on-site uses. At the North East New Territories Landfill, the treated LFG is piped to a town gas production plant in Tai Po as alternative energy source. At present, about 50% of the landfill gas collected from the three strategic landfills has been utilised for production of RE. To further utilise the remaining LFG, treatment facilities are being

installed at the South East New Territories Landfill for conversion of surplus LFG into synthetic natural gas, which will be fed into the supply grid of town gas in 2017. Upon their commissioning, around 70-80% of the LFG collected from the three strategic landfills will be utilised beneficially. Besides, there is also plan for utilising the surplus LFG at the West New Territories Landfill for generation of electricity and export to the existing power grid. Apart from the strategic landfills, there are 13 closed landfills with restoration works completed. At the Shuen Wan Landfill, one of the closed landfills, the LFG is piped to a nearby plant in Tai Po as process fuel in town gas production. For the remaining 12 closed landfills, LFG is also collected and utilised for various on-site uses (fuel, thermal energy for leachate treatment and electricity generation).

Hong Kong also collects and produces biodiesel from waste cooking oil. Energy will be captured from the first organic resource recovery centre scheduled to open towards the end of 2017, and a second plant is being planned for commissioning by 2021. It is targeted for both plants to attain at least Gold rating under BEAM Plus. A large-scale WTE plant to treat municipal solid waste is expected to be operational by 2024. It will supply about 480 GWh of surplus electricity each year, which equates to the usage of about 100,000 households. Thus, by 2024, the abovementioned projects are expected to provide about 1% of Hong Kong's total electricity needs. By 2030, another 0.5% may be possible with new projects (such as more resource recovery centres) – i.e. a total of not more than 1.5% of Hong Kong's total electricity needs may be derived from WTE projects.



We will continue to actively take forward a number of large-scale RE projects. For example, the Drainage Services Department (DSD) has the largest solar installation in Hong Kong as well as a number of combined heat and power generation systems to capture solar and biomass energy respectively, and the Water Supplies Department has developed innovative small hydropower plants at its treatment works. The solar farm at the Siu Ho Wan Sewage Treatment Works of the DSD opened in December 2016 is the largest of its kind in Hong Kong. It comprises over 4,200 polycrystalline photovoltaic panels with an installed generation capacity of over 1,100 kWh, which can generate as much as 1.1 million kWh of electricity annually.



activities are carbon-free. The revenue from the RE certificates will be used to help alleviate the overall tariff impact on all consumers brought about by the introduction of the FiT scheme. Apart from FiT and RE certificates, we also agreed with the power companies that in the next SCA period, the power companies will facilitate grid connection to promote distributed RE development, and improve the relevant arrangements. In tandem, the current incentive arrangements in relation to RE will be revamped to incentivise the power companies in developing RE and facilitating their customers to do so.

Green Building Certification

The Government has promulgated the Sustainable Building Design Guidelines and a list of green and amenity features for which developers may obtain gross floor area (GFA) concessions in new buildings. Under the current arrangement, a private housing development project is required to register for BEAM Plus as one of the pre-requisites for application for GFA concessions for green and amenity features. As announced in the 2017 Policy Address, DEVB will review this arrangement and consider tightening the pre-requisites by requiring a development project to attain certain specific standards of performance in environmental protection.

Since 2010, over 950 projects comprising over 30 million m² space were registered under BEAM Plus assessment, which represented about 40% of all new buildings completed up until May 2017.

The Green Government Building circular provides that all new government buildings of construction floor area above 5,000 m² with central air-conditioning or above 10,000 m² should aim to obtain green building rating at the second highest grade or above as far as practicable. In the past two years (2015 and 2016), a total of 17 newly completed government building projects (with a total gross floor area of 480,000 m²) carried out by the Architectural Services Department (ArchSD) applied for BEAM Plus assessment, of which six obtained a Provisional/Final Platinum rating, nine obtained a Provisional/Final Gold rating, one obtained a Provisional Silver rating and one is under assessment.

Apart from new buildings, the Government has also completed BEAM Plus assessments for existing government buildings to demonstrate its commitment and showcase innovative practices. Examples include the EMSD Headquarters Building, an adaptive reuse project completed in 2005, which was awarded BEAM Plus (Existing Buildings) Platinum rating in 2016.



As regards BEAM Plus Interiors, two projects, namely the renovation of the 1/F Main Block of the APB Centre Office of ArchSD, and the Printing Workshop of the Government Logistics Department, completed BEAM Plus Interiors assessment and have been awarded a Platinum rating.

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DRIVING HONG KONG'S GREEN BUILDING INDUSTRY



In order to achieve long-term success in creating a sustainable built environment, the promotion of green building must involve more than just industry habits - such as technical master planning, building design and construction, and guidelines on operation and fit-outs. It must also address the behaviours and habits of the buildings' users.

Both the CIC and HKGBC are key leaders in Hong Kong's green building movement, bringing together the Government, industry and academia to drive the transformation of Hong Kong into a sustainable built environment.

DRIVING HONG KONG'S GREEN BUILDING INDUSTRY

Leading Hong Kong's Transformation: The CIC and HKGBC



**CONSTRUCTION
INDUSTRY COUNCIL**
建造業議會

The Main Functions of the CIC

The Construction Industry Council (CIC) was established in 2007, being a statutory body incorporated under the Construction Industry Council Ordinance (Cap. 587). The CIC consists of a chairman and 24 members representing various sectors of the industry including employers, professionals, academics, contractors, workers, independent persons and Government officials. The vision of CIC is to drive for unity and excellence of the construction industry of Hong Kong. In keeping with this vision, CIC has a mission to strengthen the sustainability of the construction industry in Hong Kong by providing a communication platform, striving for continuous improvement, increasing awareness of health and safety, as well as improving skills development.





The Hong Kong Green Building Council is a non-profit, member led organisation established in 2009 with the vision to help save the planet and improve the wellbeing of the people of Hong Kong by transforming the city into a greener built environment. Its mission is to lead market transformation by advocating green policies to the Government; introducing green building practices to all stakeholders; setting design, construction and management standards for the building profession; and promoting green living to the people of Hong Kong.

HKGBC Members by Sector

13%

Developers / Management Companies

4% Professional Organisations / NGOs

4% Universities

2% Public Bodies

2% Utility Companies

1% Others



Founding Members:



DRIVING HONG KONG'S GREEN BUILDING INDUSTRY

Setting the Standard for Hong Kong's Construction Industry



BEAM Plus

HK-BEAM was Hong Kong's first green building assessment tool. After more than 20 years of refinements, the current version of the tool, BEAM Plus, is now Hong Kong's leading independent assessment tool for building sustainability performance. Tailored to Hong Kong's high-density urban environment, BEAM Plus, since its official launch in 2010, offers a comprehensive set of performance criteria for a wide range of sustainability issues related to the planning, design, construction, commissioning, management, operation and maintenance of a building, providing a holistic assessment of its overall performance throughout its life cycle.

In 2016, a number of new milestones were reached in the BEAM Plus family, namely the launch of BEAM Plus Existing Buildings V2.0, BEAM Plus Bespoke, and BEAM Plus Neighbourhood.



“ We are committed to developing high quality and environmentally sound buildings, and are striving to attain reputable third-party green building certifications such as BEAM Plus for all our new and existing portfolios. Under our new SD 2030 Strategy, we target to achieve the highest environmental building assessment scheme rating for all projects currently under development by 2020. This is a demonstration of our commitment to making a positive contribution to our communities and the environment. ”

Dr Raymond Yau, General Manager of Swire Properties' Technical Services and Sustainable Development

BEAM Society Limited

The successful implementation and industry-wide acceptance of BEAM Plus assessment tools is driven by close collaboration between the HKGBC and BEAM Society Limited (BSL). Known as BEAM Society when it was established back in 2002, BSL is a separate entity open to individual and corporate members from all building-related disciplines. The establishment of BSL was the key to getting buy-in for the rating tool, not only in the construction of buildings, but also in operating them.

While the HKGBC is the certifying body of BEAM Plus, it entrusts the assessment work to BSL. In addition to working on the continuous enhancement of BEAM Plus to meet the needs of all stakeholders, BSL is also committed to building further BEAM capacity in the industry by organising training programmes and examinations for BEAM practitioners, including BEAM Professionals (BEAM Pro) and BEAM Affiliates.

Development of Hong Kong Green Building Assessment Tool



1996	2004	2009	2010	2012	2013	2016
Launch of HK-BEAM	Launch of HK-BEAM 4/04 (New Buildings) & 5/04 (Existing Buildings)	HKGBC Established			Launch of BEAM Plus Interiors V1.0	

BEAM Plus Family



- **BEAM Plus Neighbourhood** is used at the master planning stage of building development projects.



- **BEAM Plus New Buildings** can be applied to new building projects and major renovation/alteration works on existing buildings.



- **BEAM Plus Existing Buildings** evaluates the operation and maintenance performance of existing buildings.



- **BEAM Plus Interiors** can be applied to fit-out works of non-domestic premises.

Launch of BEAM Plus New and Existing Buildings V1.1, accredited by the Hong Kong Green Building Council

Launch of BEAM Plus New and Existing Buildings V1.2, with passive design criteria

Launch of BEAM Plus Existing Buildings V2.0, with Comprehensive and Selective Schemes

Launch of BEAM Plus Bespoke for projects of special building types

Launch of BEAM Plus Neighbourhood V1.0

DRIVING HONG KONG'S GREEN BUILDING INDUSTRY

Setting the Standard for Hong Kong's Construction Industry



Building Competence

Working in collaboration with BSL, the HKGBC accredits BEAM Professionals (BEAM Pro) and BEAM Assessors (BAS) as green building specialists, thus helping to drive the development of sustainability in the community. As an alternative to the BEAM Pro route, the HKGBC also accredits BEAM Affiliates to support green building design, construction and operations.

Representatives of the HKGBC and BSL select the most experienced BEAM Pro members for the Green Building Faculty (GB Faculty), which provides a pool of expert advice on green building related matters. The HKGBC likewise authorises assessors such as building energy professionals to provide independent verification for the Hong Kong Benchmarking and Energy Saving Tool (HK BEST) and HK G-PASS.

No. of accredited green building professionals (as of May 2017)



BEAM Pro **2760**



BEAM Affiliate **268**



GB Faculty **137**

BEAM Assessor **61**

HK BEST
Authorised
Assessor

28



**green
building
award**
環保建築大獎

Green Building Award

The HKGBC and Professional Green Building Council (PGBC) co-organise the biennial Green Building Award to recognise the industry's concerted efforts and commitment to a sustainable built environment. The overwhelming response and participation in this Award is a testament to the industry's increased awareness and wider adoption of green building practices. As such, the Award plays a key role in driving the mainstream market towards wider implementation of sustainable planning, design, construction, management, operation, maintenance, renovation and decommissioning of buildings.



Industry Schemes

In addition to green building certification systems, the HKGBC uses a number of other tools and initiatives to help industry stakeholders identify and implement effective green building measures.

- **HK BEST Series**

Provides tenants and building owners with guidance on how to improve energy efficiency. Designed for office occupants and commercial buildings, the tool has a 'what-if' function that allows users to identify and quantify opportunities to improve energy intensity and efficiency.

- **HK G-PASS**

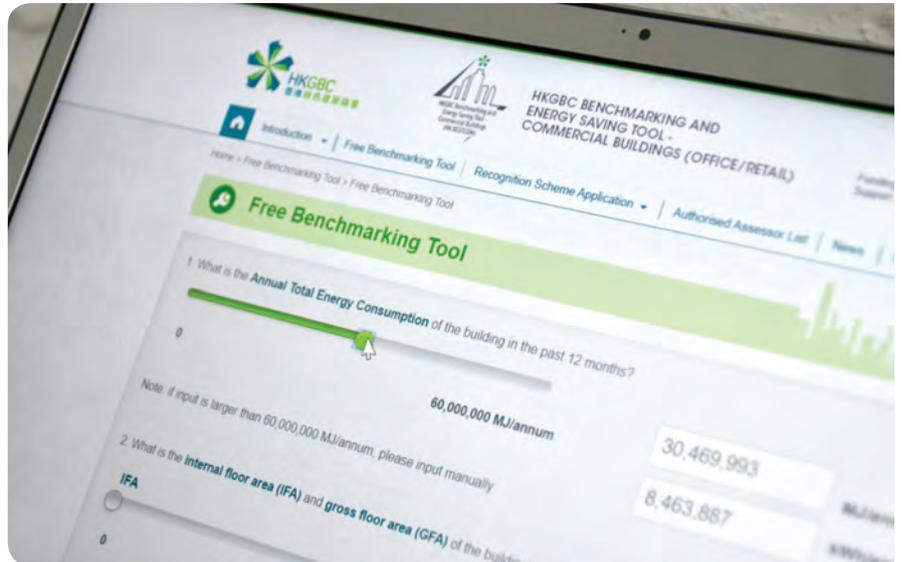
Certifies green building products, and encourages stakeholders in the construction industry to participate in green procurement.

- **Eco Product Directory**

Provides a reliable platform for manufacturers and suppliers to promote their eco-products, and for industry practitioners to make smart purchases.

- **ACT-Shop**

Supports the Environment Bureau's *Energy Saving Plan for Hong Kong's Built Environment 2015~2025+* by strengthening industry competence in retro-commissioning, and promoting the adoption of knowledge-based energy-management best practices.



“ With certification conferred by an independent organisation, the credibility helps promote our products and build a positive image of our brand. We are thus in a better position for the latest trend of green product market and ready to explore the overseas markets. ”

Wong Kwan-yin, Managing Director of
Kwan Jiu Company Limited



DRIVING HONG KONG'S GREEN BUILDING INDUSTRY

Industry Initiatives by the CIC

Carbon Labelling Scheme for Construction Products

Buildings are not only resource-intensive to construct, they also generate a huge amount of waste and emissions. One rather overlooked aspect is the embodied carbon of construction materials, which can account for up to 70% of greenhouse gas emissions during the construction stage, and a further 25% of the building's carbon footprint throughout its lifecycle.

To address this issue, the CIC launched a voluntary Carbon Labelling Scheme for Construction Products (CLS) in 2014. The Scheme aims to provide accurate and verifiable information on the carbon footprint of construction products for clients, designers, contractors and end-users. It currently covers four groups of key construction materials, namely Portland cement, reinforcing bars, structural

steel, and ready-mixed concrete.

To provide additional knowledge about the carbon footprint of products (CFP), as well as to offer professional training on CFP quantification, the CIC holds a variety of training programmes, including awareness courses and auditor courses. Certified carbon auditors approved under the Scheme are able to provide professional CFP quantification and reporting.

As a voluntary scheme, CLS implementation is an ongoing challenge. To date, several pioneering material suppliers have applied for the CIC Carbon Label to showcase their low-carbon construction products. To further encourage participation, the adoption of certified low-carbon products in a project

is now eligible for credits under the latest BEAM Plus Existing Buildings V2.0 launched in March 2016. The CIC is further exploring the integration of CLS with the BEAM Plus New Building scheme, so that developers and designers will more readily use CLS-certified products in their projects.

It is hoped that the growing recognition and continuous development of the Scheme will help to build stronger awareness and adoption of low-carbon construction, thereby accelerating the uptake of green building practices across the whole industry.

For a list of certified products of the Scheme, please visit:



http://www.cic.hk/eng/main/zcb/carbon_labelling_scheme/find_products/



Innovation Award

The CIC plays an important role in elevating the quality and competitiveness of the construction industry by encouraging continual improvement. The Innovation Award, which was launched in 2015, is an excellent example of this.

Designed to recognise and showcase innovation and initiatives that have the potential to transform the entire construction industry, the Award is a high-profile recognition of local

academics and practitioners in the categories of materials, technology and management, with an additional award for international participants. The inaugural 2015 Award Presentation Ceremony was held at Government House on 15 December 2015. A total of eight submissions were selected by the judging panel.

The winning projects for the International Grand Prize and Local Grand Prize were, respectively, Bendable Concrete, and Anti-heat-stress Clothing for construction workers in hot and humid weather. The winning projects for the Academia and Industry Practitioners sectors were, respectively, the Z-Panel System of Lightweight Prefabrication, and Mechanised Construction.

Other winning projects included innovation relating to construction sustainability, namely 'Carbon Neutral Construction Products Manufactured with Cement and Concrete Wastes' developed by the research team at The Hong Kong Polytechnic University. This project, which won the Local Academia Second Prize, created a carbon-neutral concrete block from construction wastes, such as concrete slurry waste (CSW) and recycled concrete aggregates, and cured with carbon dioxide. This first-of-its-kind technology reutilises fresh CSW, which is generated at concrete batching plants every day in Hong Kong, as a cementitious binder.

The Second Prize for Local Industry Practitioners was awarded to the development of the 'City Air Purification System' invented by Ove Arup & Partners HK Limited and Sino Green Hong Kong Limited. This innovative project is an air purification system that aims to build a cleaner and healthier environment by tackling roadside pollution. The system has been built and tested in a number of environmental conditions, including cities with heavy road traffic and severe atmospheric air pollution such as Hong Kong and Beijing.

Another sustainability-related project, namely 'Innovative Use of Polymer Solutions for the Construction of Diaphragm Walls' by the Civil Engineering and Development Department, won the Young Innovator for Local Industry Practitioners Prize. The proposed polymer solution is a novel material that can stabilise loose soils during excavation for the construction of diaphragm walls. Compared to traditional bentonite clay slurry, the polymer solutions offer several advantages, including a smaller site footprint and lower pollutants, less construction waste, and a higher wall surface interface friction.

CIC Research Fund

To further encourage research and innovation, and to establish standards for the whole construction industry, the CIC collaborates with various research institutes. The CIC Research Fund was established in 2012 to support research projects that enhance construction productivity, site safety and health, sustainability, and construction procurement.

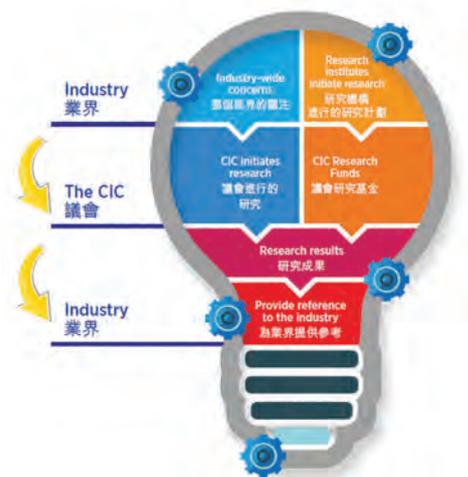
Since 2012, CIC has granted over 30 research proposals, not only from local universities but also local professional bodies and research centres. CIC evaluates all proposals based on their practical value and benefits to Hong Kong's construction industry. The cost-effectiveness and project implementation of the proposal are also essential criteria during the evaluation process.



• The 2015 CIC Award Presentation Ceremony at the Government House on 15 December 2015

Projects funded under the CIC Research Fund cover a wide range of areas, including productivity, safety and health, and environment. To date, 12 research projects are related to construction sustainability, including formulation of a sustainable trigeneration system for high-rise buildings, identifying measures to improve energy efficiency in retrofitting existing buildings, development of ultra-ductile cementitious waterproofing rendering by recycled plastic, exploring the potential of alternative ingredients to replace cement in producing concrete, investigating the thermal and power performance of vacuum solar PV curtain wall technology, and recycling used timber formwork into lightweight, thermal-insulating cement-bonded particleboards.

The CIC also publishes a research journal called *Innovation in Construction* (iCON) on a bi-annual basis, not only to promulgate the successful outcomes of its funded research projects, but also to serve as a communication channel between industry practitioners and researchers in the wider construction industry community.



For details of Innovation Award 2015 winners, please visit :



<http://cicinnovationaward2015.hkcic.org>

DRIVING HONG KONG'S GREEN BUILDING INDUSTRY

Industry and Public Guidebooks

As part of its commitment to disseminating knowledge and making Hong Kong a greener and more liveable city, the HKGBC has developed a series of guidebooks to introduce green building practices.

In addition to its existing *Hong Kong Green School Guide* and *Hong Kong Green Shop Guide*, the HKGBC, with funding support from the CIC, has launched the *Green Tenancy Driver for Office Buildings*, *Green Tenancy Driver Training Toolkit* and *Hong Kong Green Office Guide* in recent years.



Green Tenancy Driver for Office Buildings and Green Tenancy Driver Training Toolkit

This guide offers a step-by-step approach for formulating plans and terms in achieving green lease by encouraging landlord-tenant collaboration to create a comfortable working environment which could raise employees' productivity, minimise the operating cost of both landlords and tenants as well as achieve energy saving, water saving and waste reduction for the community.

To facilitate first step action in adopting the *Green Tenancy Driver for Office Buildings* and going green, the HKGBC has thus developed the *Green Tenancy Driver Training Toolkit*, which contains the necessary materials for implementing green measures at offices.



“ With the inclusion of local case studies, the HKGBC guidebooks not only introduce best practices to industry practitioners, but also raise public awareness of the sustainable built environment. Our company is honoured to participate in the development of the *Green Shop Guide* and *Green Office Guide* to advocate the green building movement. ”

Grace Kwok, Chairman and Executive Director of Allied Sustainability and Environmental Consultants Group Limited

Hong Kong Green Office Guide

Launched in early 2017, the *Hong Kong Green Office Guide* provides green guidance to stakeholders including the owners, property facility managers and occupants of office premises. Introducing environmental benefits, opportunities and best practices with dozens of local successful case studies as illustrations, the new guidebook is a practical reference for making offices green.

Expected to be published in second half of 2017, the newest guidebook, *Green Design Guide for Minimisation of Construction and Demolition Waste*, aims to provide guidelines for green design and construction management strategies so as to promote more environmentally friendly building projects.

A Leading Policy Advocate



The HKGBC plays a crucial role in advocating green building in Hong Kong. In partnership with key stakeholders across the industry, it regularly submits suggestions and recommendations to the Hong Kong Government to promote green and sustainable construction practices in areas such as minimising construction and demolition waste, green rental policies, the future fuel mix for electricity generation, and the mitigation of climate change.

Launched in 2013, the HKGBC's flagship campaign HK3030 offers a long-term roadmap to reduce the absolute electricity consumption of buildings in Hong Kong by 30% of 2005 levels by the year 2030. As such, it plays a leading role in Hong Kong's journey to a low-carbon and sustainable built environment.

In recent years, the HKGBC has explored additional market drivers for the green transformation of buildings in Hong Kong, working in collaboration with local and overseas green building professionals, academia and government representatives. The HKGBC likewise fully supports the launch of the Government's reports and policy papers in relation to climate change and the creation of a sustainable built environment, including the *Energy Saving Plan for Hong Kong's Built Environment 2015~2025+*, *Hong Kong Climate Change Report 2015* and *Hong Kong's Climate Action Plan 2030+*, in which the development of green building takes a vital role in achieving the goals outlined.

In response to the Government's strong support and recognition of its work, the HKGBC continues to work closely with the Government regarding industry promotion and public education initiatives that further drive sustainable development in Hong Kong.

DRIVING HONG KONG'S GREEN BUILDING INDUSTRY

International Outreach in 2014 - 2017



In addition to its local advocacy work, the HKGBC continues to expand its international outreach to build closer ties with overseas counterparts and gain the latest insights on green building and sustainability. It has been an Established Member (the highest level of membership) of the WorldGBC since November 2012. It was also on the WorldGBC Directorship from July 2013 to June 2016.

WorldGBC Congress 2015 Hong Kong

In 2015, Hong Kong was the host of the annual WorldGBC Congress. This annual top-level conference is hosted each year by an Established Member of the WorldGBC. The event gathers top leaders from Green Building Councils worldwide to exchange the latest developments

in government policy, technology and research, rating systems, and industry best practices globally. For Congress 2015 Hong Kong, it welcomed around 500 delegates from 37 countries.

World Sustainable Built Environment Conference 2017 Hong Kong

The Sustainable Built Environment (SBE) Conference Series is the pre-eminent international conference series on sustainable building and construction. The series began in 2000 and operates on a three-year cycle.

Despite stiff competition worldwide, the CIC and HKGBC won the hosting right of the World Sustainable Built Environment Conference 2017 Hong Kong (WSBE17 Hong Kong). This marked

a significant milestone for the CIC, HKGBC and the whole green building industry in Hong Kong in leading the global green building movement. The event, to be held on 5-7 June 2017 under the theme 'Transforming Our Built Environment through Innovation and Integration: Putting Ideas into Action', will conclude the 2015-2017 cycle by bringing together 1,800 of the world's top speakers and green building experts, and embracing the findings from the 20 regional

conferences held in different parts of the world throughout 2016.

As the first conference to extend the focus of sustainable buildings to small urban scales, WSBE17 Hong Kong is expected to be an important milestone in the study of sustainability in the context of dense urban environments.

International co-owners:



IEA EBC Annex 66

Annex 66 of the International Energy Agency's (IEA) Energy in Buildings and Communities Programme (EBC) aims to create a standard occupant behaviour definition platform, establish a quantitative simulation methodology for modelling occupant behaviour in buildings, and understand the influence of occupant behaviour on buildings' energy use and the indoor environment. The HKGBC was involved in this Annex as a subtask leader on the topic of applications in building design and operations.

COP21

During COP21, the 2015 United Nations climate change conference in Paris, the WorldGBC and its network of Green Building Councils in over 70 countries worldwide made a high-level commitment to reduce emissions from buildings by 84 gigatonnes of CO₂ (GtCO₂) by 2050.

In support of this, the HKGBC is committed to working towards the following targets in five years:

- To certify at least 150 million ft² (14 million m²) of GFA under BEAM Plus
- To accredit at least 350 new BEAM practitioners per year, and work with BSL to provide at least 12,000 CPD training man-hours per year to existing BEAM practitioners
- To support the creation of a building energy consumption database through BEAM Plus and other schemes.



“*Hong Kong Green Building Council plays a vital role in the global green building movement. Its work with the Construction Industry Council is resulting in action on-the-ground in Hong Kong; its collaboration with Green Building Councils across Asia Pacific is delivering change in the region; and its input into global projects like Better Places for People provides a valuable contribution into efforts to green buildings on the world stage.*”

*Terri Wills, CEO of
World Green Building Council*

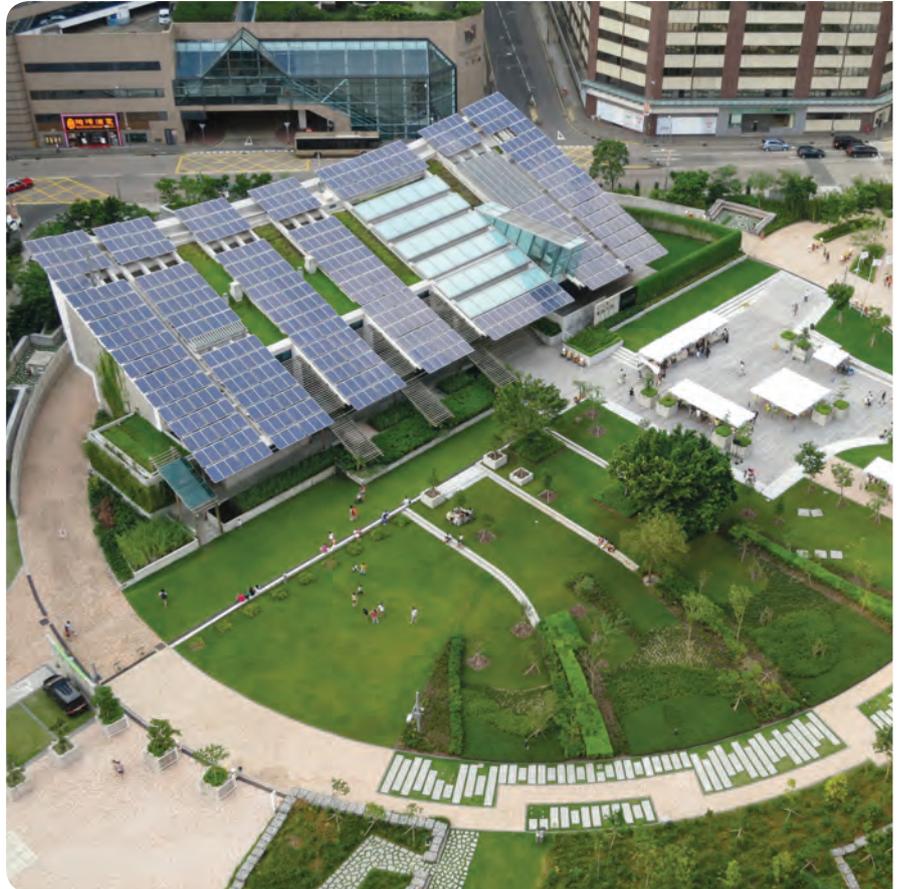


DRIVING HONG KONG'S GREEN BUILDING INDUSTRY

Construction Industry Council ZCB

The Construction Industry Council ZCB (ZCB) is Hong Kong's first zero carbon building. Developed by the Construction Industry Council in collaboration with the Hong Kong SAR Government, ZCB is designed to be an education, exhibition and information centre to help people learn more about green building technologies and low-carbon living. As such, it not only serves as a platform for the construction industry to share knowledge and expertise about low/zero-carbon building design and technologies, it also helps to raise community awareness of low-carbon living.

Since the building's public opening in 2013, over 65,000 visitors have joined ZCB's guided tours, and many more have used ZCB's facilities and enjoyed ZCB's outdoor landscaped garden. In 2016 alone, more than 160 events were held at ZCB, and over 50,000 people visited in a single weekend for an event in October 2016. Since 2014, ZCB has also hosted an ambassador training scheme, with over 1,000 students enrolling as ambassadors. The building has even become a popular venue for low-carbon weddings.



As befits a ground-breaking building of this kind, ZCB continues to evolve and showcase the latest green technology. For instance, it revamped its Eco-Home in 2014, which became the first BEAM Plus Interiors Platinum-certified project in Hong Kong. Located on the first floor of ZCB, this Eco-Home demonstrates to the public how low-carbon living can also be chic and stylish.



To further demonstrate the use of low-carbon construction materials, ZCB collaborated with the Chinese University of Hong Kong and various contractors to construct the ZCB Bamboo Pavilion in 2015. Its four-storey, long-span gridshell structure was constructed using traditional Cantonese bamboo scaffolding craftsmanship, and later became a popular public event space. The pavilion has won many local and international accolades including:

- World Architecture Festival in Berlin, Germany - 'Small Project of the Year 2016'
- Japan Institute of Design Promotion - G-Mark 2016 'GOOD DESIGN BEST 100'
- Asia Pacific Property Awards 2016-2017-5 Star Award for Best Leisure Architecture Hong Kong

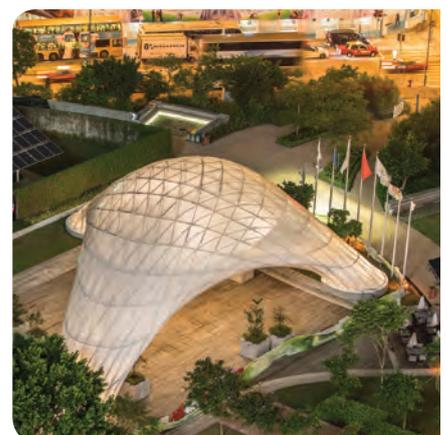


ZCB itself continues to be recognised for its innovative zero-carbon design in a high-rise, high-density sub-tropical city. To date, it has won a variety of local and international awards, including:

- Quality Building Award 2014 - Grand Award (New Building, Non-residential)
- Australian Institute of Quantity Surveyors 2013 International Project of the Year
- World Architecture News.com - Sustainable Building Awards 2014 - Highly Commended Award
- National Energy Globe Award Hong Kong 2015

- WorldGBC's Asia Pacific Leadership in Green Building Awards 2016 - Leadership in Sustainable Design and Performance Award (Institutional)

The ZCB's success, both locally and internationally, has far exceeded its original design intention to be a demonstration of green building techniques. ZCB is now a dynamic focal point for Hong Kong's growing green movement, as demonstrated by its popularity with construction industry stakeholders and the general public.



COMMUNITY ENGAGEMENT



Green building is not only a matter for industry professionals. Education and engagement at all levels of society are essential if we want the whole city to support the creation of a sustainable built environment. When citizens are aware of green issues, they will push the industry in the right direction.

With an ever-growing awareness of carbon emissions and climate change, particularly after the historic Paris Agreement, all strata of society, from government, institutional bodies and NGOs to individuals, are more active than ever before in taking the lead to influence the rest of the community to work towards a greener city and planet.

The number of local initiatives and programmes in this regard is enormous. We have selected only a few for this report to show at a glance how the momentum of change in society is growing in four major areas: energy saving, waste management, general green building promotion, and public education.

COMMUNITY ENGAGEMENT

Energy Saving

With 90% of Hong Kong's electricity consumed by our activities in buildings, which contributes to 60% of the city's total carbon emissions, energy saving is a key part of our roadmap to a sustainable built environment.

In addition to the installation of energy-efficient equipment and technologies, the occupants of buildings also play a major role in achieving higher energy efficiency. To address this issue, a number of organisations have dedicated great effort to inspire and educate building users to reduce their energy use.

CLP Power - 'Power Your Love' and other Environmental Education Programmes



Empowering Hong Kong's development

As well as providing Hong Kong with a stable and reliable electricity supply, CLP Power Hong Kong Limited (CLP Power) strives to protect the environment and contribute to the community.

CLP Power Your Love Programme

In 2015, CLP Power launched a world-first initiative, the Power Your Love programme, which combines energy saving with a mission to help the less fortunate in society.

It achieved a record-breaking result in its first year of launch, with over 200,000 participating customers saving a total of 9.5 million kWh of electricity in a two-month period, equivalent to the annual electricity consumption of more than 2,000 households.

In return for the energy saved, CLP Power donated HK\$6 million to relieve the electricity costs of the needy in society, including the elderly, the severely disabled, families living in sub-divided flats, and the families of boarders at special schools.

The Power Your Love programme is a win-win strategy because it helps customers save energy and money, benefits families in need, and promotes environmental protection to combat climate change. CLP Power ran the programme again in 2016 to light up the lives of tens of thousands of people in need.

Environmental Education Programmes

CLP Power is committed to educating the public about environmental protection. Over the years, it has introduced a host of programmes for primary and secondary schools, as well as university and college students. This holistic approach to public education even stretched to kindergartens with the launch of the POWER YOU Kindergarten Education Kit programme. Designed to spark the interest of kindergarten students in the world of electricity, this engaging programme gives them a basic knowledge of energy and teaches them good habits regarding energy efficiency.

The Green Elites Campus Accreditation programme and Green Elites Portal likewise

encourage primary schools and their students to apply green tips in everyday life through an award scheme. For secondary school students, the Engineer in School programme further increases their literacy about electricity, enriches their knowledge about energy and the environment, and inspires them to pursue a career in engineering under the guidance of CLP mentors.



<https://www.clp.com.hk/en/community-and-environment>

Friends of the Earth (HK) - Power Smart Energy Saving Contest



Use energy wisely: our common wish

The Power Smart Energy Saving Contest originally started as an advocacy campaign in 2006 to push the Government to set a clear target for the reduction of Hong Kong's overall energy consumption. All organisations or buildings which are able to reduce their electricity consumption by 2% or more are eligible to join the competition.

Over the years, the Contest has gradually

evolved and become a community engagement programme. It has been widely supported by the public and, particularly, all major property management companies. Over the past five years, on average 2,500 participants have joined the Contest each year and have achieved a 6-8% electricity consumption reduction. The Contest has cumulatively reduced electricity consumption by 260 million kWh since its launch in 2006.



<http://powersmart2016.foe.org.hk>

WWF-Hong Kong - Solarizing Tai O



Together we can motivate Hong Kong to move towards a solar powered city

WWF-Hong Kong is working hard to demonstrate the potential of rooftop solar systems by engaging local communities and motivating them to envision a Hong Kong powered by clean and sustainable energy resources in the near future.

Renewable energy currently accounts for less than 1% of Hong Kong's energy fuel mix, yet the potential for developing solar energy is huge, with a mean solar radiation of 1350 kWh/m² each year. A study found that solely by installing rooftop solar PV systems, Hong Kong could meet up to 14% of its total electricity use.

WWF-Hong Kong began its 'Solarizing Tai O' project in June 2016. With great support from the Tai O community, local organisations and committees, it developed three local on-grid solar PV systems on villagers' rooftops, with a total system size of 6 kW and an annual solar energy generation of 6,000 - 7,000 kWh. These distributed solar energy systems now provide an alternative clean energy supply to power the public lighting system in Tai O village, as well as meet some of the regular demand for electricity in private households. To ensure the stability and consistency of the system, all solar energy generated by the systems is recorded by an online monitoring

platform. The project demonstrates the potential for solar panels on rooftops across the city, and also demonstrates the economics of solar power in Hong Kong. It underlines the need for a supportive government policy – such as a feed-in tariff, which guarantees that all electricity generated will be purchased at a preferential rate – to further encourage their installation across the city.

Guided by this successful case study of Tai O's solar rooftops, together we can motivate Hong Kong towards a solar-powered and net-zero carbon city!

COMMUNITY ENGAGEMENT

Waste Management

Landfilling is currently the major means of final disposal for all the municipal solid waste (MSW) generated in Hong Kong. According to figures from 2015, MSW accounts for 67% of the total waste disposed at Hong Kong's three strategic landfills, with over 10,000 tonnes of MSW dumped into landfills every day.

This startling waste production rate means that we need more effective and sustainable ways to achieve waste reduction. To address this challenge, the Government and a number of organisations have been working hard to encourage the community to reduce and recycle waste.

Environmental Protection Department – Community Green Station



Green innovation to promote 'Use Less, Waste Less'

The development of Community Green Stations (CGSs) in Hong Kong brings people together to tackle the challenges of climate change with an emphasis on sustainable waste management. In Hong Kong, local waste treatment accounts for about 5% of total carbon emissions. After heated public debate on the city's strategy to tackle landfill exhaustion, Hong Kong people have now acknowledged that change is needed.

Under the theme 'Use Less, Waste Less', the Government unveiled a 10-year blueprint in 2013 to reduce the per capita waste disposal rate by 40% by 2022. However, lingering questions remain on how to actually achieve, which have hampered people from taking action.

To address the gaps in people's understanding and knowledge, CGSs are being developed in each of the city's 18 districts to directly engage people and enable behavioural change. These CGSs are mostly built on unused land that is unattractive for other developments. Thanks to their innovative design, these green and open spaces surprise many people, who often have the pre-conception that recycling involves dirty operations. The design is intended to use green building technologies and materials, such as recycled cargo containers and timber, skylights and solar panels, to reduce CO₂ emissions. Indeed, the architectural design has been highly acclaimed thus far, with individual projects winning both local and international architectural awards.

To date, four CGSs have been completed. Operated by non-profit organisations with a sound track record in social services, these CGSs are now playing a key role in driving greater environmental awareness, while also providing practical neighbourhood collection of recyclables to guarantee their proper recycling. The complete CGS network will be in place by 2019, helping to create bottom-up sustainable communities in Hong Kong.



https://www.wastereduction.gov.hk/en/community/cgs_intro.htm

World Green Organisation - School Waste Analysts Training Programme



Reduce waste by analysing your waste

This project trained up more than 100 student waste analysts recruited in ten local secondary schools through a series of well-planned programmes, from student briefings and training workshops to educational activities. Participating students were then required to conduct two waste analyses at their own schools over a five-day period.

Making reference to data obtained in this first audit, the student waste analysts held in-school waste reduction activities for two months, including school talks and other activities led by the students and assisted by WGO. Finally, a second audit was conducted

by the same group of students to evaluate the effectiveness of the waste reduction activities.

At the end of programme, nine out of ten schools had successfully reduced the amount of waste by an average of 17%, and the best performing school cut its waste by 33%! This dramatic change was mainly achieved through a reduction in paper, plastic and food waste. These very encouraging results prove that schools can make a significant contribution to waste reduction.

In order to encourage more schools to participate in this project, the programme

materials were uploaded to a dedicated website, and all schools were invited to download them and start their own waste reduction journey.

Upon deducting mandatory operational expenses, all remaining funds are donated to support Hong Kong's environmental protection.



<http://wasteanalysts.thewgo.org/>

Woodrite - Upcycling of Used Furniture



Wood the Right Way!

Woodrite is a social enterprise established in 2013. It saves valuable wood that would otherwise end up in landfills and transforms it into durable, functional and beautifully handcrafted furniture, thus extending its lifecycle.

To ensure the quality and safety of Woodrite products and services, all components and furniture are made in a workshop in Hong Kong by locally-acclaimed carpenters, and all materials are carefully selected from

around Hong Kong. A large percentage of wood comes from the renovation sites of commercial units and apartments. A small percentage also comes from households and small organisations.

By adhering to the 'Upcycling & Refurbish' concept, Woodrite aims to reduce the impact of waste on our planet and help educate the next generation to cherish the Earth's resources.

Upon deducting mandatory operational expenses, all remaining funds are donated to support Hong Kong's environmental protection.



<http://www.woodrite.com.hk/>

COMMUNITY ENGAGEMENT

General Green Building Education

While the industry has long made painstaking efforts to implement green building concepts and practices in development projects, the general public has not been aware of the subject and its progress until recent years, in particular after the establishment of the HKGBC in 2009.

As such, promotion of green building knowledge is now an integral part of community engagement. Today, citizens are actively looking for a greener lifestyle, and the buildings they occupy have become an excellent starting point for this.

Hong Kong Green Building Council- Hong Kong Green Building Week and Other Community Engagement Programmes



Linking up green building concepts with behavioural change

As an overarching body for local green building development, the Hong Kong Green Building Council spares no effort in educating the public on the concept of green building and its development progress in Hong Kong, and, more importantly, influencing the public's perception of green building and encouraging more sustainable lifestyles.

Hong Kong Green Building Week

First launched in 2013 and co-organised with the Construction Industry Council, the Hong Kong Green Building Week is an annual territory-wide campaign to encourage the public to live a greener lifestyle and learn more about local green building development through a series of educational programmes.





'My Green Space' Green Building Competition for Schools

Students, our future leaders, are a leading audience of the green building message. In view of this, a variety of student development programmes are in place to nurture the next generation of decision-makers. The 'My Green Space' Green Building Competition for Schools has been held annually since 2011 to encourage students to envision their ideal green spaces, and present their creative ideas for the application of green building concepts in real-life built environments.



Hong Kong Green Alliance

To echo the Government's 'Climate Ready @ HK' Campaign, the Hong Kong Green Shop Alliance was established in 2016 to foster collaboration between landlords and shop tenants in going green and combating climate change. There are also long-term plans to expand the Alliance to cover even more stakeholders in future, such as office occupants.



<https://www.hkgbc.org.hk>

COMMUNITY ENGAGEMENT

General Green Building Education

Mission Healthy Greens - City Farming



How city farming makes Hong Kong people happier

With funding support from the Hong Kong Jockey Club and the District Councils of Wong Tai Sin and Kwun Tong, Mission Healthy Greens has, as of March 2017, designed, built and managed 18 City Farms in Kowloon and Tseung Kwan O, and directly educated

6,900 people in organic farming practices. City Farming demonstrably contributes great value and benefits to the community, in particular increasing the happiness and health of the participating farmers and greening the environment.



<http://www.mhg.org.hk/>

Rooftop Republic Urban Farming - Community Farm @ Hing Wah (II) Estate



Building a sustainable neighbour- hood through tri-sector initiatives

Rooftop Republic believes that green buildings should not be limited to physical infrastructure, but also human activities that involve the wider community. An edible farm at the 40-year-old Hing Wah (II) Estate now serves as a sustainable neighbourhood education platform, making a positive impact on residents' quality of life. Not only is the

podium now more aesthetically pleasant, city dwellers have reconnected to their food sources. Bees and butterflies are also attracted to the farm, bringing new vibrancy to the estate. This project has demonstrated that urban farming is effective in providing physical and social revitalisation through public-private partnership in green building projects.



<http://www.rooftoprepublic.com/>

aTempspace - Attempts to Utilise Temporary Spaces



Making better use of vacant urban spaces

aTempspace, winner of the 2015 Techathon organised by Hong Kong Science Park, attempts to optimise the use of commercial vacant spaces to reduce demand for new buildings and minimise the city's urban footprint.

With the support of a major developer, aTempspace has turned a large temporarily vacant space into pop-up event spaces. It provides affordable offline spaces for non-profit organisations, entrepreneurs, SMEs and

startups to try out new ideas and drive social innovation. This is vital for any city to fuel its growth with new jobs for young people and nurture new business in the development cycle. It also removes deserted spots and unsightly defaced street frontages from the city. Activities and services at these temporary locations bring convenience and more choices to the neighbourhood, break the monotony of chain stores, enrich city life and, ultimately, make high-density cities more liveable. aTempspace has clearly demonstrated

the business value of this proposition, and tested out various innovative solutions to the problems encountered.



<https://www.facebook.com/atempspace/>

Ronald Lu & Partners - Project ACT (Architecture • Community • Teenagers)



Nurturing young green architects for a sustainable future

Project ACT is specially designed by professional architects from Ronald Lu & Partners (RLP) for 140 secondary students who have a keen interest in architecture. Green missions such as the Archi-Tour help excite students' interest in Hong Kong's architecture,

while a fun model-making workshop helps enhance students' understanding of an architect's responsibilities and design rationales. This inspirational programme aims to instil the concept of sustainable development in the minds of the next

generation while they are still young. When teenagers grow up to be pillars of society, they will naturally care about the built environment and take the initiative to create a better community.

COMMUNITY ENGAGEMENT

Public Education

Engaging the public to build a sustainable future is not only about engaging them in green building development, it's also about shaping sustainability as a mindset for everyone.

There are many initiatives that aim to increase different aspects of people's environmental awareness, thus inducing behavioural change in society and achieving a real change in both the city and the world.

Hong Kong Housing Authority – Residents Engagement Programmes



Providing happy and harmonious homes in caring and stable communities

The Hong Kong Housing Authority (HKHA) develops and implements one of the world's largest public housing programmes. As a progressive public sector developer, and guided by its core values of being caring, customer-focused, creative, and committed, HKHA is dedicated to providing happy and harmonious homes in caring and stable communities.

Conversion of Chai Wan Factory Estate to Public Rental Housing

As the only surviving example of an H-shaped factory building in Hong Kong, Chai Wan Factory Estate (CWFE) was granted Grade II Historic Building status in 2013. By that time, plans were already in place to transform it into public rental housing.

Through a series of community engagement activities, HKHA introduced the community to the heritage value of CWFE, helped to collate the collective memories of ex-tenants

and local residents, and collected opinions from the district on the preservation of CWFE. These consultations and follow-up workshops successfully built up the estate's strong identity, and encouraged a vibrant spirit of community ownership.

Hand in Hand - Action Seedling

Through Estate Management Advisory Committees, schools and community organisations, seedlings were given out by HKHA and its building contractors. Participants were encouraged to nurture these seedlings at home until the plants were ready for transplanting into purpose-built planters on residents' estates.





Estate Improvement Programme for Kwai Shing West Estate

First completed in 1975, Kwai Shing West Estate achieved Final Platinum rating under BEAM Plus Existing Buildings V1.2 in October 2015, making it the first existing building to receive this recognition. To achieve this, various improvement measures were integrated with an Estate Improvement Programme to enhance its environmental performance and promote sustainable living.

In addition to building improvements such as energy-saving light fittings and water-saving installations in common areas, HKHA installed ten LCD panels on the estate to display the consumption of electricity, gas and water consumption in the domestic blocks.

To further strengthen social cohesion and a sense of belonging, the public was invited to participate in the re-design of the estate's elevated walkway. By engaging about 60 representatives from various stakeholders, the elevated walkway was finally designed as an Art Gallery displaying old estate photos and students' drawings. An open space was also adopted as a fitness and children's recreational area. This helped foster a strong neighbourhood spirit and nurtured harmonious relationships in the community.

'Green Delight in Estates' Programme

Since 2005, HKHA has partnered with green groups for its Green Delight in Estates programme, which aims to raise

environmental awareness among public rental housing residents and instil a culture of protecting and improving the environment. Each year this light-hearted programme comprises an estate-wide campaign on a main environmental theme, as well as in-depth educational and promotional programmes, such as eco-tours, carnivals and markets for selected estates.

HKHA has also trained up residents as volunteers to become Green Ambassadors and further spread environmental information to their relatives and friends. To date, about 22,000 Green Ambassadors have participated in the programme. Annual post-programme surveys indicate that it is well-received by residents, and that it successfully improves both their environmental knowledge and habits.

COMMUNITY ENGAGEMENT

Public Education

Environmental Protection Department - Food Wise Hong Kong Campaign



Don't be a Big Waster!

The Food Wise Hong Kong Campaign is a city-wide campaign raising awareness of food waste reduction to enable permanent behavioural change at a community level. The Campaign mascot is Big Waster, whose appearance is based on the Cantonese slang for having eyes that are bigger than one's stomach, namely referring to people who waste food by preparing or ordering more than they can actually consume. The mascot has been well received by the public since its launch, and Big Waster's Facebook page now

has received over 45,000 likes.

In addition to roving exhibitions and training sessions in various districts, a Food Wise Eateries Scheme was launched in November 2015, recruiting over 970 local eateries to engage in food waste reduction measures.

The Campaign also promotes food donations by using the Environment and Conservation Fund (ECF) to subsidise NGOs' food donation projects. Since 2014, ECF has set aside about

HK\$32 million to support non-profit making organisations, collecting around 2,300 tonnes of surplus food for donation to about 1.9 million recipients.



<http://www.foodwisehk.gov.hk>

World Green Organisation - 'Linking Food with Love - From the Golden Age to the Greens' Surplus Food Donation Project



Taking unwanted food from fresh markets directly to those in need

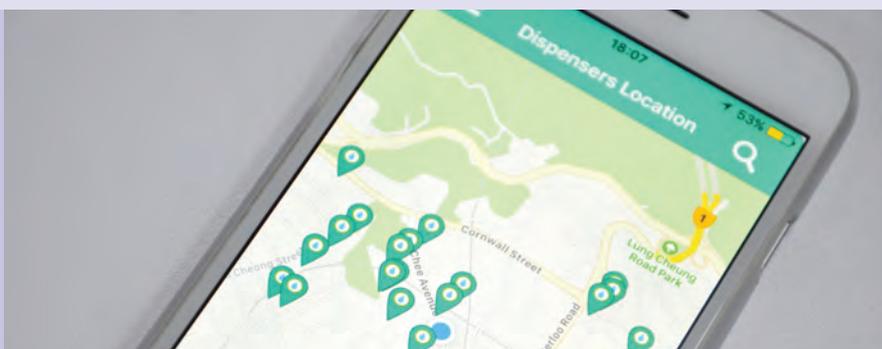
With 3,300 tonnes of food waste dumped into local landfills every day, 'Linking Food with Love' aims to rescue fresh and edible surplus food to support deprived groups. This community project has already saved seven tonnes of surplus food, benefiting 283 deprived elderly people while also raising youth awareness of environmental

protection, and encouraging stronger cross-generation integration. This socio-economic-environmental delivery model has enhanced sustainable development and achieved valuable ripple effects by tackling food waste through the concerted efforts of diverse community stakeholders.



<http://thewgo.org/website/chi/fooddonation/>

Go Green Hong Kong - Water for Free (撲水)



Bring your own bottle to reduce plastic waste

Water for Free is the latest effort of Go Green Hong Kong, which was formed by regular people who care deeply about the environment and want to take action.

In view of the excessive consumption of plastic bottled water and drinks, and the fact that Hong Kong dumps 132 tonnes of PET waste plastic into its landfills everyday, there is an urgent need to promote the reuse of bottles by refilling them at water dispensers across the city.

Water for Free is a mobile app (iPhone and Android) and website that shows the locations

of public water fountains and dispensers throughout Hong Kong. The mechanism is simple: after switching on the mobile app with its GPS function, the app shows a map that indicates nearby water dispensers where users can get water for free.

Since the launch of the campaign in September 2013, the app has been downloaded over 10,000 times, and widespread media coverage has helped raise awareness of plastic waste. This initiative is now generating a strong demand for more water dispensers in the city, and pushing the community's leading organisations, such as

MTR and the Government, to install more water dispensers in MTR stations and at public buildings and other venues.



<http://www.waterforfree.org/>

Hong Kong Baptist University - Campus Sustainability Guide and Campus Environmental and Sustainability Index



Guiding behavioural change and indexing sustainability performance to build a low-carbon campus

Sparing no efforts to develop a sustainable university, Hong Kong Baptist University (HKBU) sees driving behavioural change towards sustainability as equally important to improving energy efficiency on its campus, which is home to around 20,000 staff and students. In light of this, it launched a Campus Sustainability Guide in 2016 to provide staff and students with practical green

recommendations on resource and energy conservation, and waste reduction, all of which was intended to help nurture a sustainable low-carbon culture.

The overall sustainability performance is being measured by the HKBU Campus Environmental Sustainability Index, which helps to quantify and track the University's

sustainability efforts, as well as to identify opportunities for further improvements.



<https://lowcarbon.hkbu.edu.hk/live/en/>

COMMUNITY ENGAGEMENT

Feedback from Participants



“ I participated in the Community Workshop. I am deeply impressed by the estate improvement programme, which has made a refreshing change. The fitness equipment has been particularly welcomed by the elderly residents, who have told me that their physical condition is gradually improving through daily exercise. I would like to express my sincere gratitude to the Housing Authority for these excellent improvement works, and I hope that the estate revitalisation and community engagement will continue. ”

Ho Kwok-wah,
Estate Management Advisory Committee
Member and the Mutual Aid Committee
Chairman of Block 6, Kwai Shing West Estate



“ One of the student programmes for building a low-carbon campus is 'U-Wise Energy Patrol', which audits the wise use of energy on campus. I joined this programme because it's a meaningful way to help lower our carbon footprint by inducing behavioural changes and setting best practices, as promoted by HKBU's Campus Sustainability Guide. I also feel inspired to further adopt a greener and more sustainable lifestyle on campus and at home as well, so as to encourage my peers to do the same and help build a more sustainable society. ”

Wong Lok-yee,
Year 3 student studying China Studies (Economics)
programme at Hong Kong Baptist University



“Elderly people usually have concerns about their electricity expenses. With the subsidy from CLP’s Power Your Love programme, they are more relaxed about switching on the lights at home, which can minimise other household hazards, like falling. In addition, participants of the programme can join hands together to save energy.”

*Daniel Poon Ka-ming,
Registered Social Worker from Caritas*



“This is a meaningful programme. As the landfills of Hong Kong will be full very soon, I am happy to play my part in mitigating the problem. This is also the first time for our school and for me to take action in analysing the waste we produce. It’s been a unique experience!”

*Participating Student in the School Waste
Analysts Training Programme*

The Way Forward

The community is always at the heart of creating a sustainable built environment. The projects showcased here are only a brief overview of how a wide range of parties are taking multiple approaches to achieving the same goal, namely turning our community green in the local context of sustainable development. Combined, these initiatives represent a growing momentum that is impacting the entire community, enabling new achievements in energy savings and the reduction of greenhouse gas emissions.

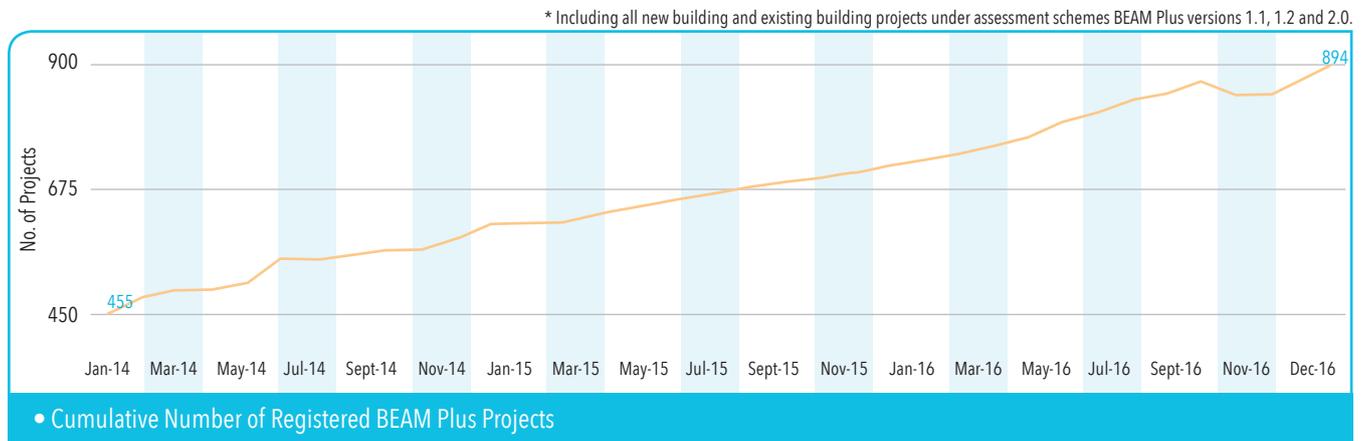
MARKET RESPONSE



Hong Kong was one of the first places in the world to introduce a green building certification system. The number of registered green buildings in Hong Kong has been steadily increasing over the past few years, indicating that the green building movement is gaining acceptance in the industry. What can Hong Kong do to enhance that market response and shape a healthy green building market? This section attempts to answer that question by examining the findings of a recent survey .

MARKET RESPONSE

BEAM Plus is Hong Kong's green building assessment tool. Over the past three years (from January 2014 to December 2016), the number of registered BEAM Plus projects almost doubled, showing an accelerating trend towards green building adoption.



The earlier sections of this Report have already discussed the Government's policies, the CIC's and HKGBC's initiatives for the industry, and the community's participation in creating a sustainable built environment. How is the industry responding to all these factors? By conducting a company-based survey, the researchers hoped to better understand the attitudes and upcoming trends in Hong Kong's green building market.

About the Respondents

From November 2016 to January 2017, the survey drew responses from 44 commercial companies and non-governmental organisations that have participated in green building projects. Some 24% of these

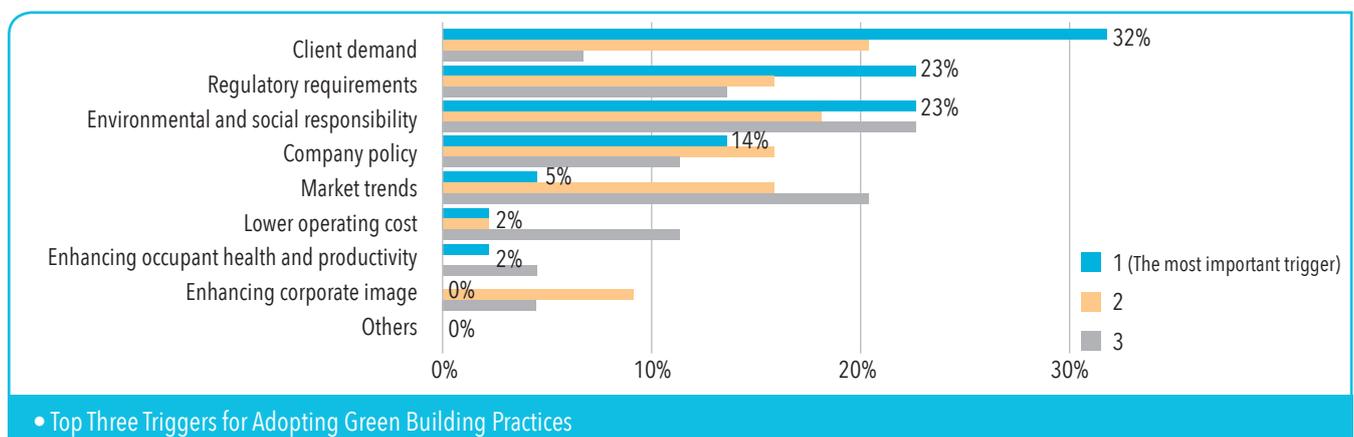
respondents were project owners, while the others were mostly contractors and professional firms providing various services. Around 80% of respondents indicated that Hong Kong is their largest geographical market (in terms of company turnover), and most indicated that new building construction makes up the largest proportion of their green building projects, as compared to retrofitting of existing buildings and the fitting out of commercial interiors.

Due to the limited sample size, the results are not sufficiently exhaustive to indicate comprehensive market trends. That said, however, the responses still provide valuable insights on the current views of industry players, and serve as a reference for future studies.

1. Influencing Factors for Green Building Adoption

1.1 Triggers

When asked to select the three most important triggers for adopting green building practices, 32% of respondents ranked 'Client demand' as the most important trigger, which confirms the vital importance of green building awareness in driving commercial green building development. The other two top triggers were regulatory requirements, and environmental and social responsibility, from which it is possible to conclude that government policies and guidelines also have an important role to play in the development of green building.

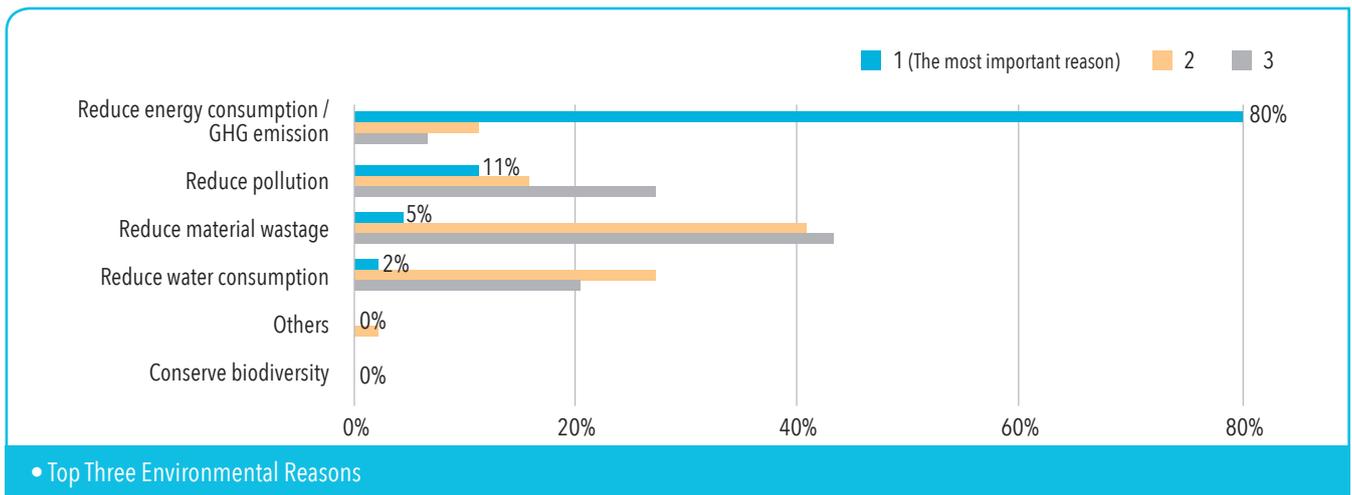


1.2 Environmental Reasons

Regarding the environmental reasons for the adoption of green building, the survey

found that reducing energy consumption or greenhouse gas emissions was the top reason, as indicated by 80% of respondents. This may be due to the ease with which reduced energy

consumption and GHG emissions can be monetised. Other environmental factors, such as reducing pollution and material wastage, were deemed to be secondarily important.

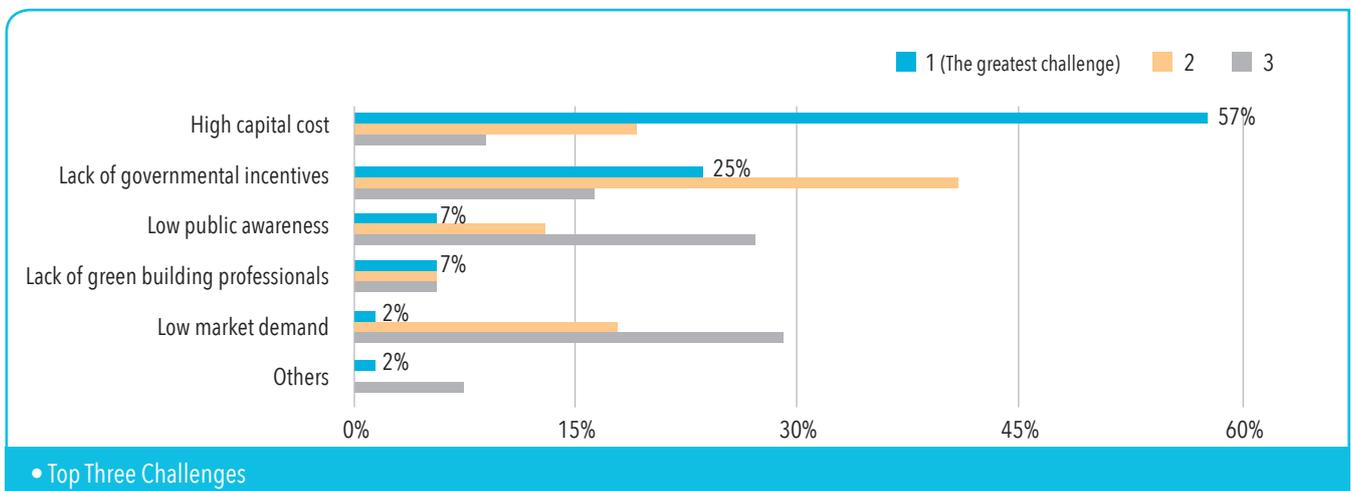


1.3 Challenges

Although there is an increasing market demand and an urgent need for green building, there are a number of challenges and obstacles to implementation. The survey reveals that the top challenge faced in the green building market is high capital cost, which was selected by 57% of respondents

as the most significant challenge. The second was deemed to be the lack of governmental incentives, which was selected by 25% of respondents. In commercial terms, it is clear that budgeting green building costs as a necessary cost in the construction process and pricing in the benefits of green building (e.g., higher rental yields and goodwill) would help to break down some of the current barriers to

green building. The Government already has schemes in place to promote green building (e.g., GFA concessions), though the survey's results make clear that additional optimised government incentives would further enhance the development of green building in Hong Kong and be well received by industry participants.



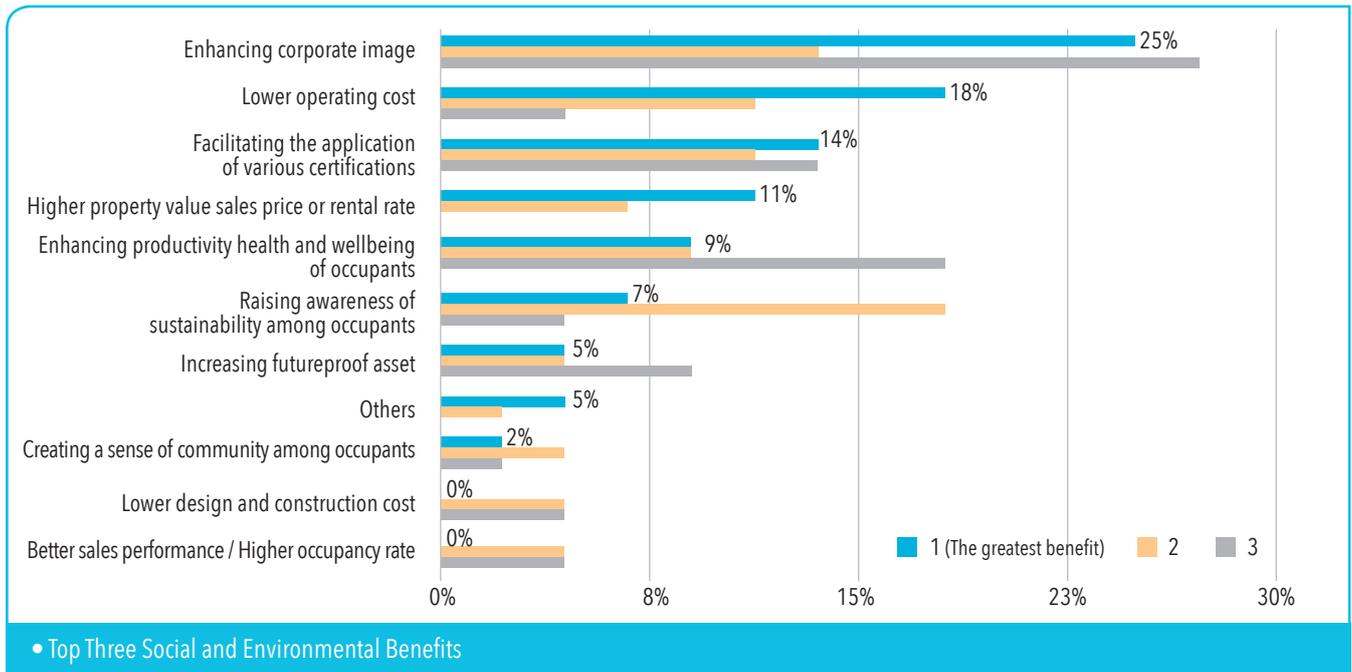
MARKET RESPONSE

2. The Business Aspects of Green Building

2.1 The Benefits of Green Building

The highest percentage of respondents (25%) believe that the leading benefit of green building is enhancing corporate image, while the next highest benefit was lowering operating costs (18%). Other benefits selected

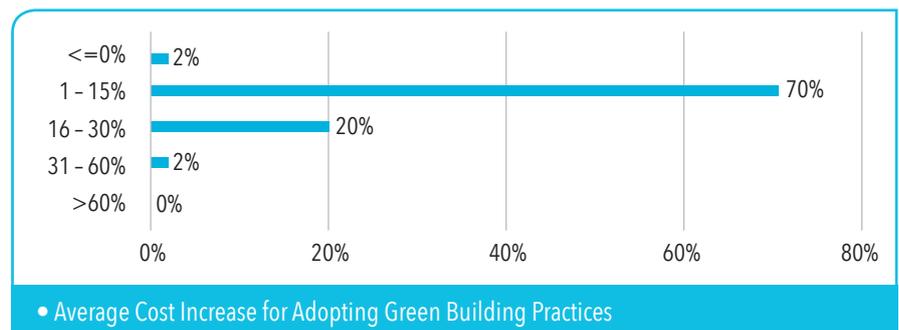
by respondents included raising awareness of sustainability. Assuming that an enhanced corporate image can attract more business, this benefit can be shown to have clear monetary value.



2.2 Green Building Costs and Premiums

Costs and returns are essential thresholds for investors who decide to build green. Over 90% of respondents expressed the belief that adopting green building practices increases the cost of a project, with over 40% of them expecting it to take more than 10 years to achieve payback, and some even unable to estimate the payback time. These higher upfront costs undoubtedly remain a hurdle to the wider adoption of green building.

It is interesting to note, however, that overseas studies have found that green buildings do not necessarily cost more. A publication (*The Cost of Green Revisited*, published 2007) by the firm Davis Langdon showed that 'there is no significant difference in average cost

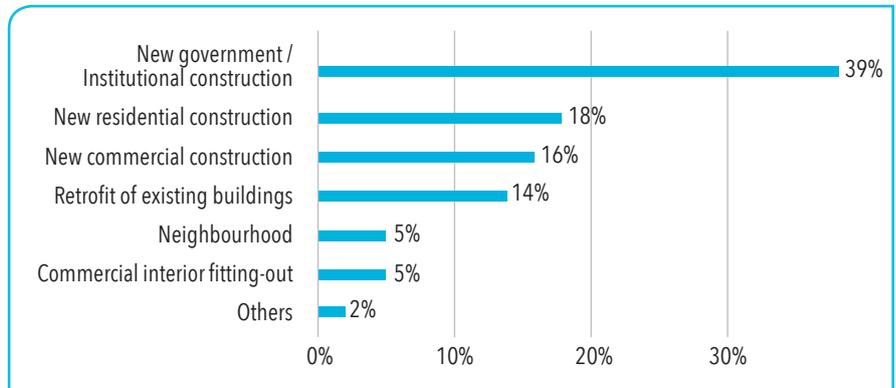


for green buildings as compared to non-green buildings'. The study compared the construction costs of LEED-seeking versus non-LEED-seeking projects, and found many projects achieved LEED in the same cost range as non-LEED projects. Instead, the study found 'project teams conceiving of sustainable design as a separate feature', which led to the belief that green designs must be more expensive.

Closing this perception gap is therefore essential to enabling wider adoption of green building. Taking an optimistic view, there is also strong potential for future cost reductions as more green products become available, emerging green technologies become more mature, and the industry as a whole becomes more skilful at delivering green buildings.

2.3 Expected Growth in Green Building Activities

A total 39% of respondents expect that new government and institutional construction will account for the highest growth in green building in the coming three years (2017-2019). Overall, 73% of respondents believe that growth lies mainly in new buildings, while only 14% think so for existing buildings.

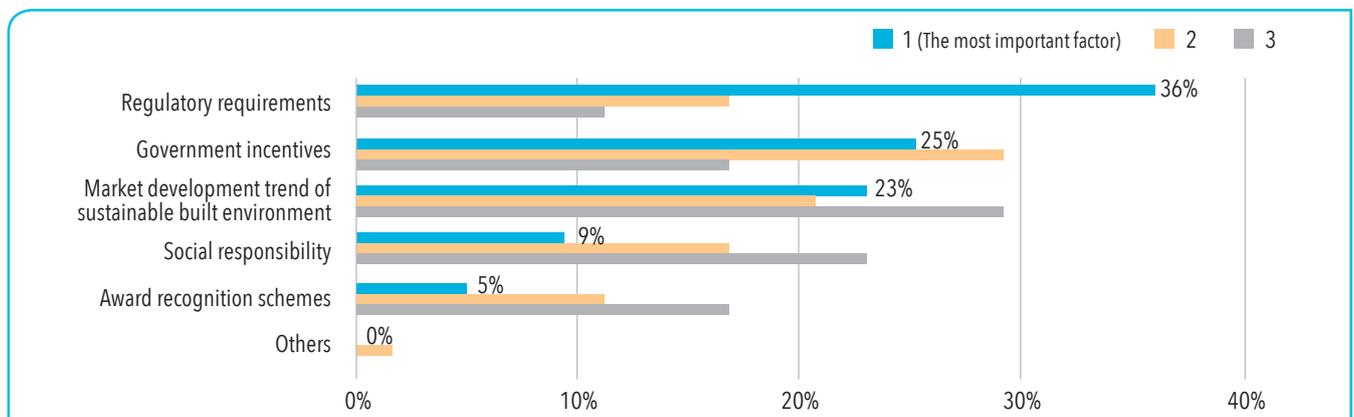


• Sectors Expected to Have the Highest Growth in Green Building in 2017-2019

In *Hong Kong's Climate Action Plan 2030+* released in 2017, the Government identified major existing public sector and commercial buildings (which collectively account for about 20% of the total electricity consumed in Hong Kong) as the primary targets for energy-saving initiatives in the coming years. The Plan also drew attention to the fact that Hong Kong

has a large and rapidly ageing building stock that poses significant challenges in terms of strengthening the urban fabric to better prepare for climate change. The results of this survey suggest that the importance and potential of retrofitting existing buildings has not yet been fully understood by the market.

The majority of respondents expressed the belief that regulatory requirements (36%) and government incentives (25%) are the key factors influencing the future growth of green building. In light of this, the Government has a key role to play in driving the adoption of green building and encouraging all sectors to build green, especially for existing buildings.



• Key Factors Influencing the Expected Growth

3. Common Green Building Rating Systems

Green building rating systems provide guidelines to create better-performing buildings, and help create new marketing and competitive advantages. There are still only a few green building rating systems worldwide. In Hong Kong, the most common systems are BEAM Plus and LEED, with 70%

and 57% of respondents indicating that they had participated in projects rated by BEAM Plus and LEED respectively. The China Green Building Evaluation Label ('Three-Star System') came third, with 25% of respondents indicating that they had achieved ratings under that system.

Although respondents explained that there had been a moderate level of difficulty in

applying for the certification (6-7 out of 10), all respondents who had participated in BEAM Plus or LEED projects managed to achieve the highest Platinum or Gold ratings in most of their projects. This is encouraging proof that project teams are already aiming beyond the systems' minimum requirements.

MARKET RESPONSE

4. Knowledge-based Energy Management

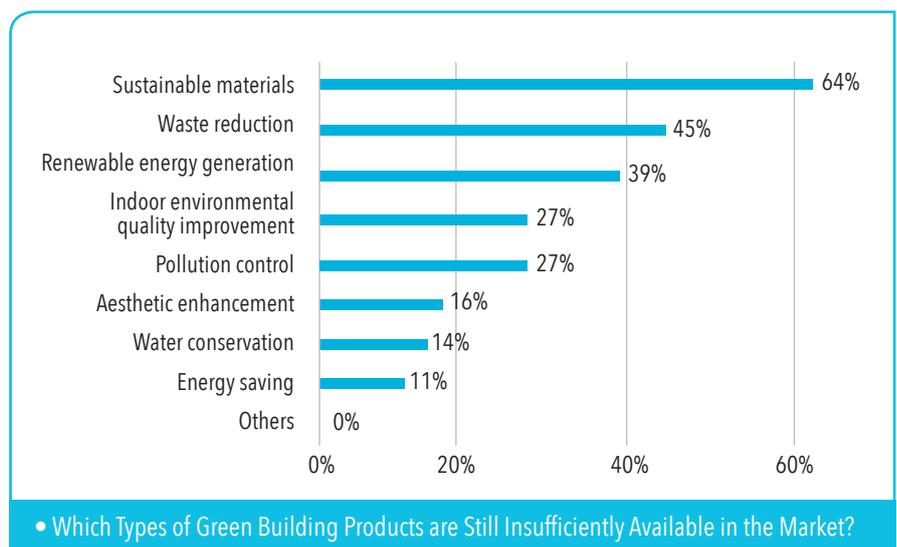
Energy saving is the most critical means by which communities worldwide can reduce their carbon emissions. Identifying opportunities for improvement naturally starts with accurate data, which is where knowledge-based energy management

comes in. Among all survey respondents, 52% owned or managed properties. As air-conditioning consumes the largest portion of energy in Hong Kong's hot and humid climate, this particular group of respondents were asked if they collected data on the major air-conditioning plants in their property portfolio. Encouragingly, 70% of them reported that they do. Moreover, more than 90% of these

respondents have used that data for analyses and enhancements, leading to a reduction in their energy use intensity over the period 2011-2016. These findings not only confirm that energy-based management is effective in saving energy, but also point the way to the rich potential for retro-commissioning and the stimulation of an energy-efficiency market.

5. Green Building Products

Energy saving was stated as the primary reason for using green products, with around 70% of respondents citing this motivation. As explained earlier, this echoes the top environmental reason for green building, namely to reduce energy consumption and GHG emissions. This demand for energy-saving products is reflected by their market availability, with respondents reporting that these products are the most widely available of all green products in Hong Kong. Interestingly, the least available product types were deemed to be sustainable materials and waste reduction products, suggesting that the demand for green building products already goes beyond mere energy-saving appliances.

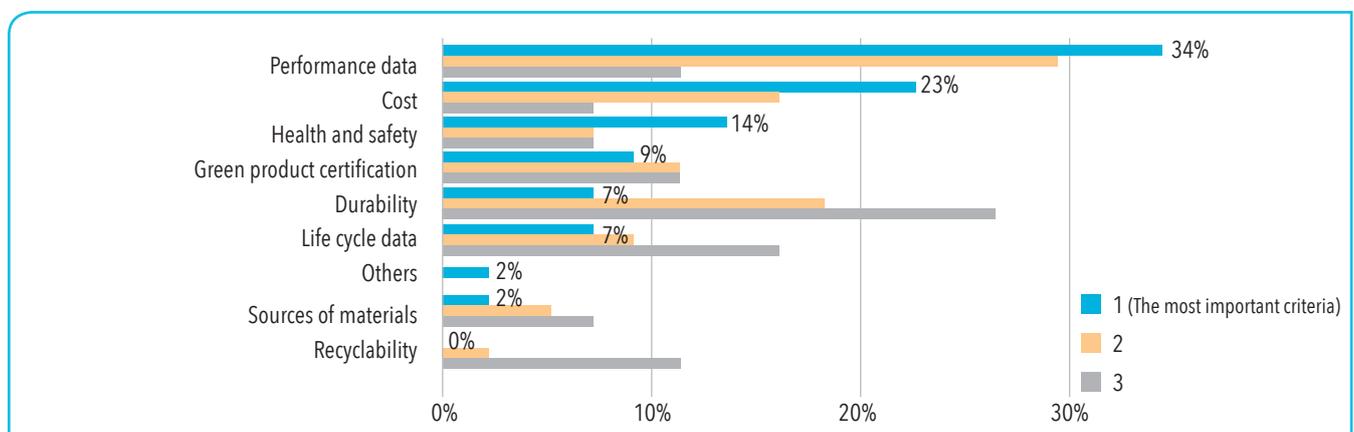


* Respondents were able to choose more than one type of product.

Respondents were also asked what they considered most important when choosing green products. Performance data (e.g.,

energy efficiency) was given as the most essential criterion, followed by cost, and health and safety. These findings may provide

useful insights for product suppliers when developing and marketing new products.



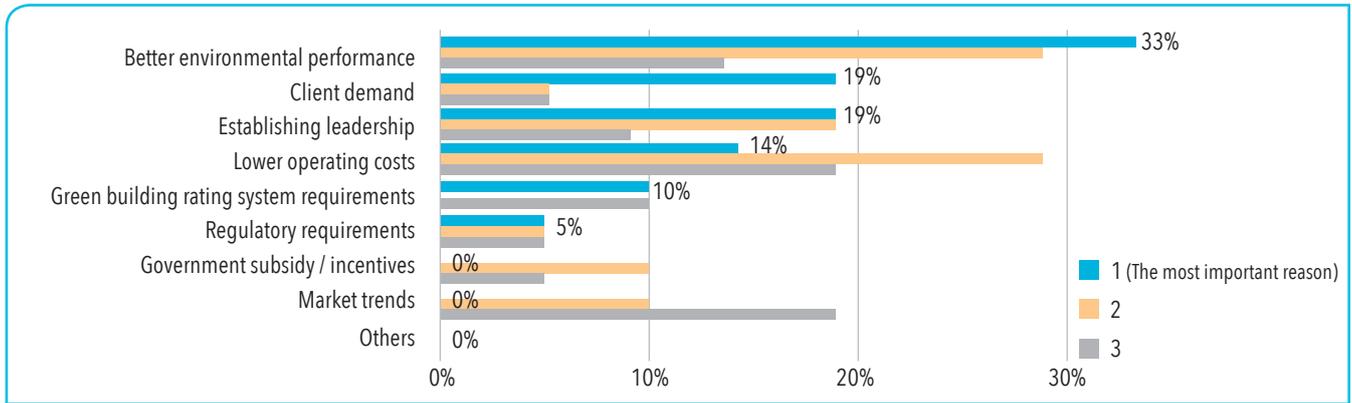
• Criteria for Choosing Green Products

6. Innovation in Green Building

In the period 2014-2016, less than half of all respondents (48%) introduced new

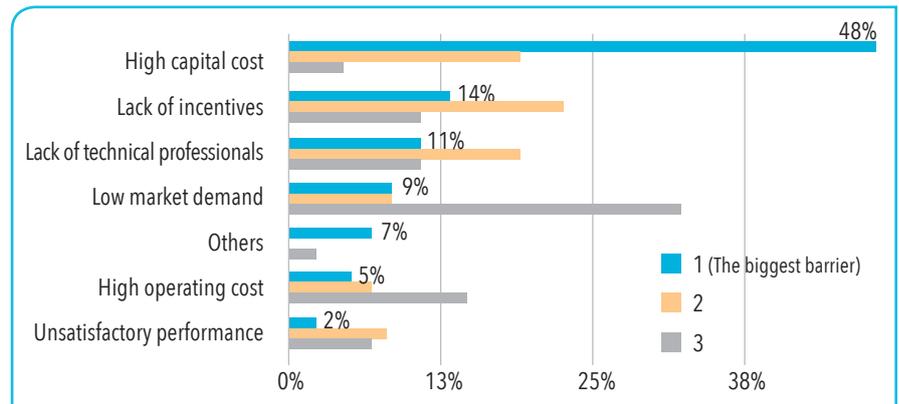
or significantly innovative green building technologies, either of their own creation or available from other commercial companies. The responses from the 48% offer valuable

insights on what motivates the industry to think and act green: better environmental performance, client demand, establishing leadership, and lower operating costs.



• Top Three Reasons for Using Innovative Technologies

With only 48% of respondents using innovative new products between 2014 and 2016, the obvious question is what stopped everyone else from doing so? The survey revealed that financial reasons remain the biggest barrier. When asked about their yearly budget for the application or development of innovative new technologies, 59% of respondents had less than HK\$500,000, and some even had no budget at all, with only a few receiving financial support from the Government. In view of this, funding support for R&D is crucial to pushing forward technological innovation in the industry.



• Top Three Barriers of Using Innovative Technologies

Conclusion

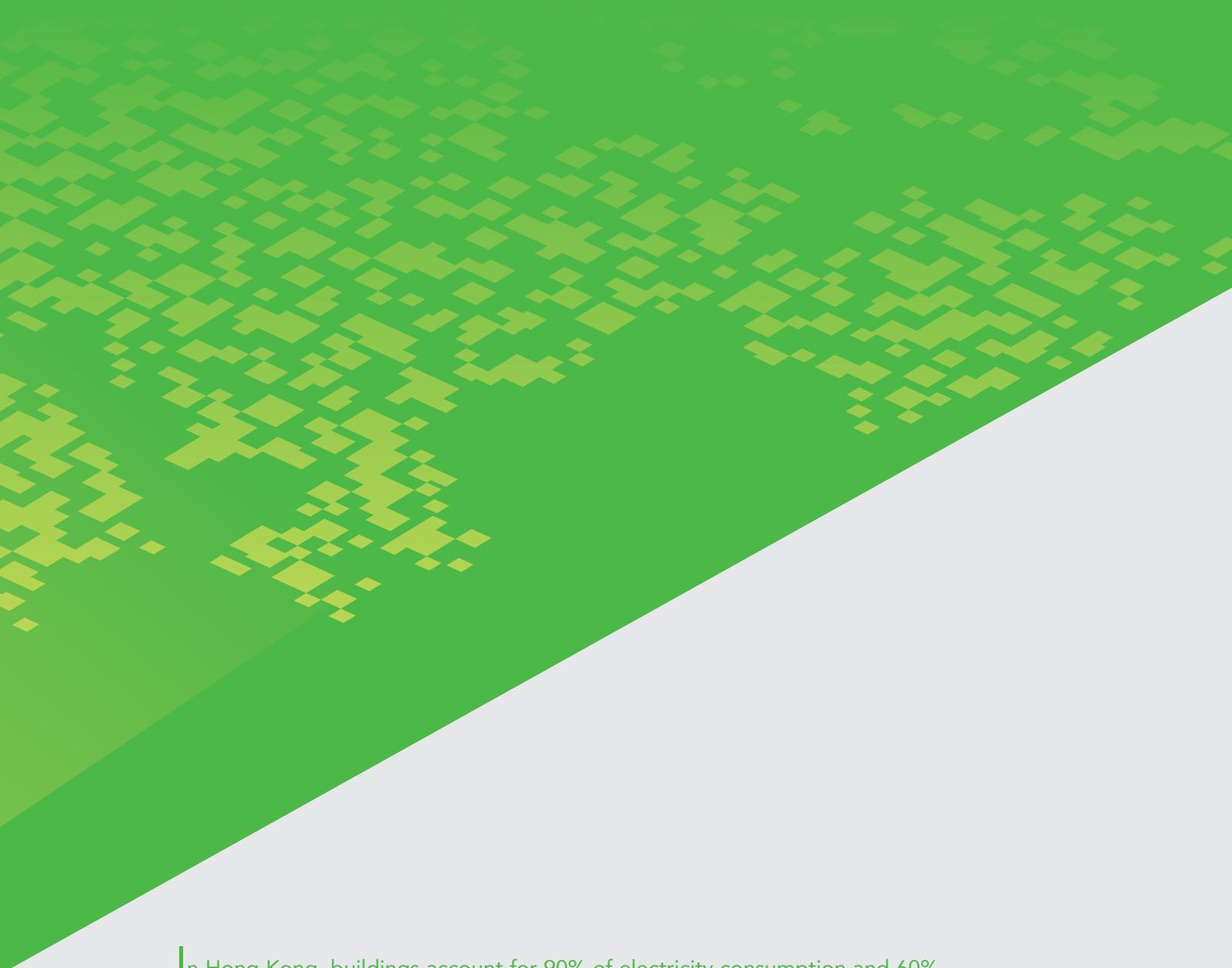
Based on the survey's findings, there are three key areas in which it is possible to encourage even stronger market participation. High capital cost was selected as the top challenge in adopting green building practices. Lowering this capital cost is clearly crucial, but of equal importance is communicating the measurable benefits brought by green building. This can be achieved through the sharing of successful business case studies, thereby changing the common perception that 'building green is expensive'.

The industry has long focused on new buildings. Recent government publications have drawn attention to Hong Kong's vast stock of existing buildings and the need to refurbish them. Faced with this rich potential of new opportunities in existing buildings, now is the time for the industry to attach more importance to existing buildings, and to recognise the benefits of retro-commissioning and retrofitting with green building products and practices.

Last but not least is innovation. Only continual innovation will deliver green building technologies and products that are more efficient and cost-effective. In turn, this will not only lower their capital cost, but also cultivate a healthy market for green building products, providing even more choices for the industry and building users, and creating more opportunities for all stakeholders to participate in the green building movement.

The background is a vibrant green with a subtle, pixelated pattern of lighter and darker green squares. A thick, solid green diagonal line runs from the bottom left towards the top right, separating the green area from a white area at the bottom right.

PUBLIC AND INDUSTRY PROJECTS



In Hong Kong, buildings account for 90% of electricity consumption and 60% of greenhouse gas emissions. With its development still accelerating in parallel with an ever-growing population, Hong Kong's unique high-rise, high density urban landscape remains a critical challenge in the creation of a sustainable built environment.

Thanks to tremendous support from the Government, building developers and building owners, industry professionals are now able to showcase their skills and talents in incorporating green technologies, features and innovations. These efforts not only help to conserve scarce resources, but also create high quality indoor environments and sustainable communities for the long-term well-being of all users.

PUBLIC PROJECTS

Kai Tak Development

New opportunities to create a quality urban environment in the heart of the city

The relocation of Hong Kong International Airport to Chek Lap Kok on 6 July 1998 made available a large piece of valuable land at Kai Tak. Covering about 323 hectares, this prime real estate is directly on Victoria Harbour in southeast Kowloon, offering unique new opportunities to create a quality urban environment through the application of sustainable development and environmentally friendly design concepts.

The visionary and multi-faceted Kai Tak Development (KTD) comprises many high-profile public works projects. These include: the Kai Tak Cruise Terminal (KTCT), which has two berths designed for the world's largest cruise vessels; the Kai Tak District Cooling System (DCS), which is the first-of-its-kind in Hong Kong; and the ambitious Kai Tak Sports Park and Metro Park. When complete, KTD will be home to a population of more than 110,000, and will be a major leisure resource for members of the public from the entire urban area. Designed to become the 'Heritage, Green, Sports and Tourism Hub of Hong Kong', the guiding vision behind KTD





is the creation of a 'distinguished, vibrant, attractive and people-oriented community by the Victoria Harbour'. To achieve this, it is being developed with integrated public spaces, and maximised waterfront areas for the public's enjoyment. Residential, office, retail and hotel provisions have been carefully integrated with sports and leisure activity nodes to ensure vibrancy. Through meticulous urban planning and careful deliberation, KTD seeks to improve the quality of life for the local population and cultivate a strong sense of belonging, with particular attention given to the creation of open spaces, greening, environmental concerns and respect for heritage.

Apart from providing a large piece of available land for development and acting as a catalyst for Kowloon East to evolve into a new Central Business District by rejuvenating the surrounding older districts, KTD also plays a pivotal role in promoting sustainable development and fostering a green environment for future generations. In particular, the Kai Tak DCS, which is groundbreaking in Hong Kong, is being set up to provide cooling water for the air-conditioning systems of commercial buildings, thus helping to save energy. Extensive open spaces amounting to one-third of the total KTD area, including about 11 kilometres of waterfront promenade, have also been planned to form a green web for sustainable development and a quality environment for everyone.

To promote natural ventilation in Kai Tak and to allow the wind to penetrate the existing built-up areas in the hinterland, detailed micro-climate studies were taken into consideration during the planning of the development layout. This led to a key characteristic of the KTD, namely its grid layout with breezeways to capture the prevailing wind from the east and south-east. In addition, the building blocks are separated in a manner to avoid wall effect, with a 'podium-free' design concept that further enhances air ventilation and street-level views. The pedestrian corridors separating the building sites will likewise improve the townscape and allow better air circulation.

PUBLIC PROJECTS

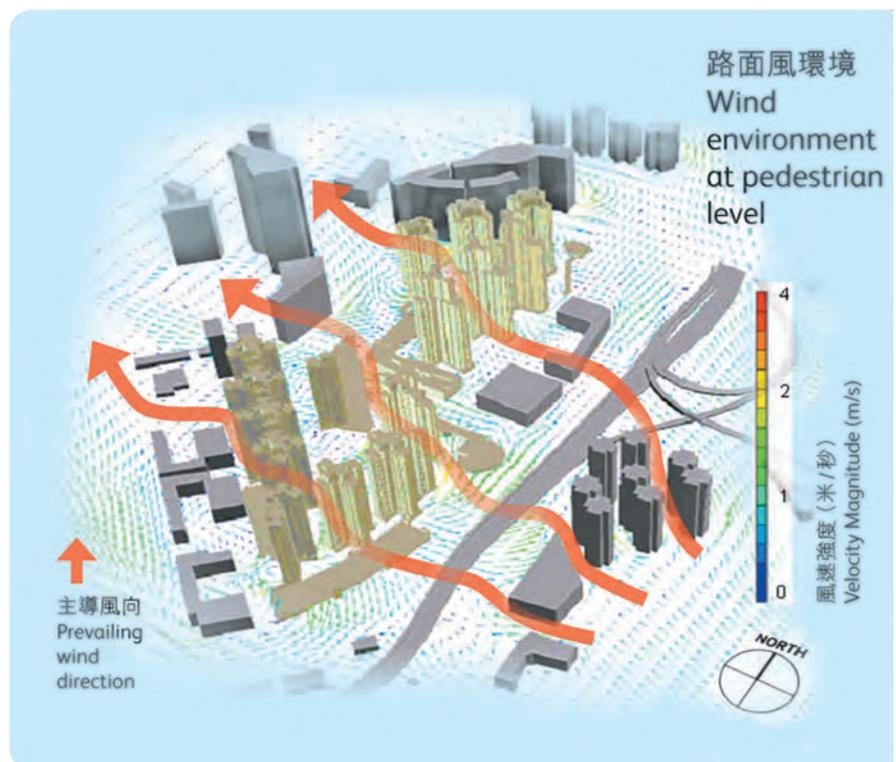
Kai Tak Development

The greening requirement of KTD has been pitched at the very highest level. An overall minimum greening ratio of 30% of the site area has been specified to ensure adequate provision of landscaping outside the public realm and to minimise the heat island effect. A minimum 20% at-grade greening ratio is also being adopted, taking into account development parameters such as site coverage, development quantum, and pedestrian and vehicular circulation.

The Kai Tak Approach Channel (KTAC) and Kwun Tong Typhoon Shelter (KTS) are semi-enclosed water bodies next to the former runway which receive stormwater discharges from a large urban catchment area in Kowloon East. Over the decades, the continuous inflow of polluted water had led to significant water pollution and contaminated sediments on the seabed, resulting in an odour nuisance in the vicinity. Following substantial efforts in 2014 to complete bioremediation treatments under the first phase improvement works in KTAC / KTS, together with associated drainage and sewerage improvement works in KTD and the adjoining hinterland, the odour issue and water quality were substantially improved. Upon its full commissioning in 2015, the

Kwun Tong Promenade became a popular destination in the area, enabling the public to finally enjoy the KTS waterfront. As an on-going initiative to further enhance water quality, the second phase improvement works in KTAC / KTS, now in its planning stage, aim

to further intercept inflowing water through a proposed pumping station at the upstream KTAC, and to enable mechanical flushing by drawing seawater from KTAC towards the harbour side of the runway.



• Water Sports at KTS after the Treatment

BEAM Plus is the green building rating system endorsed by the Hong Kong Green Building Council, under which there are different tools corresponding to the overall sustainability performance of the built environment. KTD is striving to achieve a high standard of green building features under this system. To date, the KTCT Building, Energizing Kowloon East Office, two sewage pumping stations, Kai Tak Fire Station, two desilting compounds, and the Trade and Industry (TI) Tower are all KTD government buildings that have achieved a Provisional or Final Platinum rating, the highest available under the BEAM Plus scheme.

No longer a blueprint on paper, KTD is materialising in phases, with the overall timeframe for completion to span more than a decade. KTD has already witnessed the progressive completion of its first package of projects since 2013, covering the KTCT Building and its two berths, public rental housing, the TI Tower, early phases of the DCS, Phase 1 improvement works at KTAC / KTTS, the Runway Park, Kwun Tong Promenade, two primary schools, a fire station, and associated infrastructure. Other major public works currently under active construction include the Hong Kong Children's Hospital, a portion of the Shatin to Central Link, upgrading of the Kai Tak Nullah, further phases of the DCS, a secondary school, two special schools, the Police's Kowloon East Regional Headquarters, and various stages of major infrastructure works.

From the formulation of a blueprint that reflected public aspirations, through extensive engagement programmes, KTD has garnered widespread community support and is steadfastly moving towards its goal of becoming a visionary green community in the heart of the city.



• Kowloon City No. 1 Sewage Pumping Station



• Kwun Tong Promenade at Daytime



• Runway Park

Project Team

Owner / Developer

Civil Engineering and Development Department (CEDD), HKSAR Government

Project Manager

Kowloon Development Office, CEDD

PUBLIC PROJECTS

EMSD Headquarters Building

The green transformation of a former air cargo terminal



The Electrical and Mechanical Services Department Headquarters Building (EMSD HQ) is an excellent showcase of sustainable development through the complete renovation of a former air cargo terminal into an office-cum-workshop building.

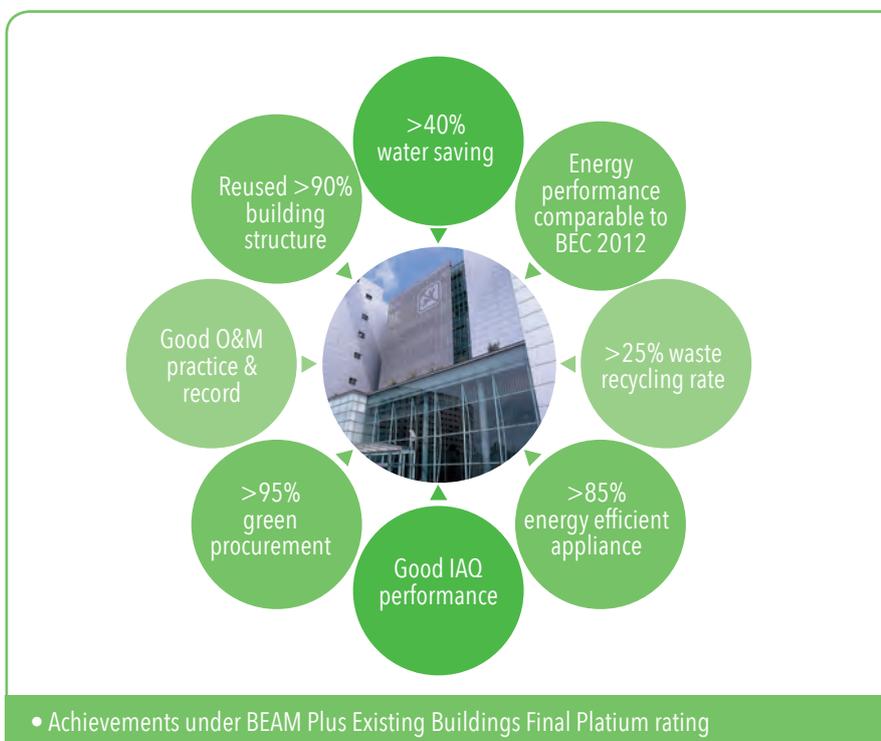
Since moving into the new headquarters in 2005, EMSD has continued implementing many initiatives that further enhance the indoor and outdoor environment, making it greener, more environmentally friendly and more sustainable. These enhancements include the application of advanced technologies to improve energy efficiency, waste reduction, and achieve better environmental quality. Examples include a high-efficiency oil-free chiller, electromagnetic induction descale system, window solar film, LED lamps with automatic control system, rainwater harvesting, a food waste decomposer, a sun-tracking photovoltaic system, light shelves, a solar hot water system, solar-powered street lights, and the reuse

of air-conditioning condensates for toilet flushing. The EMSD HQ has also pioneered the use of Building Information Modelling (BIM) and Radio-frequency Identification (RFID) technology to better manage its electrical and mechanical (E&M) installations. Additional initiatives include the provision of indoor and outdoor vertical greening, bicycle parking spaces, and charging facilities for electric vehicles.

Ongoing enhancements, either under construction or planning, include the adoption of a district cooling system to replace the conventional chiller system for building air-conditioning, as well as the enhancement of the building energy management system, use of LED luminaires, the revamp of an educational path to promote public awareness of energy efficiency and new E&M technologies, and improvements to outdoor areas to help enhance the quality of life for the whole community.

Thanks to these continual improvements and ongoing optimisation of the building, EMSD has enhanced the well-being of the building's occupants and its neighbours, while also minimising environmental pollution. These efforts have been well received and earned widespread recognition and accolades both locally and internationally, including:

- HKIA Merit Award in 2004
- Grand Award in the Newly Renovated Buildings Category of the Green Building Award 2006
- Merit Award in the Public Sector and NGOs Category of the Hong Kong Awards of Environmental Excellence in 2008
- Merit Award at the Skyrise Greenery Awards 2012
- ISO 50001 Certification issued by Accredited Certification International Limited in 2015



A green building can only achieve true sustainability when it is an integral part of the surrounding community. By joining the BEAM Plus Neighbourhood pilot scheme, EMSD was able to affirm its commitment to social responsibility. The key objective of this pilot scheme is to encourage positive integration in terms of environment and social aspects for on-site occupants and neighbours. Following its pilot assessment in 2016, the EMSD HQ achieved a Platinum rating. This outstanding performance is likewise reflected in the building's Platinum rating under the BEAM Plus Existing Buildings assessment scheme. It is the first existing government building to receive such a rating, making it an exemplar and role model in the promotion of sustainable development to other stakeholders of existing buildings.

In response to public aspirations to improve the quality of Hong Kong's built environment, the facilities at EMSD HQ are continually being enhanced to meet new standards of environmental excellence through the adoption of state-of-the-art technologies. This process of non-stop self-improvement has continued for more than 10 years, the major highlights of which include:

Building Energy Management System (BEMS)

BEMS is an information network through which a building's central control system can manage energy consumption by communicating with the building's various energy-related components, particularly the principal energy-consuming building services equipment. The information network enables the real-time monitoring of the EMSD HQ's energy performance, with automatic alerts to inform operational and maintenance staff of abnormal conditions. Logged operational parameters are also used for further analysis, as well as the identification of more energy-efficient modes of operation and new energy management opportunities.

PUBLIC PROJECTS

EMSD Headquarters Building

Oil-free Magnetic Bearing Water-cooled Chiller

In parallel with the advancement of chiller technology, EMSD took the opportunity to pilot a new variable-speed oil-free centrifugal compressor chiller in 2008, which was the first time such a system had been used in a government building. With a cooling capacity of 300 tonnes, the chiller operates with magnetic bearing technology to reduce energy loss, and is quieter and more energy efficient than traditional chillers. The chiller achieves a good part load COP of nearly 10. It operates 24/7, achieving an annual saving of about 110,000 kWh. To make the EMSD HQ even greener, in mid 2017 the air-conditioning system will be connected to the district cooling system (DCS), which is Hong Kong's first district-wide air-conditioning engineering system. At that time, the EMSD HQ will become the first existing building to adopt DCS, providing a model for other existing buildings to follow.

Renewable Installations

To cope with the hot water demand from the EMSD HQ canteen and shower facilities of workshops, and to better use solar energy, a solar water heating system was installed in 2007. The system consists of a 60 m² solar collector area, which achieves an annual saving of about 25,000 kWh. To further promote utilisation of solar energy, a sun-tracker concentrated photovoltaic panel, light shelves and solar powered street lights were also installed.

Energy Efficient Lighting

LED lighting was widely adopted in the EMSD HQ renovation works. The lighting power density of the renovated meeting rooms and toilets completed between 2013

and 2015 is around 11 W/m² and 7 W/m² respectively, which outperform the minimum requirements set out in the Code of Practice for Energy Efficiency of Building Services Installation 2015 Edition by about 21% and 36% respectively.



• Solar Water Heating System



• Daylight reflected from light shelves

Vertical Greening

To improve the aesthetic environment of both the interior and exterior of the building, vertical greening has been installed in the open entrance courtyard and main entrance lobby of the EMSD HQ. This not only highlights the function of the space, but also enlivens these areas in the midst of an industrial district, providing a contrast of patterns, colours and textures. EMSD is committed to installing external greening in additional locations to further enhance the environmental quality.

From its roots as an air cargo terminal building, the EMSD HQ has been transformed into a dynamic and sustainable facility that meets the needs of its occupants and neighbours through the implementation of sophisticated technologies. Through a process of continual improvement and evolution, the EMSD HQ is constantly transforming into an ever-more sustainable building that is integrated seamlessly with its surrounding community, offering an inspirational example of Hong Kong's journey to becoming a low-carbon city.



- Vertical greening to enhance environment

Project Team

Owner / Developer	Electrical and Mechanical Services Department (EMSD), HKSAR Government
Project Manager / Architect / C&S Engineer / M&E Engineer / Landscape Architect / Quantity Surveyor	Architectural Services Department for construction of EMSD HQs Building and EMSD for other works
Main Contractor	Different contractors

PUBLIC PROJECTS

Trade and Industry Tower

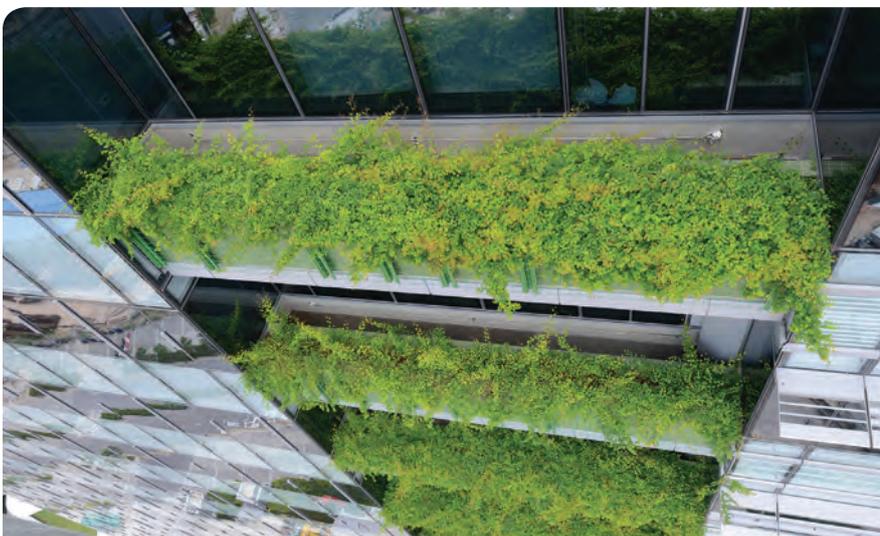
A gift of green architecture and services to the community



The Trade and Industry Tower (TI Tower) is located on the North Apron of the Kai Tak Development (KTD), adjoining Prince Edward Road East to the north and Concorde Road to the south.

The project is organised into a 20-storey Office Tower, home to government offices, and a separate Community Hall comprising a multi-purpose hall and ancillary facilities. The composition of the Office Tower and the Community Hall is further complemented by a grand staircase connecting the ground floor on Concorde Road to a covered walkway on the first floor.

A distinctive 'Green Ribbon' is the project's signature design. The aesthetic interest is further enhanced by introducing an organic, aerodynamic form – the 'White Ribbon' of the Community Hall – to contrast with the efficient and functional image of the Office Tower. The two 'Ribbons' combine to conjure up the concept of a gift of services from the government to the local community. The completed building provides daily services and leisure facilities to the general public, and is therefore an excellent tool for promoting sustainability and green features.



• Vertical greenery on façade forming the 'green ribbon'



• White ribbon on the Community Hall green roof

In keeping with the KTD's 'Green City' concept, strong emphasis has been placed on greening. An exemplary 42% greening ratio has been achieved and over 120 trees have been planted, over 40 of which are on the office tower roof.

Designed to be a showcase of energy efficiency, the project also emphasises sustainability. Passive consideration of sustainability began with the site planning and building layout, and later extended to the application of a wide variety of features:

Passive Devices

- High-performance façade materials were selected to maximise the amount of natural daylight provided to the building while also reducing solar heat gain.
- Solar shading is provided to all façades, providing shading from solar energy and protecting the façade from glare in the east and west under low angle sun conditions.
- Solar chimneys use solar energy to heat the air inside two chimneys serving the Community Hall and basement car park, driving an upward stack that entrains the air in the low zones and extracts it from the space. This enables a reduction in the amount of air conditioning and ventilation required for both the Community Hall and car park.

Active Energy-Efficient Features

- Connection to the Kai Tak District Cooling System (DCS) provides the centralised air-conditioning system with a reliable supply of chilled water for building heat rejection. The DCS is over 20% more energy-efficient than a conventional air conditioning system using cooling towers.
- Free cooling design has been adopted for the entire air-conditioning system so that the conditioned space is served by 100% untreated fresh air when the outside air meets the prescribed air intake conditions.
- Each of the building's six primary air units (PAUs) is equipped with a heat recovery thermal wheel between the supply and return air streams for reclaiming the waste energy from exhaust air and pre-cooling or pre-heating the incoming fresh air.
- Demand control of PAUs based on indoor CO₂ levels and temperature facilitate energy saving in the fresh air supply system, especially for indoor spaces with significant variations in the number of occupants.
- Service-on-demand operational modes have been adopted for the four escalators at G/F and M/F, whereby passenger proximity sensors are installed at the entrance of each escalator for controlling the ON/OFF operation of the escalator, thereby contributing to a substantial energy saving when there is no passenger traffic.
- Occupancy sensors are used extensively for both inner zones and perimeter zones, and daylight sensors in perimeter zones throughout all open-plan offices and cellular offices contributes to a significant saving in lighting energy.
- Regenerative power converters are installed on all of the 18 lifts serving the building. This regenerative energy can be reclaimed under both light-load lift ascending and heavy-load lift descending operational modes.
- Water-saving sanitary fittings are used to save water usage, which in turn reduces the operational time of water pumps and their associated power consumption.



• Solar Chimney in basement carpark for ventilation

PUBLIC PROJECTS

Trade and Industry Tower



- Solar hot water panel in external landscaped area



- Solar tracking light pipes on community hall roof

Renewable Energy

- The photovoltaic (PV) system comprises 189 opaque PV panels on the rooftop, as well as 48 see-through thin-film PV (TFPV) panels on the main entrance canopy and 96 TFPV panels on the 1/F elevated walkway.
- The solar hot water supply system is equipped with evacuated tube solar collectors, which serve to pre-heat incoming water for the shower room.

Other Features

- Twenty-seven fixed light pipes, three anidolic sun pipes and six sun-tracking optic fibre sun pipes have been installed to reduce the artificial lighting energy consumption.
- Task lighting has been adopted in office areas to further reduce the energy consumption of background lighting.
- An automatic refuse collection system enables effective waste management for the entire building.
- Educational provisions for the public include an interactive display in the main 1/F lobby and various signage to enhance public awareness of the building's sustainable architecture.



• Automatic Refuse Collection System (container in basement carpark)

These efforts to create a green and sustainable building have earned it widespread recognition and awards. The project received a Grand Award at the Green Building Awards 2014, organised by the Hong Kong Green Building Council and the Professional Green Building Council. It was also a Finalist in the Quality Building Awards 2016, Special Architectural Award, at the Architectural Services Department Annual Awards in 2015, and is certified Platinum under LEED and Provisional Platinum under BEAM Plus.

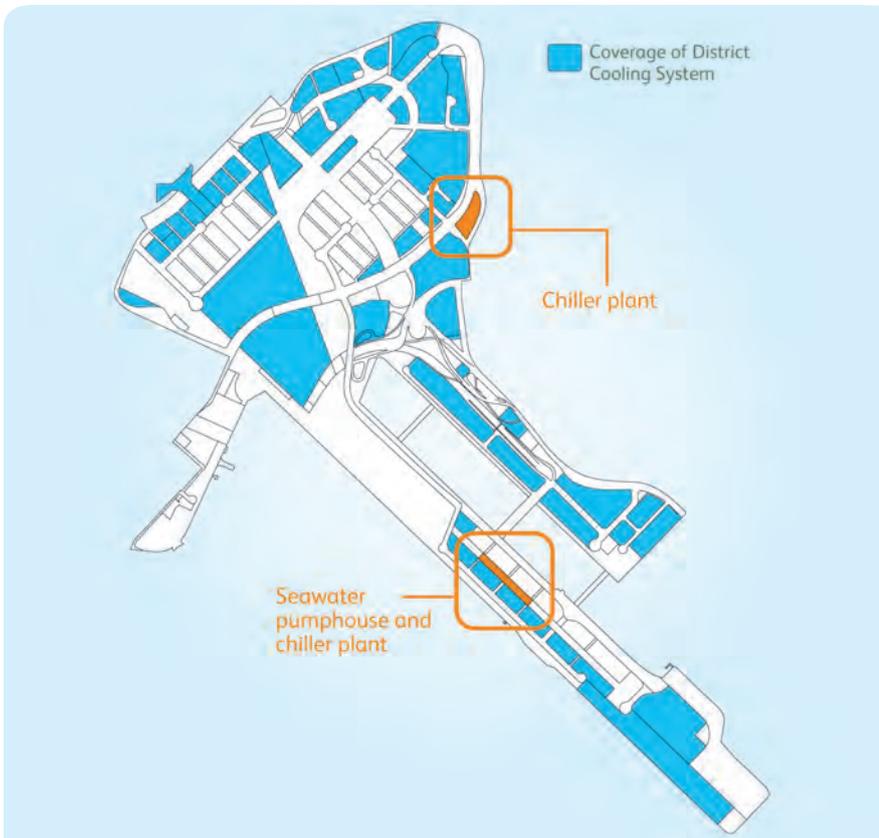
The office building has been meticulously designed not only to meet its occupants' needs in respect of comfort, security, safety and operational efficiency, but also to achieve eco-friendly operations. It demonstrates an exemplary performance of energy efficiency, reducing energy consumption by around 27%. The high level of greening and other green features have likewise resulted in around 36% less carbon emissions when compared with the Building Energy Code (BEC) 2007 baseline model.

Project Team	
Owner / Developer	Government Property Agency, HKSAR Government
Project Manager	Architectural Services Department, HKSAR Government
Architect	Wong Tung & Partners Limited
C&S Engineer / M&E Engineer / Sustainable Design Consultant / Environmental Consultant	Arup
Landscape Architect	Urbis Limited
Quantity Surveyor	CS Toh & Sons & Associates Limited
Main Contractor	Dragages Hong Kong Limited
Interior Designer	TeamDeco Limited
Wayfinding Designer	Marc & Chantal Design Limited
BEAM Plus & LEED Consultant	Stephen Lau and Joyce Tai

PUBLIC PROJECTS

The District Cooling System at the Kai Tak Development

A pioneering centralised air-conditioning system for realising sustainability vision



• Locations of DCS Pumphouse and Chiller Plants



• DCS North Plant



• Inside DCS Plant

The HKSAR Government is taking the lead to implement a first-of-its-kind district cooling system (DCS) in Hong Kong at the Kai Tak Development (KTD). Spanning a total area of more than 320 hectares, the KTD is a huge project that covers the site of Hong Kong's former-airport and adjacent areas. It comprises various types of buildings, including commercial buildings, hospitals, schools, sport facilities and government buildings. The planned total public and private non-domestic air-conditioned floor areas in the KTD amounts to about 1.73 million m², for which the air-conditioning demand is expected to be about 284 megawatts of refrigeration (MW_r).

To meet this large-scale challenge, the DCS at KTD consists of two central chiller plants, namely the North Plant and the South

Plant. The cooling capacities of the North Plant and the South Plant will be 162 MW_r and 122 MW_r respectively. Both plants are mainly underground structures. Chilled water is produced in the chiller plant room and distributed to the consumer buildings through the underground chilled water pipes. The total length of the chilled water pipes is about 40 kilometres.

A DCS is the most energy-efficient form of centralised air conditioning system, consuming about 35% less electricity than traditional air-cooled air conditioning systems. Upon completion, the DCS at the KTD is expected to achieve an annual saving of about 85 million kWh in electricity consumption.



The DCS also plays an important role in helping to mitigate the heat island effect by eliminating the heat rejection of separate air conditioning systems from individual buildings. Other benefits for individual users include a reduction in the upfront capital cost for installing chiller plants, which often account for about 5-10% of the total building cost. This translates into more flexible building designs for consumer buildings as developers do not need to install their own chillers and the associated electrical equipment. Furthermore, the DCS is a highly adaptable air-conditioning system that can be tailored to the varying demands of different users.

The DCS project at KTD is being implemented in three phases. Phases I and II are now completed, and Phase III is in progress. The DCS has been in operation since February 2013, and the whole project is expected to be completed by 2022.

As of mid-2016, the DCS at KTD was providing services to five consumers, namely the Kai Tak Cruise Terminal, Ching Long Shopping Centre (serving Kai Ching Estate and Tak Long Estate), the Trade and Industry Tower, and two primary schools. In 2017-2019, five more consumers will be connected to the DCS, including the Shatin to Central Link (SCL) Kai Tak Station, the SCL To Kwa Wan Station, the Hong Kong Children's Hospital, the EMSD Headquarters, and the Kowloon East Regional Headquarters and Operational Base cum Ngau Tau Kok Divisional Police Station.

Project Team

Owner / Developer	Electrical and Mechanical Services Department, HKSAR Government
Project Manager	Arup
Architect / Landscape Architect	Andrew Lee King Fun & Associates Architects Limited
C&S Engineer	Jacobs China Limited
M&E Engineer	J. Roger Preston Limited
Sustainable Design Consultant / Environmental Consultant	Allied Environmental Consultants Limited
Acoustic Consultant	Aerotech Acoustics Limited
Main Contractor	Hong Kong District Cooling DHY Joint Venture

PUBLIC PROJECTS

Development of Anderson Road Quarry Site

Turning a former quarry into a sustainable and spongy community



Since the 1950s, the Anderson Road Quarry (ARQ) in East Kowloon has played a significant role in Hong Kong's development, supplying aggregate, asphalt, stone and concrete to the local construction industry. Now vacant, this 40-hectare site will soon be reborn, this time playing a significant role in Hong Kong's move towards a greener and more sustainable built environment.

The project will feature about 12 hectares of housing, comprising about 9,400 private and subsidised housing flats, with a planned population of about 25,000. The population intake will start from 2023/24 onwards. Land will also be used for commercial uses, government, institution or community facilities, open space and amenity areas. The construction of the site formation and associated infrastructure works commenced in

December 2016, with a targeted completion date of 2022.

ARQ's location and its status as a piece of precious virgin land in a highly urban area make this a unique opportunity to develop an exemplary new showcase of sustainable and spongy living area. 'Smart' and 'blue-green' are the two major initiatives that will guide the entire development process.

Smart initiatives include features such as pedestrian walkable networks, cycling networks with shared/rental bikes, interactive bus-stop concepts, and smart phone apps, all of which can be used to encourage residents to use convenient and healthy ways to commute within the area, thus helping to reduce vehicular transportation and emissions.

The integration of total water management with low impact development (LID) concepts will likewise help to create a leisure-oriented, socially integrated and harmonious community. In the context of this development, LID will be a blue-green infrastructure, integrating water planning with landscape and urban design, namely an artificial flood attenuation lake cum park, an underground storm water storage tank, rainwater harvesting system, bio-retention system, porous pavements, natural rock channels, some of which will be the first of their kind in Hong Kong. The rainwater retained inside the underground storm water storage tank will further serve as a valuable water source for revitalising the downstream Tsui Ping River, which will result in significant environmental, ecological and landscaping benefits for the entire region. To better conserve water resources, an intelligent water network and automatic meter reading systems will be implemented. The feasibility of using the first public grey water recycling system is also being studied.

In addition to all the initiatives mentioned above, a new bus-to-bus interchange (BBI) will be constructed at the toll plaza of the nearby Tseung Kwan O Tunnel. This will help to address surging demand for public transportation in the area, and mitigate the impact of new traffic generated by the ARQ development. A series of associated off-site road improvement works and pedestrian connectivity facilities is likewise proposed to enhance pedestrian connectivity between the ARQ site and the surrounding neighbourhoods.

When complete, ARQ will undoubtedly be a dynamic showcase of green and sustainable thinking; a vibrant new community at the forefront of Hong Kong's transition to a low-carbon city.



Project Team

Owner / Developer	Civil Engineering and Development Department (CEDD), HKSAR Government
Project Manager	New Territories East Development Office, CEDD
C&S Engineer / M&E Engineer / Landscape Architect / Quantity Surveyor / Sustainable Design Consultant / Environmental Consultant	AECOM
Main Contractor	Chun Wo - STEC - Vastream Joint Venture

PUBLIC PROJECTS

1/F Main Block of the APB Centre

Setting a new standard for sustainable office renovation



The renovation of the 1/F Main Block of the APB Centre is the first government office in Hong Kong to achieve a BEAM Plus Interiors V1.0 Platinum rating, making it an exemplary showcase of sustainable office renovation.

During this renovation project, which was completed in March 2015, the premises were transformed from a pre-existing store with an internal floor area of around 800 m² to office accommodation for the Architectural Services Department (ArchSD), with about 100 staff now working there.

The renovation project adopted a holistic approach to sustainable design, green construction, and environmentally friendly operation and maintenance. Sustainable and innovative design strategies, such as a radiant cooling system, indirect LED lighting, automatic controls for building systems, water-efficient fixtures, sustainable materials and flexible layout, were all integrated in the renovation, with adoption of Building Information Modelling (BIM), to create a low-carbon, green, healthy and modern indoor environment.



More than 97% of all the furniture and partitions in the new office were relocated from the previous office, and more than 80% of all newly installed materials were from sustainable sources. For instance, the new office adopted bamboo for its wall coverings and skirtings. The raised floor system and carpet are likewise made of recycled materials, and the doors are made of sustainable timber. All newly installed elements were

also modular in design and therefore can be easily disassembled and reused in the event of future renovations.

During the demolition stage, the demolished concrete was reused as filling material at another site. Later, at the construction stage, recyclables were sorted and stored in designated areas to facilitate recycling. This commitment to recycling is now reflected in

the building's day-to-day operations, with dedicated collection points for the recycling of paper, metal, plastic, glass and rechargeable batteries.

The office's extensive energy conservation measures include building automation controls such as occupancy sensors to turn off the lighting and air-conditioning system after office hours, as well as daylight sensors that automatically minimise the artificial lighting whenever possible. The office's real-time energy consumption is displayed in the entrance, providing a means for all occupants to better understand its environmental performance. The use of Building Information Modelling (BIM) likewise enables continuous energy optimisation.

A wall of greenery in the main corridor of the office serves as a natural air filter. Other key elements that support the building's indoor environmental quality include task lighting for every workstation, CO₂ sensors that monitor the CO₂ concentration in the air, and an independent local exhaust system in the printing room. In keeping with the project's green focus, the building's existing podium roof was transformed into a green roof with around 60 m² of vegetation.

Following the renovation works, a survey was conducted that revealed the majority of occupants experience this new indoor environment as being healthier, more comfortable and a more efficient place to work. Indeed, the completion of this landmark project successfully demonstrates the feasibility of sustainable office renovation, and is powerful confirmation that green thinking can offer rich benefits in terms of the health, well-being and productivity of all occupants.



• Bio-filtration green wall



Project Team

Owner / Developer / Project Manager	Architectural Services Department, HKSAR Government
Architect	Llewelyn-Davies Hong Kong Limited
M&E Engineer	Wong & Ouyang (Building Services) Limited
Sustainable Design and BEAM Plus Interiors Consultant	Arup
BIM Consultant	Vircon
Main Contractor	Able Engineering Company Limited

PUBLIC PROJECTS

Tai Po Water Treatment Works

Stepping up to the water-energy nexus challenges

The expansion of Tai Po Water Treatment Works forms part of the overall strategy to enhance the reliability and flexibility of Hong Kong's water supply. Together with the Sha Tin Water Treatment Works, these two major plants meet up to about half of Hong Kong's total water demand. Since the Sha Tin plant has been in service since 1964, the Water Supplies Department has decided to carry out in-situ re-provisioning. To maintain the water supply during this partial shutdown, it is necessary to expand the Tai Po plant to increase its output capacity from 400 million litres per day (MLD) to 800 MLD. The project involves upgrading the existing water treatment facilities and constructing additional treatment components known as Stream II. When complete, the expanded plant will be able to take up the existing load of the Sha Tin plant to supply freshwater to a significant part of Kowloon, Central and Western Districts. In the long term, the expansion will also allow a more balanced territory-wide distribution of treatment capacity.

In line with the Government's policy to promote sustainability, the design of the expanded Tai Po plant incorporates various sustainable features, particularly in terms of water and energy efficiency.

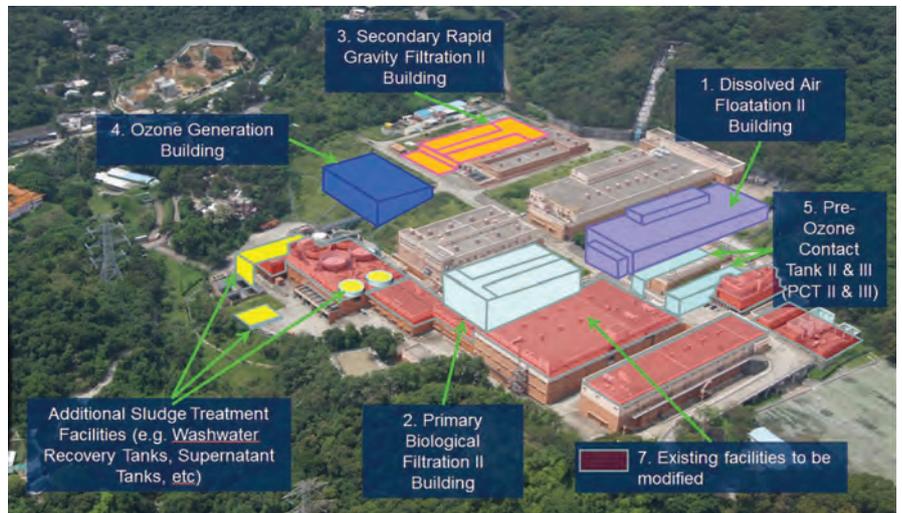
For instance, rainwater and used sample water have been identified as two alternative water sources for non-potable applications, which include landscape irrigation and toilet flushing. A rainwater harvesting system and a sample water recycling system will be provided to collect rainwater and recycle used sample water respectively. The systems will be operated in a hybrid supply mode, namely fed by both harvested rainwater and used sample water. Lifecycle cost analysis has confirmed the economic viability of using these alternative water sources.



The water treatment process and the delivery of fresh water for public consumption require energy, all of which comes from electricity. The expanded Tai Po plant is designed to adopt a gravity flow conveyance system for the treatment process to minimise energy use. High-efficiency pumps will be used in the treated water pumping station, and their efficiency will be further enhanced by the application of a special epoxy internal coating. Photovoltaic panels will also be installed on the roof of one of the new buildings to generate electricity. Furthermore, LED lighting will be installed in the existing and new buildings with a zonal setup, which can be controlled and monitored through a new building and energy management system.

A benchmarking study was conducted to compare the energy performance of the Tai Po plant with overseas water treatment works in reference to the Final Report on Electricity Use and Management in the Municipal Water Supply and Waste Industries published in 2013 by the Electric Power Research Institute and Water Research Foundation. The comparison shows that its energy performance is on a par with the world's best-performing water treatment works.

In addition to all the above features, vertical greening and rooftop edge planters will be provided with an aim to softening the buildings' hard edges and blending the entire plant into the natural surrounding environment.



- New treatment components to be constructed in Tai Po Water Treatment Works Expansion Project



- Prospective view of greenery features near administration building

Project Team

Owner / Developer	Water Supplies Department, HKSAR Government
Project Manager	Black & Veatch Hong Kong Limited
C&S Engineer / M&E Engineer / Landscape Architect	Black & Veatch Hong Kong Limited (Preliminary Design) China State - ATAL Joint Venture (Detailed design)
Main Contractor	China State - ATAL Joint Venture

PUBLIC PROJECTS

The Sustainable Neighbourhood Design of Shek Wu Hui Sewage Treatment Works

Transforming sewage treatment facilities into an Environmental Campus



Shek Wu Hui Sewage Treatment Works, originally built in the 1980s, has been serving the Fanling and Sheung Shui areas for over 30 years, during which time it has witnessed the rapid development of both towns, from quiet rural villages to the major population hubs that they are today. To double its capacity from 93,000 m³/day to 190,000 m³/day, the plant will embark on its third upgrade. When complete, it will be the largest tertiary sewage treatment works in Hong Kong, meeting future development needs while also increasing effluent quality to meet rising discharge standards.

Guided by its vision to provide Hong Kong with world-class wastewater treatment and storm water drainage services, the Drainage Services Department (DSD) is taking this opportunity to transform the conventionally function-driven plant into an 'Environmental Campus' that not only adopts state-of-the-art tertiary treatment technologies, but also incorporates green design and community provisions. It is hoped that this will change these traditionally unwanted facilities into

an integral asset in the local environment, thus playing an important role in creating a sustainable neighbourhood.

The new treatment technologies will allow expansion flexibility for streamlining future treatment technology options. Together with planned reclaimed water treatment facilities next to the plant, high quality effluent could be further polished for non-potable uses such as flushing, potentially saving up to 21 million m³ of fresh water per year.

Harvesting renewable energy from sewage treatment is a global trend, and the plant at Shek Wu Hui is no exception. Apart from conventional anaerobic digestion to generate biogas, Hong Kong's first thermal hydrolysis pre-treatment (THP) system will be installed to enhance sludge digestion, thus increasing biogas yields by up to 30%. This 'green' power is forecast to reduce the plant's power consumption by 20 million kWh per year, equivalent to the annual power consumption of 4,000 families.



- Hong Kong's first thermal hydrolysis pre-treatment (THP) system.

To further promote co-use of the plant with the community, its site boundary will be set back to provide an aesthetic riverside promenade that connects with Sheung Shui town centre, thus enhancing intra-district travel and connections with the community. The roofs of the plant's Workshop Buildings will also be open to the public as a viewing platform, enabling people to enjoy the scenery of Long Valley and its picturesque sunsets. The Shek Sheung River adjacent to the plant will likewise be beautified with riparian vegetation, and replenished with high-quality effluent to enhance local flora and fauna.

The design features an overarching theme of an 'Environmental Campus', using interactive educational exhibits to illustrate the plant's functions along a tour path. A virtual tour of the plant using Building Information Modelling (BIM) will also be available to the public, showcasing the power of BIM in design, construction and future asset management, as well as DSD's vision in driving sustainable development in the construction industry through smart, innovative and resilient design.



• Precision point cloud scans combined with revit model to virtually recreate existing SWHSTW and the phased upgrading works

Project Team

Owner / Developer	Drainage Services Department (DSD), HKSAR Government
Project Manager	Sewerage Projects Division, DSD
Architect / C&S Engineer / M&E Engineer / Landscape Architect / Quantity Surveyor / Sustainable Design Consultant / Environmental Consultant	AECOM

PUBLIC PROJECTS

Ko Shan Theatre New Wing

The seamless integration of a green theatre and public park

The Ko Shan Theatre New Wing is the first purpose-designed modern venue commissioned by the Government to preserve, promulgate and develop Cantonese Opera in the Greater Pearl River Delta area. It is situated adjacent to the existing Ko Shan Theatre, which has already been a popular venue for Cantonese Opera performances in Hong Kong for some time. The New Wing, together with the existing theatre, transforms the whole Ko Shan Road Park into a cultural incubator for the development of Cantonese Opera.

From the outset, the building's architecture needed to address a fundamental dichotomy between the natural and urban worlds. This dichotomy is intrinsic to the site, namely an existing green park within a high-density residential district. Every design strategy had to strike a balance with the precious natural context of the park, which was interwoven with the daily life of the local community. In many respects, the design actually created a positive impact on the environment and the community.

The New Wing was specifically designed to preserve the park's unique green context. The design of the curvilinear main foyer responded to the existing park's topography and preserved the precious mature trees on site. Lush greenery on stepped green roofs and terraces, together with a slatted façade crafted from timber, harmoniously integrate the building's bulk into the scale, texture and colours of the natural context.

The Theatre was also designed to be a vertical extension of the existing park. Apart from the auditorium and ancillary functions required by the project brief, the design created a Green Trail and a sizable public green space – the Moon Lawn – to offer the local community additional park space for leisure and exercise. All these spaces were designed to be barrier-free and universally accessible to all people.



“*Ko Shan Theatre New Wing is a contemporary theatre that integrates seamlessly into the surroundings. The theatre is indeed an architectural masterpiece that is well positioned and designed to meet the artistic and functional needs of Cantonese opera performances and rehearsals.*”

*Ms Michelle Li, Director of
Leisure and Cultural Services*

The project site was formerly the size of four tennis courts, which could only host around 100 people at a time. The New Wing caters for more than 1,000 people via a 600-seat auditorium and ancillary functions. At the same time, it offers a greater than 300% increase in green coverage when compared to the original site, and creates additional green public space for park users.



Positive impacts on the environment are further enhanced via green building strategies, including the use of a high-performance Low-E double glazed building envelope, external sun-shading slats, rainwater recycling, PV renewable-energy installation and dimmable LED-lighting. Floor tiles are made from recycled porcelain, and titanium oxide treatment is used to decompose organic waste and oxidise nitric dioxide into less harmful substance. Extensive green roofing mitigates the heat island effect and provides a good thermal barrier against solar radiation. Natural daylight, sounds, breezes and scenery are all brought into the interior via the high-performance glazed building enclosure, which has electrically-operated windows for opening under favourable weather conditions, thus enabling free-cooling ventilation in the foyer to further minimise energy consumption. The project received the Green Building Award 2016 – Grand Award, The International Architecture Award 2016, Quality Building Award 2016 – Merit Award, and the Hong Kong Art & Design Festival – Outstanding Greater China Design Award.



Project Team

Owner / Developer	Leisure and Cultural Services Department, HKSAR Government
Project Manager	Architectural Services Department, HKSAR Government
Architect	Ronald Lu & Partners
C&S Engineer	Mott MacDonald Hong Kong Limited
M&E Engineer	Electrical and Mechanical Services Trading Fund, HKSAR Government
Landscape Architect	ACLA Limited
Quantity Surveyor	Rider Levett Bucknall Limited
Environmental Consultant	Allied Environmental Consultants Limited
Main Contractor	Gammon Construction Limited
Town Planner	PlanArch Consultants Limited

PUBLIC PROJECTS

Tiu Keng Leng Sports Centre and Tiu Keng Leng Public Library

An inspirational green community hub



Public facilities not only play a critical role in promoting quality of life and a strong community spirit, they can also serve as everyday icons of sustainability and help promote green thinking to all members of society.

Although the sports centre and district library in this project each have a unique identity, the two are united by a multi-layer 'green carpet' district open space, which embraces the distinct building masses in a harmonious master plan. Lawns are accessible to all, offering a natural leisure experience, and greening is used on multiple planes, including green roofs and vertical greening. The overall outlook of the project was also thoughtfully designed to minimise the height of the buildings and reduce the visual impact on the surrounding neighbourhood.

Environmentally-friendly and sustainable elements were included at every stage of planning and construction. For instance, during the initial construction stage, the cut and fill of the site – which was necessary to achieve the overall green-slope design –

“ *The project makes use of the synergy of a park, sports centre and library, creating a unique place for people of all ages to enjoy. These visitors are not just from local districts, but from many different districts throughout Hong Kong. Indeed, this is one of the few public libraries in Hong Kong where people can enjoy reading in such a marvellous space with park views, and walking through different levels on a grand staircase. As a public building, they can also come with their family members to enjoy quality time together.* ”

*Architectural Services Department,
HKSAR Government*

was carefully planned so that the cut and fill balanced each other out to minimise waste. A twin building design was likewise adopted, with the curvilinear building mass directing the natural breezeway to the district's open space and adjacent areas, thus optimising urban street level ventilation.

The finished site features extensive green coverage, with the planted area accounting

for 33% of the total site. This minimises the heat island effect and provides a green oasis for local residents. To help kindergarten and primary school children participate in creating this green communal space, a community planting event was organised for these children, enhancing community interaction and giving children a hands-on opportunity to make Hong Kong a greener city.

Internally, a CO₂ monitoring system controls the amount of fresh air provided to each space, minimising the energy required to cool and dehumidify outside air while also maintaining optimal indoor air quality. Low-VOC materials, including paints, carpets, adhesives, vinyl flooring and carpentry work, were adopted throughout the project.

Double glazed low-e glazing, skylights and sun-shading screens have been employed to optimise the penetration of daylight, while minimising the heat gain and energy consumption from air-conditioning and lighting. The library's double-volume allows ample natural light from the north to diffuse into the interior, with perimeter photo sensors automatically adjusting artificial lighting levels to further minimise energy consumption.

In parallel with these measures, a Building Management System allows maintenance personnel to monitor the entire system via a web-based network. This reduces maintenance resources, effectively addresses operational parameters, and allows information to be accurately collected and analysed, leading to better planning and subsequent energy-saving improvements.

All the green features – from the green roofs and vertical green walls to the shading devices, BV panels, BIPV panels, solar hot water panels, and solar lighting – are all highly visible throughout the development, helping to make a green lifestyle more attractive and understandable to local residents. In addition to the building's quantitative performance in terms of energy and water consumption, the project greatly enhances the quality of the overall neighbourhood and plays an important educational role, too, with guided tours organised to promote sustainable design and environmental concepts to local residents and schools.



Project Team

Owner / Developer	Leisure and Cultural Services Department, HKSAR Government
Project Manager	Architectural Services Department, HKSAR Government
Architect	Ronald Lu & Partners
C&S Engineer	Grey Wong & Associates Limited
M&E Engineer	BMT Asia Pacific Limited
Landscape Architect	ACLA Limited
Quantity Surveyor	Langdon & Seah Hong Kong Limited
Wing/Air Ventilation Consultant	Arup
Main Contractor	Lanon Development Limited
Building Services Engineer	Parsons Brinckerhoff (Asia) Limited

PUBLIC PROJECTS

Hong Kong Housing Authority

Large-scale sustainability in action for the community



The Hong Kong Housing Authority (HA) is dedicated to providing affordable quality housing for low-income families. Over 2 million people, approximately 30% of Hong Kong's population, live in over 750,000 public housing flats, and over 90,000 new flats will be constructed between now and 2020/21 to meet growing demand. Despite the enormous size of its property portfolio, HA follows green procurement and construction practices, conducts micro-climate studies, promotes greening, makes use of eco-friendly materials, conserves energy and water, and reduces waste in design, construction and management of the developments, as an integral part of development strategy and environmental policy.

Since 2004, HA has pioneered microclimate studies and air ventilation assessments to facilitate passive design at the planning and design stages of all its new projects. Designs optimise the use of daylight and natural ventilation to reduce the use of artificial lighting and mechanical ventilation, which benefit both residents and neighbouring community.

To save water, HA pioneered a sub-soil irrigation method and has even launched a 'zero irrigation system' which is a self-sustaining design that achieves a 100% saving in irrigation water and minimises topsoil evaporation. HA has also innovated a Twin Tank System, which provides an uninterrupted water supply to tenants at all times, even

during periodic inspections. By eliminating occasions when tenants would otherwise tend to hoard water, this innovative system has cut water wastage by about 5,300m³ per annum.



HA has voluntarily implemented Building Energy Codes in all its project designs since 2000, long before these were made mandatory in 2012. Initiatives to save lighting energy include:

- Electronic ballasts
- T-5 fluorescent tubes
- Photo sensors and time switches
- Two-level lighting control systems in lift lobbies, corridors and staircases in domestic blocks
- LED bulkheads in selected projects

To support the Government's target to reduce carbon intensity, it has also created Carbon Emission Estimations (CEE) for all domestic blocks of new public housing developments since February 2011. The CEE model embraces the embodied carbon emissions from major construction materials and building operations, as well as the carbon reduction from renewable energy systems and absorption from planted trees. This provides a means of controlling carbon emissions throughout the entire life of a building, from cradle to grave.

Since the 1980s, precast and prefabricated elements have been widely adopted in HA public housing developments, including precast staircases, facades and beams, partition walls, semi-precast slabs, volumetric precast bathrooms (VPB), kitchens and even precast roof water tanks. This promotes construction quality, efficiency, better site safety and reduces environmental impacts. In recycling, too, HA sets the standard for all others to follow: marine mud is recycled for backfilling and making masonry blocks, pavers and roof tiles; glass and broken concrete debris from demolition works are recycled as aggregates for paving blocks; bore-logs from ground investigation works are recycled as planter kerbs; granulated blast furnace slag (GGBS) is reused to partially replace cement in precast concrete construction; and excavated rock materials are recycled for the construction of footings of site hoardings and for the construction of gabion structures.



HA has pioneered a systematic way to demolish a structure such that re-usable items are selectively and systematically taken down in a way suitable for removal off site for re-use or recycling. All fixtures, electrical appliances and loose furniture are identified and removed for salvaging or recycling by local NGOs. The remaining concrete structure is then demolished using a low-noise Hydraulic Concrete Crusher. By using this technique, over 99% of all inert C&D materials can be recycled.

The conversion of the Chai Wan Factory Estate (CWFE) into public rental housing was a showcase example of the adaptive reuse of old buildings. CWFE was constructed in June 1959 to meet the demand for low-cost factory spaces resulting from the clearance of squatter areas. As the only remaining H-shaped factory building in Hong Kong, it was granted Grade II Historic Building status by the Antiquities Advisory Board in 2013. Through careful planning, HA was able to retain over 70% of the existing structure, which not only helped to preserve the original appearance of the building, but also reduce the use of

new construction materials, thus minimising construction waste, conserving energy and reducing carbon emissions. The project achieved BEAM Plus Provisional Platinum with innovative sustainable features include:

- Eco-wells to enhance day lighting and facilitate cross-ventilation
- Careful planning of the site to minimise noise disturbances

- Balconies on habitable rooms to improve daylight access and shading
- Over 40% greening
- Rainwater harvesting
- Natural cross ventilation and enhanced daylight in the entrance lobby and lift lobbies



In keeping with its commitment to provide safe, healthy, and innovative environments, HA has also obtained ISO 50001 certification for its residential designs, with over 170 occupied estates certified by 2016.

Kwai Shing West Estate was Hong Kong's first occupied residential estate to gain ISO 50001 in 2013. Completed in 1975, the estate required various improvement measures to enhance its environmental performance and promote sustainable living. In 2015, it achieved a Final Platinum Rating under BEAM Plus Existing Buildings V1.2, the first to receive this award.

PUBLIC PROJECTS

Hong Kong Housing Authority

HA now aims to be 'BEAM Plus ready' on all new projects, targeting a minimum rating of Gold regardless of GFA concession. A number of new HA projects have also achieved BEAM Plus Platinum besides the above-mentioned CWFE. These include:

San Po Kong

- Acoustic windows were developed for all windows of living accommodation
- A photovoltaic system on the rooftop water tanks achieves energy generation equal to at least 1.5% of the building's communal consumption
- Rainwater harvesting is used to irrigate planters by gravity, thus achieving carbon neutrality
- Greening on roofs of all low-rise structures, including car parks, and vertical greening in selected locations
- All parking spaces feature cable containment facilities for future installation of vehicle charging systems
- Solar lamps help to educate residents about renewable energy
- Microclimate studies were used for planning block disposition and common areas, including lift lobbies and corridors
- A Twin Tank System provides an uninterrupted water supply
- Two-level lighting in corridors and lift lobbies
- Hard-paved construction
- Multi-sensory map for people with disabilities



Ex-Kwai Chung Police Married Quarters

- Air ventilation assessment studies were used to maximise corridor ventilation
- Microclimate studies were used for play areas to enhance ventilation
- Photovoltaic panels were installed on two rooftops
- Two-level lighting in corridors and lift lobbies
- Hard-paved construction
- Photo-catalytic air purifiers were installed at the construction site toilets
- A Twin Tank System provides an uninterrupted water supply
- Multi-sensory map for people with disabilities
- 30% greening

Anderson Road Sites A and B Phase 1 & 2

- More than 50% of hardscaping uses pervious materials to reduce surface runoff to the drainage system
- 30% greening is achieved through vertical greenery, at-grade planting, and green roofs
- Well designed spaces, building forms and alignment create a safe and comfortable microclimate
- Noisy building services equipment is contained in acoustic enclosures and silencers
- The building's high-performance envelope reduces energy consumption and carbon emissions
- The solar reflective roof has a high solar reflectance index (SRI)
- Energy-efficient LED lights in all common areas
- Over 2.5% of energy comes from photovoltaic panels
- Standardised components and building fabric components reduce construction off-cutting waste
- More than 50% of building elements are manufactured off-site to further reduce waste
- 5D-BIM is used to enhance construction efficiency and streamline the design process



HA's implementation of a wide spectrum of environmental initiatives demonstrates its commitment to the well-being of everyone and its core values - 'Caring, Committed, Creative and Customer-focused'. This is also reflected in HA's remarkable achievements to date:

- HA constructions have an accident rate 75% lower than the norm in Hong Kong
- HA's customer satisfaction index continues to rise, achieving over 80% since 2006/07
- HA constructions cost 40% less than similar buildings in Hong Kong's private sector
- HA constructions generate 30% less waste



INDUSTRY PROJECTS

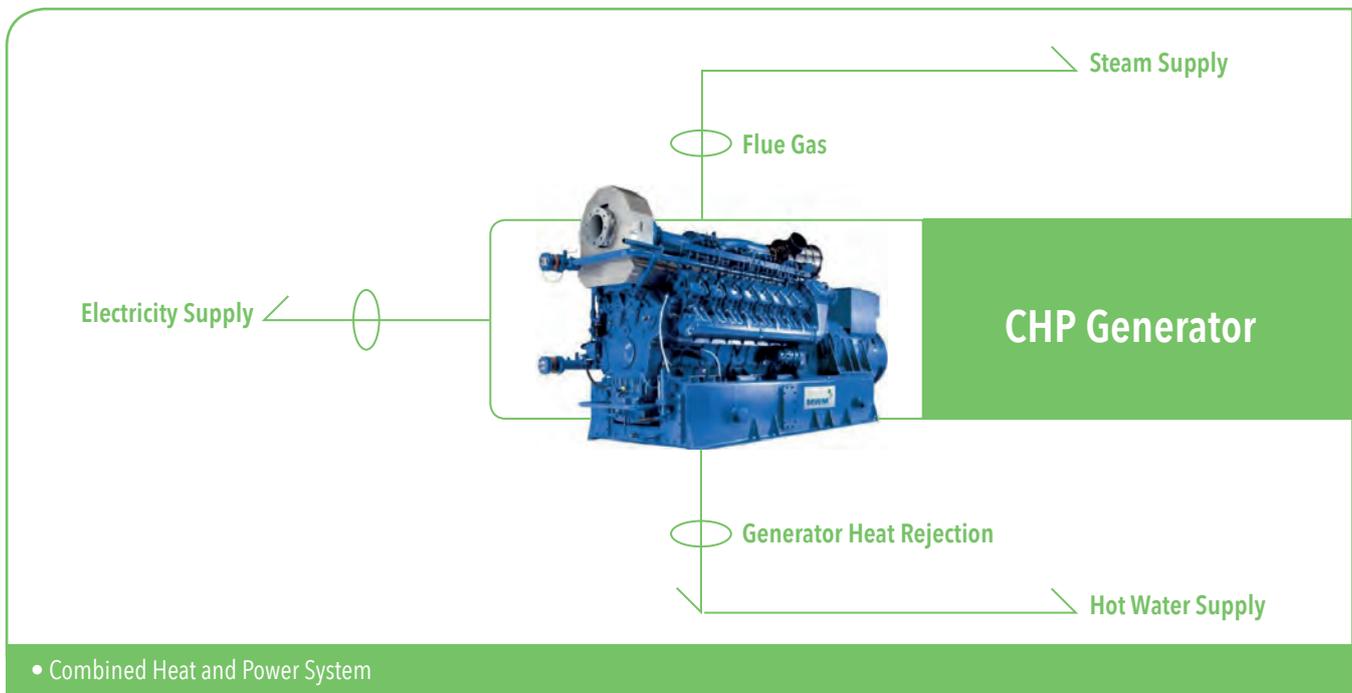
Green Initiatives at the Hospital Authority

Strategic energy saving initiatives in healthcare facilities



“ The Combined Heat and Power (CHP) System recently introduced at Alice Ho Miu Ling Nethersole Hospital can save approximately HK\$2.7 million in energy costs yearly. Using renewable fuel to generate electricity, CHP improves air quality and protects the environment by reducing an annual estimation of around 2,000 tonnes carbon emissions. ”

*Dr Man chi-yin, Hospital
Chief Executive of Alice Ho Miu Ling
Nethersole Hospital and Tai Po Hospital*



Hong Kong's Hospital Authority (HA) currently manages 41 hospitals and institutions, 47 Specialist Out-patient Clinics, and 73 General Out-patient Clinics, comprising over 2,800,000 m² floor space in approximately 300 buildings. In 2016, the Government dedicated HK\$200 billion for a ten-year hospital development plan to enable HA to expand and upgrade its healthcare facilities, with a floor area of 1,800,000 m² expected to be added to its existing portfolio in the next ten years. Given this large building stock, and that hospitals are high energy consumers with continuous hours of operation and high internal heat loads from both equipment and people, HA is committed to designing and running greener hospitals that harness emerging technology to create environments that are more conducive to sustainable operations.

A good example of innovative technology application is the Combined Heat and Power (CHP) project at the Alice Ho Miu Ling Nethersole Hospital. CHP is an energy-efficient technology widely adopted internationally for various types of buildings, including hospitals. It features the simultaneous production of electricity, heating and even cooling on-site through a single fuel source. The overall energy efficiency of CHP can be up to 80%, as compared to the 40% achieved by the conventional remote electricity generation system run by power companies. The efficiency gain of CHP is derived from the recovery of waste heat generated from the on-site production of electricity, which provides useful thermal energy for building use rather than being ejected into the atmosphere. In fact, hospitals are ideal for CHP due to the concurrent demands for

electricity and hot water or steam supplies all year round. This CHP application is made possible by the availability of a landfill gas fuel supply: gas pipes from the North East New Territories landfill site run in close proximity to the hospital. By deploying the concept of transforming waste into energy, the CHP system enables the hospital to consume less fossil fuels and significantly reduce its greenhouse gas (GHG) emissions equivalent to the planting of around 2,000 trees every year.

INDUSTRY PROJECTS

Green Initiatives at the Hospital Authority



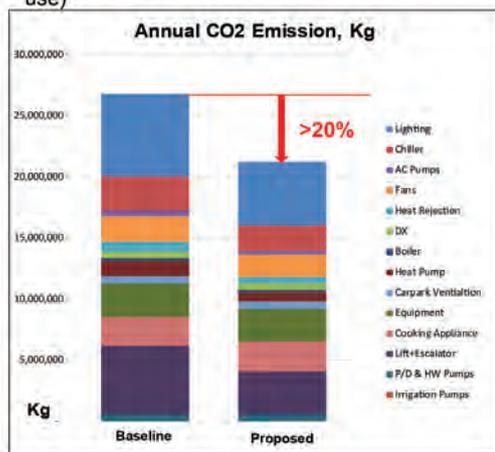
HA has always taken proactive steps to save energy and minimise the impact of its operations on the environment. Wherever possible, energy-efficient elements are incorporated upfront in the planning and design of the facilities, both in areas of architecture and hospital engineering. For instance, in the architectural design of building façades, various criteria are considered to minimise both energy use and running costs over the life of the building while also maximising the indoor environmental

quality for patients and staff. Such criteria include thermal performance, weather control, quality control, speed of construction, aesthetics and material quality to maximise the building's energy performance. A critical review of the window-to-wall ratio reduces the number of glazed areas in order to avoid unwanted solar heat gain, while still providing adequate natural daylight. Moreover, high-performance low-emissivity insulated glass units are used to allow daylight but not heat to enter the buildings, whilst shading devices are incorporated to block unwanted direct sunlight and glare, thus further reducing the cooling load.

In terms of hospital engineering, HA commissioned in 2015 a team of overseas energy experts to conduct a comprehensive hospital energy-efficiency study. Drawing on international best practices and the latest technological developments, the study identified opportunities for energy conservation and the introduction of green initiatives. These included installing energy-

efficient variable speed air-conditioning chillers, recovering heat from boiler flue exhausts, heating water at higher energy efficiency through the use of heat pumps, as well as introducing energy-efficient LED lighting and lighting controls. Reviews pursuant to the findings of the study have also identified more than ten key types of energy-saving opportunities in seven major acute hospitals, which will be progressively implemented over the coming five years.

- Applied sustainable design and high energy efficiency building service system
- Achieved **>20% annual energy reduction** compared to BEC Baseline standard (hospital use)



- Apply Reduction Approach:
 - Reduce Demand at the first place
 - Improve Efficiency in design
 - Renewable Generation at last



Reducing Demand at the First Place

- Reduced Window to Wall Ratio, **-45%**
- Highly performance glazing and facade achieving
 - OTTV value of Tower A = **14.51 W/m²**
 - OTTV value of Tower B = **13.53 W/m²**
- Efficient shading device (**0.25** for vision panel IGU) to reduce solar heat gain
- Low Power Lighting to reduce unwanted heat generated inside the building
- Use Free Cooling when the parameters are favourable

• Summary of energy and carbon reduction performance

To sustain the momentum of pursuing energy efficiency amongst all stakeholders, from hospital engineering staff and maintenance service providers to works agents for hospital construction projects, HA has adopted a systematic approach to enable coherent and consistent energy management. A steering committee on energy management was set up to provide governance, direction and coordination, with a view to ensuring that concerted efforts are made by the HA Head Office, hospital clusters, the Architectural Services Department, and the Electrical and Mechanical Services Department to systematically and continually pursue better energy management in HA hospitals. This covers not only the use of new energy-

conservation technologies but also the organisation of energy-management information structures. In line with this approach, a comprehensive hospital energy-efficiency design standard checklist has been consolidated from findings of the 2015 study to enable the integration of applicable energy-efficiency features into design considerations for all new hospital construction and existing hospital renovation projects. In particular, new HA hospitals will now be equipped with an advanced Building Energy Management System for more effective tracking of their energy performance and identification of energy-saving opportunities for continuous improvement.

The aim of controlling energy consumption arising from hospital operations ultimately converges with the goal of minimising GHG emissions and combating climate change. To this end, HA has specially developed a standardised carbon reduction calculation template for its hospitals. Since 2012, carbon audits are conducted annually by qualified auditors for each HA hospital. In 2016, 19 of its hospitals officially achieved a reduction of more than 3% over a three-year period, thus making them eligible for certification under the 'Carbon-less' scheme of the Hong Kong Productivity Council.

Project Team

Owner / Developer	Hospital Authority
Project Leader	Dr S V Lo
Project Manager	Mr P L Yuen, Mrs Sheila Mair

INDUSTRY PROJECTS

Midfield Concourse

A testament of commitment to build one of the world's greenest airports



Located on the island of Chek Lap Kok, Hong Kong International Airport (HKIA) commenced operation in July 1998. Between 1998 and 2015, air traffic movements at HKIA grew by 149%, with over 100 airlines linking HKIA with more than 190 destinations worldwide. In 2015, HKIA served 68.5 million passengers and handled 4.4 million tonnes of cargo, maintaining its status as the world's third busiest international airport and the world's busiest cargo airport.

Situated to the west of Terminal 1 and between the two runways, the new Midfield Concourse (MFC) increases HKIA's handling capacity by over 10 million passengers per year. The 105,000 m², five-storey MFC commenced construction in December 2011 and began operation in December 2015. The construction works included an extension of the automated people mover (APM) system from the existing Terminal 1. It also made available some 20 new aircraft parking stands, significantly increasing the ratio of passengers

boarding and disembarking aircraft using air bridges, thus enhancing the overall passenger experience.

The MFC has been designed as an exemplar sustainable building that contributes to HKIA's pledge to be one of the world's greenest airports. From the outset, the MFC project team understood that life-cycle performance in terms of resources and energy consumption needed to be incorporated at every stage of the design. This commitment to sustainable design ultimately led to the creation of a project-specific 'Green Airport Design Strategy', which was specifically drafted to identify opportunities for incorporating elements in the design that would enhance environmental efficiency and minimise the project's impact on the environment throughout its life cycle. Where possible, 25-year life-cycle costs (LCC) and the environmental benefits/impacts of green design options were considered as a core part of the design process. The Strategy put emphasis on three key pillars of green

building design, namely the reduction of resource use; maximisation of operational efficiency; and enhancement of health and wellbeing for the building's occupants.



In terms of resource reduction, some of the key initiatives evaluated by the team and incorporated into the MFC design included:

- Adoption of a standardised grid system, allowing the use of standard-size factory-built and factory-assembled components, thus facilitating efficient use of building materials.
- Use of precast structural floor units (in total approximately 1,800 units comprising 6,000 m³ concrete), modular roof units and extensive prefabrication of steelwork.
- Sourcing of building materials from recycled materials (approximately 20%) for façade and structural components.
- Specifying the use of Forest Stewardship Council (FSC) certified timber.

“ With our client Airport Authority Hong Kong’s support and our commitment to ‘Use Wisely, Waste Less and Low Carbon Construction’, we are able to achieve the highest standards of environmental performance and receive the Gold Award of Hong Kong Awards for Environmental Excellence. The close partnership has inevitably facilitated our operation to build the greenest airport. ”

SY Yu, Executive Director of Gammon

- Exceeding the target of sourcing at least 20% of building materials locally (achieved 65%) or from within 800 km of the project site.
- Establishment of an on-site concrete batching plant in order to minimise the energy used in delivery.

INDUSTRY PROJECTS

Midfield Concourse



With a view to maximising operational efficiency, the project team systematically evaluated and prioritised the best possible combination of passive design strategies and low-energy active design techniques for incorporation into the MFC design. Energy modelling undertaken at the initial scheme design stage of the project indicated that lighting alone could account for almost 30% of the building's baseline energy consumption. The design of a natural daylight system was developed to optimise the amount of daylight entering the interior spaces, thereby decreasing energy consumption and increasing occupant connectivity with the outdoors.

The MFC was designed to be oriented along the north-south axis, and adopted an environmentally responsive cross section. Taking into account lower annual solar heat gains on east-facing façades in Hong Kong, the east face of the MFC has a high expanse of glazing, which significantly increases daylight and views, while the west façade glazing is lower. Performance is enhanced by

incorporating skylights on the roof that face due north. Intelligent daylight and occupancy controls work in parallel to further optimise performance, and a shading hierarchy was formulated to reduce solar heat gain, thereby lowering the cooling system's energy consumption.

In addition to the consideration of passive design strategies, low-energy techniques were adopted in the design of the air-conditioning and lighting systems. Key highlights include:

- Installation of variable air volume (VAV) systems for the air-conditioning.
- A binnacle air delivery system is used in departure areas with high ceilings to provide air-conditioning to the lower occupied zones.
- Free cooling to indoor spaces is provided via increasing the flow of external fresh air when the external air temperature and relative humidity are lower than the pre-determined values.

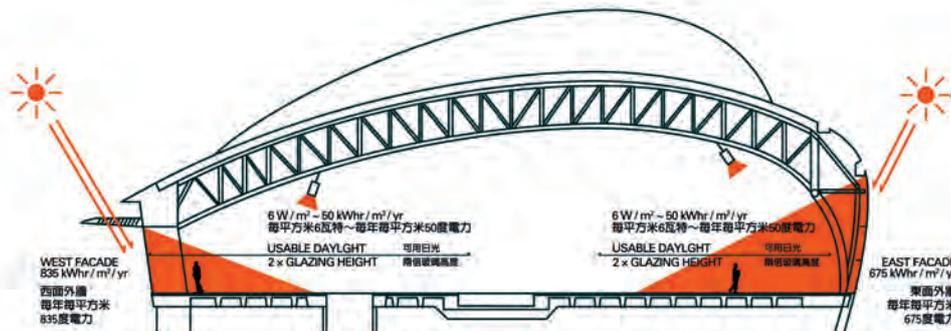
- Variable chilled water flow is adopted along the long and narrow MFC building to save energy by reducing the flow of chilled water when demand is low.
- Variable speed water cooling towers are used for chiller cooling.
- Regenerative power is captured from the operation of the APM and lift systems.

The MFC design also includes the provision of renewable technologies. Approximately 1,200 m² of photovoltaic panels are installed on the MFC roof to offset the use of grid electricity. With consideration of the various passive and active design technologies incorporated, the MFC is expected to achieve beyond the targeted annual energy consumption reduction of 20%.

In terms of water conservation, a sustainable water strategy was likewise adopted to cover demand reduction, grey water recycling and condensate water harvesting. Demand reduction is mainly supported by installing

ENVELOPE OPTIMISATION 優化建築物外殼

West facade glazing minimised, east facade raised up to increase daylight and views
盡量降低西面外牆玻璃高度，並提高東面外牆高度，以引入更多天然光線及令景觀更開揚



water-conserving sanitary fittings and the use of seawater flushing. Grey water is collected and treated by an on-site wastewater treatment plant. This is then reused together with condensate water recovered from the air-conditioning system, thereby offsetting the use of potable water for cooling tower operations.

To achieve the best possible indoor environmental quality (IEQ), air pollutants were minimised from the outset by specifying the use of materials that do not emit high levels of volatile organic compounds, formaldehyde or radon. In parallel with this, a high quality plumbing system reduces the potential for transmission of harmful bacteria,

viruses and odours. Some of the other key features incorporated into the MFC design include:

- Provision and required use of fixed ground power and pre-conditioned air to eliminate use of aircraft's auxiliary power units and associated emissions at aircraft parking stands, thus improving both outdoor and indoor air quality.
- Provision of chargers for use by electric vehicles and also electric ground service equipment.
- An outdoor observation deck to enhance passengers' connectivity with the outdoors.

Although there are significant constraints on the provision of external planting areas at the MFC building – due to close proximity to taxiways and runways, where bird control is vital for operational safety – landscaping features including planters and green walls have been incorporated into the interior design of the building, further optimising the user experience and indoor environment.

In summary, there are 35 key green initiatives that have been incorporated into the design of the MFC project in order to deliver a sustainable, high-performance building. The MFC serves as testament confirming HKIA's commitment to being a green airport.

Project Team

Owner / Developer / Project Manager	Airport Authority Hong Kong
Architect / Landscape Architect / Façade Consultant	Aedas Limited
C&S Engineer / M&E Engineer	Mott MacDonald HK Limited / Arup
Sustainable Design Consultant / Environmental Consultant	Arup
Quantity Surveyor	Davis Langdon and Seah
Acoustic Consultant	Mott MacDonald HK Limited
Main Contractor	Gammon Construction Limited
Project Designer	Mott MacDonald - Arup JV
Airport Planner	OTC Limited

INDUSTRY PROJECTS

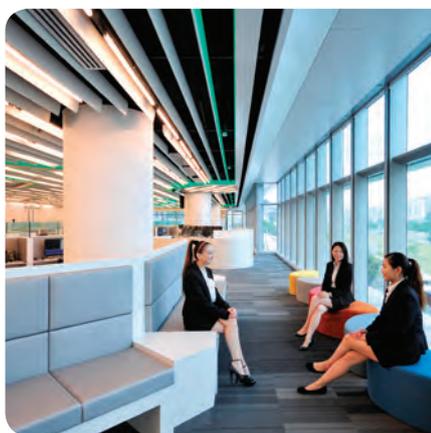
Sha Tin Communications & Technology Centre

Planning, design and operation for all-round sustainability



“ *The Sha Tin Communications and Technology Centre is the latest addition to the Club extensive property portfolio. This remarkable building demonstrates what can be achieved with the early involvement of facilities management and a thorough understanding of the user requirements.* ”

*Graham Tier, Head of Property
Facilities Management of the
Hong Kong Jockey Club*



The decision to construct a new technology-focused office building at Sha Tin Racecourse, the nine-storey Sha Tin Communications & Technology Centre, gave the Club a unique opportunity to take this commitment a stage further. Its vision was to create an innovative building that would seamlessly integrate a number of operations that previously operated from disparate locations. The Club also set itself the goals of adopting a high standard of energy-efficiency over the life of the building and enhancing the working environment for the 3,000 staff who would be based there.

operation and life-cycle management.

'Mean, Lean and Green' (MLG) and building life-cycle costing were selected as the two key drivers, with the objective of achieving sustainability in a cost-efficient manner. Under the MLG approach, Mean refers to reducing demand for energy and materials through passive building design, Lean refers to increasing efficiency through state-of-the-art technology, while Green involves using cost-effective renewable energy to reduce reliance on fossil fuels.

As a major local employer and the city's largest charitable benefactor, The Hong Kong Jockey Club is committed to adopting and promoting environmentally-friendly practices and sustainable operations. Its extensive property portfolio includes two world-class racecourses, four Clubhouses, several corporate office buildings and more than 100 retail outlets citywide.

To help put these goals into practice, the Club reviewed eight different sustainability assessment tools from around the world before deciding to adopt Hong Kong's BEAM Plus and the international LEED approaches, which place a high emphasis on energy efficiency and environmental quality. German DGNB guidelines were also adopted for their high focus on building maintenance,

Full use was made of life-cycle costing and assessment tools to achieve an optimum balance between the cost and environmental performance of different designs and systems. This provided the opportunity to evaluate design alternatives, forecast costs over the entire life of the building, and reduce future costs, whilst also achieving the required level of building performance.

INDUSTRY PROJECTS

Sha Tin Communications & Technology Centre



Particular attention was paid to the building's orientation as it was bounded by a highway and residential buildings on one side and open views across Sha Tin Racecourse on the other. A key design objective was to harmonise with the surroundings and minimise any adverse impact on the neighbouring community. This dictated that the main core be located at the rear (road-facing) elevation, accommodating stairs, lifts, toilets and plant rooms. This opened up the majority of the floor plate to the racecourse panorama, enabling staff to benefit from green views and daylight. Meanwhile the rear elevation makes use of shielded exterior lighting and external shading devices to reduce energy loss and avoid light or noise spill to the surrounding neighbourhood.

A sunken roof garden on the 8th and 9th floors is one of the largest in Hong Kong, enabling

staff to enjoy a relaxing environment in proximity to nature. The garden features abundant greenery, sheltered seating and open decking, making it suitable for a wide variety of outdoor events. It can also be used as a break-out space during office hours, with a clever design that provides shelter during hot or rainy weather. The trees and plants further help cool the building and reduce both its heat load and energy consumption.

At least 10% of the materials used in the building's construction were recycled products, and more than 50% of the timber came from sustainable forest sources. In terms of ongoing operations, waste management systems have been put in place to sort food, paper, plastic and metals, and recycle them wherever possible. The use of high-efficiency water fixtures and a rainwater recycling system have reduced water usage significantly. Low

VOC products were also used in fitting-out to ensure good indoor air quality.

From the outset, end-user departments were fully consulted to ensure that their different needs could be fully integrated into the building's design, and that the building created a productive and harmonious working environment. The Club's goal was to make staff at all levels, whether full- or part-time, feel inspired and empowered by the experience of working there. SCTC's first-class amenities include a staff restaurant and coffee corner, both run by a community NGO that promotes employment for the disadvantaged, as well as comprehensive in-house training facilities. Its location also offers improved access to public transport, and convenient access for cars, taxis and bicycles.

Extensive use of technology was made in planning the building's operating systems, with computer simulations conducted to assess the most energy-efficient means of cooling and lighting. These confirmed the use of water-cooled centrifugal chillers for air-conditioning, and the predominant use of LED lighting coupled with occupancy and daylight sensors. The chillers operate in sequence to maximise efficiency, while CO₂ sensors are also employed to optimise fresh air ventilation. These systems are now achieving a 20% energy reduction relative to the baseline model. Solar panels have been adopted to provide hot water supply to the toilets, changing rooms and kitchens.

In recognition that a building's life span is normally over 50 years, it was always the mission of the Property Facilities Management (FM) team to ensure that SCTC becomes a genuinely sustainable building which can offer long-term flexibility to suit the needs of the building's users and support the Club's

business operations. The FM team was actively involved in the design, specifications and operating plans to ensure that all operational and maintenance aspects were fully considered and justified in the design stage.

The intelligent Building Management System (BMS) has a total of 30,000 monitoring and control points, and more than 300 energy meters have been installed to facilitate energy recharge under the user-pay energy principle. This aims to change occupants' behaviour and also prepare for future retro-commissioning, energy auditing and further system optimisation.

The Club's efforts in creating a truly sustainable and user-friendly building have received local and international recognition, including Gold ratings under Hong Kong's BEAM Plus New Buildings certification and the New Construction category of LEED. The project was a finalist in the 2014 Green Building Awards co-organised by the Hong Kong Green

Building Council and Professional Green Building Council, and a winner of the ASHRAE Technology Award for Asia Pacific Region XIII, which was given in recognition of SCTC's outstanding achievement in the design and operation of an energy-efficient building.

To date, SCTC has already achieved a high standard of environmental performance and provides opportunities for further energy savings in the future. In addition to possessing a clear architectural character and identity, it now plays an important role in promoting the Club's image as an employer of choice that is strongly committed to the betterment of the whole community.

Project Team

Owner / Developer / Project Manager	The Hong Kong Jockey Club
Architect	Arquitectonica / WCWP International Limited
C&S Engineer / M&E Engineer / Acoustic Consultant	Arup
Landscape Architect	Arquitectonica
Quantity Surveyor	Rider Levett Bucknall
Sustainable Design Consultant / Environmental Consultant / Façade Consultant	BuroHappold International
Main Contractor	Hip Hing Construction

INDUSTRY PROJECTS

Hong Kong Science Park Phase 3

Creating strong foundations for sustainable innovation and technology exploration



“ *The foundation and structural design enables the stability of building floors housing sensitive equipment, despite strong vibrations from nearby traffic. The adoption of a raft foundation allows the design of a sunken landscaped court in the middle, so natural ventilation can penetrate the car park. The need for mechanical ventilation is minimised and much lower running costs are achieved. The additional office space and parking bays resulting from the column grid and slab system help provide additional income for park operations, raising the sustainability of the development.* ”

*Jacky Wong Woon-ki,
Structural Team Director of AECOM*



<https://www.hkstp.org>

Hong Kong Science Park Phase 3 is one of the largest showcases of sustainable construction practice in Hong Kong. Designed according to the key principles of reduction, efficiency and generation, the project goes beyond existing industry standards and best practices to uphold the far-reaching corporate vision and mission of Hong Kong Science and Technology Parks Corporation (HKSTP). Through the close collaboration of all disciplines throughout the project's conception, design, construction, operation and management life-cycle, Phase 3 now offers one of the best R&D ecosystems in the region for developing and commercialising new innovations.

The development comprises three main buildings providing R&D offices and laboratories for tenants, and an exhibition hall with a semi-underground car parking area, landscaped green podium and an iconic curved link bridge. The site is on a piece of reclaimed land on the coast of Tolo Harbour, with Science Park Phase 2 to the east and Tolo Highway to the south-west.

Foundation and structural engineering design are often the keys to long-term sustainability. The mixed geological conditions at the Phase 3 site, coupled with the varying loads imposed by each building, warranted a tailor-made foundation system which consists of driven H-piles, large diameter bored piles, and a shallow raft foundation.

Since the foundation system is tailor-made for the uneven loading of each building and structure, the project adopted link slabs seated on bearings, which is a technique more commonly found in bridges. This combination of bridge and building construction techniques resulted in a far more economical and practical foundation system.

Structural schemes and column grids were also tailored to suit the functional and geological

requirements of each building. Environments with low and stable vibration levels are essential to achieve the desirable performance of the highly sensitive equipment. It was identified that Building 15W, being closest to the highway, would be subject to vibration mainly from highway traffic. Analyses revealed that an in-situ beam slab system would provide better vibration control in the Ground Floor laboratories, where sensitive equipment was recommended to be placed. Therefore, an in-situ reinforced concrete beam slab system was adopted.

For the office areas in Buildings 12W and 16W, an in-situ reinforced concrete flat slab system was generally adopted for its reduced structural depth. Within the overall height and the required headroom, an extra floor could therefore be added to each building.

The gravity loading for a car park is greater than that of general offices, and therefore a smaller column grid was adopted for the

Podium Car Park. Owing to the closer column grid, the main beam sizes were reduced in order to maximise the number of parking bays. The shallower beams also allowed more spatial headroom to accommodate different types of vehicles.

In short, the longevity of these buildings and the sustainable operations associated with them all started from the ground up. The strong foundations, together with other passive, adaptive and low energy architectural designs, and the widespread adoption of emerging green building technologies, earned a BEAM Plus Final Platinum rating for Buildings 12W, 15W and 16W.

Now in its third year of operation, Phase 3 of HKSTP continues to empower more sustainable living through the continued provision of tenant sub-metering, pay-per-use air-conditioning and hybrid natural ventilation. These state-of-the-art buildings truly showcase the concept of a 'living laboratory' to its fullest extent.

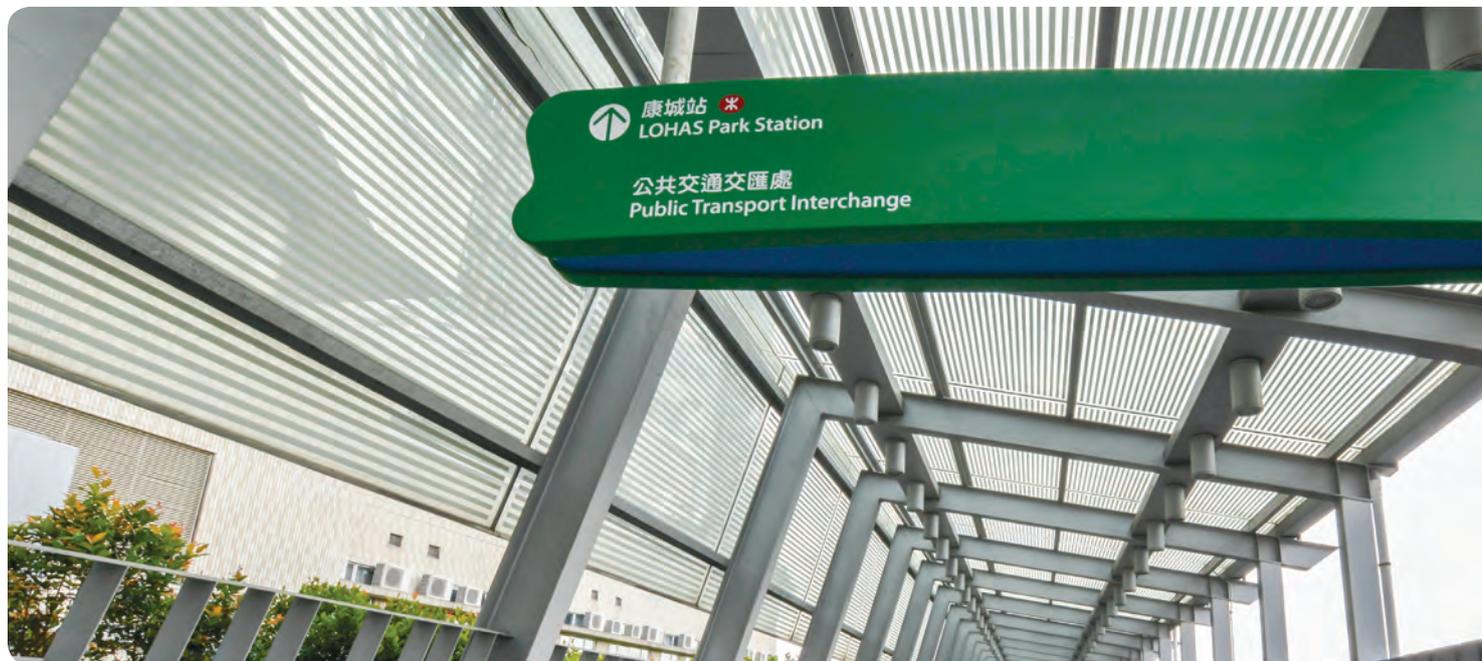
Project Team

Owner / Developer	Hong Kong Science and Technology Parks Corporation
Project Manager	Mace Limited
Architect	Simon Kwan & Associates Limited
C&S Engineer	AECOM
M&E Engineer	J. Roger Preston Limited
Landscape Architect	ADI Limited
Quantity Surveyor	Rider Levett Bucknall
Sustainable Design Consultant / Environmental Consultant	Cundall Hong Kong
Façade Consultant	Hiersemenzel & Associates
Acoustic Consultant	SMW Limited
Main Contractor	Gammon Construction Limited

INDUSTRY PROJECTS

LOHAS Park

Building a vibrant transit-oriented township



Carrying an average of 5.5 million passengers every weekday, MTR Corporation (the Company) is regarded as one of the world's leading railway operators in terms of safety, reliability, customer service and cost-efficiency. Since the opening of its first line in 1979, the Company has adopted a 'rail-plus-property' development strategy that integrates its railways with the urban fabric and optimises land utilisation. Under this model, the Hong Kong Government grants development rights to the Company for the land above or adjacent to MTR stations, which helps support the financing of railway construction, operations and maintenance. This innovative model is recognised as one of the best examples of its kind in the world, using the 'value capture' principle to finance further railway investments and build sustainable communities.

As of the end of 2015, the Company had completed developments at 39 MTR stations, providing some 100,000 housing units and more than 2 million m² of commercial space. The largest of these developments is LOHAS Park.

The word LOHAS stands for Lifestyle of Health and Sustainability – a key objective of the development. Situated in Tseung Kwan O New Town in the east of Hong Kong, LOHAS Park is built above the railway depot of the MTR Tseung Kwan O Line and covers an area of about 32 hectares.

In total, LOHAS Park comprises 50 residential towers from 46 to 59 storeys housing some 68,000 people in 25,500 units. From the outset, the Company sought to develop LOHAS Park as an attractive, pedestrian-friendly garden city that could offer a high quality of life to its residents, with segregated vehicular and pedestrian traffic, and easy access to shops, open space, recreation and community facilities. The development emphasises green and open community space, environmental efficiency, barrier-free access to amenities, and a central park that residents can enjoy for various activities and festive functions.

The multilevel rail station below serves as a principal transport hub for the community, connecting people to different parts of Hong

Kong via the MTR network and providing interchange facilities to other public transport nodes. The site itself faces the sea and is surrounded by rolling hills, with all buildings configured to maximise airflows, as well as green views and sea views.

A comprehensive people-centric planning approach was adopted to provide a functional, visually attractive and environmentally-friendly living environment. By reducing tower footprints, as much as 40% of the total land area is devoted to open space, all strategically planned to optimise the distance between buildings, preserve views and encourage social interaction. Breezeways likewise provide enhanced micro-climatic conditions. A grade-separated, barrier-free, weather-protected walkway network links up all 50 residential towers to ensure that all residents are able to reach the MTR station, shops and other amenities within an easy 10-minute walk.

In contrast to the alienation often generated by high-density developments, which are



commonly dominated by roads and traffic, LOHAS Park was specifically designed to encourage the emergence of a sustainable, self-sufficient community, including the provision of schools, shops, restaurants, a community hall, and facilities for both young people and the elderly. The seamless integration of transport and urban planning also significantly reduces residents' reliance on cars, which encourages walking and healthier lifestyles, and increases patronage of local businesses.

As the Company's largest rail-integrated development to date, LOHAS Park is a visionary example of what can be achieved through careful planning. It sets the standard for the creation of yet more well-connected, socially sustainable communities, and ultimately serves as an important milestone in Hong Kong's long-term development towards a sustainable and supremely liveable mega city.



“ *The seamless integration of transport and urban planning has significantly reduced residents' reliance on cars, while also encouraging walking and healthier lifestyles. LOHAS Park has certainly set the standard for developing more well-connected, socially sustainable communities in Hong Kong.* ”

*Wilfred Yeung, Head of Property
Project of MTR Corporation*

Project Team

Owner

MTR Corporation

INDUSTRY PROJECTS

The Tanner Hill

Innovation and integration for 'ageing in place'



“*'Ageing in place' is a quality living initiative that provides residents with a relaxed ambience, a continuum of professional healthcare and skilled care services, thoughtful home and lifestyle services, and a wide range of social activities to enrich their wellbeing, so as to help residents spend their golden years in a hassle-free environment.*”

*Patrick Chui, Director of
Ronald Lu & Partners*



<http://www.thetannerhill.hkhs.com/>

Hong Kong has a relatively high elderly institutionalisation rate of over 6%, many living in nursing homes where they report feeling socially isolated and lacking both privacy and dignity. To provide a much-needed alternative for this fast-growing demographic, The Tanner Hill is designed to put into action the concept of 'ageing in place' to offer lifetime residency. This innovative high-rise project provides the full continuum of care, namely independent and assisted living in self-contained residential flats, and

dependent living in a Residential Care Home for the Elderly (RCHE) that offers 24-hour care. Its integrated all-in-one Wellness and Recreational Hub caters for seniors at different phases of ageing, enabling them to live a sustainable and quality lifestyle characterised by autonomy, dignity and social interaction. In terms of environmental sustainability, too, both the project's consultants and developer strived from the earliest stage to achieve the highest HK-BEAM rating despite the lack of any bonus GFA incentive.

The design offers a variety of units and age-appropriate furniture, coupled with senior-friendly, universal accessibility features throughout the development, such as (1) 24-hour CCTV, nurse calls, motion sensors, smoke detectors, AV alarms, sprinklers, and convertible out-fittings inside living quarters; and (2) seating in lifts and lift lobbies, wheelchair-friendly lifts, vibrant contrasting colours, large graphics, handrails, and lavatory provision in common areas. Accessibility is further enhanced by shuttle services to local public transport hubs.

The development's integrated Wellness and Recreational Hub offers a variety of facilities, including a Geriatric Day-care Centre, Chinese Medicine, Family Medicine and Primary Care Clinics, an indoor heated swimming pool with pool lift for hydrotherapy, a gymnasium for seniors, a Cantonese restaurant serving a healthy menu, as well as an entertainment room, art studio, multi-function room for sports and social activities, a serviced office for residents engaging in voluntary or other work, and a children's playroom, all of which enable

residents to spend quality time with family and friends and connect with society at large. Seniors in the surrounding local community can also access some of these facilities, such as the Day-care Centre, thus further increasing interaction with residents.

Environmental sustainability is inherent in the 'ageing in place' concept, as residents have no need to travel to access key services, and there is little or no need to move home or embark on major renovations. In the development's overall planning and design, the towers are positioned to allow for optimal natural ventilation, lighting and views, while at the same time re-using the pre-existing foundation, which was completed in 2000 for a different design. Layouts were carefully developed to allow a modular system of metal form works and off-site pre-cast façades, thus achieving a higher build quality while also making more efficient use of resources. The façade design is simple, practical and in harmony with the vicinity, while accent colours have been chosen to create a lively and inspirational atmosphere.

Some of the development's special sustainability features include the provision of ventilation paths around and above the podium, which have been validated by Computational Fluid Dynamics (CFD) models as enhancing the surrounding environment. Residents can also enjoy the senior-centric podium and sky gardens, as well as tailor-designed bay-windows that optimise natural lighting and ventilation to reduce energy consumption. To further improve the overall environment in the neighbourhood, the developer voluntarily proposed and funded the full refurbishment of the adjoining public open space, including service lanes, a hiking trail, and an MTR Ventilation Building. To help advocate a reduction in vehicle carbon emissions, the project team likewise submitted a Traffic Impact Assessment to successfully reduce the statutorily required number of car-parking spaces from 24 to 17, and the loading/unloading facilities from six to three, as the project is conveniently located near a MTR station.



Project Team

Owner / Developer / Project Manager	Hong Kong Housing Society
Architect	Ronald Lu & Partners
C&S Engineer	Greg Wong & Associates Limited
M&E Engineer	Hyder Consulting Limited
Landscape Architect	Urbis Limited
Quantity Surveyor	Currie & Brown
Environmental Consultant	AECOM
Main Contractor	Paul Y. General Contractors Limited

INDUSTRY PROJECTS

URA's Development at 3 Muk Chui Street (燦然壹居)

Setting a new benchmark for socially responsible urban regeneration



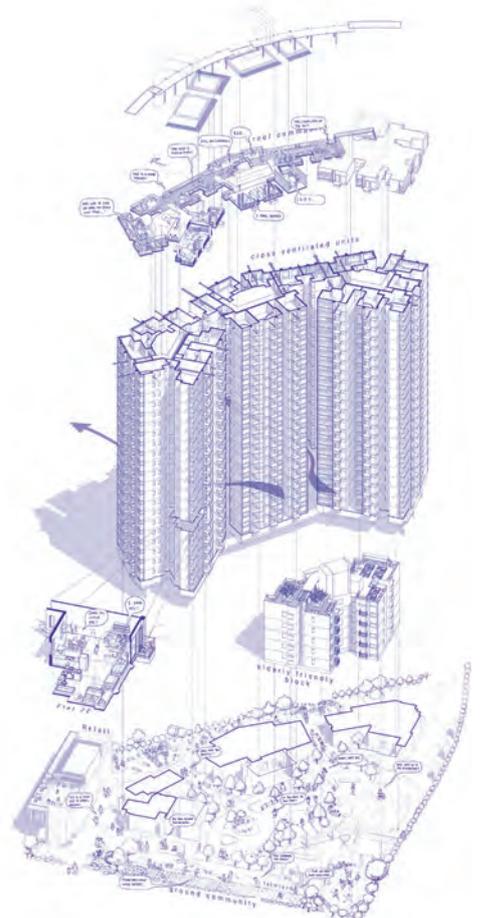
Designed as a pilot proposal for the Urban Renewal Authority (URA), this groundbreaking new project focuses on community-building and healthy, affordable living. Comprising three towers, a low-rise elderly-friendly block and a retail building, it is the first privately owned housing development in the new Kai Tak area. Ultimately, it aspires to set a new benchmark for socially responsible development that is also economically and environmentally sustainable.

A mix of flat sizes – from 63m² three-bedroom units to 31 m² studios – allows for families and residents across a broad spectrum of backgrounds and generations to live in the same development, creating a vibrant community conducive to 'ageing in place'. The communal amenities further support this integration. For instance, the TV lounge in the elderly-friendly low-rise block is purposely juxtaposed beside the children's playroom to generate a greater synergy between old and young. Residents' interactions are likewise enhanced through the use of sliding glazed doors that fully open to connect lobbies and clubhouse spaces with the communal landscape. The multi-level communal greenery and farming area are similarly

designed to foster community building. In total, some 32% of the site is landscaped, of which 79% is at pedestrian level. This makes it an oasis for residents, while also helping to improve the microclimate of the entire neighbourhood. In addition, the podium-free and permeable design enhances natural ventilation for the public at street level, while still offering a comfortable communal space where residents can gather.

The development is a showcase of URA's modest, sustainable and inclusive approach. In 2011, URA held a joint forum with the Hong Kong Institute of Architects (HKIA) and other professionals to define a simple residential design that would provide practical and meaningful solutions for a healthy and affordable urban lifestyle. Modest room sizes and the provision of common facilities were just some of the parameters which were discussed at that time and later incorporated into the Kai Tak Development.

The sustainable design utilises low-e glazing in all habitable rooms, with a low window to wall ratio of 9.77 W/m² Residential Thermal Transfer Values (RTTV), and a passive design that has only 7% of façades facing west. All



living rooms likewise feature cross-ventilated windows, with 1/6 of all windows being openable. In recognition of these important design features, the development achieved a BEAM Plus Provisional Platinum rating.

All common areas in the development are universally accessible, with a socially responsible design that also reserves the rooftop spaces for community use, thus serving the needs of all residents rather than solely the most affluent residents.

Highlights of the development's visionary technological features include:

- 100% recycled water for all irrigation, resulting in a 31% reduction in freshwater consumption;
- 80% of all on-site appliances are Energy Label Level 1;
- LED light fittings in all common areas;
- Low-emission double-insulated glass units in all habitable spaces;
- 18% reduction in annual energy consumption.

Highlights of the low-science, passive design include:

- 88% north-south facing units to minimise solar glare;
- Natural ventilation in the clubhouses, entrance lobbies and lift lobbies;
- Optimum window to wall ratio of 0.3;
- 62 plant species in a 0.57-hectare site to promote biodiversity and further enhance residents' quality of life.



“ Our residents enjoy lush green environments with the communal landscape and commonly farm. All the communal rooms are provided with cross ventilated windows and this is an excellent demonstration on energy saving design. The roof garden with spectacular views serving all the people is remarkably appreciated by residents. ”

An Estate Manager of Great Eagle Property Management

Project Team

Owner / Developer / Project Manager	Urban Renewal Authority
Architect	Ronald Lu & Partners
C&S Engineer / M&E Engineer / Sustainable Design Consultant	AECOM
Landscape Architect	ADI Limited
Quantity Surveyor	Currie & Brown (China) Limited
Main Contractor	Bordon Construction Co Limited

INDUSTRY PROJECTS

Green Sky: Conservation International Hong Kong

An inspiring showcase of top rated green office



“ A greener office reduces costs in the long run, increases staff morale and productivity, and showcases the organisation as a forward-thinking community player. ”

*Kelvin Hah, Green Sky's
Interior Designer*

Conservation International Hong Kong (CI-Hong Kong) is committed to minimising its environmental footprint for a greener Hong Kong. When it decided to build its new office, called Green Sky, it wanted to inspire and lead by example. CI-Hong Kong utilised green building techniques to create a beautiful, healthy and inspiring office, which also became Hong Kong's first office to achieve BEAM Plus Interiors Platinum certification.

The key to Green Sky's success is the collaboration of professional teammates who shared the same vision of sustainability.

The interior designer worked closely with the BEAM consultant to meet all targeted standards in terms of material aspects and IEQ (Indoor Environmental Quality). The contractors, too, played an important role by sourcing green materials, carefully controlling air and noise pollution, reducing waste and maximising recycling.

Through innovative planning, 87% of Green Sky can be easily relocated to a future office space. The Genius Walls, an eco-friendly moveable glass wall partitioning system, take just a few days to install or disassemble.

As smaller tenants in Hong Kong are often restricted to only two- or three-year leases, planning ahead to reuse building materials saves money and reduces construction waste. This glass wall partitioning also provides a spacious feeling, reduces the use of artificial lighting, and allows all staff to enjoy natural light and a harbour view, thus creating a healthy environment and boosting morale.

By using eco-friendly paint and adhesives, and no ozone-depleting substances during construction, both staff and guests can breathe easy and enjoy fresh air, and the Government awarded Green Sky an Indoor Air Quality Certificate of Excellent Class in 2014.

The innovative Net Effect carpet is a great showcase of using materials from recycled content, which can later be recycled again: the manufacturer pays fishermen from small communities in the Philippines to collect discarded fishing nets as raw materials for carpets, thus helping to protect sea and marine life while also supplementing local incomes.

At Green Sky, 100% of the loose office furniture is second-hand, purchased at only 60% of the cost of new furniture. This freed up funds to invest in other green features, such as a real-time energy monitoring display and Carbon Offsets from Conservation International's Carbon Fund, which offsets Green Sky's carbon emissions by protecting Amazon forests in Peru.

Paper, glass, metal and plastic waste are organised into recycling bins and picked up by the social enterprise, Hong Kong Recycles. All artificial lighting uses low-energy and long-life LED bulbs, contributing to a 40.9% reduction in Lighting Power Density (LPD). Motion sensors switch on lights only when someone is in the room. Nearly all electronics and appliances have high energy-efficiency ratings, and annual water savings of 60% are achieved through the use of low-flow water faucet aerators. A sophisticated water filter likewise replaces the need for plastic bottled water.

Perhaps most importantly, Green Sky inspires, educates and encourages all staff and visitors to think green and implement similar measures in their own lives. These people then spread the word to their families and friends, thus helping to promote environmental protection even further.



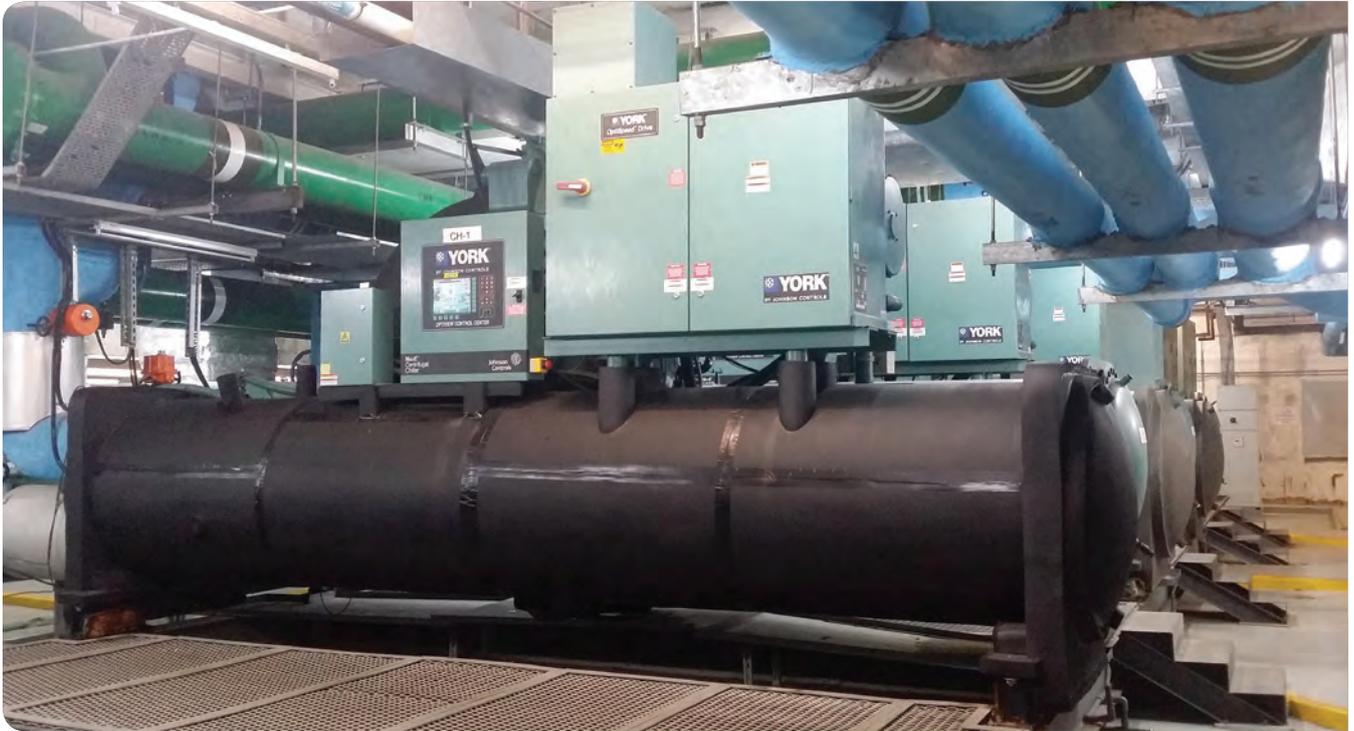
Project Team

Owner	Conservation International Foundation Hong Kong, Limited
Project Manager	Jude Wu (Conservation International Foundation Hong Kong, Limited)
Interior Designer	Kelvin Hah
M&E Engineer	Yauki Construction Co., Limited
Sustainable Design Consultant / Acoustic Consultant	BeeXergy Consulting Limited
Main Contractor	Yauki Construction Co., Limited

INDUSTRY PROJECTS

Standard Chartered Bank Building

Running greener with energy-efficient central water-cooled chiller plant



“ Conversion of the existing air-cooled chiller plant to a new water-cooled chiller plant has rectified the problem of low reliability of the existing chiller plant. Besides, a better system coefficient of performance results less energy use. The project has been awarded BEAM Plus Existing Buildings V1.2 Final Platinum rating with 96 % achievement rate in Energy Use category. ”

*Alex Chan, Technical Manager of
Standard Chartered Bank Building*



In Hong Kong's hot and humid climate, air-conditioning accounts for a significant percentage of energy consumption. To address this issue in the Standard Chartered Bank Building, which is located in the heart of Hong Kong's Central Business District, the decision was made to adapt three water-cooled centrifugal chillers to achieve more efficient and eco-friendly operations.

Using a built-in microprocessor-based control panel, each cooling tower was equipped with

a Variable Speed Drive (VSD) to optimise its operation via an automated control system. This immediately enabled a 4% to 5% improvement in efficiency. Under normal conditions, the condensing water supply temperature is usually preset at about 30°C during summer, and any idle cooling towers operate at a lower speed. This results in lower total fan power consumption and a lower condensing water temperature. A plume abatement design was also adopted in each cooling tower to mitigate any public nuisance. All chillers operate with an environmentally-friendly R-134a refrigerant and have a Coefficient of Performance of 0.6 kW/ton.

The building automation system uses auto-sequencing based on a number of factors – namely the constant chilled water flow, the variable chilled water return temperature, and the running current – and only brings the next chiller online when the current chiller is at 90% capacity or above, and the return temperature exceeds the set point. The chilled water supply temperature is also automatically re-set according to variations in the ambient temperature, with a set point that decreases linearly when the ambient temperature falls below 33°C. A standalone console is located in the control room for daily monitoring by operators, and a central console is located in the Bank's headquarters office in Kowloon to enable remote monitoring on this and other 15 chiller plants in Hong Kong.

An automatic tube cleaning machine and cyclone separator were installed to maintain the chillers' efficiency and the cleanliness of the cooling towers. A new motor control centre was likewise located on the building's 34/F mechanical floor, with two incoming power feeder cables under a 2-keys/3-switches mechanical interlock mechanism. All sub-main and main switches have been installed with power analysers to monitor the power quality and energy consumption.

Together, these measures enabled a 19.8% reduction in total electricity consumption in 2016 when compared to baseline operations in 2012. To further ensure ongoing sustainability, all equipment features easy access, including service platforms, for hassle-free maintenance. Continuous operational monitoring covers not only daily operations and energy consumption, but also annual carbon audits, monthly testing of cooling tower water quality, and the ongoing identification of new opportunities to optimise energy savings.

This commitment to eco-friendly performance makes the system a benchmark for Hong Kong's many offices, and is yet further proof that even world-class office buildings have a role to play in helping Hong Kong become a sustainable, low-carbon city.

Project Team

Owner / Developer	Hang Lung Properties Limited
C&S Engineer	CT & Associates (HK) Limited
M&E Engineer	Thomas Anderson & Partners (H.K) Limited
Main Contractor	Johnson Controls Hong Kong Limited

INDUSTRY PROJECTS

77 Hoi Bun Road

Creating a commercially viable and environmentally responsible community in CBD2



“ This project put into action lots of innovative ideas not commonly found in commercial buildings in Hong Kong. Outdoor gardens, a green terrace, fitness bikes, jogging tracks, Air Induction Units (AIU) and a solar desiccant system are just a few examples. As a good neighbour in the CBD2 community, many of these facilities are also open for public use. We expect the project to become a leading model for future buildings in Hong Kong’s CBD2. ”

Gary Cheung and Teri Tan,
Sustainability Consultants of Arup

77 Hoi Bun Road is located in the Kwun Tong industrial district, within the Kowloon Bay Action Area which is one of the Hong Kong Government's regeneration initiatives to create a second Central Business District (CBD2). The project has been pre-certified under the world's most renowned sustainable frameworks including LEED-CS Pre-certification Platinum and BEAM Plus Provisional Platinum. The project has also been pre-certified as WELL-CS Gold, which is the leading healthy building label in the world.

The project provides 82,000 m² of office and retail areas, comprising 17 levels of Grade-A offices, three levels of retail, three levels of basement parking, a roof garden and a podium sky garden. Situated along the busy Kwun Tong by-pass, the architectural design draws upon the unique concept of 'Urban Dynamics' inspired by the fast-moving vehicles on the surrounding roads. Excessive solar heat gain is mitigated through the optimisation of horizontal fins which provide passive shading and use advanced computer technology to identify localised shading requirements. As a result, the varying shapes and sizes of the horizontal fins across the different façades give the impression that the building never sits still, but is in fact moving with the sun. Combined with high performance glass, this innovative design achieves an Overall Thermal Transfer Value (OTTV) of about 18 W/m².

Given the polluted air, heat and noise generated from surrounding industrial buildings and busy roads, 77 Hoi Bun Road goes to significant lengths to create a pleasant and desirable environment. For example, building setbacks, public spaces, green walls and extensive landscaping create buffer zones between the heavily trafficked roads, while also enhancing the walkability of the neighbourhood and enriching the pedestrian experience.

Facilities like bicycle tracks, jogging tracks and exercise areas are incorporated in the 3/F podium sky garden, providing an outdoor recreational facility where people can escape the stresses of day-to-day life. The design likewise uses innovative Air Induction Units (AIU), developed by renowned engineering firm Arup, together with carbon filters and pollutant-reducing plants to enhance the air quality and thermal comfort in the podium gardens. Meanwhile, accessible stairs with clear signage, enhanced lighting and vibrant artworks encourage people to take the stairs rather than vertical transportation.

The development's dehumidification system is cleverly integrated with solar hot water panels. Specifically designed for Hong Kong, which is humid for most of the year, this innovative desiccant system is able to absorb the water moisture in the air and then regenerate it using solar hot water. This renewable

system generates energy equivalent to 2% of the annual building consumption. Other implemented carbon reduction measures include VSD chillers, a heat recovery system, LED lighting in office spaces, and a regenerative unit for lifts, to name just a few. Combined, these measures are targeted to reduce energy use by around 30%, compared to the Building Energy Code (BEC) 2012 Baseline established by the Electrical and Mechanical Services Department.

Real-time data from electricity and water meters is converted into meaningful performance information, which is displayed in real-time in the lobby area to encourage broader interest and participation in sustainability. Interactive tips are also shared with all occupants and users to encourage greener decisions and habits. This commitment to holistic health even extends to the sharing of tips on healthy eating, exercise and community activities.

Project Team

Owner / Developer	Link Asset Management Limited/ Nan Fung Development Limited
Project Manager	Land Champion Limited (A subsidiary of Nan Fung Development Limited)
Architect	P&T Architects and Engineers Limited
C&S Engineer / Landscape Architect	AECOM
M&E Engineer	Parsons Brinckerhoff (Asia) Limited
Quantity Surveyor	Langdon & Seah HK Limited
Sustainable Design Consultant	Arup
Façade Consultant	BuroHappold Engineering
Acoustic Consultant	Shen Milsom & Wilke Limited
Main Contractor	Gammon Construction Limited
Lighting Designer	LIGHTLINKS International Limited
Interior Designer	CL3 Architects Limited

INDUSTRY PROJECTS

BeeXergy Conceptual Workshop

A showcase of sustainability features for an optimal work environment

'Work for a greener life, a better world for all' is the motto and philosophy of BeeXergy. Its green office is the natural outcome of the company's extensive experience in green design and operation, and also a reflection of its commitment to providing a comfortable, healthy and efficient working environment for staff. It was the first commercial office in Hong Kong to achieve the highest Platinum rating under the BEAM Plus Interiors.

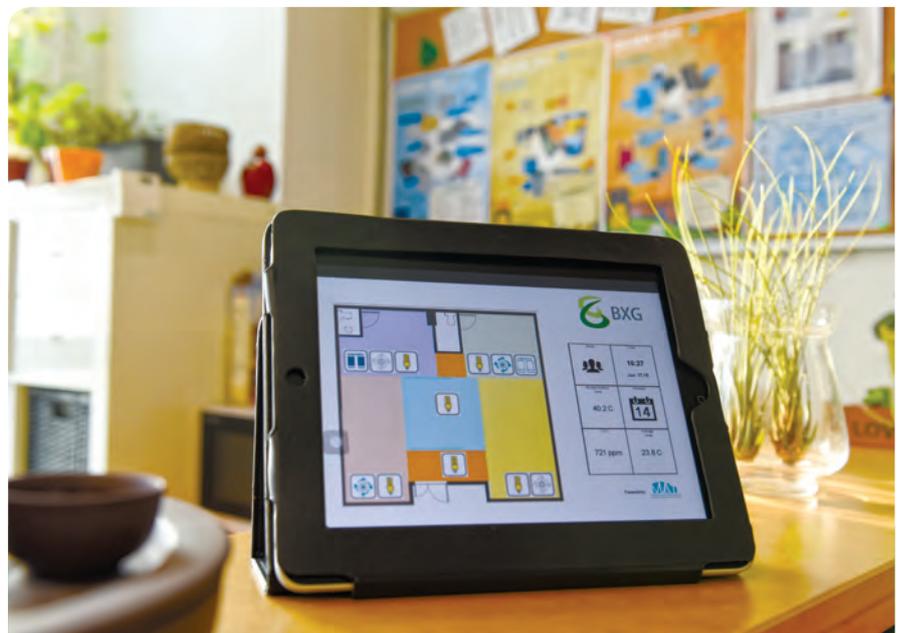
A number of sustainability features were designed, developed and installed by BeeXergy's own specialists and researchers in a short renovation period of just four calendar weeks. These include highly energy-efficient

technologies such as daylight and occupancy sensors, Indoor Air Quality (IAQ) sensors, and dimmable LED and hydronic-balancing valves for the lighting and AC systems to optimise their energy performance. An all-in-one control platform was also developed to control the building services installations within the office. This control platform is accessible through mobile devices, enabling each staff member to control his or her local comfort. To better understand the performance of these systems, an integrated energy monitoring and management platform has been developed to monitor the energy consumption of each system. This platform also serves as the basis for the company's ISO 50001 management

accreditation.

An IAQ monitoring device was installed to measure key IAQ indicators (covering TVOC, CO and CO₂ parameters), and the collected data is transmitted to a centralised control platform for real-time monitoring. The company has always received an annual IAQ 'Excellent Class' certificate, and remains committed to regular auditing to maintain this status.

Greenery is used extensively in the office, which benefits both the visual comfort and the IAQ. Indeed, vertical green walls and plants feature more than 50 different species of plants including herbs and herbal plants



“ *Work for a better, greener life, and a better world for all.* ”

*Henry Mak, Founder and Director of
BeeXergy Consulting Limited*



such as mint and Tillandsia, achieving an average 0.5m² area of greenery per head. A plant nursery at pantry area likewise offers an opportunity to learn more about urban farming while also providing a relaxing natural environment.

As a prominent environmental consulting leader, BeeXergy understands the importance of sustainable management. To this end, it offers various internal and external environmental training programmes to staff in order to raise their awareness of sustainability and help them gain experience from external enrichment activities. For example, the

company encourages staff to participate in training sessions offered by local environmental organisations, such as the HKGBC, BEAM Society Limited, and Environmental Campaign Committee of the HKSAR Government. In the office, reminders about energy-saving practices have been posted on the notice boards to promote energy conservation. Recycling bins likewise encourage the recycling of useful materials like paper, plastic bottles, metal cans, glass and re-chargeable batteries. The company even tailor-made a green cleaning manual to help employees adopt sustainable practices in waste treatment and procurement of cleaning products.

Not surprisingly, this commitment to environmental care sees BeeXergy actively participate in a wide variety of local environmental campaigns, including Earth Hour, Green Monday, and the Carbon Reduction Charter. As such, it continues to set an excellent example for all companies in Hong Kong, proving that truly green and sustainable thinking covers every aspect of business operation, from the physical space in which a company operates all the way down to the individual decisions, habits and values of its users.

Project Team

Owner / Developer / Project
Manager / M&E Engineer /
Quantity Surveyor /
Sustainable Design Consultant /
Environmental Consultant /
Acoustic Consultant

BeeXergy Consulting Limited

Main Contractor

Houng Kwong Engineering Co. Limited & BeeXergy
Consulting Limited

INDUSTRY PROJECTS

Green Plus Powerland: Hong Kong-Zhuhai-Macao Bridge Substation

Demonstrating environmental power excellence in a regional development project

As one of Hong Kong's main power companies, CLP Power Hong Kong Limited (CLP Power) is fully aware of the importance of balancing the community's economic success with environmental sustainability. It actively promotes environmental awareness among its colleagues, suppliers and contractors, encouraging them to take an active role in contributing to the conservation of natural resources. Indeed, caring for the environment has always been one of its core values, as reflected in the development of its Hong Kong-Zhuhai-Macao Bridge Substation project.

The Hong Kong-Zhuhai-Macao Bridge is a major sea-crossing that will link Hong Kong with Zhuhai City in Guangdong Province and Macao. A comprehensive power transmission network is required to support the Hong Kong Boundary Crossing Facilities in this strategic regional infrastructural development.

In addition to providing a highly reliable electricity supply, CLP Power is going even further by building a sustainable substation that also takes social and environmental objectives into account, including the adoption of state-of-the-art green features. The substation project commenced in 2015.

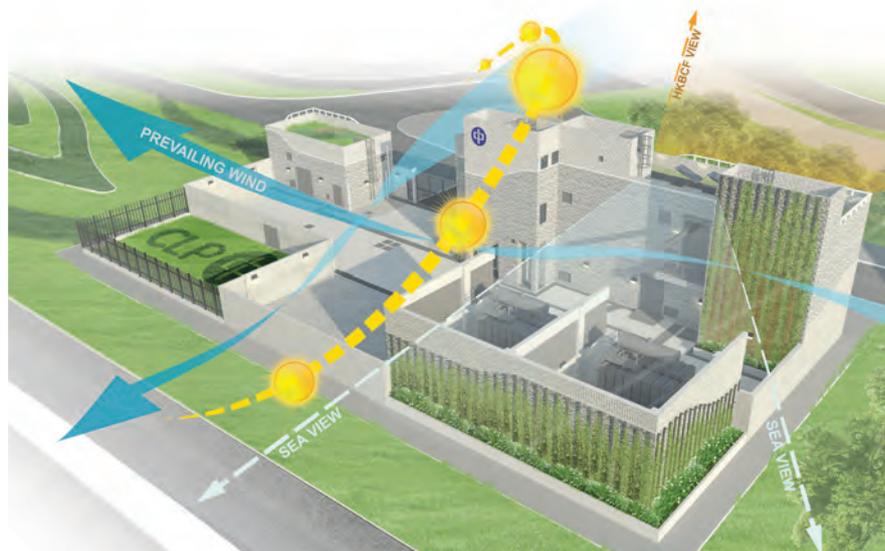
The intention of going beyond crafting a transmission substation with a high supply reliability by adding sustainable and community-oriented elements has been challenging. To overcome these challenges, CLP Power has adopted a number of innovative measures that now provide a strategic blueprint for future substation projects. Highlights include:

Conservation of natural resources

- Building Information Modelling (BIM) has been employed to facilitate the design and construction management
- Rainwater will be harvested in an underground rainwater storage tank for irrigation using water-efficient devices, leading to a projected 40% saving in annual water consumption
- About 80% of all building materials will be manufactured within 800 km of the site
- Solar sensing irrigation and a drip line system will be used to reduce the loss of water from the soil through evaporation
- Environmentally friendly construction management measures are being adopted to reduce the impact on the surroundings during construction
- Over 60% of all demolition and construction waste will be recycled or reused

Conservation of energy

- The architectural design enables natural ventilation of the high-voltage transformer units
- Energy-efficient lighting installations will be used, such as LED lights and lighting zone controls
- All electrical appliances inside the substation will be products with a Grade 1 Energy Label
- A green roof and vertical green wall will be provided to reduce the building's temperature and carbon emissions
- Low-e glazing will be adopted to reduce solar heat gain
- A low window-to-wall ratio will be adopted to reduce solar heat gain
- Reflective paint will be applied on the roof to minimise the heat island effect





- Separate meters will be installed to monitor power consumption of the MVAC, lighting, power and other building services installations
- Soft landscaping will cover more than 30% of the total site area
- Solar-tracking photovoltaic panels will provide nearly 8% of the building's electrical energy

This ground-breaking project has already achieved a BEAM Plus Provisional Platinum rating. After commissioning, the project's commitment to contributing to a sustainable environment will continue to be reflected in its use of quiet heavy electrical plant equipment for significant noise abatement as well as the introduction of additional measures to further improve operational safety.

“ We are committed to integrating social, economic and environmental objectives into the development of new substations. ”

*Anthony Ip, Senior Project Engineer -
Civil Design of
CLP Power Hong Kong Limited*

Project Team

Owner / Developer	CLP Power Hong Kong Limited
Project Manager	Mr Anthony Ip Wai-leung
Architect	Andrew Lee King Fun & Associates Architects Limited
C&S Engineer	Meinhardt (C&S) Limited
M&E Engineer	Parsons Brinckerhoff (Asia) Limited
Landscape Architect	Urbis Limited
Quantity Surveyor	Beria Consultants Limited
Sustainable Design / Environmental Consultant	Ramboll Environ Hong Kong Limited
Main Contractor	Hip Hing Construction Co Limited

INDUSTRY PROJECTS

Jade Grove

Less is more in the quest for long-term sustainability



“ *The project team adopted a passive design, using natural resources, and integration of sustainable measures to create a pleasant place for residents and the neighbourhood. Upon entering Jade Grove, all the worries and stress from the fast tempo of city life are gone.* ”

*David Wong, Deputy Project Director
of Citi-Sky Development Limited*



<http://www.jadegrove.com.hk/>

Jade Grove is a BEAM Plus Platinum rating residential development consisting of 34 low-rise buildings that form a comfortable, sustainable and energy-efficient estate, with no adverse impact on the environment or the overall neighbourhood.

The development is bounded on either side by medium-rise residential blocks, while the busy Castle Peak Road is elevated on a slope at the back of the site. To create a long-term

sustainable environment, it was vital that the project achieving optimal air ventilation. For this, an Air Ventilation Assessment (AVA) of the site was conducted in relation to Computational Fluid Dynamics (CFD). A three-dimensional CFD model was also constructed to capture all major components that would likely affect the wind flow.

Based on the results of the study, the following measures were incorporated into the design:

- An increase in wind permeability by increasing the spacing gaps between buildings to 1.8 m side-by-side and 12 m face-to-face
- To divert the intensity of the housing development away from the centre of the site
- To re-align Type 1 and Type 2 houses with the topography

- To place the buildings in the direction of the prevailing winds

These measures created a smoother wind channel and facilitated air movement, thus minimising the screen wall effect. In addition, microclimate studies were conducted to enhance the usage of natural ventilation and daylight, as well as to optimise both indoor and outdoor thermal comfort.

Using the concept of 'less is more', the development emphasises simplicity in its built forms, architectural elements, envelope colour and construction materials. The design features rectangular built forms and high headroom (3 - 3.5 m) together with glazed façades that maximise useable space and enable deep daylight penetration.

Although many new developments use decorative lighting to create a specific ambience, a different approach was adopted for this development, reflecting a sincere concern for the environment and the surrounding neighbourhood. To further

ensure that exterior lighting at Jade Grove would not have a negative impact on the area, a light pollution assessment using a 3D simulation tool was also conducted.

Other sustainable measures implemented on site include:

- A tree-lined walkway which leads to the centre of the development, with a swimming pool surrounded by palm trees and largely native tree species
- Moisture holding materials in the soil substrate to retain adequate water content for tree growth
- 70% of the roof area is covered with high emissivity materials to alleviate the heat island effect
- A granite spray coating with cement sand bedding was used for external wall finishes resulting in less wastage, less labour intensive fixing, fewer joints and lower maintenance

- 10% of all materials used in the exterior surfacing work were recycled materials
- Flow regulators were installed on faucets and shower heads to control water flows

The project was awarded a BEAM Plus New Buildings Final Platinum rating in October 2015. Some key statistics of its environmental performance include:

- Average daylight factor in normally occupied areas is about 3.21% (the BEAM Plus criterion is 2%)
- Annual energy consumption was reduced by 21%, equivalent to a reduction in carbon emissions of 431 tonnes/year, or planting 18,739 trees
- 23% annual water savings
- The embodied energy of the development is 10.9 GJ/m², some 4.6% lower than the baseline



Project Team	
Owner / Developer / Project Manager	Citi-Sky Development Limited (a subsidiary of Chinachem Group)
Architect	CASA Design International
C&S Engineer	Atkins China Limited
M&E Engineer / Sustainable Design Consultant	AECOM
Landscape Architect	Team 73 HK Limited
Quantity Surveyor	David Langdon & Seah Hong Kong Limited
Main Contractor	Chevalier (Construction) Co. Limited

INDUSTRY PROJECTS

Nan Fung Textiles Mills 4, 5 and 6

Transforming an industrial icon into a vibrant and sustainable new landmark



Following its establishment in 1954, Nan Fung Textiles Limited became Hong Kong's most productive cotton spinning mill. Following Hong Kong's economic transformation in the 1980s, the textile industry began relocating to China, with the last of the local mills closing in 2008. However, as a pioneer in the textile industry, Nan Fung still aspired to share this significant piece of history with younger generations, offering its mills as an exemplar of cultural preservation.

To achieve a sustainable regeneration of the Mills, it was important to take social, economic and environmental elements into account. By embracing the challenge of the buildings' physical constraints, both in terms of structural loading and building envelope, the design team created a sustainable development strategy that will see the Mills comprising three interrelated components: (i) a fashion and textile gallery and resource centre; (ii) a fashion incubation centre; and (iii) facilities for complementary commercial use.

Upon project completion, walkable internal lanes and pedestrian passageways will feature striking artworks. This design choice will not only improve accessibility between

surrounding streets, but also add new vibrancy to the whole Chai Wan Kok Industrial Area (CWKIA) and enhance its community engagement. Moreover, a landscaped roof garden at Mill 6 with horizontal greenery will help to create an oasis for CWKIA tenants and the local community, while also promoting social interaction and work-life balance.

The Mills' existing signature elevations will be retained, with a new curtain wall integrated in Mill 5 to enhance daylight penetration into the offices and meeting rooms. This design also provides quality views for occupants, with the added benefit of increasing their productivity. To achieve further energy-efficiency, perimeter office lighting is designed to be controlled by a daylight sensor. In addition, a large skylight will be integrated in the atrium at Mill 6 to enhance daylight penetration and reduce the need for artificial lighting. Vertical architectural fins and verandas will likewise help to mitigate solar heat gains and glare. Sun shading devices will also be integrated in the building envelope, in addition to the skylights in Mills 4, 5 and 6.

Despite their landmark regeneration, the Mills will retain over 80% of their existing building

structure, supported by additional steel strengthening. The old timber doors, metal windows, metal gates and equipment used in the Mills will all be re-used and incorporated into the interior design and signage. This will significantly reduce the use of new construction materials and greatly minimise its embodied energy.





In contrast to conventional BMS systems, an app-based BMS system will be adopted which offers real-time monitoring and control of the entire building, resulting in faster and more efficient maintenance services. This app-based system will greatly simplify the administrative process for both tenants and the landlord. Each tenant will also be equipped with an energy meter to measure and control their actual air-conditioning consumption. All tenants will be encouraged to use the app to adjust their air-conditioning schedule to minimise energy consumption and tailor the operation of their air-conditioning to their individual business hours. This flexible and interactive approach to energy saving will make it much easier for tenants to adapt their behaviour to greener and more sustainable operations.

“ This has been one of the most fun and meaningful projects I have ever worked on. The Mills is a living laboratory where sustainable design concepts can be tested and developed. The project allows the team to test materials such as cork insulation and dehumidification systems, which would not necessarily achieve a credit under official green building rating tools. ”

Dr Conn Yuen, Director of
CO2nnsulting Limited

Project Team

Owner / Developer / Project Manager / Landscape Architect / Façade Consultant / Interior Designer	Nan Fung Development Limited
Architect	Thomas Chow Architects Limited
C&S Engineer	AECOM
M&E Engineer	Aurecon Hong Kong Limited
Quantity Surveyor	Rider Levett Bucknall Limited
Sustainable Design Consultant	CO2nnsulting Limited
Acoustic Consultant	SM&W
Main Contractor	Paul Y. Builders Limited



<http://www.themills.com.hk/>

INDUSTRY PROJECTS

SK Yee Healthy Life Centre

Green architecture that addresses patients' holistic needs



“ Despite of its modest scale, the design was practical and yet very innovative. It embraces a lively ‘Green Pulsation’ over the entire light weight structure. The project was quite complicated in terms of its site constraint. It was successfully carried out without making disturbance to the existing users and patients. ”

Dr Tung Yuk, Deputy Hospital Chief Executive of Tuen Mun Hospital

In the quest for optimal health, it's important to think beyond mere treatments and therapies, and start also considering the physical spaces in which patients are diagnosed and treated. By creating green, harmonious, and feel-good spaces, it is possible to not only serve patients' physical needs, but also their mental, emotional and spiritual needs too.

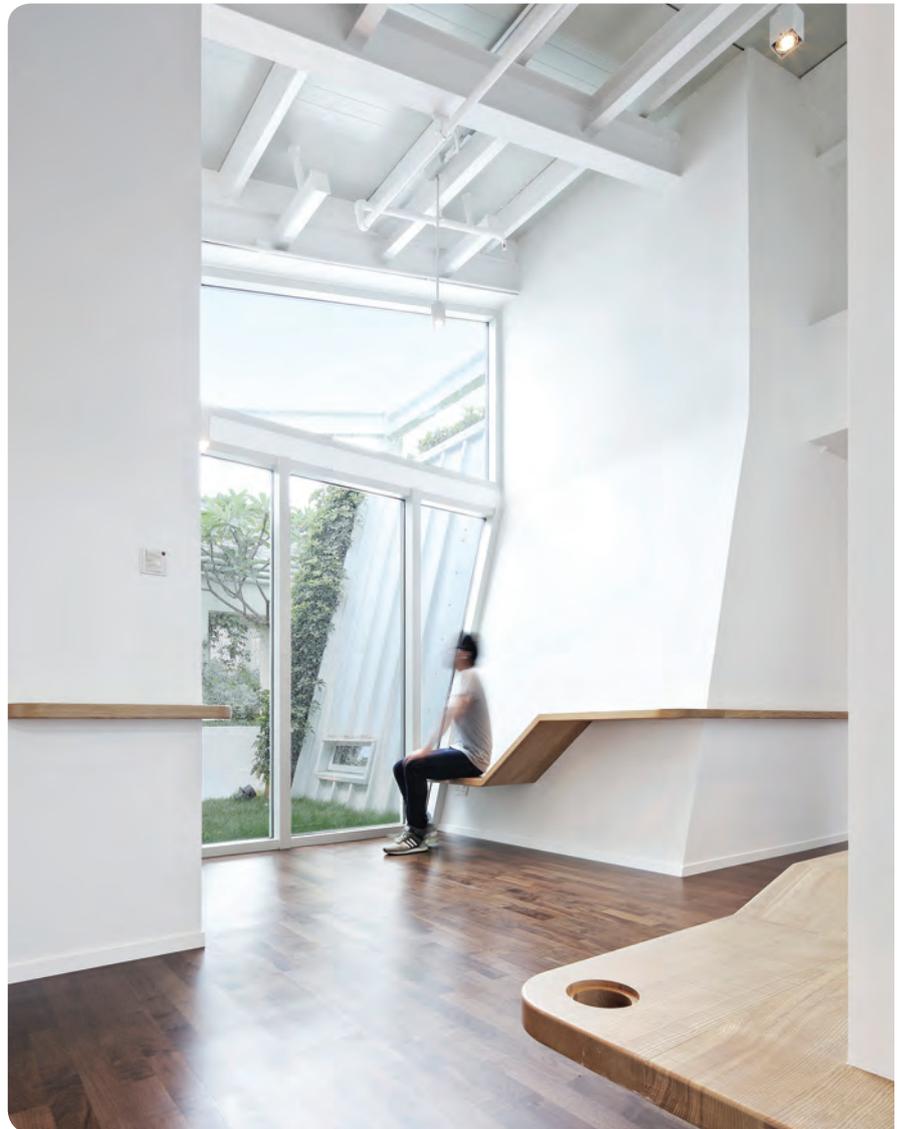
This was a foremost consideration when the SK Yee Healthy Life Centre was looking to expand and revitalise an existing facility. As a result of its commitment to green and sustainable design principles, the finished centre is a low-carbon oasis of calm and serenity that offers a soothing and healing environment while also functioning in an environmentally responsible and sustainable manner.

For instance, its well-considered layout enables cross-ventilation in all areas. By giving patients control over the ventilation of individual spaces, the design creates a place of respect, comfort and dignity. All activity rooms and facility spaces are likewise adapted for natural lighting throughout the day, with energy-efficient LED lighting providing supplementary support when necessary. This emphasis on natural light intensifies the domestic quality of the space and helps to significantly reduce patient anxiety.

Hong Kong's unforgiving sub-tropical climate makes it vital for new architecture to give careful thought to thermal mass. The extensive use of green roofs and walls helps to successfully regulate the indoor temperature and reduce the energy needed for air-conditioning. In the surrounding neighbourhood, too, the greenery helps to mitigate the heat island effect. On a human level, this extensive use of greenery also creates a pleasing landscape for patients and surrounding residents. Covering approximately 57% of the site, the greenery retains rainwater runoff, and plays a role in filtering the water for subsequent re-use for irrigation.

A key aspect of Hong Kong's journey to greener, sustainable construction is reducing waste. To minimise the use of scarce materials and maximise the use of recycled and salvaged materials, the overall design adheres to the '4R' concept, namely Reduce, Reuse, Recycle and Renew. For instance, the simple and unadorned design includes use of renewable natural rubber and recycled timber for the floor finishes. Likewise, by using the existing rooftop and structural support, construction waste was kept to a minimum.

To maximise the building's IEQ and complement its energy-efficiency, the design specified the use of materials that release fewer and less harmful chemical compounds. The centre, with a high-science-low-technology design adopted, not only meets the operational needs of a medical facility, but also addresses the very human needs for a space that feels welcoming, nurturing and relaxed.



Project Team

Owner / Developer / Project Manager	Tuen Mun Hospital
Architect	Ronald Lu & Partners
C&S Engineer	DCL Consultants Limited
M&E Engineer	Far East Consulting Engineers Limited
Quantity Surveyor	Rider Levett Bucknall Limited
Main Contractor	EDM Construction Company Limited

INDUSTRY PROJECTS

Towngas Headquarters

A corporate headquarters that puts sustainability into everyday practice

Awarded one of the first Final Platinum ratings under HK-BEAM 5/04 in 2010, and the same for BEAM Plus Existing Buildings V1.2 in 2015, the Towngas Headquarters building is a pioneer in green building management. Through a stringent sustainability programme of monitoring building energy consumption, auditing water and material resources, adopting best operating practices, cultivating a green lifestyle and investing in energy-efficient technologies, Towngas has not only created an environmentally responsible building, it has also made a high-profile statement of her commitment to sustainability.

A new efficient oil-free centrifugal type water-cooled central chiller plant installed on the building's rooftop came into full operation in 2014, replacing the old air-cooled chillers. This measure alone resulted in an annual saving of 1,000,000 kWh, which is equivalent to a 700-ton reduction in CO₂ emissions. Optimisation of the chiller plant was also carried out in 2015 to further enhance its overall performance.



“ Sustainability is a fundamental core value at Towngas. The aim of this green building project was to reduce the environmental impact of buildings while also maintaining and, in many areas, even improving the quality of the built environment and users' satisfaction ”

*Nelson Lo, Property Management
Manager of The Hong Kong and China
Gas Company Limited*

Various energy-efficient lighting fixtures, including LED luminaires and T5 fluorescent tubes, have been installed. Occupancy sensors have likewise been installed in intermittently occupied spaces, such as conference rooms, staircases, pantries, toilets, etc., to switch off lighting when unoccupied.

In the office areas, CO₂-based Demand Control Ventilation has been incorporated to modulate the fresh air supply based on real-time occupancy, which makes the cooling system particularly energy-efficient when office occupancy is low.

An innovative Building Management System enables users to extend the operation times of lighting in particular zones via the intranet. Hundreds of energy meters have also been installed to facilitate more accurate building energy analysis. Other green initiatives include conducting a waste audit to reduce waste, upgrading water fixtures, maintaining the building's Indoor Air Quality Certificate, promoting a rooftop organic farm, irrigating with rain water, and recycling condensate.

Towngas has also engaged in Sustainability Reporting (SR) over the past ten years. To enhance communication between Towngas and her stakeholders, including employees and the public, SR reveals the company's sustainability performance and encourages feedback from stakeholders. This helps contribute to establishing sustainability policies, and achieving a balance between business operations and stakeholders' needs.

Actually, the success of a company depends on employees' ability to achieve work-life balance. A rooftop organic farm at the Towngas Headquarters serves as a practical demonstration of how a green and healthy lifestyle can be applied to a corporate environment. Towngas has already stated her commitment to continue promoting this rooftop organic farm, and will continuously study and develop other environmental best practice in various areas.

In future, with effective monitoring systems, Towngas will keep monitoring and auditing the consumption of various resources, waste generation and recycling. Based on the information, it will enable Towngas to

identify and explore new initiatives relating to emissions reduction and resources conservation, and to implement appropriate measures that further reduce waste and enhance recycling. Following a company-wide climate change risk assessment, Towngas has also implemented an adaptation plan, and continuously monitors the progress and effectiveness of the adaptation plan throughout the Company.



Project Team

Owner / Developer	The Hong Kong and China Gas Company Limited
Project Manager	Mr Nelson Lo Mr Jeffery Chiu
Environmental Consultant	Allied Environmental Consultants Limited

INDUSTRY PROJECTS

WHITESANDS

An elegant expression of environmental sustainability with minimal cost impact



Swire Properties Limited has a long history of continuous green building performance improvement. An internal Sustainability Development Steering Committee chaired by its Chief Executive has been established to set up environmental targets and strategies.

Its new development projects give it the chance to incorporate sustainable design throughout the projects' lifecycles by embodying sustainability, from design through construction and operation. WHITESANDS adheres to this sustainable development philosophy and approach, which encapsulate the idea that green architecture does not mean a compromise in design, while also demonstrating minimal cost impact.

A contemporary enclave of detached homes in an area of truly natural beauty, WHITESANDS was conceived as a perfect example of environmental sustainability. This environmental focus was a key aspect of the project from the very earliest stages of site planning. For instance, the houses were situated to maintain five rare incense trees, which honoured and protected the site's natural vegetation, while also enhancing residents' privacy. The site's topography,

too, was closely respected to minimise the use of both cut-and-fill and steel piling, thus reducing the development's carbon footprint and mitigating noise pollution during construction. This careful site planning and massing not only significantly reduced resource use, but has also helped to optimise air flows and create a lush green, pedestrian-friendly community.

WHITESANDS was built using an integrated design approach, which positions sustainability at the centre of the design process and brings a multidisciplinary design team together from an early project stage to collectively deliver sustainability solutions. This enables sustainability considerations to be taken into account during the design process.

Throughout construction, environmentally friendly building materials were used to minimise the development's environmental impact. For instance, recycled concrete pavers in both public and private areas use 19% recycled aggregate, and the recyclable, low-maintenance decorative screens used in various areas were made from aluminium instead of real or composite wood. All items

were also sourced regionally to reduce their carbon footprint. Highlights of this commitment to environmentally responsible decision-making include:

- 51.6% of the hard landscape area is paved with pervious materials
- No ozone depleting materials were used
- No virgin forest products were used during the temporary works
- 21.7%, by cost, of all building materials were manufactured regionally
- 14.8% of all exterior materials were recycled material
- 38.6% of all construction waste was recycled or reused

Looking ahead to the development's long-term operation, the design maintains its environmental sustainability in a number of key aspects. For instance, the aluminium screens – used for fence walls, external decorations and to cover air-conditioning units – are crafted to mimic real wood, but do

not need expensive annual re-staining, have a much longer lifecycle, and can ultimately be recycled at the end of that life. Likewise, the textured stained concrete used for retaining walls resembles stone, but has less embodied energy and can also be recycled at the end of its life.

The site design and orientation encourages fresh air cooling, rather than the use of air-conditioning, while a relatively low window-to-wall ratio and extensive use of low-e double glazing further reduces heat gain. Overall, the development's annual energy consumption is reduced 26.94% compared to the BEAM Plus baseline for residential developments.

Energy is also saved through a number of other initiatives, including the installation of certified energy-efficient appliances, the use of energy meters and monitoring devices, the issuance of O&M and Energy Management Manuals, and Electric Vehicle Chargers that encourage the use of electric cars. All these measures have resulted in a peak electricity demand that is 37.42% lower than the baseline model.

In terms of water consumption, too, the development has achieved a 30.3% reduction in annual water consumption by using water taps and shower heads with flow regulators. The annual effluent volume has also been reduced by 50.5% through the use of low-flush toilets and urinals.

The end result is that WHITESANDS is a compelling showcase of how to achieve significant energy and water reductions through practical, passive and effective design rather than the use of expensive gadgets or systems. As such, it is powerful proof that sustainable design does not need to cost more.



“ This is an excellent example that sustainable design can also be beautiful with minimal or no additional cost impact. ”

*Diane Kolaritsch,
Project Manager of
Swire Properties Limited*

Project Team

Owner / Developer	Bao Wei Enterprises Limited / Swire Properties Limited
Project Manager	Ms Diane Kolaritsch
Concept Architect	PDP London Limited
Project Architect	LWK & Partners Architects
C&S Engineer	C M Wong & Associates Limited
M&E Engineer	Wong & Ouyang (Building Services) Limited
Landscape Architect	Urbis Limited
Quantity Surveyor	Langdon & Seah Hong Kong Limited, An Arcadis Company
Main Contractor	Gammon Building Construction Limited

RESEARCH AND PLANNING



The availability of funding support has enabled both academia and industry stakeholders to actively research innovative new solutions for a sustainable built environment. To date, research projects have explored a number of directions, including highly efficient materials and greener construction practices.

Building on this strong foundation of acquired knowledge, Hong Kong is now in a position where ambitious planning is enabling it to put research into practice and realise its long-term vision of a greener and more sustainable city. Indeed, its achievements in recent years are powerful proof that the thoughtful use of information and smart technologies can dramatically improve the well-being of building users and everyone in the wider community.

RESEARCH AND PLANNING

Development of Ultra-Ductile Cementitious Waterproofing Rendering by Using Recycled Plastic

This research project focuses on the development of an ultra-ductile cementitious rendering for waterproofing. The proposed waterproof rendering targets to repel water and have an ultimate tensile strain up to several percent.

In reinforced concrete structures, water seepage is a major problem. For polymeric waterproof coatings, the water permeability is extremely low, but they are either too brittle or limited in their application on dry concrete surfaces. Also, for a high-quality polymeric waterproof coating, a primer is necessary, which significantly increases the duration of the disturbance to occupants. Cementitious-based waterproof rendering can breathe, enabling water vapour to pass through without causing bubble formation. However, it cracks easily and quickly loses protection. Hence, this research on a new waterproofing material that can combine the advantages of high water resistance, breathability and high ductility would meet the urgent demands of the construction industry.

Tonnes of plastic bottles are dumped into landfills every day. These plastic bottles are mostly made of polyethylene terephthalate (PET). One of the potential applications of these recycled plastic bottles is to replace man-made polyvinyl alcohol fibre, which is commonly used in engineered cementitious

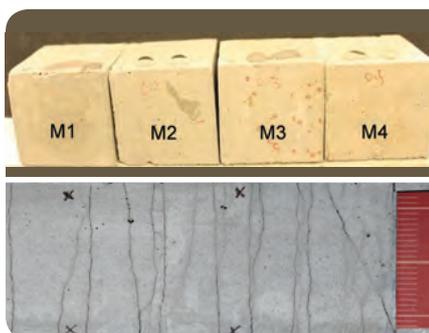
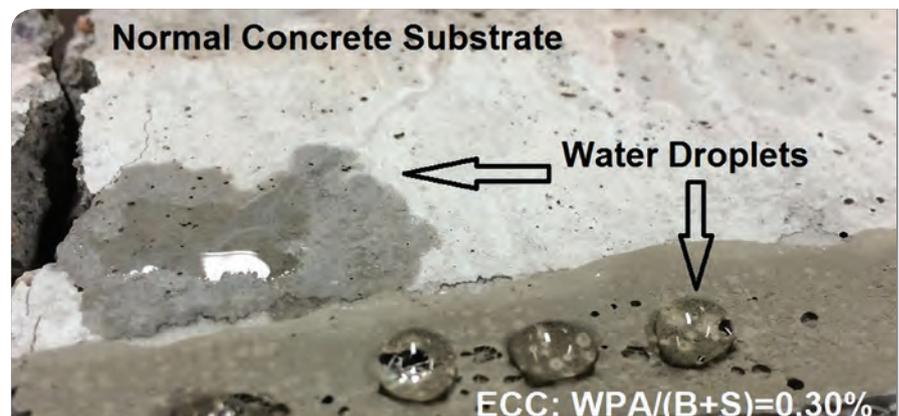
composite, to form an ultra-ductile cementitious rendering for waterproofing.

The development of this ultra-ductile cementitious rendering will optimise the extrusion condition and additives to transform plastic bottles into discrete fibre. Using advanced surface modification techniques, the fibre will efficiently disperse in the wet mix to form a uniformly distributed network. The bond strength between the fibre/matrix interface will be optimised to achieve the multiple-cracking ultra-ductile behaviour.

In this research study, different advanced surface modification techniques for changing the cementitious matrix from hydrophilic to hydrophobic (water repelling) will be compared. By using nanotechnology, the thixotropy of the cementitious matrix can be

improved. The cementitious matrix will also contain ground granulated blast-furnace slag and pulverised fuel ash in order to reduce the carbon footprint. The mix proportion will be optimised with different geometrical and mechanical properties of the PET fibre from recycled plastic bottles, as well as the constituents of the cementitious matrix. The ultimate objective of the mix proportion optimisation is to achieve high ductility, high water resistance, low dry shrinkage, and water repelling.

Besides developing a new generation of waterproof rendering material, this project creates an opportunity to recycle plastic bottles in Hong Kong, thus relieving pressure on the limited landfill space, and demonstrating a practical application of waste utilisation.



Research Team

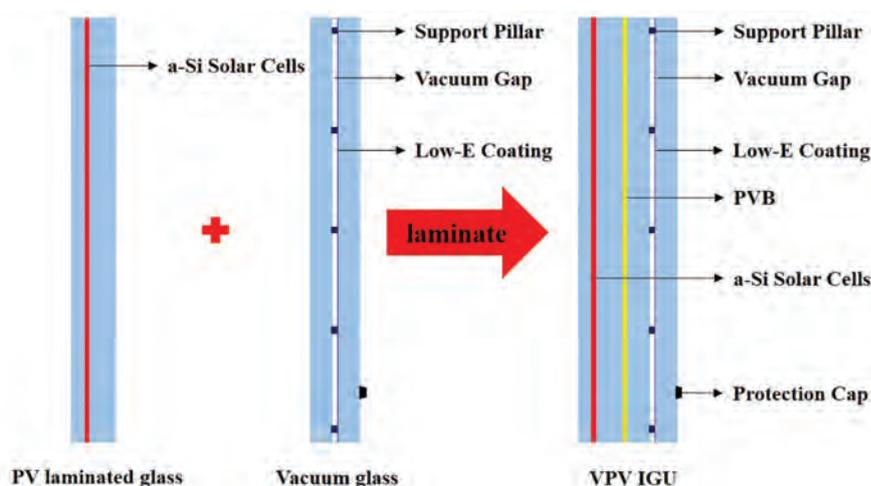
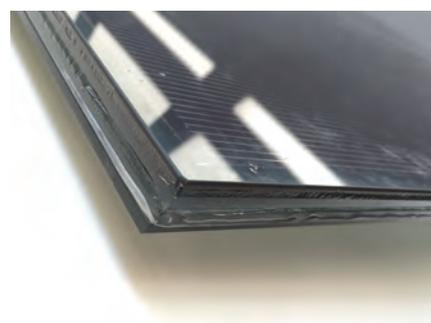
Institution	Nano and Advanced Materials Institute Limited (NAMI)
Members	Ivan Sham (NAMI); Christopher K.Y. Leung (The Hong Kong University of Science and Technology); Kaimin Shih (The University of Hong Kong)
Funding Source	Construction Industry Council [CICR/11/13]

Investigation on the Thermal and Power Performance of Vacuum Solar PV Curtain Wall Technology and its Application Potential in Buildings in Hong Kong

Traditional photovoltaic (PV) curtain walls usually have poor thermal insulation and sound insulation performances, which in turn seriously hinder their large-scale use. Although PV curtain walls can generate electrical power in situ, they also significantly increase the cooling load and heating load of buildings due to their high solar heat gain coefficient (SHGC) and U-Value respectively. However, vacuum glazing, which has excellent thermal insulation and sound insulation performance, can effectively solve the above issues in PV curtain walls.

In this project, a novel high-efficient energy-saving vacuum PV curtain wall, which combines a photovoltaic curtain wall and vacuum glazing technologies, will be proposed and developed. This vacuum PV curtain wall can not only generate electricity in situ, but also significantly reduce solar heat gain and heat losses due to its improved thermal insulation performance, such that it can reduce the building's overall energy use. The key issues to be investigated include the fabrication technology of vacuum PV modules, and the overall energy performance of the vacuum PV curtain wall. The thermal and power performance of the vacuum PV curtain wall will be investigated by means of experiment and numerical simulation. An experimental prototype of the vacuum PV curtain wall will also be set up outdoors, and a long-term testing campaign will be conducted to demonstrate its thermal and power performance under real environmental conditions. A comparative experimental study will likewise be carried out to compare the overall energy performance of the proposed vacuum PV curtain wall and other common PV curtain walls, as well as other advanced window or façade technologies, such as low-e glazing windows, double glazing inert gas-filled windows and so on.

Ultimately, this study seeks to develop a comprehensive energy model to predict the dynamic power and thermal performance of the vacuum PV curtain wall so as to evaluate its annual energy-saving potential compared to other advanced window technologies commonly used in buildings in Hong Kong. Based on this simulation model, an optimum design of the vacuum PV curtain wall can be achieved. In addition, the annual overall energy performance of the commonly used windows or façades will be simulated with typical meteorological year (TMY) weather data. This will enable recommendations for an optimum window type adapted to the local climate, together with clear design guidelines for the advanced building-integrated photovoltaics technology.



Research Team

Institution	The Hong Kong Polytechnic University
Members	Prof. Yang Hongxing; Dr Lu, Lin; Mr Peng Jinqing; Dr Wang Yuanhao
Funding Source	Construction Industry Council [CICR/03/14]

RESEARCH AND PLANNING

Feasibility of Delivering High-rise Low Carbon Buildings in Hong Kong

The Paris Agreement has explicitly set low greenhouse gas emissions as a fundamental climate change strategy. Buildings worldwide account for over one third of energy consumption and carbon emissions, and therefore are the biggest contributor to anthropogenic climate change. In Hong Kong, buildings account for 92% of all electricity consumed in the city, and account for 60% of all carbon emissions.

Many countries and regions have promoted Low or Zero Carbon Building (L/ZCB) as the most innovative model of sustainable development, but this presents unprecedented challenges. First, there is a lack of a consistent L/ZCB definition and methodology. Second, the vast majority of L/ZCBs to date are located in cold and temperate climates. Third, few high-rise L/ZCBs have been reported worldwide.

The project has addressed these challenges by examining the feasibility of delivering high-rise L/ZCBs in Hong Kong. The study was supported by a wide range of organisations and institutions.

The study focuses on two building types, namely public residential and private offices, and then developed design strategies and scenario-based design solutions for both. The established Base Cases are status quo real-life green buildings. For residential buildings, the developed Quick-win and Optimisation Scenarios offer the maximum potential of achieving 49% in Energy Use Intensity (EUI) (52.72 kWh/(m²-yr)) and 58.3% in Carbon Emission Intensity (CEI) (32.39 kg/(m²-yr)) when compared to the Base Case. For offices, the developed Quick-win and Optimisation Scenarios offer the maximum potential of achieving 57% reductions in EUI (162.2 kWh/(m²-yr)) and CEI (113.56 kg/(m²-yr)). Both examples are very low-energy and low-carbon high-rises, specifically in a hot and humid climate. The solutions require the integration of passive design,

energy efficiency, behavioural changes and renewable energy, and thus facilitate systems thinking addressing political, economic, social and technological perspectives.

However, to achieve the goal of high-rise net zero carbon, even more efficient or emerging renewable energy technologies and/or decarbonisation technologies must be adopted.

This project is significant as its findings provide a useful definition of L/ZCB, as well

as meaningful strategies and a roadmap for achieving very low carbon-and-energy high-rise buildings in Hong Kong. The findings will encourage the take-up of innovative low-energy and low-carbon technologies in the building sector, which will accelerate the transition of Hong Kong's built environment towards low carbon and sustainability. The findings also contribute to a better understanding of high-rise L/ZCBs in the context of socio-technical systems, which will have profound implications on the design and delivery of future high-rise buildings.



• Figure 1 Public residential case building and different floors
(Courtesy of Hong Kong Housing Authority and Yau Lee)

Research Team

Institution	The University of Hong Kong
Members	Project Coordinator and Principal Investigator: Dr Wei Pan Project Team Members: Prof Thomas Ng; Prof S.C. Wong; Prof Mohan Kumaraswamy; Dr Sam Hui; Dr Frank Xu Research Personnel: Dr Hao Qin; Ms Cong Yu; Dr Yan Ning; Dr Yisong Zhao; Ms Xiaojing Zhao; Ms Jie Wang; Ms Mi Pan; Dr Pingying Lin; Dr Hui Long
Funding Source	Construction Industry Council [CICR/01/13]

Retrofitting Existing Building (Energy Efficiency) - A Quantitative Approach

The HK3030 campaign initiated by the Hong Kong Green Building Council (HKGBC) aims to achieve a 30% reduction in buildings' electricity consumption by 2030, and the Government's Energy Saving Plan targets a 40% reduction in energy intensity by 2025. To achieve these ambitious targets, the participation of Hong Kong's many existing buildings is crucial. This project aims to evaluate the energy-efficiency measures applicable to Hong Kong's current office building stock. Through a Steering Committee led by academics who have no direct conflict of interest with the commercial market, the goal of the project was to provide the building industry with reliable technical data for implementing useful energy-saving measures in major retrofitting work.

With the help of the Steering Committee, potential retrofitting technologies (Table 1) applicable to Hong Kong's high-rise and high-density subtropical environment were identified. The Committee members then searched for feasible cases for further assessment.

Each assessed case was accompanied by a study report, in which the various factors that affected its energy and economic merits were discussed, particularly the impact of the wide-ranging constraints imposed by different buildings. As a consequence of this process, it was found to be desirable to have at least three study cases per retrofitting technology. The findings were then disseminated to the industry through seminars and conferences.

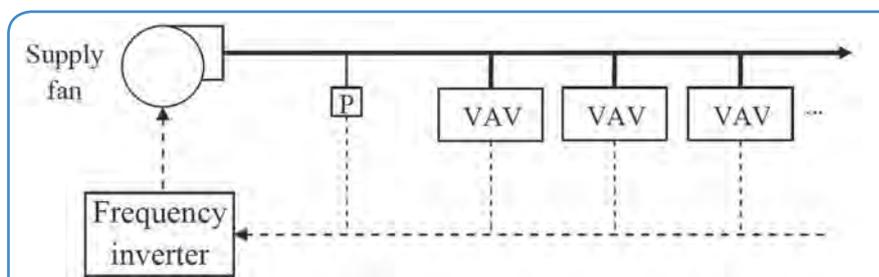
To summarize, the lighting retrofit works offered energy saving potentials which ranged from over 22% for the replacement of T8 lightings by T5 luminaires up to nearly 85% for occupancy-controlled lightings at the staircases. Meanwhile, those related to HVAC system varied widely, with a minimum of around 5% for ductwork pressure optimization in VAV AHU's up to more than 77% for the adoption of VSD for fancoils. Regarding the

lift retrofit works, a minimum energy saving of around 38% could be reached and that the pre-heating of domestic water by heat pump led to an energy reduction of 55%. Consequently,

it can be anticipated that with the increased implementation of suitable energy retrofitting works, a more sustainable built environment in Hong Kong can be achieved.

Building services system	Retrofitting Technology
Air-conditioning related	<ul style="list-style-type: none"> • Replace air-cooled chiller with water-cooled type • Upgrade to oil-free/magnetic bearing chiller • Use variable speed primary chiller pump station • Use fan coil unit with variable-speed-drive fan • Add CO₂ sensor to reduce fresh air rate • Adopt ductwork pressure optimization
Lighting related	<ul style="list-style-type: none"> • Replace light tubes with T5 or LED fixtures • Adopt lighting with motion/occupancy sensor controls • Add daylight sensor with/without dimming effect
Lift related	<ul style="list-style-type: none"> • Use lift motor with variable-voltage-variable-frequency drives and/or regenerative power
Other technologies	<ul style="list-style-type: none"> • Add heat pump to domestic hot water supply • Install solar collectors: thermal and/or photovoltaic

• Table 1



• 11kW frequency inverter provided to modulate fan speed of each AHU

Research Team

Institution	City University of Hong Kong
Collaborating Parties	Building Services Operation and Maintenance Executives Society (BSOMES); Business Environment Council (BEC); Hong Kong Green Building Council (HKGBC); Parsons Brinckerhoff Asia (PBA); Swire Properties Limited (SPL)
Members	Dr T.T. Chow, Dr C.K. Lee, Dr Alan Fong (CityU); Martin Wan, Wommy Wong (BSOMES); C.F. Leung, Alan Hung (BEC); Colin Chung (PBA); Isaac Tsang (SPL)
Funding Source	Construction Industry Council [CICR/05/14]

RESEARCH AND PLANNING

Envelope Design to Improve Ventilation Performance of Residential Buildings in Dense Urban Environments

Given that most people spend more than 50% of their time at home, the indoor air quality in residential buildings is of great importance. This landmark study examined the role of ventilation in residential buildings in Hong Kong by looking at both air-conditioned and naturally ventilated scenarios, since residential buildings in Hong Kong are generally air-conditioned in summer and naturally ventilated in the cooler winter months. The environmental issues under both scenarios were first identified through a systematic literature review, following which envelope-based design solutions were then proposed and investigated.

Since room air-conditioners provide little to no fresh air, insufficient ventilation and excessive CO₂ concentration are common problems in air-conditioned residential environments. Three possible ventilation strategies to address this were examined through field measurements in a typical bedroom in a high-rise residential building in Hong Kong. In general, overnight natural ventilation even via a small opening is associated with excessive energy consumption and a deteriorated indoor thermal environment. Short-term natural ventilation strategies are likewise inefficient. The most energy-efficient ventilation strategy, namely one requiring a minimum mechanical ventilation period, was found to be a short single ventilation period on a high frequency. In other words, between several and dozens of several-minute ventilation periods were able to maintain an acceptable indoor air quality for a normal sleeping period of eight hours.

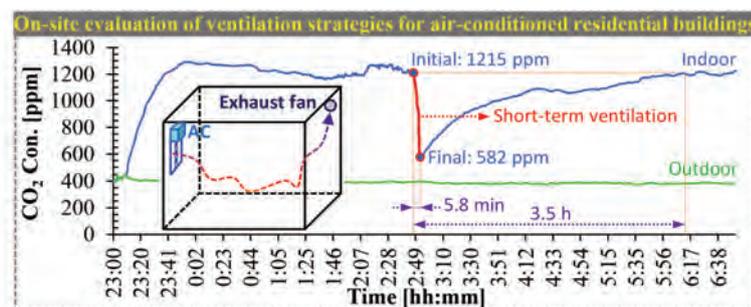
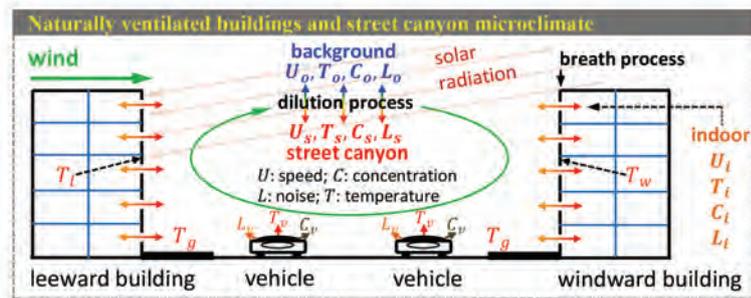
Owing to the moderation of local wind fields and the accumulation of traffic-related pollutants in street canyons, low ventilation rates and the penetration of outdoor pollutants are two key risks involved in naturally ventilated residential buildings. To further examine this urban context, the wind-induced natural ventilation in buildings near a long street canyon was investigated using computational fluid dynamics (CFD). Four aspect ratios (AR) of a street canyon were investigated

to examine the influence of street configuration, while eight envelope designs were compared to explore the possibility of using envelope design to improve the natural ventilation performance of urban buildings.

AR influences the ventilation rate and its distribution among rooms along the height of a building. The percentage decrease in the ventilation rate of buildings reaches 67% when the AR of a street canyon increases from 1.0 to 6.0. Careful envelope design thus provides the potential to enhance the adaptability of

buildings to dense urban environments, which is a primary solution to maximise the utilisation of natural ventilation. A good envelope design, such as a horizontal feature in the middle of an opening, can effectively break the along-facade flow of air, and thus create a large pressure difference that further drives ventilation.

The findings of this project would increase our understanding of the relationship between buildings and their environments, while also providing useful information and implications for the ventilation design of both air-conditioned and naturally ventilated residential buildings.



Research Team

Institution	The Hong Kong Polytechnic University
Members	Professor & Principal Investigator: Prof. Cheuk Ming Mak Postdoctoral Fellow: Dr Zhengtao Ai Research Assistant: Mr Da Yang
Funding Source	Environment and Conservation Fund [ECF 18/2014]

Study of the Energy Potential of Integrating the Sustainable Building Environmental Model (SBEM) in Hong Kong

The choice of air-conditioning and ventilation strategy has a significant influence on the energy consumption and indoor environmental quality (IEQ) of office buildings. In order to enhance the integration of energy conservation and IEQ in offices, this study proposed a mathematical model for predicting both cooling load and acceptable IEQ levels in air-conditioned offices in Hong Kong.

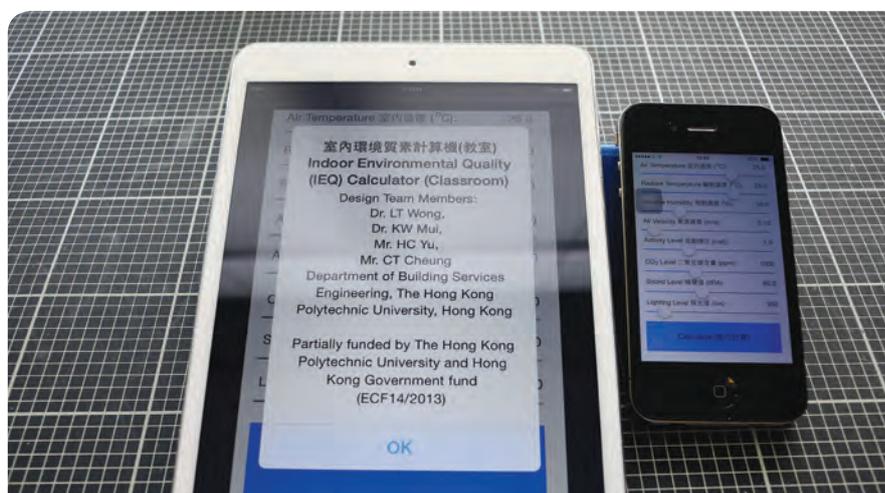
Four air-conditioning and ventilation (ACV) strategies, namely conventional constant air volume (CAV), demand-controlled ventilation (DCV), adaptive comfort temperature (ACT) set-point adjustment, and a combination of DCV and ACT (DCV + ACT), were included in the investigation. It was found that thermal comfort acceptance was the dominant component contributing to overall IEQ acceptance. Strategies with an ACT set-point adjustment gave 'Good' to 'Average' IEQ acceptance levels, while the base case and DCV strategies yielded 'Bad' acceptance levels. The results showed that DCV + ACT was the most energy-efficient strategy for maintaining an acceptable IEQ. The findings also revealed that DCV was a more energy-efficient strategy than conventional CAV. When taking energy efficiency and IEQ acceptance levels into account, ACV strategies with an ACT set-point adjustment (i.e. outdoor temperature-dependent) must be considered. To avoid complex system operations, the office temperature set-point should also be adjustable to maintain a decent thermal environment during both working and overtime hours.

As a consequence of this study, a user-friendly, five-star IEQ acceptance benchmarking calculator for air-conditioned offices was developed and is now available on iOS and Android platforms. The outcomes refer to the expression of occupants' overall IEQ acceptance regarding thermal comfort, indoor air quality, and aural and visual comfort data, as collected in our previous studies. The

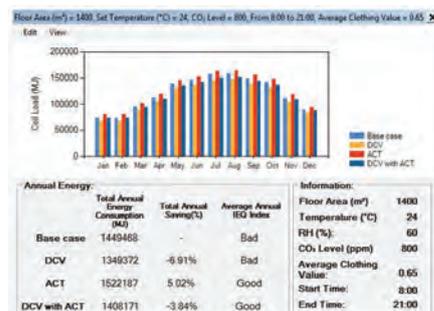
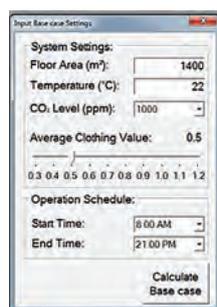
proposed model serves as a quantitative IEQ measure for air-conditioned offices in Hong Kong, and a useful reference for validating occupants' IEQ satisfaction regarding energy policies implemented via the Sustainable Building Environmental Model (SBEM).

A user-friendly computer interface has also been created for building management officers to improve existing or pre-constructed

air-conditioning systems in Hong Kong. This flexible simulation tool satisfies different set-points and operational criteria, and addresses the improvement of operational strategies in specific office environments. By eliminating sophisticated simulation processes, this simple prediction tool is designed for laymen's understanding, thus making it easier and simpler to improve the operation of air-conditioning systems in Hong Kong.



• BSE IEQ APPS



Research Team

Institution	The Hong Kong Polytechnic University
Collaborating Party	Environmental Protection Department, HKSAR Government
Members	Ir Dr Mui Kwok-wai; Dr Wong Ling-tim; Dr Xiao Fu, Linda
Funding Source	Environment and Conservation Fund [ECF 14/2013]

RESEARCH AND PLANNING

Encapsulation of Next Generation Solar Cells for High Humidity Environments

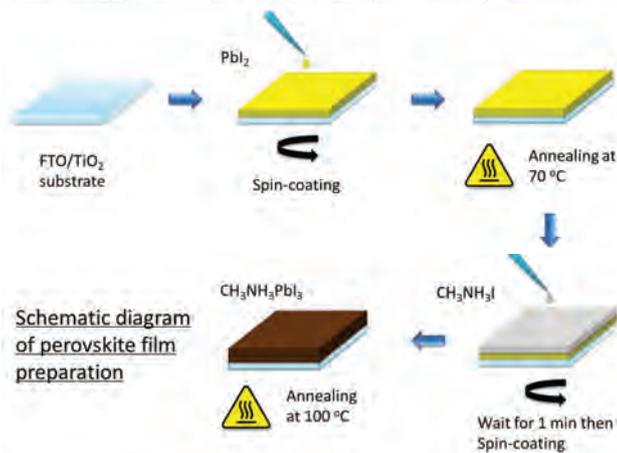
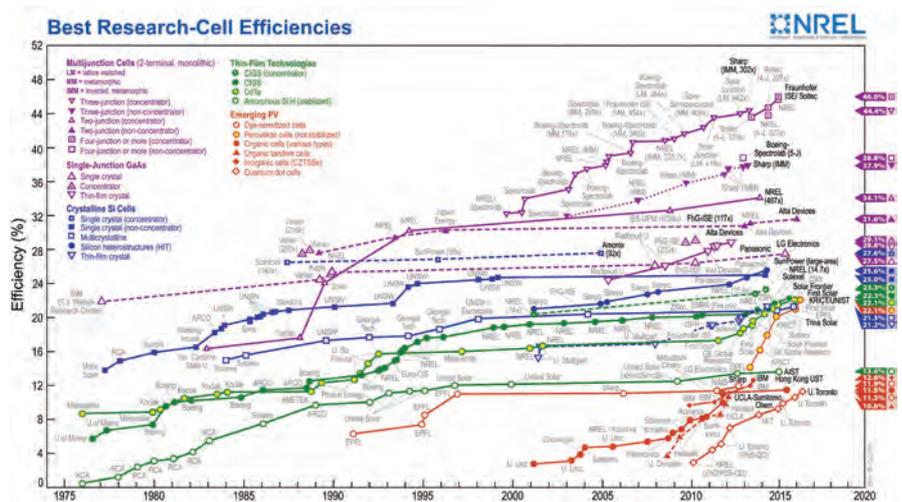
Wider use of renewable energy is expected to play a significant role in mitigating the effects of global climate change. While available solar energy is more than adequate for meeting all our energy needs, the cost of harvesting solar energy using silicon solar cells is very high. Many alternatives to single crystal silicon solar cells have been explored over the years, with photovoltaics attracting the most attention due to the possibility of low-cost manufacturing, as well as the use of flexible substrates.

Among emerging solar cell technologies, perovskite solar cells are the most promising thanks to their high efficiency. Indeed, their record efficiency of 22.1% is higher than that of even well-established technologies, such as amorphous Si, multicrystalline Si, and thin film Si, and is comparable to thin film technologies (CdTe, CIGS). Perovskite devices are solution processed and inexpensive, but they are sensitive to exposure to the ambient atmosphere, in particular to humidity. Due to the fact that the perovskite material rapidly degrades in a humid environment when subjected to illumination and elevated temperatures (both of which are standard conditions for solar cell operation), it is critical to assess their performance in a hot and humid environment such as Hong Kong.

While there have been several reports of outdoor testing of organic photovoltaics, this is not the case for perovskite solar cells which are a considerably newer technology; the first report of these solid state devices was in 2012. Previous outdoor testing for perovskite solar cells was performed in Saudi Arabia for two weeks at ~60% ambient humidity. No data were available for higher humidity environments, such as that found in Hong Kong. The objectives of ongoing research at The University of Hong Kong, which started in May 2016, are to develop novel epoxy materials suitable for encapsulating perovskite and polymer solar cells for operation in a humid environment, and perform outdoor testing

of these encapsulations. The preliminary results of the study, which compared different encapsulation strategies, demonstrated that perovskite solar cells in optimised encapsulation exhibit stable performance for more than four weeks, following an initial burn-in period of degradation that occurs on the first day. This is the longest outdoor test performed on these devices. The champion cells exhibited

stable performance exceeding 1,000 hours in a variety of weather conditions, including high humidity, rain, extreme temperatures, and even a typhoon. The continued development of suitable encapsulation techniques and the demonstration of stable operations in a hot and humid climate will have important implications for the possible commercialisation of this vital technology.



Research Team

Institution	The University of Hong Kong
Members	Prof. Aleksandra Djurišić; Prof. Wai Kin Chan; Mr Tiklun Leung
Funding Source	Environment and Conservation Fund [ECF 35/2015]

Integrating BIM for Sustainable Planning, Design, Construction and Facility Management for Hong Kong's Public Housing Development

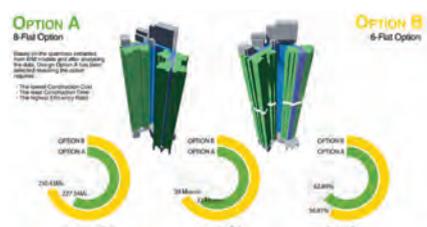
The Hong Kong Housing Authority (HA) implements a public housing programme that covers all stages of development: from planning and design, to construction and facility management. In the past decade, it has devoted itself to integrating the use of Building Information Modelling (BIM) to enhance the design efficiency and improve the environmental performance of its buildings, as well as advance the quality and safety of its construction work for each building's entire development lifecycle.

In 2014, it developed a data transformation tool to allow BIM models to be imported into its Geographic Information System (GIS) platform. This successful integration of BIM and GIS was a significant breakthrough, which facilitated a number of useful applications in the area of planning and design, including visual impact assessments, and analyses of ridge lines, vantage points and shadows (Figure 1).

BIM has also been used as a Value Management tool at the scheme design stage. For instance, at the HA's Hin Tin Street development in Shatin, BIM was used for value management to compare the merits between a six-flat and an eight-flat per floor design option, as well as other structural design options to achieve optimum time and cost efficiency for the project (Figure 2).



• Figure 1



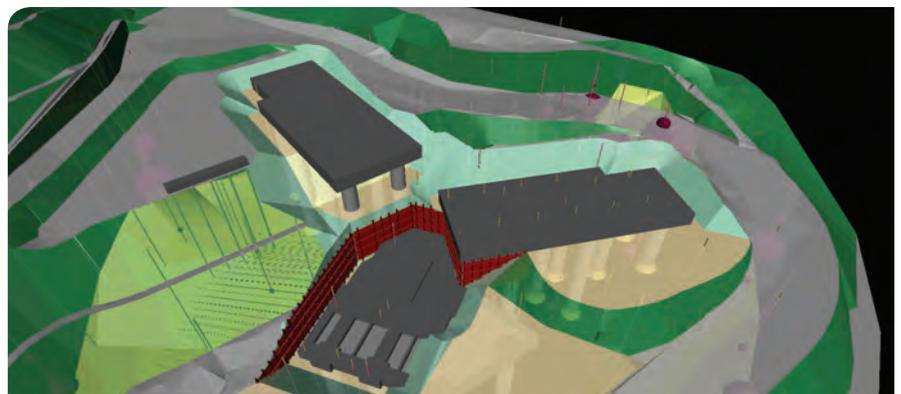
• Figure 2

Through the integration of BIM and other environmental analysis software, HA is now able to carry out sophisticated environmental and other technical analyses at the detail design stage, including lighting simulation, solar radiation and computational fluid dynamics (CFD). For its project at Sheung Shui Area 36, it integrated BIM with a lighting simulation software to optimise the lighting design in order to achieve new energy savings (Figure 3).



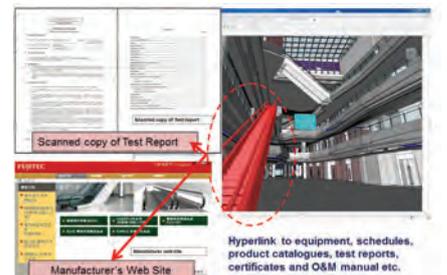
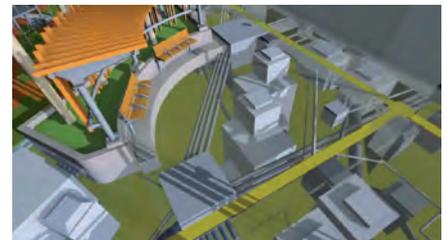
• Figure 3

Tung Tau Cottage Area East is a project with complex topography comprising three platforms of significant level difference, thus requiring careful design and planning. BIM was used as a design and visualisation tool to allow the whole team to plan, design and rehearse in a virtual 3D environment to resolve problems well in advance of construction work (Figure 4).



• Figure 4

For Domain, which is a retail development located in Yau Tong, HA created a data rich model at the construction stage to facilitate future facility management. This data rich model has since proven extremely valuable for facility management and maintenance. Likewise, for its project at Sheung Shui Area 36, all underground utilities were carefully documented in the BIM model to streamline and optimise future maintenance work (Figure 5).



• Figure 5

Project Team

Organisation

Hong Kong Housing Authority

RESEARCH AND PLANNING

Trial Study of a Zero Irrigation System in a Public Housing Project

A Zero Irrigation System (ZIS) is a sub-irrigation system installed at the sub-soil level of a planting area. There are two major design objectives of such a system: firstly, it aims to harvest the rainwater directly underneath the planting areas for irrigation purposes, so as to minimise the need for manual irrigation and thus reduce maintenance costs; secondly, since it plays a role in the uptake of storm water runoff, it reduces the potential for storm water flooding.

With the aim of achieving zero consumption of potable water, a pilot ZIS project was launched at a public housing estate in Tuen Mun in 2013. Consumption of irrigation water and the performance of plant growth in trial ZIS planters were monitored for a period of 24 months.

The ZIS project comprised a wicking bed mechanism, which is a passive and self-sustaining design that delivers rainwater stored in water retention cells to the vegetation, and minimises topsoil evaporation through capillary action, as shown in Figure 1.



• Figure 1

After installation in November 2013, the trial system was monitored over a 24-month period. The construction sequence is illustrated in Figure 2.

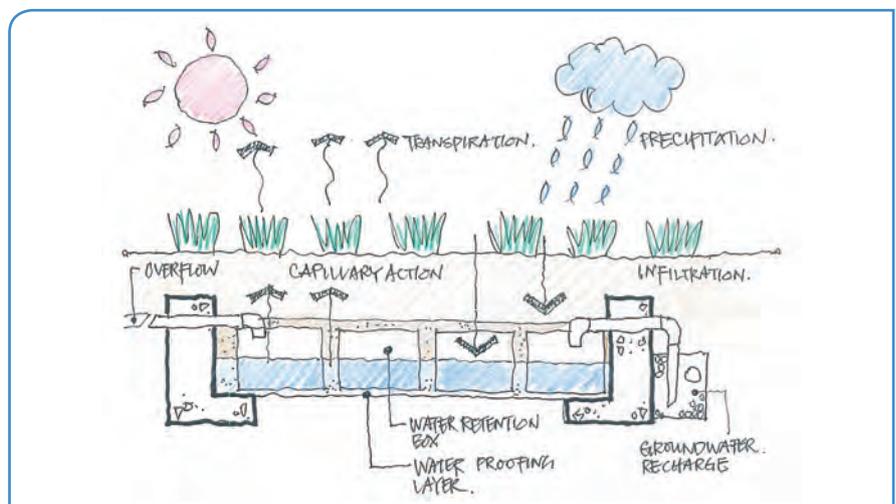
Six plant species were selected in the study based on their characteristics of drought tolerance, easy maintenance and aesthetics, all of which thrived during the course of the study.

After an initial infill of water to the system, no further manual watering was applied. The average water consumption was found to be 2.2 L/m²/day. No waterlogging occurred, and no odour was generated. Compared with a conventional irrigation system, the ZIS trial resulted in a water saving of 54.75 m³/year for each trial planter.

The water consumption and rainfall records further indicate that the system performed satisfactorily under both wet and dry conditions.

The water retention cells were also found to serve as a rainwater buffer zone, with no flooding observed, even under Black-level rainstorm conditions.

The results of this ZIS trial are very encouraging, proving that the system is effective both in saving water resources, and in reducing the manpower needed for maintenance. ZIS looks to have great potential for wider use on new housing estates, and further research is now being conducted with the aim of refining the design so as to reduce the construction time and costs through modularisation.



• Figure 2



• Figure 3

Project Team

Organisation

Hong Kong Housing Authority

Transforming Building Information Modelling to Sustainable Building Asset Management

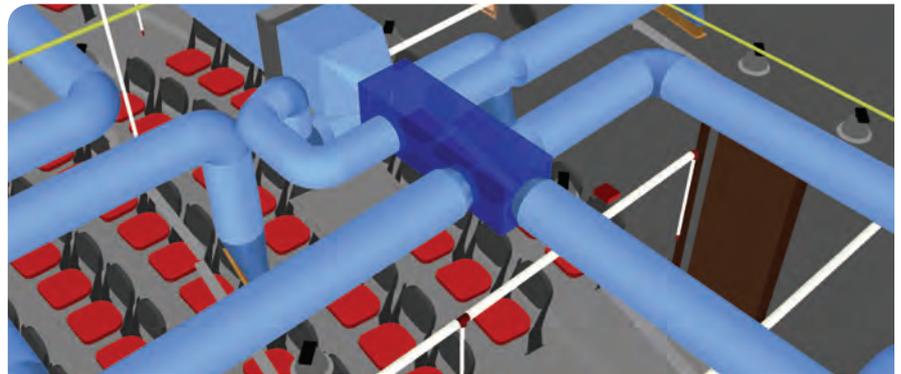
The use of Building Information Modelling (BIM) technology has made rapid progress in recent years in the architecture, engineering and construction industries to optimise design and engineering works, and reduce construction and design efforts. However, its application in the entire lifecycle of a building, namely at the operation and maintenance (O&M) level, is little explored. A pilot BIM project to explore the application of BIM in Asset Management (AM) was commenced in 2014 and recently completed. On the basis of its findings, the Electrical and Mechanical Services Department (EMSD) has derived a novel framework for transforming BIM to sustainable building asset management through the visually intuitive integration of BIM, AM and multiple other electronic systems and devices.

Under the proposed framework, the system provides a seamless and intuitive way to access heterogeneous O&M information, such as photos, attributes, equipment relationships, manuals, drawings, maintenance records, live views from Closed Circuit Television (CCTV)

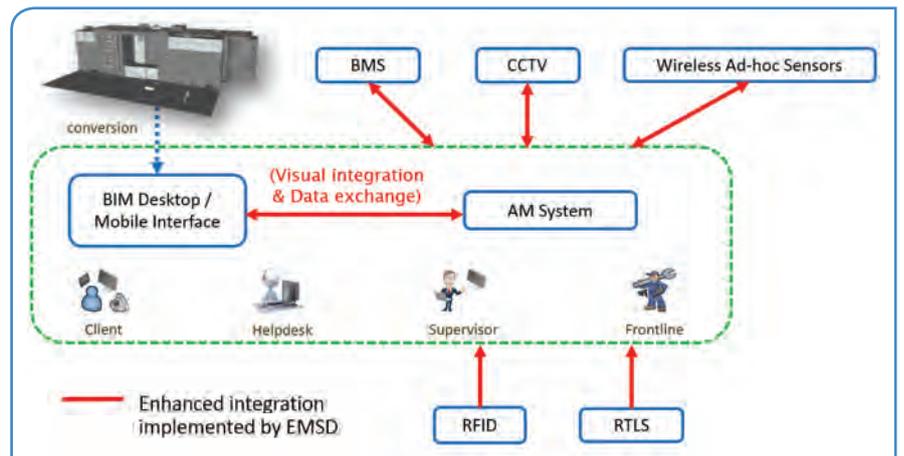
Systems, real-time sensing data from a Building Management System (BMS) and wireless ad-hoc sensors, as well as location information from Real Time Location Systems (RTLS), all collated in a single integrated mobile platform. All these data are made accessible in a simple asset repository, manoeuvring through a BIM model, or even via a handheld Radio Frequency Identification (RFID) scanning tool. Besides, BIM visualisation of asset georeferencing is beneficial not only for O&M, but also for effective pre-planning and site preparation in alteration, addition and

improvement (AA&I) works.

Having selected the EMSD Headquarters Building as a showcase project, an integrated BIM-AM System with four key generic user models has now been developed to implement this novel framework. The results have successfully demonstrated the system capabilities in not only facilitating daily O&M works and effective asset management, but also responsive incident handling, thus enhancing the building's overall sustainability



• VAV Box



• Novel Framework

Project Team

Organisation

Electrical and Mechanical Services Department,
HKSAR Government

RESEARCH AND PLANNING

Transformation from River Channelisation to River Revitalisation



Hong Kong experienced flooding in various areas in the 1970s and 80s as its drainage systems had become obsolete due to rapid urbanisation. To alleviate the flood risk, one of the solutions was to straighten, widen and deepen the natural meandering rivers, and channelise them to create concrete-lined canals with increased hydraulic capacity.

By the late 1990s, the flooding situation had been greatly improved by the completion of a series of drainage improvement works. With a vision of providing sustainable storm water drainage services and pursuing a higher standard in environmental and ecological preservation, the Drainage Services Department (DSD) embraced a sustainable development approach by adopting 'green' elements into 'blue' water bodies to enhance the ecology in waterways. Most of these works were implemented with the goal of enabling aquatic fauna to breed and stay healthy within the channels. Ho Chung River and Upper Lam Tsuen River are typical examples showcasing the integration of ecological enhancement features and engineering techniques in a sustainable manner so as to address the social needs for ecological preservation and flood control.

In its 2015 Policy Address, the HKSAR Government stated that it would continue adopting the concept of revitalising water

bodies in large-scale drainage improvement works, and plan drainage networks for new development areas so as to build a better environment for the public. From this point onward, the concept of river revitalisation became manifest with an aim of changing the community-wide culture towards water friendliness. In the revitalisation of Kai Tak River and King Yip Street nullah, and the development of Tung Chung River Park, the HKSAR Government will adopt new standards in the planning and construction with the objective of promoting greening, biodiversity, beautification and water friendliness, in addition to achieving efficient drainage.

It has been a long journey from river channelisation to river revitalisation, from flood protection to ecological enhancement, and from isolation to water friendliness. The transformation of channelisation to revitalisation demonstrates the HKSAR Government's agility in embracing change and adapting to society's desire for a sustainable environment.

Looking ahead, river revitalisation is an overwhelming and irresistible trend, and a core aspect of water management in response to global climate change. Starting with Hong Kong's existing rivers and waterways, the revitalisation of water bodies will be considered in all planning and construction of drainage facilities for new development areas. By taking a broader perspective in this water-sensitive city, we can create a better environment for the future.



• Kai Tak River

Project Team

Organisation

Drainage Services Department,
HKSAR Government

BEAM Plus Existing Buildings V2.0

BEAM Plus Existing Buildings (EB) measures the actual performance of a building and evaluates its facility management practices. In 2014, the BEAM Society Limited (BSL) engaged the Business Environment Council (BEC) to conduct a research study to develop a new version of BEAM Plus EB, namely Version 2.0. By enlisting the assistance of various stakeholders, among them the Hong Kong Green Building Council (HKGBC), which provided funding support, BSL successfully rolled out BEAM Plus EB V2.0 in March 2016.

This new version contains major revisions to the assessment guidelines and offers greater flexibility in the scope of assessment. These changes have been implemented with a view to encouraging the 42,000 existing buildings in Hong Kong to participate in the BEAM Plus certification scheme.

BEAM Plus EB V2.0 encompasses the assessment and certification of a wide range of existing buildings, including residential, commercial, industrial, educational and government premises. It covers all the management, operation, maintenance and improvement aspects under the control of the applicant. Additional or bonus credits are awarded when the building's tenants, who are critical to the building's long-term environmental performance, are also involved in the assessment.

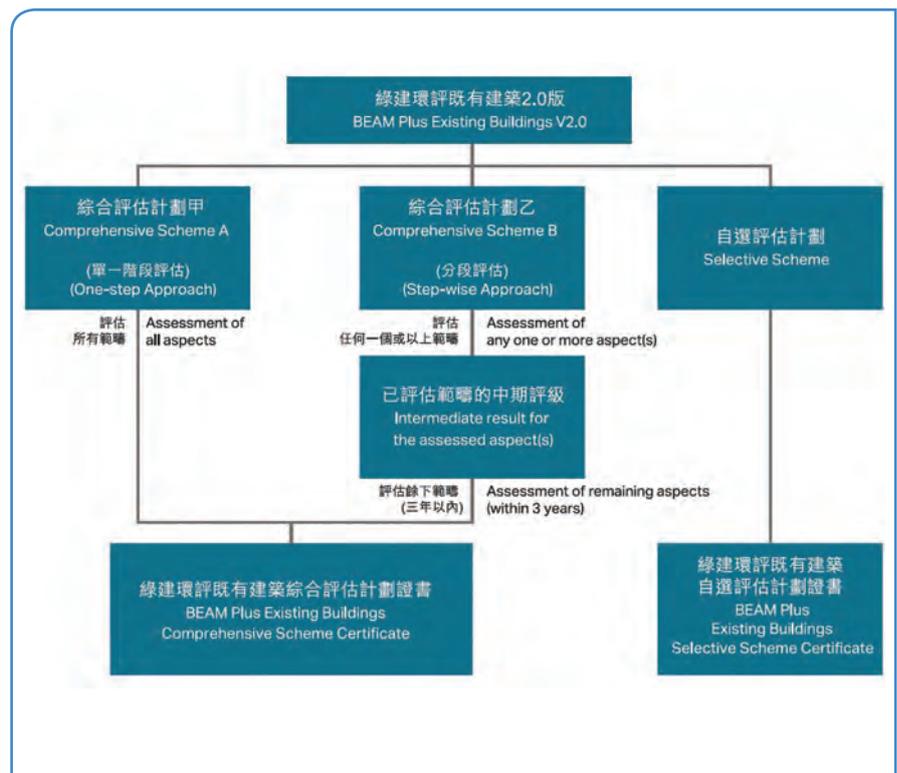
This new BEAM Plus tool is designed to give applicants more flexibility in customising the assessment to suit their needs, which is why applicants have the freedom to apply for a Comprehensive Scheme or a Selective Scheme according to the current conditions of their buildings.

The holistic Comprehensive Scheme review is primarily targeted at buildings certified under BEAM Plus New Buildings, and buildings that are to be upgraded to achieve BEAM Plus certification. The stepwise assessment option offers greater flexibility to applicants who have budgetary and time constraints. Four assessment ratings are available, namely Platinum, Gold, Silver and Bronze.

By contrast, the Selective Scheme assesses each aspect on an individual basis, with a certificate issued for each assessed aspect. Certification under the Selective Scheme is more flexible than the Comprehensive Scheme, as it allows applicants to implement assessments

that match the physical conditions of their buildings. Grading is awarded separately for each individual aspect, namely Excellent, Very Good, Good or Satisfactory.

To keep pace with global trends, BSL has been working closely with the HKGBC to further expand the scope of its assessments from green buildings to green built environments by launching a new tool for green neighbourhood assessment, namely BEAM Plus Neighbourhood, in December 2016. The sustainability principles are now ingrained in the DNA of a development, which will guide the subsequent stages of development.



• The mechanism of EB V2.0 Assessment

Project Team

Organisation	BEAM Society Limited
Collaborating Party	Business Environment Council
Funding Source	Hong Kong Green Building Council

RESEARCH AND PLANNING

Development of HKGBC Benchmarking and Energy Saving Tool (HK BEST) for Commercial Buildings of Office and Retail Use in Hong Kong

Hong Kong possesses a unique building stock with many mixed-use buildings performing a diverse range of services. This stock of existing buildings accounts for 90% of all the electricity used in Hong Kong. There is, therefore, huge potential to drive the market to low energy use by grasping the low-hanging fruit of retro-commissioning. However, the traditional approach of conducting energy audits—namely, comparing a building’s energy use against itself over a certain period—is too one-dimensional. The Energy Utilisation Index (EUI) is less valuable when blurred by all the inherent characteristics of different buildings.

The HKGBC Benchmarking and Energy Saving Tool (HK BEST) series addresses the needs of stakeholders for a rigorous, user-friendly and recognisable means by which commercial building owners and managers can compare and improve their buildings’ energy efficiency. The tool can benefit decision-making, predict expected outcomes of energy-saving practices, and help enable market transition in the process of achieving the Government’s long-term energy-saving target.

The HKGBC’s HK3030 Campaign clearly identifies that reporting, benchmarking, legislation and assessment are all essential, and will serve as a pivot point for achieving new energy-reduction targets in Hong Kong’s existing building portfolio. In response, the HKGBC commissioned world-renowned engineering firm Arup to tailor-make an energy benchmarking tool for Hong Kong that reflects local building design and operational performance, with the following key issues identified for the tool’s development:

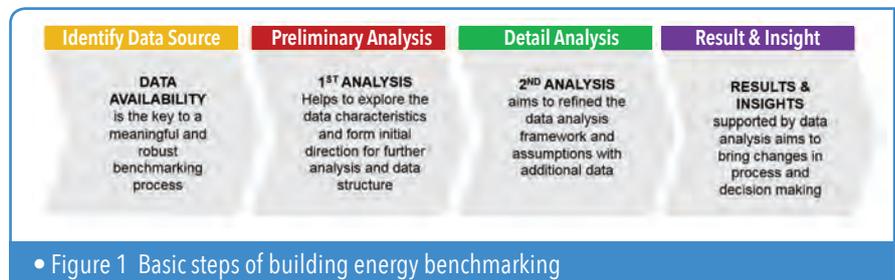
- Identification of building types suitable for benchmarking
- E&M system categorisation
- Analysis and adjustment of building energy data

- Selection of key parameters for normalisation and improvement suggestions

With help from the Electrical and Mechanical Services Department (EMSD), Arup was able to collect the energy consumption data of numerous commercial buildings in Hong Kong to construct a robust database. The development of the tool was based on the outcome of available data through a series of statistical analyses and regression modelling for different building categories with different types of air-conditioning system (Figure 1). The Recognition Scheme was then created to give certified ratings to building owners based on their buildings’ operational energy performance. The building owners can compare their building energy consumption with their market peers (Figure 2). If their performance is in the top 10%, they will achieve

the Platinum rating. The Gold, Silver, Bronze and Green ratings are 10% apart respectively. In addition, the world’s first ‘What-If’ function has been developed to allow building owners to test different improvement opportunities for their buildings’ major energy-consuming systems. This unique function encourages and guides building owners to plan continuous improvements to their buildings’ performance.

An official online platform for office and retail buildings has now been launched by the HKGBC. Today, HK BEST is helping building owners and managers to explore new opportunities for energy savings in existing buildings through retrofitting. The significance of this research will be even further enhanced when it is expanded to high-energy-consuming buildings and integrated with Hong Kong’s green building certification systems.



• Figure 1 Basic steps of building energy benchmarking



• Figure 2 HK BESTCOM rating logos

Project Team

Organisation	Hong Kong Green Building Council
Collaborating Party	Arup
Funding Source	Construction Industry Council

Better Places for People – Global Campaign

A report on *Health, Wellbeing and Productivity in Offices: The Next Chapter for Green Building* was published by WorldGBC in 2014. It presented overwhelming evidence that office design significantly impacts the health, wellbeing and productivity of staff. The report revealed that a range of factors – from air quality and lighting, to views of nature and interior layout – can affect the health, satisfaction and performance of office occupants. The report further raised awareness of different building sectors and set out a framework for organisations globally to measure how their buildings impact on their most valuable asset, namely their employees.

To build on the foundation provided by this report, WorldGBC launched a two-year 'Better Places for People – Global Campaign' in 2015 to ensure these principles can be taken forward beyond just the office sector. The campaign aims to raise awareness of how buildings impact upon health and wellbeing, and encourage those who design, build, own, occupy, operate or sell them to shape buildings for the long-term benefit of the occupants. Building upon evidence linking office design with health and wellbeing outcomes among employees, the campaign focuses on a wide range of building types, including retail stores, offices and residential buildings.

Health, Wellbeing & Productivity in Retail: The Impact of Green Buildings on People and Profit was launched by WorldGBC on 1 February 2016. This report builds on a variety of research from around the world regarding the health and wellbeing benefits of green buildings, including three retail case studies from Hong Kong (Langham Place, Hysan Place and Pacific Place). The report's main finding was that retailers can improve the shopping experience for their customers and potentially increase their profits by providing greener and healthier stores, which are more attractive to consumers and thus potentially more profitable for retailers.

With the intention to present the progress made since the report was published in 2014, a follow-up report entitled *Building the Business Case: Health, Wellbeing and Productivity in Green Offices* was launched on 25 October 2016, bringing together the best and most innovative case studies from around the world, measuring and managing the health and wellbeing of benchmark offices. This follow-up report highlights the global momentum behind healthy and green office design and operation, and showcases over 15 buildings that are leading the way. The HKGBC was honoured to feature a number of office case studies in 'Spotlight on Hong Kong'.



Project Team

Organisation	Hong Kong Green Building Council
Collaborating Party	World Green Building Council
Members	<p>Task Force Co-chairman: Dr Benny Chow ; Mr Robert Lam</p> <p>Member: Ir Sunny Chan; Ir Colin Chung; Ar. Yvonne Jeong; Mr Lewis YH Lam; Ms Gidget Lun; Mr CW Tong; Ms Julie Wong</p> <p>Advisor: Ms Ada Fung</p> <p>HKGBC Secretariat: Dr Paul Sat; Dr Karen Cheung; Ms Jennifer Cheung</p>
Funding Source	Construction Industry Council

CONCLUSIONS



CONCLUSIONS



Each of us, regardless of where we call home, has the privilege of living at an historic time. In years to come, historians will note that 12 December 2015 was an important day for mankind. On that day, 195 nations agreed to the landmark Paris Agreement, the first legally binding global climate agreement designed to keep global temperature rise in this century well below 2°C.

Hong Kong is not immune to the many risks of climate change. Signs of extreme weather are already evident and, as a coastal city, it is vulnerable to rising sea levels if nothing is done to curb global warming.

In January 2017, the Government released *Hong Kong's Climate Action Plan 2030+*, outlining the Government's long-term plan to combat climate change, and setting out clear carbon emission reduction targets for 2030. Using the proposed 4T framework, both the Government and industry are working closely together to achieve this ambitious target.

The road ahead

Hong Kong is a high density city, with a large number of skyscrapers. While climate change presents massive challenges, it also brings new opportunities to re-think urban development and commit to a sustainable built environment. In fact, Hong Kong's high-rise buildings help draw even more attention to the importance of green building in achieving a low-carbon society, and are powerful reminders that human wellbeing and climate resilience must be taken into account when planning a liveable high density environment.

Hong Kong is proud to be playing a leading role in promoting the wellness of people as an important performance metric of green building in high density urban environments. Wellness elements are now fully integrated in Hong Kong's widely used assessment tool, and an ever greater number of studies is being conducted in the local context. By attracting more attention to this subject, these studies are helping to safeguard the productivity and wellbeing of all residents.

The successful creation of a sustainable built environment in Hong Kong involves not only buildings, but also green communities, district-level master planning, smart cities, and climate-resilient infrastructure. Supported by the comprehensive suite of assessment tools already available, which are also being continuously improved, project owners of all types are now empowered to take green buildings to the next level, thus enhancing and enriching the city's built environment.

Naturally, energy saving remains an important task to achieve Hong Kong's carbon reduction target. As buildings account for 90% of the total electricity consumption in Hong Kong, saving energy in buildings is of utmost importance. This is especially true of existing buildings, which represent the majority of the city's building stock and therefore possess the greatest potential for new energy savings. To meet this challenge, the HKGBC, for example, is actively encouraging the wider adoption of various industry tools such as BEAM Plus Existing Buildings and the HKGBC Benchmarking and Energy Saving Tool (HK BEST). It has also developed the innovative

new ACT-Shop programme to build up industry competence in retro-commissioning, and ultimately raise the overall quality and standard of building operation. Looking ahead, the industry is committed to inspiring all stakeholders to share the Government's target of moving energy saving and building transformation in existing buildings from a secondary activity to a mainstream focus.

In addition to the transformation of existing buildings, there is clearly an urgent need to grow the market for green products and technologies. While supply can be sustained by industry-driven research, demand must be further enhanced through continuous educational efforts, so that all industry players and, even more importantly, all members of the public understand and recognise the benefits of implementing green measures.

The work of the industry in the years ahead is therefore two-fold: to enhance its stakeholders' environmental consciousness, and drive behavioural change among all members of the public. With the imminent threat of climate change on our physical and economic health, both the industry and the public are becoming more aware of sustainability principles. Indeed, it is heartening to see that an ever-increasing number of community-based initiatives are now bringing everyone together to combat this global issue.

Conclusion

Hong Kong has come a long way since the 1980s as a pioneer of high density urban development in the world. Today, many industry professionals are committed to the creation of a sustainable and highly liveable urban environment, and they are more than willing to share the experience to others under the unstoppable trend of urbanisation worldwide. This report has provided a brief overview of the things accomplished so far, but our journey does not stop here.

The threats of climate change are becoming increasingly urgent, and the role of green building is now more important than ever. That's why we are dedicated to promoting every opportunity brought by emerging technologies, increasing awareness and participation among all industry stakeholders and the public, and continually sharing the message that we can combat climate change through innovation and collaboration.

Wherever you call home, we urge you to join us in these efforts. Together, we really can change the world.



The logo for the World Sustainable Built Environment Conference 2017 Hong Kong, featuring a stylized, pixelated globe in shades of yellow and orange.

WORLD SUSTAINABLE BUILT ENVIRONMENT CONFERENCE 2017 HONG KONG



Regarded as the 'Olympics' of the green building industry, the World Sustainable Built Environment Conference 2017 Hong Kong (WSBE17 Hong Kong), co-organised by the Construction Industry Council (CIC) and Hong Kong Green Building Council (HKGBC) from 5 to 7 June, was attended by a total of 1,800 green building advocates, public sector leaders, industry and commercial sector pioneers as well as academics from 57 countries and regions. With the theme of 'Transforming Our Built Environment through Innovation and Integration: Putting Ideas into Action', the three-day conference successfully created a platform for knowledge sharing and forging collaborations to drive towards a sustainable built environment.

WORLD SUSTAINABLE BUILT ENVIRONMENT CONFERENCE 2017 HONG KONG

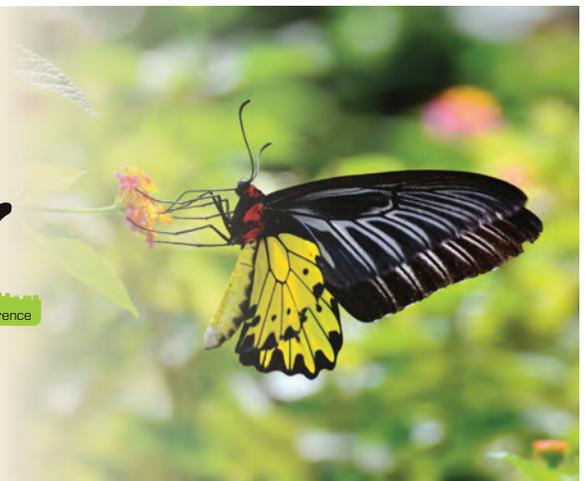
The Conference

The three-day Conference, comprising keynote speeches, a dedicated Plenary Session on Climate Change and Sustainable Development, and Roundtable Sessions from globally respected thought leaders, as well as about 100 parallel sessions, engaged delegates in deep-dive discussions based on academic research, business case studies, industry best practices and governmental perspectives.



Behind the Logo

A butterfly dancing above the green city skyline symbolises the transformation to a sustainable urban built environment around the world. It is developed from *Troides Helena*, a species that is protected by a local ordinance. The '2017' in a Chinese calligraphic style represents the East-meets-West culture of Hong Kong.



Government Support

Starting from the bidding stage in 2014, the Government of the HKSAR granted tremendous support to the organisation of WSBE17 Hong Kong.

The Government's support included participation in the conference's Organising Committee, Scientific Committee and Honorary Advisory Panel. It also facilitated the invitation of representatives from the Ministry of Housing and Urban-Rural Development of the People's Republic of China to officiate at the Opening Ceremony and deliver a keynote speech. In addition, the Development Bureau, Environment Bureau, and Transport and Housing Bureau showcased the Government's effort in promoting a sustainable built environment at a concurrent exhibition. WSBE17 Hong Kong was also one of the official celebration events of the 20th anniversary of the establishment of the Hong Kong Special Administrative Region.

A number of government representatives participated in the discussions at the conference. Apart from the keynote speech given by Chief Secretary for Administration, Mr Matthew Cheung Kin-chung, Secretary for the Environment, Mr Wong Kam-sing, and Under Secretary for the Environment, Ms Christine Loh, joined the Plenary Session on Climate Change and Sustainable Development led by the United Nations Environment Programme (UNEP). Also, representatives of various Government departments submitted over 30 papers and shared their experience in policy and technology development during the parallel sessions.



- Hong Kong's Chief Executive, Hon. CY Leung, was the Guest of Honour at the Opening Ceremony of WSBE17 Hong Kong.



- Secretary for Development, Mr Eric Ma Siu-cheung, concluded WSBE17 Hong Kong at the Closing Ceremony.

WORLD SUSTAINABLE BUILT ENVIRONMENT CONFERENCE 2017 HONG KONG

Main Conference

Keynote Sessions

WSBE17 Hong Kong invited six world-leading policymakers, industry authorities and experts to present the latest policies, standards and pioneering initiatives in sustainable built environments.



Mr Matthew Cheung Kin-chung, Chief Secretary for Administration, The Government of the Hong Kong Special Administrative Region

Mr Cheung echoed the theme of the event by referring to the Government's goal 'to develop Hong Kong into a liveable, competitive, and sustainable "Asia's world city"'. He elaborated on 'Hong Kong 2030+: Towards a Planning Vision and Strategy Transcending 2030', a long-term territorial development strategy drawn up by the Government to achieve this goal and respond to global climate change.



Ms Christiana Figueres, Vice-Chair, Global Covenant of Mayors for Climate & Energy

Ms Figueres pointed out that decarbonisation of the global economy has become inevitable, irrevocable and unstoppable because of market forces, and put the urban built environment at the centre of the climate change challenge for three reasons, namely, the physical impacts of climate on the built environment, the rising demand for environmentally sustainable buildings and the projected world population growth from 7.5 billion in 2017 to 9.8 billion by 2050. She predicted the cities of the future, particularly Asian ones, will be crowded, connected and clean.



Prof. Thomas Auer, Managing Director, Transsolar and Professor, Building Technology and Climate Responsive Design, Technical University of Munich

Balancing the competing claims of user comfort and energy conservation, Prof. Auer cited an example from his home town to illustrate the discrepancies between target projections and actual results, and the need to consider local specifics and the influence of building form and material.



Mr Su Yunshan, Director-General, Department of Science & Technology and Energy Saving on Buildings, Ministry of Housing and Urban-Rural Development, People's Republic of China

Mr Su acknowledged that the work related to conservation of the ecosystem and protection of the environment is the duty of any government. His speech was complemented by four mainland China sessions.



Prof. Peter Guthrie, Professor, Engineering for Sustainable Development, University of Cambridge

Prof. Guthrie described the daunting challenge facing project developers as the need to construct green buildings that consume little or no energy. There are multiple ways to achieve this goal, but the impact on carbon footprint must also be considered.



Dr Raymond Cole, Professor, School of Architecture and Landscape Architecture, University of British Columbia

In the final keynote speech of the conference, Dr Cole commended the emerging notion of 'regenerative' design and development, and urged the industry to rethink the role of buildings as a catalyst to support the co-evolution of human and natural systems.

Plenary Session on Climate Change and Sustainable Development

Led by UNEP, the Plenary Session on Climate Change and Sustainable Development gathered influential leaders from a number of international organisations and representatives of the HKSAR Government, including the Secretary and Under Secretary for the Environment, to discuss the solutions and necessary actions to achieve the objectives

set out in the Paris Agreement and the UN's Sustainable Development Goals. The international organisations included:

- Global Covenant of Mayors for Climate & Energy
- Global Energy Program, World Resources Institute
- United Nations Human Settlement Programme (UN-Habitat)
- International Energy Agency
- International Initiative for a Sustainable Built Environment
- The 10YFP Sustainable Buildings and Construction (SBC) Programme
- World Business Council for Sustainable Development
- Directorate for Housing, Urban Development and Landscape of France



WORLD SUSTAINABLE BUILT ENVIRONMENT CONFERENCE 2017 HONG KONG

Main Conference

Roundtable Sessions

Vibrant discussions of emerging trends and practice-focused viewpoints on leading the changes to transform the sustainable built environment took place in two Roundtable Sessions. The panels of renowned speakers were from various sectors and countries.

Roundtable 1: Emerging Perspectives for Transforming the Built Environment

This session discussed how the emerging perspectives relate to the topics of high-performance building, deep building renovation, sustainable neighbourhoods and community empowerment, along the topics of:

- Winning the Battle Against Climate Change
- An Emerging Trend of Green Building Development in China
- Towards Buildings as Active Agents in Low Carbon Cities
- Disruptive Innovations Transforming the Sustainable Built Environment



Roundtable 2: Leadership Driving for the Sustainable Built Environment

This session discussed the importance of leadership and how various stakeholders can act to drive changes. The topics were:

- The use of data to showcase outcomes and results to demonstrate environmental, financial and other benefits
- Decision-making tools to clarify and help leaders make sense of different types of challenges
- The case of Singapore and Hong Kong in how government leaders approached developing policies for sustainable buildings and environments
- Experience of how decisions have been made and what will continue to drive change



Mainland China Sessions

The four Mainland China Sessions focused on various aspects addressing the issues relating to the transformation of existing buildings, technological challenges of eco skyscrapers, health and well-being for better places for people, and green finance opportunities for low carbon economic development.



Parallel Sessions

The Sustainable Built Environment (SBE) Conference Series maintains a core emphasis on peer-reviewed papers and presentations of regional policy papers. WSBE17 Hong Kong concluded the 2015-2017 conference cycle and embraced all the top findings from the 20 regional conferences held in 2016. Moreover, WSBE17 Hong Kong Organisers launched a global call for papers in 2016. The papers received were reviewed by the International Scientific Review Panel. In the end, about 400 top papers were presented in around 100 parallel sessions during the three-day conference.



WORLD SUSTAINABLE BUILT ENVIRONMENT CONFERENCE 2017 HONG KONG

Side Events

Exhibition

Apart from the discussion sessions, about 40 exhibitors participated in an exhibition at WSBE17 Hong Kong to showcase the use of the latest technologies, innovative products and visionary policies in transforming the built environment.

The booth of the WSBE17 Hong Kong Organisers, CIC and HKGBC, was located at the centre of the exhibition venue. The recyclable wooden structure resembled the shape of a tree, symbolising the close proximity of the urban landscape and the natural environment of Hong

Kong. The booth featured an overview of Hong Kong's built environment and highlighted Hong Kong's green building assessment tool, BEAM Plus.



Gala Dinner

The Gala Dinner brought together more than 400 guests from the Government and various industry sectors to network and celebrate the success of the Conference. Several BEAM Plus Awards were presented to pay tribute to some of the industry's most outstanding projects and contributors.



• Chief Secretary for Administration, Mr Matthew Cheung Kin-chung, addressed guests as the Guest of Honour at the Gala Dinner.



BEAM Plus Milestone Awards

Organisations with the Most BEAM Plus Final Platinum Projects	<ul style="list-style-type: none"> • Architectural Services Department (ArchSD) • Hang Seng Management College • Swire Properties Limited
Highest Score for Commercial Projects of BEAM Plus New Buildings	<ul style="list-style-type: none"> • Hysan Place
Highest Score for Residential Projects of BEAM Plus New Buildings	<ul style="list-style-type: none"> • AREZZO
Highest Score for Government, Institutional & Community Projects of BEAM Plus New Buildings	<ul style="list-style-type: none"> • Building 16W Hong Kong Science Park Phase 3
Highest Score for Other Projects of BEAM Plus New Buildings	<ul style="list-style-type: none"> • LMX Maintenance Building
Highest Score for BEAM Plus Existing Buildings	<ul style="list-style-type: none"> • Towngas Headquarters
Highest Score for BEAM Plus Interiors	<ul style="list-style-type: none"> • Renovation of 1/F Main Block APB Centre, ArchSD

WORLD SUSTAINABLE BUILT ENVIRONMENT CONFERENCE 2017 HONG KONG

Side Events

International Youth Competition

The International Youth Competition invited imaginative ideas, projects and action plans that best demonstrate the conference theme and key discussion areas. Around 100 teams of young innovators from 25 countries submitted their finest works, and eight finalists were selected by the jury panel for the final presentation during the conference.



Green Building Technical Visits and Eco Tour

WSBE17 Hong Kong was concluded by the Green Building Technical Visits and Eco Tour on 8 and 9 June 2017. By visiting selected green building projects and ecological sites, delegates explored the latest green building development in Hong Kong and Shenzhen, as well as Hong Kong's unique natural environment.



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ACKNOWLEDGEMENTS



ACKNOWLEDGEMENTS

List of WSBE17 Hong Kong Organising Committee and Hong Kong Report Sub-committee Members

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Chairman of Scientific Committee	Ir Prof. Wong Sze-Chun	CIC & HKGBC
Vice Chairman of Scientific Committee	Dr Benny Chow	CIC & HKGBC
Member	Mr Nils Larrson	SBE Series Co-owner Representative
Member	Mr Albert Lam	Development Bureau, HKSAR Government
Member	Mr Vincent Liu	Environment Bureau, HKSAR Government
Member	Ms Ada Fung	Transport and Housing Bureau, HKSAR Government
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Member	Ir Antonio Chan	HKGBC
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Member	Mr Tony Ip	Ronald Lu & Partners
Member	Ms Grace Kwok	Allied Environmental Consultants Limited
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 - Electrical and Mechanical Services Department
 - Water Supplies Department
- Hong Kong Housing Authority
- Ronald Lu & Partners

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- Arup
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- CLP Power Hong Kong Limited
- Conservation International Hong Kong
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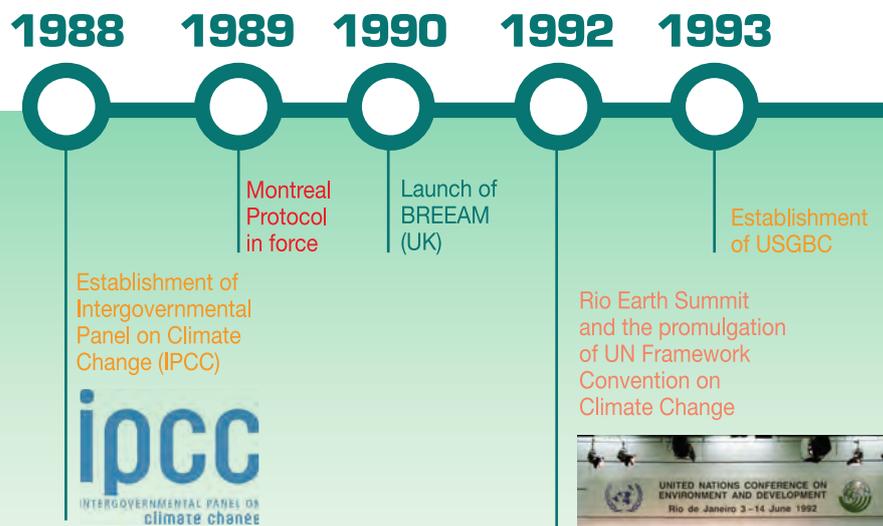


Any opinions, findings, conclusions or recommendations expressed in this material/event (or by members of the project team) do not reflect the views of the Government of the Hong Kong Special Administrative Region, the Innovation and Technology Commission or the General Support Programme Vetting Committee of the Innovation and Technology Fund.

Our Journey to Sustainable Built Environment

Hong Kong Milestone

Global Milestone



Establishment of
HK-BEAM Society
(currently BEAM Society Limited)



Launch of HK-BEAM
New & Existing Office Buildings
(Version 1/96 & 2/96)



Launch of
IAQ Certification
Scheme



Launch of HK-BEAM for
New & Existing Buildings
(Version 4/04 & 5/04)



1996

1997

1998

2000

2001

2002

2003

2004

2005

Launched of
HQE (France)

Commencement
of Kyoto
Protocol

Launch of
LEED (US)

First SB
Conference
in Maastricht ,
the Netherlands

Launch of
CASBEE
(Japan)

Establishment
of
WorldGBC

Launch of
GreenStar
(Australia)

Launch of
BCA
Green Mark
(Singapore)

SB Confer
2005 in To
Japan



WORLD
GREEN
BUILDING
COUNCIL

SB Conference 2002
in Oslo, Norway



Establishment of Construction Industry Council



Establishment of Hong Kong Green Building Council



Release of 'Green Government Building' circular

Launch of BEAM Plus New & Existing Buildings V1.1



Promulgation of Practice Notes on:

- Building Design to Foster a Quality and Sustainable Built Environment
- Sustainable Building Design Guidelines

2006 2007 2008 2009 2010 2011 2012

Launch of Green Building Label (China)

Launch of First Green Building Masterplan by Singapore

SB Conference 2008 in Melbourne, Australia

Climate Change Act passed in the UK

UN climate summit in Copenhagen

SB Conference 2011 in Helsinki, Finland



Enactment of Building Energy Efficiency Ordinance

Opening of ZCB, the first zero carbon building in Hong Kong



Launch of BEAM Plus New & Existing Buildings V1.2



Launch of HK3030 Campaign by HKGBC

Target: To reduce the absolute electricity consumption of buildings in Hong Kong by 30% by 2030, from 2005 level.



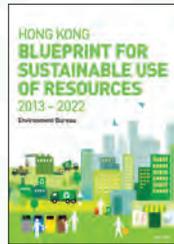
Launch of BEAM Plus Interiors V1.0



Release of A Clean Air Plan for Hong Kong

Release of Hong Kong Blueprint for Sustainable Use of Resources 2013-2022

Target: To reduce the per capita disposal rate of municipal solid waste by 40% by 2022



SB13 Hong Kong Regional Conference



Release of A Food Waste and Yard Waste Plan for Hong Kong 2014-2022

Release of Energy Saving Plan for Hong Kong's Built Environment 2015-2025+

Target: To reduce Hong Kong's energy intensity by 40% by 2025



WorldGBC Congress 2015



Update of 'Green Government Building' circular

Release of Hong Kong Climate Change Report 2015



Launch of BEAM Plus Existing Buildings



Opening of T... waste-to-energy



Launch of Hong Kong Towards a Plan Vision and Strategy

Launch of BEAM Plus Neighbourhood



Release of Hong Kong Strategy and Action

2013

2014

2015

2016

Establishment of International WELL Building Institute

Vatican City became the world's first carbon neutral country

WSB Conference 2014 in Barcelona, Spain



COP21 and commencement of Paris Agreement

Target: To limit the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels



PARIS2015
COP21-CMP11

Ratification of Paris Agreement



BEAM Plus
Existing Buildings V2.0



WONG TAI PARK, the first
solar power plant in Hong Kong



Hong Kong 2030+:
Planning
Strategy Transcending 2030

BEAM Plus
Existing Buildings V1.0



Hong Kong Biodiversity
Action Plan

Release of Hong Kong's Climate Change Action Plan 2030+

Target: To reduce Hong Kong's carbon intensity
by 65-70% by 2030 compared with the 2005 level



WSBE Conference 2017 in Hong Kong, China



2017 2018 2019 2020 2023 2025 2030 2060



Paris Agreement



Sweden
pledged to cut
all greenhouse
gas emissions
by 2045
through a
new Climate
Change Act

WSBE
Conference
2020

First Global
Stocktake of
Paris Agreement

Greenhouse
gas emissions to
reach net zero for
reaching 1.5°C
target in Paris
Agreement

Promulgation
of HK2030+

Review of
Climate Change
actions

Release of
the next
Climate Action

Release of
the next
Climate Action













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