HONG KONG REPORT ON THE STATE OF SUSTAINABLE BUILT ENVIRONMENT 2020

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Chief Executive
Hong Kong Special Administrative Region

Mrs Carrie LAM, GBM, GBS
Chief Executive, Hong Kong Special Administrative Region

I am pleased to congratulate the Hong Kong Green Building Council on the publication of the "Hong Kong Report on the State of Sustainable Built Environment 2020". Published every three years, the Hong Kong Report details the joint efforts of the Government of the Hong Kong Special Administrative Region (HKSAR), together with industry, the academic sector and the community at large, in building a sustainable future for us all.

The 2020 Report, published in e-Book format, showcases Hong Kong's accomplishments in striving to meet the United Nations Sustainable Development Goals. Electricity consumption is the largest contributor to carbon emissions, and the buildings of Hong Kong — a global city renowned for its skyscrapers account for the majority of our electricity consumption. It is, therefore, essential that we adopt sustainable policies throughout the building life cycle, from design and construction to post-commission operation and maintenance, if we are to achieve our goal of lowering carbon emissions.

In this regard, allow me to highlight our efforts at promoting the use of such innovative building methods as modular integrated construction (MiC) and building information modelling (BIM). The HKSAR Government is a pioneer in the use of MiC technology. We have been working with it in various public projects since mid 2017, providing incentive for the private sector to follow. And we have mandated the use of BIM technology in major government public works projects since 2018. At the end of June 2020, the total worth of government works contracts using BIM technology exceeded HK$ 143 billion, I am pleased to say.

In support of the Paris Agreement, we published Hong Kong's Climate Action Plan 2030+ in 2017 which details our plan to reduce Hong Kong's carbon intensity by 65% to 70% between 2005 and 2030. This is to be achieved through improving the fuel mix for electricity generation and promoting energy efficiency, renewable energy, green buildings, low-carbon transport, etc. Among other things, we are installing photovoltaic systems in hundreds of schools and welfare organisations, conducting energy and carbon audits for more than 200 government buildings and pursuing a new Green Energy Target for the Government. We are also working with the community to enhance the energy efficiency and conservation of buildings through various measures, such as enhancing statutory standards, providing tax incentives, and promoting retro-commissioning and other innovations. With the implementation of these measures, Hong Kong's carbon intensity in 2018 had decreased by about 36% compared to 2005, indicating that we are moving steadily towards our decarbonisation target.

Working hand in hand with the community, I am confident we will create a sustainable built environment for Hong Kong — today and throughout this 21st century of economic opportunity and environmental promise.

Mrs Carrie LAM, GBM, GBS
Chief Executive
Hong Kong Special Administrative Region

Message From

Secretary for Development
Hong Kong Special Administrative Region

Mr Michael WONG, JP
Secretary for Development, Hong Kong Special Administrative Region

The World Sustainable Built Environment Conference this year focuses on how best to engage the global building sector to contribute to the sustainable development goals of the United Nations in the coming decade. This echoes well with our on-going aspirations to drive the transformation of our city towards a sustainable built environment.

Over the years, the Government has been working closely with the Hong Kong Green Building Council (HKGBC) and the industry in setting standards and promoting the adoption of green building certification – the BEAM Plus. I am delighted to know that, to take the remarkable accomplishments of BEAM Plus scheme to the next level, HKGBC is exploring the benchmarking of BEAM Plus with other international sustainable assessment tools, and to promote its use beyond Hong Kong, particularly in the cities of the Greater Bay Area.

On the Government's part, we will continue to work in partnership with HKGBC and, amongst others, explore the extension of our sustainability assessment work from individual buildings to non-building projects. We will also continue to work with our construction industry to promote the use of Modular Integrated Construction which, apart from benefits such as better quality and site safety, can significantly minimize on-site waste, reduce energy consumption and improve sustainability performance.

Looking ahead, we will redouble our efforts to strive for a sustainable built environment and collaborate with our working partners to get prepared for challenges arising from climate change which require international and borderless co-operation.

Mr Michael WONG, JP
Secretary for Development
Hong Kong Special Administrative Region

Message From

Secretary for the Environment Hong Kong Special Administrative Region

Mr WONG Kam-sing, GBS, JP
Secretary for the Environment, Hong Kong Special Administrative Region

The year 2020 will be remembered as a momentous year when people from around the world work together to fight the marauding pandemic. The same collaborative spirit is needed when it comes to tackling climate change and other sustainability issues. The transformation to a more sustainable built environment is a mammoth challenge that calls for our decisive actions both in 2020 and beyond.

WSBE 2020 is a timely opportunity for officials, experts, academics, practitioners and other stakeholders to share their experiences and exchange ideas on how various sectors can contribute towards the creation of sustainable cities and communities. The conference theme "Beyond 2020" aptly encapsulates our common goal: to set ambitious short- and long-term targets; and to look beyond 2020 for audacious solutions to reduce carbon emissions and other environmental loading while creating a healthier living environment.

The Hong Kong Special Administrative Region Government is working at full steam to meet our commitments under the Paris Agreement. We are rolling out a wide range of measures to reduce Hong Kong's carbon intensity by 65% to 70% by 2030, and also leading by example. Having reduced energy consumption in Government buildings by over 5% in the last 5 years, our latest pledge coined as "Green Energy Target" is to further raise the Government's overall energy performance by 6% between now and 2025. To this end, we are generating more renewable energy on Government premises, from public buildings to infrastructures, and leaving no stone unturned in the pursuit of energy efficiency and conservation. This report highlights some of our efforts in this regard.

Other key stakeholders, such as the Construction Industry Council, the Hong Kong Green Building Council, as well as leaders in the built environment, are also instrumental in reducing carbon emissions in Hong Kong. In this report one can learn more about their latest achievements.

To sustain the momentum beyond 2020, all of us will have to go beyond the present paradigm and measures. We have to keep on breaking new ground, through closer collaboration and leveraging on innovative design and technologies. I am sure readers will be inspired by the information in this report to explore new frontiers as Hong Kong advances to deeper decarbonisation.

Mr WONG Kam-sing, GBS, JP
Secretary for the Environment
Hong Kong Special Administrative Region

Joint Message From

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

Sr CHAN Ka-kui, SBS, JP
Chairman, Construction Industry Council

Mr CHEUNG Hau-wai, SBS
Chairman, Hong Kong Green Building Council

The Construction Industry Council and Hong Kong Green Building Council are pleased to present to you the Hong Kong Report 2020 (the "Report"), which provides an informative introduction to the latest developments in green building construction and research in Hong Kong. While compiling this edition, we received an overwhelming response from all stakeholders, with double the number of contributions we received in 2017 from the government, the industry, academia and the community. As such, we are confident that this Report is a faithful representation of the collective efforts and achievements of different sectors of the construction industry and building community to make Hong Kong a sustainable city.

In the past three-year cycle of the WSBE conference series, Hong Kong has seen tremendous growth in the number of new and existing green buildings and constructions adopting "BEAM Plus", Hong Kong's green building rating tool developed by the HKGBC, as well as the "Carbon Assessment Tool" and "Green Product Certification" developed by the CIC for assessing carbon performance. Moreover, we are pleased to report that Hong Kong's use of cutting-edge technology and innovative ideas in design and construction continues to increase: to tackle Hong Kong's hot and humid climate in an environmentally friendly way, recent projects have cleverly utilised underground stormwater and Hong Kong's abundant supply of seawater to cool air-conditioning systems. The construction of green buildings is also embracing new and sustainable methodologies in the form of modular integrated construction and building information modelling to improve efficiency, save energy, and reduce waste.

Creating a sustainable built environment is high on the Government's agenda. This Report showcases a wide range of exemplary public sector projects. Each of these infrastructure works in Hong Kong have contributed in their own unique way to the sustainability of the built environment. Just one example of this is the provision of floating photovoltaic panels on reservoirs, more details of which are included in this Report.

Green buildings are not only constructed for energy savings, but also designed to contribute to the sustainable built environment in their neighbourhoods. It is heartening to see that Hong Kong's many existing and old buildings are now undergoing retrofitting and recommissioning to improve their energy performance. Historical buildings, too, are being revitalised and rehabilitated to showcase their original historical and cultural value while demonstrating their flexibility for adaptive re-use.

This Report also features details of the industry's efforts to promote sustainability through public education, enhancing the public's awareness of environmental issues and encouraging behavioural changes.

The CIC and HKGBC, as key drivers in the development of a sustainable built environment in Hong Kong, will continue to promote good practices and encourage the adoption of new technology and innovative ideas for sustainable design and construction. We look forward to sharing our knowledge and experience at WSBE 2020 with international delegates around the world.

We also wish to thank all parties for the zealous support we have received in the preparation of this Hong Kong Report 2020.

Sr CHAN Ka-kui, SBS, JP
Chairman
Construction Industry Council

Mr CHEUNG Hau-wai, SBS
Chairman
Hong Kong Green Building Council

Introduction

Introduction

Welcome to the Hong Kong Report on the State of the Sustainable Built Environment 2020. On behalf of the Construction Industry Council (CIC), the Hong Kong Green Building Council (HKGBC) and all stakeholders in Hong Kong, we are pleased to present this overview of green building in Hong Kong.

The following pages offer many fascinating insights into the progress being made here in Hong Kong. These experiences and case studies have special relevance on a global scale, because they represent the quest for sustainability in a high-density, high-rise urban environment – the kind of complex and dynamic cityscape that is becoming more and more common in countries worldwide.

To put Hong Kong's density into context, we invite you to consider that the built-up areas of Hong Kong account for only a quarter of the total land area, and yet this small area accommodates the city's entire population. Naturally, this high density also translates into compact living.

Despite this extraordinarily dense built environment, nature conservation is not only a high priority, it is one of Hong Kong's defining features. Approximately 40% of the total land area – over 1,100km^2 – is protected as country parks, and a further 30% is hilly terrain or other ecologically sensitive areas. It is partly by necessity, then, that Hong Kong has evolved into the compact high-density city that is today; a limited supply of developable land has demanded high-density solutions. Hong Kong's growth over the decades has also been influenced by integrated land use-transport-environment planning that offers greater convenience to local residents and easier access to community services.

Against this unique backdrop, it is noteworthy that Hong Kong has committed to achieving sustainability in a variety of different economic and societal aspects. To this end, the HKGBC was established to join hands with the Government and the CIC to drive Hong Kong's green building movement, especially to foster collaboration and innovation within the building industry.

Today, both the CIC and HKGBC are key drivers in leading the development of a sustainable built environment in Hong Kong by promoting a wide range of best practices. These initiatives include the promotion of retro-commissioning and Advancing Net Zero, and encouraging the adoption of new technology and state-of-the-art ideas for sustainable design and construction. Just one example of this is the CIC Carbon Assessment Tool and Modular Integrated Construction Method, which offer an easy and convenient path for industry practitioners to make their projects more sustainable at every stage of the construction life cycle.

Beyond buildings

This growing maturity in relation to green building is now enabling Hong Kong to move beyond a focus on individual buildings, instead seeing the potential for developing a sustainable built environment through the creation of holistic sustainable communities. This requires a multi-dimensional view of sustainability in every aspect of the built environment, including infrastructure, open spaces, public facilities, areas of greenery, and the use of natural resources. Moreover, this thinking not only has transformative potential on a local level, it can also be applied regionally to create an end result in which neighbouring cities can function as part of a thriving, integrated macro community.

In the pages that follow, we are pleased to present some of the latest ideas and innovations that are driving this new paradigm of sustainability. We warmly encourage you to take a few moments to see for yourself how Hong Kong's experience points the way towards better, greener solutions for other cities worldwide.

This Hong Kong Report on the State of the Sustainable Built Environment is published every three years in parallel with the World Sustainable Built Environment Conference. For 2020, this Report echoes the main conference theme of the United Nation's Sustainable Development Goals (SDGs) and demonstrates how Hong Kong is working towards a built environment that fully reflects these goals and values.

Government Policies

Through collaborative thinking and concerted multi-party efforts, Hong Kong's building industry is making good progress on a number of SDGs, especially SDG 11 and 13. The Government has taken the lead to formulate policies on climate action, river protection, water management, urban forestry, sustainable infrastructure and energy. It has also set new and more ambitious targets to improve the energy efficiency and conservation of government buildings both old and new.

Public and Industry Projects

Through joint efforts in both public and industry projects, the number of buildings being certified by BEAM Plus is steadily increasing – and providing yet further proof of the power of green initiatives. Recent projects include the landmark development of Hong Kong's first children's hospital, the transformation of a public housing community from a barren quarry to a green oasis, the adoption of innovative technology in design and planning, and an ever-greater contribution from retrofitting existing buildings and revitalising historical buildings. All of these successes are impacting the urban environment and influencing people's understanding of green architecture so as to achieve good health and lifelong wellbeing.

Community Engagement

All walks of life can participate in achieving the SDGs by initiating behavioural changes. In Hong Kong, an ever-increasing number of innovative new community projects are powerful proof of this, bringing together individuals, schools, corporations and NGOs to achieve a greener and more sustainable city. Young people, in particular, are embracing the topics of energy saving, biodiversity, green education, and sustainable and replicable models for driving social change. By sharing experience and knowledge to create synergy, we firmly believe in the possibility of achieving the United Nations' SDGs, working together to protect the planet and ensure that all people enjoy greater peace and prosperity by 2030.

Driving The Green Built Environment Industry In Hong Kong

As key drivers of the green built environment industry in Hong Kong, both the CIC and HKGBC advocate the Government to formulate policies and regulations that drive market transformation. They are also committed to encouraging the industry to adopt the world's best practices, and inspiring the public to enhance their environmental consciousness and implement new behaviours to tackle climate change.

Research and Planning

Research programmes form the foundation of sustainable development. Projects focusing on Hong Kong's unique sub-tropical conditions demonstrate the effectiveness of related Government policies and strategies. They also highlight the importance of developing green infrastructural projects, and the powerful connection between the built environment and the wellbeing of the community. Cutting-edge research into concepts such as sponge city, modular integrated construction, and green building materials are likewise all helping to facilitate Hong Kong's transformation to sustainable construction and a sustainable value chain, while also mitigating the impacts of climate change and securing a brighter future for everyone.

GOVERNMENT
POLICIES

Modular Integrated Construction

Hong Kong has long been recognised internationally and ranked among the top economies globally for its formidable strengths and pioneering advances in infrastructure development. However, in recent years, the construction industry has found itself facing various challenges. These include high construction costs, an ageing workforce and declining productivity.

In the last fifty years, Hong Kong has been a leader in off-site construction methods, including the application of precast concrete components in construction. These methods have proven to be effective in a number of key aspects, such as reducing costs and enhanced productivity. To further strengthen and maintain Hong Kong's established regional leadership position in construction, and uplift the industry as a whole, since 2018 the HKSAR Government has been advocating Construction 2.0 focusing on the three key pillars of "Innovation", "Professionalisation" and "Revitalisation". To this end, the Development Bureau (DEVB) has been collaborating with the construction industry to help it modernise by uplifting its capacity and sustainability to tackle the many challenges it faces. One of the primary measures for accomplishing this is the adoption of modular integrated construction (MiC).

MiC is an innovative off-site construction method which fully integrates architectural and structural elements with all required supporting building services and advanced technologies into volumetric modules for factory assembly followed by on-site installation.

Modular construction technology has developed rapidly in recent years and is now widely adopted in many developed overseas countries including the USA, EU, UK, and Singapore, to name just a few. More and more high-rise modular buildings have been completed or are under construction in different parts of the world. This international construction trend is having an increasing impact on the global construction industry.

As evidenced in various overseas examples, the benefits of MiC technology are not limited to enhanced productivity, a shortened on-site construction period and reduced construction costs. The factory-based manufacturing process also allows for greater quality control as well as an improved working environment for some labour-intensive activities, thus reducing many health and safety risks.

More importantly, MiC is also a sustainable construction technology which can improve the environmental performance of a construction project. By shifting the majority of on-site construction activities to off-site prefabrication factories, MiC can substantially reduce the volume of site activities and vehicle traffic for delivery of construction materials. The bulk of the installation activities and manpower are likewise moved off-site, which minimises dust and noise pollution and improves site safety. The impact on the community surrounding the construction site is significantly reduced due to a much lower level of noise, better air quality and greatly reduced delivery traffic relative to the conventional construction method. With less energy consumption and a smaller carbon footprint, MiC technology has the potential to be a major contributor to the development of a sustainable built environment in Hong Kong.

To encourage wider adoption of MiC in public projects, the DEVB has been collaborating with the industry to implement and pilot public projects since 2017 to build up local experience and the confidence of the construction industry. Up to September 2020, four out of five MiC pilot projects had topped-out and more than twenty MiC projects were in the pipeline.

All MiC pilot projects reported a shorter construction period, enhanced productivity, cost neutrality or even some cost savings, as well as better performance in environmental sustainability with less wastage. For instance, one of the pilot projects reported a 40% saving in construction time, zero accidents throughout 600,000 working hours, an 80% reduction in construction waste, and some 400,000 litres saved in water consumption.

To tackle the COVID-19 epidemic, the HKSAR Government has been creating additional quarantine facilities by adopting MiC technology to meet the extremely tight programme. Taking Phase 1 of the quarantine centre at Penny's Bay as an example, the construction of 700 quarantine units was completed in just 73 days.

Through close collaboration between all relevant stakeholders, more than 2,100 quarantine units were constructed in four quarantine centres from February to September 2020. Some 2,000 quarantine units at Penny's Bay are also under construction and will be completed by the end of December 2020.

To encourage wider adoption of MiC, the DEVB has established a Steering Committee to oversee policy. Technical circulars and relevant guidelines have also been issued to set out the policy and requirements on the wider adoption of MiC both in government and private building projects.

To incentivise the industry, a HK$1 billion Construction Innovation and Technology Fund (CITF) was established in 2018 to encourage the adoption of innovative technologies, including the application of MiC. In May 2019, the HKSAR Government promulgated a gross floor area (GFA) concession of 6% of the MiC area for buildings adopting MiC in private developments.

The successful completion of MiC pilot projects and the MiC quarantine centres are unequivocal proof of the various benefits of MiC technology. We believe that by combining the concerted effort and support from enthusiastic young talent and experienced professionals, MiC will once again take Hong Kong's construction industry to new heights.

Urban Forestry

The pressures of urbanisation are acutely felt in a crowded city like Hong Kong. The contribution of trees in moderating temperatures and improving air quality is especially significant in such a compact living environment, not to mention that trees can also enhance the visual appeal of our cityscape. Urban forests can likewise help to lift the public's mood under the impact of difficulties such as COVID-19. In keeping with the Government's commitment to develop Hong Kong into a sustainable and liveable city, the Greening, Landscape and Tree Management Section (GLTMS) of the Development Bureau (DEVB) is responsible for developing a landscape and tree management policy that enables people and trees to live in harmony in our densely populated city.

Transcending from tree risk management to urban forestry

Rapid global urbanisations in the 21st century have created increased attention on the importance of urban forestry. In essence, urban forestry calls for a city-wide, integrated, multi-disciplinary approach combining strategic planning and multi-managerial practices to achieve sustainable management of our urban vegetation. In the past here in Hong Kong, our work focused on tree care and asset management. Over time, however, the GLTMS recognised the importance of building up our breadth and depth of experience in the wide and ever-evolving spectrum of topics in urban forestry. In this regard, the DEVB organised the inaugural International Urban Forestry Conference in January 2020 as a new endeavour to build up the capacity of our local industry practitioners by tapping global expertise and promoting knowledge exchange, and to also raise public awareness of urban forestry. Using the theme "Challenges and Opportunities of Urban Greening in High-density Cities", this two-day conference invited eminent professors and experts from across the globe as well as locally, and attracted over 600 participants, including professionals, government officials, members of the public and students, to share views and exchange insights on topics ranging from tree care to the holistic planning and management of a city's urban forest.

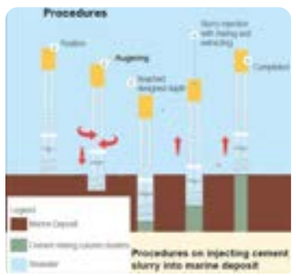
Nurturing younger generations and cultivating a quality workforce

Besides the sharing of experience and knowledge in the conference hall, interactive activities such as a field session to a local district park were arranged as part of the conference. These activities enabled experienced arborists to share hands-on knowledge with young local tree care personnel regarding proper tree maintenance practices which can reduce damage to trees under inclement weather. To enrich the educational offerings for local students and teachers, a half-day workshop was also arranged on the second day of the conference. Several overseas professors had direct dialogue and interacted with more than a hundred local tertiary students in related disciplines, discussing how to achieve sustainable urban forestry within a high-density city environment.

In addition to uplifting the professional standards of arboriculture and horticulture practitioners, and strengthening public education and the promotion of proper tree care, the Government is proactively investing in nurturing talents and attracting youngsters to join the arboriculture and horticulture industry, which is still young and evolving in Hong Kong. In this regard, in July 2020 the GLTMS launched the Study Sponsorship Scheme under the Urban Forestry Support Fund (UFSF) to provide financial incentives in terms of study sponsorships and scholarships to attract eligible students and practitioners to undertake training programmes offered by local vocational, tertiary and training institutions in the disciplines of arboriculture, tree management and tree work. A Trainee Programme under the UFSF was also rolled out in August 2020 for arboriculture and tree management graduates to receive structured on-the-job training to acquire working experience, paving the way for qualified arborists and tree climbers in the future, and creating an adequate and quality workforce for the industry.

The new initiatives undertaken since 2020 have laid a stronger foundation for the development of urban forestry in Hong Kong, and will play an important role in achieving the sustainable and liveable green city environment that we all aspire to.

Sustainable Infrastructure in Tung Chung New Town Extension



Sustainable infrastructure broadly refers to infrastructures that are designed based on environmentally friendly principles, and that are resilient to extreme climate phenomena, thus minimising the impact of natural threats on people, the economy and nature. The Tung Chung New Town Extension (TCNTE) – which was tasked in the Government's 2018 Chief Executive Policy Address as a pilot trial for the adoption of smart, green and resilient environmental concepts – will be used to showcase sustainable infrastructure in Hong Kong.

The TCNTE Project involves the reclamation of 130 hectares of land in Tung Chung East. To minimise the adverse environmental impact, the reclamation is the first public works project in Hong Kong to adopt a non-dredged deep cement mixing method for stabilising the seabed for seawall construction before the reclamation works. This non-dredged method avoids the disposal of a large amount of dredged marine mud and minimises fill material for backfilling afterward. This also reduces the noise and air impacts as a result of marine vessel trips for transporting the filling material, and minimises the disturbance to marine habitats.

Rock fill

Public fill

Asphalt

Moreover, recycled materials such as inert construction and demolition materials composed of rock pieces, asphalt and rubble will all be used as reclamation materials.

Along the Tung Chung East new reclamation area, eco-shorelines – the first of their kind in Hong Kong – are being adopted to enhance seabed biodiversity by providing a suitable habitat for marine species through mimicking the physical conditions of natural inter-tidal zones as far as practicable. The eco-shorelines comprise three different types, namely rocky, mangrove and vertical. The rocky eco-shorelines will be provided at locations relatively susceptible to wave actions or with insufficient sunlight, where bio-blocks with varying levels and sizes of cavities will be placed at inter-tidal zones to retain seawater during low-tide conditions, with a view to providing appropriate habitats and shelters for marine species. Mangrove eco-shorelines will be provided at inter-tidal zones along seashores less susceptible to sea waves. As regards the vertical eco-shorelines, they will feature pots, cavities, eco-tiles and similar items to provide uneven surfaces for the easy attachment and growth of tiny marine organisms.

Sustainable Infrastructure in Tung Chung New Town Extension

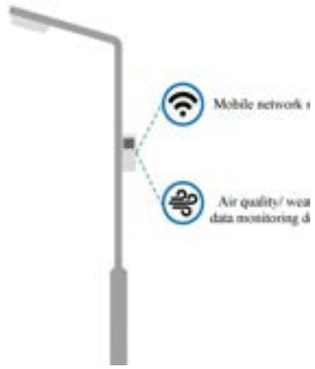
To promote sustainability and a water-friendly culture and activities, part of the Tung Chung Stream at Tung Chung West will be revitalised and converted into a River Park. At its downstream section, the stream revitalisation involves the removal of an existing concrete channel and a replacement with stones and pebbles. An active water play area and a visitor centre will be provided to promote a water friendly culture and enrich the visitor experience. Given that the Tung Chung Stream is one of Hong Kong's ecologically important streams, habitat preservation measures will be adopted in its upstream part by planting riparian vegetation to provide larval food plant for rare species. Only passive facilities, such as viewing platforms and a board walk, will be installed. With all these design initiatives, we are confident that the River Park will benefit the ecological value of the stream and promote eco-education in the area.

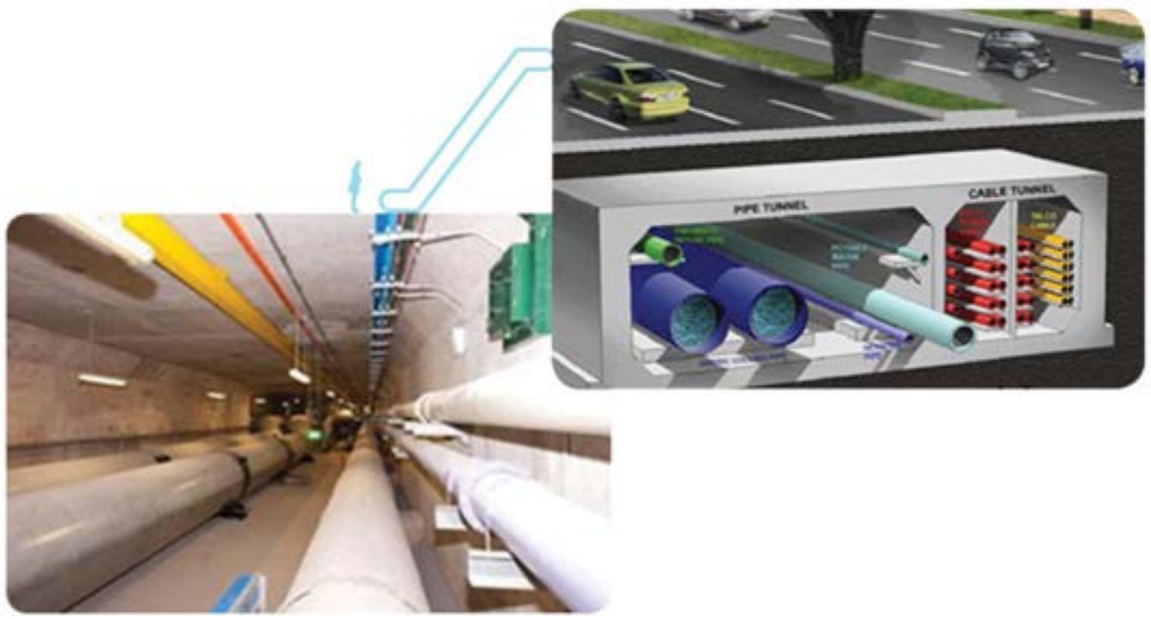
To protect the ecological environment of Tung Chung Stream, a sustainable urban drainage system (SUDS) is also being introduced to control the quantity and quality of the surface runoff discharged into the stream. The system includes the provision of stormwater attenuation and treatment ponds, bioswales, permeable pavements, and so forth. The surface runoff collected through bioswales and permeable pavements will flow into the stormwater attenuation and treatment ponds, which will be able to remove pollutants in the water before discharging it into the stream, thus serving as a buffer for flood prevention purposes. The plants in the SUDS facilities, such as the bioswales, will serve as habitats for living organisms, thereby further enhancing the biodiversity and landscapes.

Smart living will also be facilitated by new infrastructure. Smart devices on lampposts may be one of the most important resources for fostering smart living in the TCNTE. Apart from their traditional illumination function, lampposts equipped with smart devices can provide a range of convenient services for the public such as 5G mobile services and positioning services. Furthermore, sensors installed onto the lampposts can collect real-time air quality and meteorological data, enabling the public to take timely and appropriate measures to protect themselves against undesirable weather conditions.

Common utility tunnels (CUT) will be installed along some main roads in TCNTE to accommodate various underground utility pipelines. These will require no road digging in their future maintenance, thus reducing traffic and business disruption. The implementation of the CUT will facilitate the easy planning, laying, maintenance and management of utility pipes. Wastage from road paving materials due to digging, and the social cost of disrupting traffic and pedestrians, will all be minimised.

With the introduction of the above sustainable infrastructure, the TCNTE is moving towards its goal to be a smart, green and resilient environment, serving as a role model in Hong Kong for the creation of a more liveable and sustainable environment for everyone.





Using a "Rivers in the City" Concept to Reconnect our Community

Drainage facilities built in Hong Kong in the early years were designed solely for flood prevention. The channelisation of natural rivers, using concrete lining to maximise conveyance and drainage capacity, was generally adopted. However, this approach is not desirable from today's perspective as it leads to degradation in ecological habitats and overall biodiversity.

In recent decades, the public aspiration of water-friendliness in drainage facilities has increased, and the drainage design philosophy has evolved with more emphasis on sustainability and multi-dimensional uses in addition to achieving efficient drainage. In response, the Drainage Services Department (DSD) of the Government of the HKSAR has actively been introducing the river revitalisation concept with a view to reconnecting communities with their rivers, enhancing the environment, greening rivers, and promoting ecological value and biodiversity. The DSD also strives to promote water-friendly activities so that the public can enjoy these river facilities and experience the multi-functional value of water bodies. In this way, the public will learn to treasure them and jointly create a more liveable environment.

The DSD has been endeavouring to identify more rivers with revitalisation potential in the community. Building on the success of the Kai Tak River Improvement Works – a well received first green urban river corridor, where various greening and ecological elements were injected into the river in addition to the uplift of its hydraulic performance – the upcoming revitalisation project at Tsui Ping River in Kwun Tong will beautify the adjoining environment as well as improve connectivity and walkability by providing riverside walkways and landscaped decks. The project will also turn the existing nullah into a new landmark where the public can enjoy the river view and leisure activities.

In its 2019 Policy Address, the Government promoted the concept of "Rivers in the City" which aims to *"allow the public to enjoy river facilities, experience the multiple values of water bodies, treasure water bodies and create a better living environment"*.

In this context, the DSD is continuing to pursue the river revitalisation initiative by identifying more rivers with revitalisation potential in the community. The first three of these, namely Tai Wai Nullah and Fo Tan Nullah in Sha Tin and Jordan Valley Nullah in Kwun Tong, have already been selected for further investigation and implementation stages. The Tai Wai Nullah pilot scheme will be designed with ample green open spaces and water friendly facilities.

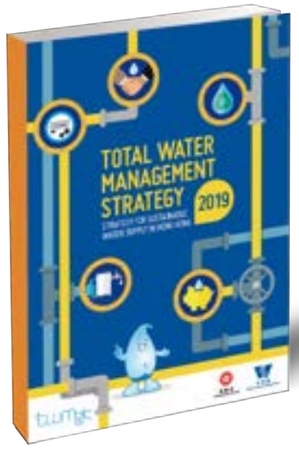
It will also comprehensively explore the technical feasibility of allowing public access and enjoyment of the quality open spaces inside the river under safe and controlled conditions. The nullah will be transformed from a single-purpose flood channel to a multi-functional water body which provides a high quality open space to engage the local community with a spectrum of water friendly elements. In addition, the DSD plans to cultivate Fo Tan Nullah with a cultural and artistic atmosphere to turn it into a focal point in the district. The revitalised Fo Tan Nullah will showcase a "River of Art" by utilising river spaces to install community artworks for the public to view along the riverfront. Lastly, Jordan Valley Nullah will be reinvented as a water garden, with a viewing platform built above the river to create a leisure space. This small-scale nullah will be revived with various greening elements, establishing a pleasurable walking avenue where the neighbourhood can enjoy a moment of tranquillity. The ecological value of Jordan Valley Nullah, in particular its upstream aquatic habitat, is planned to be restored by replacing the concrete channel bed with pebbles and rocks to mimic the environment of a natural stream.

To further echo the "Rivers in the City" concept and create synergy with the adjacent upgrading works at the Shek Wu Hui Effluent Polishing Plant (SWHEPP), detailed investigations are now underway regarding the enhancement of the Shek Sheung River in Sheung Shui by revitalising the existing concrete channel with extensive greening and ecological features. The proposed enhancement works will provide a pleasant scenic place for public leisure use and enhance the waterscaping along the waterfront walkway of the SWHEPP. Unlike a traditional river design, the use of treated effluent from SWHEPP in the Shek Sheung River will integrate SWHEPP with the local community in perfect harmony.

Looking ahead, the DSD will continue to foster community interaction through innovation and a co-use approach to sustainable drainage development. The dream is to unify the community through a thoughtful, amenity-rich open space anchored by revitalised rivers. To meet the public's current and emerging needs and aspirations, the DSD will continue to adopt an open mindset in pursuing community river revitalisation in a sustainable, resilient and cost-effective manner. In doing so, it will consider the uptake of nature-based solutions, and the repurposing of drainage facilities, with the ultimate goal of further uplifting the liveability of our city in the high-density context of Hong Kong.

Total Water Management in Hong Kong

A sustainable and reliable water supply is pivotal to the livelihood and long-term development of Hong Kong. Indeed, it is one of the instrumental contributors positioning Hong Kong as an admirable and liveable city. The Total Water Management Strategy (TWM Strategy) promulgated by the Government of the Hong Kong Special Administrative Region in 2 008 has been playing a key role in pursuing the visionary goal of water sustainability and reliability in the face of contemporary challenges such as population growth and climate change, to name just two. The TWM strategy aims to manage the water demand, and supply water in an integrated, multi-sectoral and sustainable manner.



An updated strategy adopting a two-pronged approach

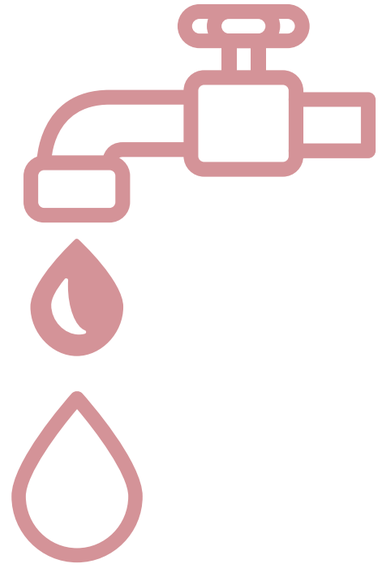
To spearhead advancement, the Government conducted a strategy review and launched an updated TWM Strategy in 2019 by adopting a two-pronged approach, with an emphasis on containing freshwater demand growth while also building resilience in the freshwater supply and catering to the extreme effects of climate change by diversifying water resources.

Containing freshwater demand growth

Under the updated TWM Strategy, water conservation, water loss management and the expanded use of lower grade water for non-potable purposes are all prioritised water management initiatives to contain freshwater demand growth. The Government has set a goal to reduce the annual per capita consumption of freshwater to about 120 cubic metres by 2030, equivalent to a 10% reduction as compared to the baseline in 2016.

Water conservation

A change in the water use habits of individuals can generate a significant saving in water consumption. Over the years, the Government has dedicated unfailing efforts to cultivating a culture of water conservation through proactive promotions, and education and engagement activities such as its Integrated Education Programme, Cherish Water Ambassador Scheme, "Let's Save 10L Water" Campaign as well as providing best practice guidelines for the use of major water-consuming trades. The Water Resources Education Centre (H_2OPE Centre) commissioned in 2019 has further enhanced public awareness of water resources and conservation. In addition, a host of measures is on-going to enhance water efficiency, including the mandatory Water Efficiency Labelling Scheme for water using devices, and the installation of flow controllers at government premises, schools and residential buildings.



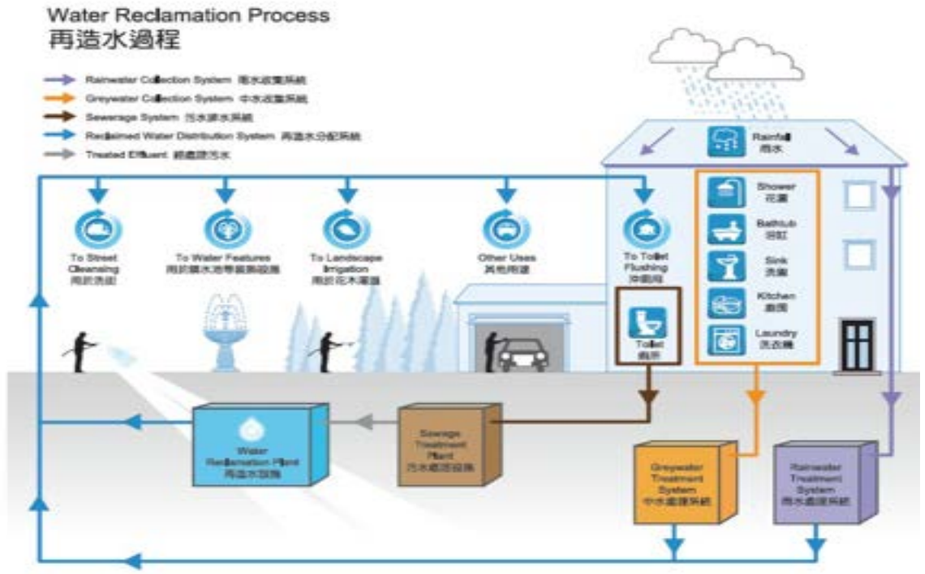
Total Water Management in Hong Kong

Water loss management

The Government has set a target to reduce the leakage rate in Hong Kong's freshwater supply network to below 10% by 2030. In this era of innovation and digitalisation, a wide range of advanced technologies will be strategically pursued to achieve that target, including the establishment of a Water Intelligent Network (WIN) by setting up District Metering Areas covering the whole freshwater distribution network, automatic meter reading, advanced leakage detection techniques and other smart water devices.

Expanded use of lower grade water

As freshwater is precious in Hong Kong, lower grade water is adopted for non-potable uses as far as possible. The Government has been using seawater for toilet flushing since the late 1950s. Currently, the seawater supply network covers 85% of the population and is supplying a total of about 300 million cubic metres of seawater per annum, thus conserving an equivalent amount of freshwater in Hong Kong. With the introduction of a recycled water supply in 2023, the Government plans to expand the network coverage of lower grade water, namely seawater and recycled water, to 90% of the population in the long run. There are also ongoing projects for the expanded use of lower grade water. These include a seawater supply to Tung Chung new town, a reclaimed water supply to Sheung Shui and Fanling, and a treated greywater supply to the Anderson Road Quarry Site development.



Building resilience in freshwater supply to cope with climate change

With the implementation of the abovementioned water demand management measures, Hong Kong's current supply portfolio of Dongjiang water, local yield and seawater for toilet flushing will be sufficient to cope with the projected water demand up to 2040. Nonetheless, in view of the possibility that the local yield may decrease substantially due to climate change, the updated TWM Strategy recommends building resilience in our freshwater supply. To cater to conservative estimates of the projected effect on local yield due to climate change, we are building resilience in our freshwater supply by implementing the first stage of a desalination plant in Tseung Kwan O.

Desalination is a strategic water resource which is not susceptible to the impact of climate change. The first stage of the desalination plant in Tseung Kwan O has the capacity to produce 50 million cubic metres of freshwater per annum, equivalent to 5% of Hong Kong's total freshwater consumption. There is also the provision for future expansion of the desalination plant to double its capacity when the situation warrants.

Looking forward

Through the implementation of a TWM Strategy, water sustainability and reliability in Hong Kong have been successfully secured in the past, and will continue to be so in the future. This will enable Hong Kong's social and economic development and the further enhancement of the city's liveability. The Government is determined to pursue the initiatives under the updated TWM Strategy with utmost effort.

The implementation of the TWM Strategy is dynamic and requires the Government's continuous monitoring and response, including the strategic deployment of suitable back-up measures for tackling worse-than-expected scenarios and a timely update of the Strategy for coping with changing socio-economic and environmental factors. To this end, the Government will join hands with the public to implement its TWM Strategy and ensure Hong Kong's continuing prosperity and liveability.

Decarbonisation Through Green Buildings, Energy Saving and Renewable Energy

The Environment Bureau of the Hong Kong Special Administrative Region (HKSAR) Government contributed a comprehensive paper titled "Tackling Climate Change Through Green Buildings and Energy Consumption" to the Hong Kong Report on the State of Sustainable Built Environment 2017 (pages 28-35). It highlighted that the HKSAR Government released in January 2017 "Hong Kong's Climate Action Plan 2030+", which is an enhanced climate change work plan setting out in greater detail the new target and key mitigation, adaptation and resilience measures in response to the Paris Agreement.

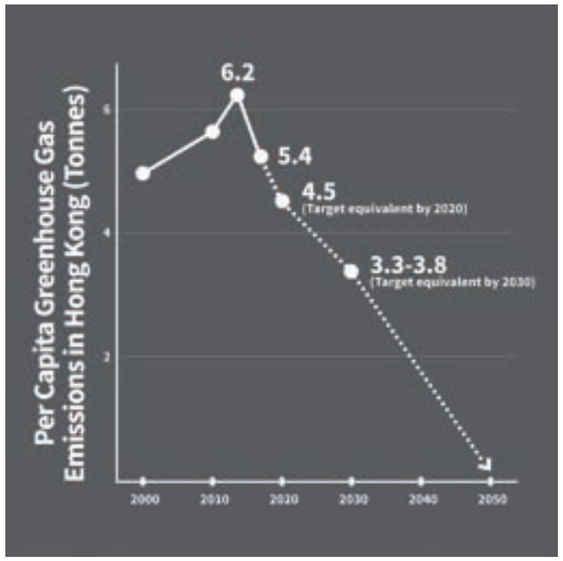
This brief report focuses on the progress of key targets and measures in relation to decarbonisation, achieved through the promotion of green buildings, energy saving and distributed renewable energy (RE) in the last three years.

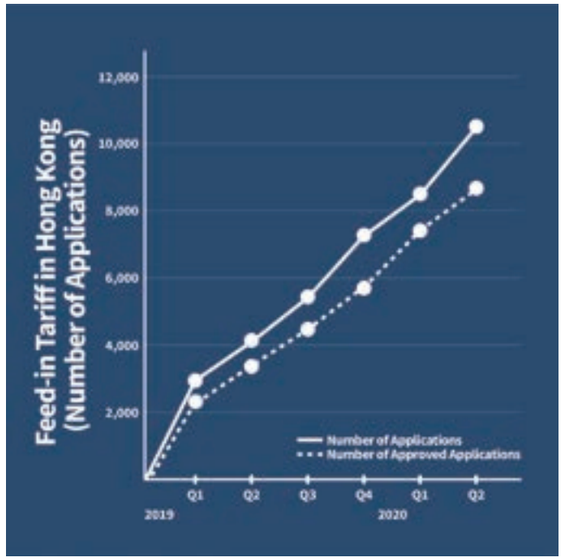
Targets and Recent Achievements

In a compact city like Hong Kong, fostering a more sustainable built environment will go a long way towards meeting the carbon emission target set out in "Hong Kong's Climate Action Plan 2030+", which aims to reduce the city's carbon intensity by 65-70% between 2005 and 2030. In 2014, Hong Kong's carbon footprint was 6.2 tonnes, which should be the peak. By 2018, it had been reduced to 5.4 tonnes per capita. We should be approaching the level of 4.5 tonnes in 2020, and then 3.3-3.8 tonnes by 2030.

Hong Kong has made reassuring progress in decarbonisation through enhancing energy efficiency and development of distributed RE since 2017. According to the Government's "Energy Saving Plan for Hong Kong's Built Environment 2015-2025+", the target is to reduce the energy intensity by 40% by 2025, with 2005 as the base year. By 2018, Hong Kong's energy intensity had decreased by over 30%. Statistics show that Hong Kong's energy performance in terms of energy intensity is the best among all APEC economies, including countries like Japan, Korea, Singapore and USA.

Since 2018, Hong Kong has launched the Feed-in Tariff (FiT) Scheme to promote distributed RE, such as photovoltaic installations on various premises. The financial incentive started off at attractive levels, in the range of HK$3-5/kWh (US$0.38-0.64/kWh), which are probably among the highest for similar schemes globally. In less than two years, the FiT Scheme has received over 10,000 applications.





Three-Year Progress and New Measures

The following highlights four groups of key decarbonisation measures, and their corresponding progress and achievements made in the past three years.

- **New Buildings / Major Renovations & New Appliances**
  (Estimated annual energy saving in 2020: About 1,800 million + 625 million kWh)

The government tightened the energy efficiency standard of the statutory Building Energy Code in late 2018, bringing about an improvement of almost 20% in energy performance of new buildings and buildings undergoing major renovation, when compared with the maiden 2012 version.

In Hong Kong, commercial and hotel buildings account for about 60% of the overall electricity consumption. The Building (Energy Efficiency) Regulation requires these buildings to meet the Overall Thermal Transfer Value (OTTV) standards in order to reduce energy consumption for air-conditioning. A recent review has been completed, with the OTTV control further tightened. These tightened requirements represent an improvement of about 10% in performance. They are applicable to new building plans and major revisions of building plans for development proposals, and designated alterations and additions proposals.

In 2018, the Government also expanded the Mandatory Energy Efficiency Labelling Scheme (MEELS) to cover more types of electrical products, helping consumers choose energy-efficient home appliances such as air-conditioners with both cooling and heating functions. Meanwhile, we are further considering suitable products for inclusion in the next phase of MEELS.

- **Existing Buildings and Behavioural Change**
  (Estimated annual energy saving in 2020: About 70 million + 50 million kWh)

The Environment Bureau continues to encourage key stakeholders in the built environment to achieve decarbonisation through a "4T" (i.e., Target, Timeline, Transparency and Together) framework. We have encouraged our 4T partners to set their own energy-saving targets and timelines, and to make known their energy-saving measures.

With about 16% of all building stock in Hong Kong under its management, the Government is leading by example to improve its building energy performance, and has adopted the "4T" framework in doing so. We had set a target of reducing electricity consumption by 5% in five years by 2020. We achieved this target in 2019, one year ahead of schedule, mainly thanks to energy audits in about 340 government buildings and an investment of over HK$900 million (US$115 million) in energy-saving projects that cut the electricity bill by about HK$85 million (US$11 million) a year.

In 2019, we unveiled the new Green Energy Target to further enhance the Government's energy performance by 6% in the next five years ending 2025. This new example of a "4T" plan is more progressive in terms of scope and measures. For the first time, we have included both government buildings and infrastructure. This is a leap from our previous targets, because they used to cover only government buildings but not infrastructure, hence missing out about half of the Government's total energy consumption. As government buildings and infrastructure together account for about 6% of the total electricity consumption in Hong Kong, our Green Energy Target, which recognises the contribution of energy efficiency and conservation as well as renewable energy, will enhance the energy performance of Hong Kong by no small measure.

Retro-commissioning of existing buildings has gained increasing recognition by both public and private sectors. In the next few years, we will conduct retro-commissioning in over 200 government buildings to systematically and effectively identify improvements to operations and energy efficiency. To support the private sector, an online resource centre on retro-commissioning has been in operation since 2018.

We also work shoulder to shoulder with the community through the "Energy Saving for All" Campaign that encompasses both conventional and online programmes. The Campaign was held annually in 2018 and 2019. At the same time, tax deductions for capital expenditure on energy-efficient and RE installations in buildings has been accelerated, thereby providing more incentive for owners of existing buildings.

Decarbonisation Through Green Buildings, Energy Saving and Renewable Energy

District Cooling System

(Estimated annual energy saving in 2020: About 10 million kWh)

The Government is pushing ahead with large-scale green infrastructure. For instance, the phased construction of the District Cooling System (DCS) at the Kai Tak Development (KTD), at a cost of HK$5 billion (US$640 million), is on schedule and offers a cooling service that is 35% more energy efficient than conventional air-cooled air-conditioning systems.

The estimated maximum annual electricity saving will be about 85 million kWh upon full commissioning. To meet the substantial increase in demand arising from a higher development density at KTD, an additional DCS at a cost of HK$4.2 billion (US$540 million) will be built, bringing an additional electricity saving of about 53 million kWh a year. In addition, we are planning for DCS projects in New Development Areas such as Kwu Tung North and Tung Chung New Town Extension. When these committed and planned DCS projects are completed, they will serve areas with a total population of about 1.6 million and a total gross floor area of about 9.45 million square metres.

DCS also helps Hong Kong adapt to climate change by reducing the heat island effect and freeing up roof space for more greenery, RE installation and other beneficial uses.

Distributed RE

(Estimated annual energy contribution in 2020: About 50 million kWh)

Since late 2018, the Government and the power companies have introduced the FiT Scheme to encourage private investment in distributed RE. Electricity account holders, including households, companies, institutions, schools, etc, can earn payments by selling to the grid the electricity generated by their distributed RE installations, and at a rate higher than the normal electricity tariff rate, thereby substantially shortening the payback period. With other facilitation measures in place, we have seen a positive response to the FiT Scheme.

Riding on the FiT Scheme, the Government has also introduced a new programme known as Solar Harvest which installs photovoltaic systems for schools and welfare non-government organisations for free, thereby encouraging STEM (science, technology, engineering and mathematics) and environmental education at the same time.

In less than two years, the power companies have received over 10,000 FiT applications. Close to 90% have already been approved. The estimated electricity generation annually can meet the demand of about 40,000 households.

To lead by example, the Government also installs distributed RE systems in both new and existing government buildings, venues and facilities. In this regard, we have earmarked HK$2 billion (US$260 million) for small-scale RE projects. We have also updated the internal circular on Green Government Buildings, which stipulates various stronger supporting measures for RE. For instance, new government buildings should have at least 10% of their available roof space allocated for appropriate RE systems.

Laying the Foundation Beyond 2020

Further decarbonisation requires us to go beyond the present paradigm and measures. To lay the foundation for deeper decarbonisation ahead, we will further harness innovation and technology ("I&T"), capitalise on Hong Kong's drive to be a green and smart city, and step up collaborative efforts with stakeholders in different sectors.

E&M InnoPortal

The Government is committed to supporting and encouraging the development and pilot use of I&T solutions for accelerating decarbonisation. Measures include providing various support programmes for start-ups; stepping up pilot tests and evaluation of nascent technologies on suitable government premises; and running the "E&M InnoPortal" which is a web-based platform to facilitate matching of operational issues and technological solutions among trades, start-ups, universities and Government departments.

Green Tech Fund

To expedite decarbonisation and strengthen environmental protection through the development and application of innovative technologies, the Government has set up a HK$200 million (US$25.8 million) Green Tech Fund (GTF) to support relevant research and development projects. The GTF will provide funding of up to HK$30 million (US$3.9 million) for each project. Apart from designated local public research institutes, we also welcome companies to apply.

Smart City Blueprint

The Government released the *Smart City Blueprint for Hong Kong* in 2017, with "smart environment" being one of the six "smart areas". During the past two years or so, relevant Government bureaux, departments and public organisations have been actively pursuing initiatives under the Blueprint, including the opening up of about 4,000 different datasets for public access since 2019. The Government will promulgate the *Smart City Blueprint for Hong Kong 2.0* later this year to report on the progress of existing initiatives and new ones. More than 100 initiatives set out under six smart areas, including those to foster smart innovation and technology for climate change mitigation, will be included.

As Hong Kong is poised for transformation into a smart city, we will work with the power companies to make the best use of their smart meter roll-out programmes to promote the smarter and more efficient use of energy. Both electricity companies will complete their smart meter roll-out programmes by 2025, providing all electricity customers in Hong Kong with their own near real-time data, while also offering public aggregate consumption and RE generation data to facilitate data analysis and usage optimisation.

Green Schools & Beyond

Regarding further collaboration with other sectors, a case in point is the "Green Schools 2.0" Programme. Launched in mid-2020, this programme not only retrofits schools' electrical and mechanical installations (such as by installing real-time energy monitoring systems and energy-smart space cooling and LED lighting), but also organises joint educational activities with teachers to impart upon students the importance of climate change mitigation, adaptation and resilience.

While better technologies can always help us save energy, we cannot lose sight of the importance of behavioural change and collaboration among different sectors. The Government will continue to work with partners in the built environment sector and the community as we drive towards a smart and low-carbon city.

Driving The Green Built Environment Industry in Hong Kong

To create a sustainable future for Hong Kong, all sectors need to work hand in hand to achieve economic and social development while also protecting and conserving the environment. In view of the pressing challenges to tackle carbon emissions and climate change, it is important to raise awareness by engaging the public, the industry and the Government, and to develop practical solutions for Hong Kong's unique, subtropical built environment of a high-rise, high-density urban area. It is our sincere hope that these efforts will result in Hong Kong becoming a world exemplar of green building development.

As key drivers of the green built environment industry in Hong Kong, the CIC and HKGBC strive to engage the Government to formulate policies and regulations that drive market transformation. They are also committed to encouraging the industry to adopt the world's best practices, and inspiring the public to enhance their environmental consciousness and implement immediate behavioural changes.

Leading Hong Kong's Transformation: The CIC and HKGBC

CONSTRUCTION INDUSTRY COUNCIL 建造業議會

The Pivotal Organisation of the Construction Industry

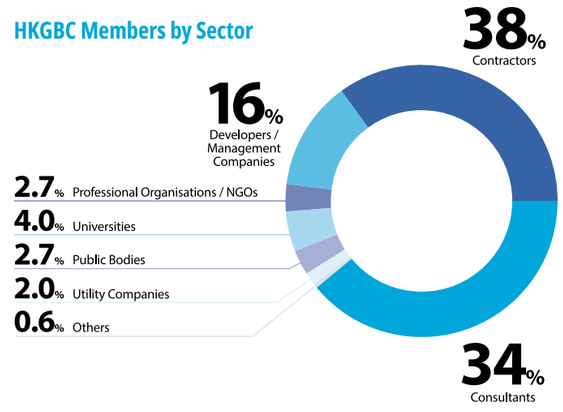
The Construction Industry Council (CIC) of the Hong Kong Special Administrative Region, PRC is a statutory body formed under the Construction Industry Council Ordinance (Cap. 587) in 2007. The main functions of the CIC are to forge consensus on long-term strategic issues, convey the industry's needs and aspirations to the Government, provide professional training and registration services, and provide a communication channel for the Government to solicit advice on all construction-related matters.

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. It oversees a number of Boards and Committees such as the Building Information Modelling (BIM) Appeal Board, BIM Certification and Accreditation Board, Construction Industry Training Board, Construction Innovation and Technology Application Centre Management Board, and Zero Carbon Building Board; and Committees on BIM, Construction Business Development, Construction Safety, Environment, Productivity, and the Registered Specialist Trade Contractors Scheme. In every aspect of its work, the CIC and its Boards and Committees are dedicated to pursuing initiatives that will be conducive to the long-term development of the construction industry.

HKGBC 香港綠色建築議會

The Hong Kong Green Building Council is a non-profit, member-led organisation established in 2009, and has been a public body under the Prevention of Bribery Ordinance since 2016. Its vision is 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



Founding Members

CONSTRUCTION INDUSTRY COUNCIL 建造業議會

BUSINESS ENVIRONMENT COUNCIL 商界環保協會

BEAM 建築環保評估協會

HKGBC 環保建築專業議會

Setting the Standards for Hong Kong's Construction Industry

HKGBC BEAM Plus 綠建環評

www

BEAM Plus

As Hong Kong's leading initiative to offer independent assessments of building sustainability performance, BEAM Plus is specially tailored to Hong Kong's high-density built environment, adapted from its predecessor, HK-BEAM. The holistic assessments, since its launch in 2010, now cover the whole building life cycle including planning, design, construction, operation and management. Currently, BEAM Plus consists of four assessment tools, namely New Buildings, Existing Buildings, Interiors, and Neighbourhood. As of August 2020, there were more than 1,600 registered BEAM Plus projects, covering a total gross floor area of over 52,000,000 square metres. The types of BEAM Plus projects are diverse, including residential, commercial, government and institutional buildings. Since 2014, the annual percentage of private sector projects joining BEAM Plus has reached 50%.

With the mission to help the building industry adopt more sustainable practices, the HKGBC and BEAM Society Limited have continuously upgraded BEAM Plus assessment tools since their launch in 2010.

HKSAR Government's Recognition of BEAM Plus

Since 2011, certification by BEAM Plus has been one of the prerequisites for the granting of gross floor area (GFA) concessions for certain green and amenity features in new building projects. In 2018, the HKSAR Government's Electrical and Mechanical Services Department gave recognition to BEAM Plus by incorporating BEAM Plus as the primary criterion for Hong Kong's Energy Efficiency Registration Scheme for Buildings.

CLP Subsidy Scheme for BEAM Plus

Launched in 2019, the CLP Subsidy Scheme for BEAM Plus is operated by CLP Power Hong Kong Limited with an aim to subsidise non-profit-making schools and other registered charitable organisations to achieve green building certification in energy aspects. This scheme is yet further recognition of BEAM Plus as Hong Kong's leading standard for the rating of green buildings.

BEAM 建築環保評估協會

BEAM Society Limited

The BEAM Society Limited (BSL) is a non-profit organisation established in 2010 and the descendant of the BEAM Society founded in 1996. The BSL is the owner of the Building Environmental Assessment Method (BEAM) and is committed to developing and implementing the BEAM Assessment Tool – BEAM Plus (former HK-BEAM). It offers impartial assessments of building sustainability performance as well as training of BEAM Professionals (BEAM Pro) and BEAM Affiliates to benefit the community's built environment. The BSL has been a public body under the Prevention of Bribery Ordinance since 2016.

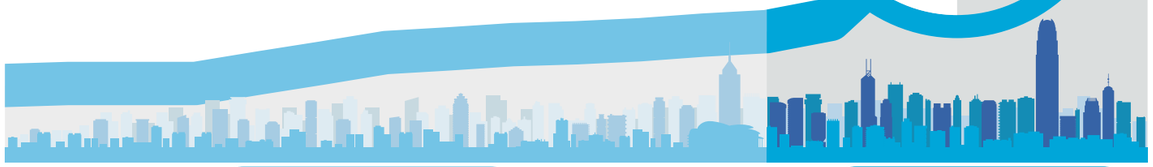
In order to achieve the vision of a sustainable community and a green liveable built environment in harmony with nature, the BSL continuously strives to improve the overall quality of the built environment in Hong Kong.

A Strong Green Building Movement in over 20 Years

Strong Market Participation

Since 2014, the annual percentage of private sector projects joining BEAM Plus has reached nearly:

50%



HK-BEAM Society

No. of Buildings First Certified by HK-BEAM
605

HKGBC BEAM Plus 綠建環評

No. of Buildings First Certified by BEAM Plus
1,669

1996 Launch of HK-BEAM

2004 Launch of HK-BEAM 4/04 (New Buildings) & 5/04 (Existing Buildings)

2009 HKGBC established

2010 Launch of BEAM Plus New Buildings V1.1, accredited by the HKGBC

2012 Launch of BEAM Plus New and Existing Buildings V1.2, with passive design criteria

2013 Launch of BEAM Plus Interiors V1.0

2016 Launch of BEAM Plus Existing Buildings V2.0, comprising Comprehensive and Selective Schemes

Launch of BEAM Plus Bespoke for projects of special building types

Launch of BEAM Plus Neighbourhood V1.0

2019 Launch of BEAM Plus New Buildings V2.0, embracing an integrated design approach to green buildings and placing more emphasis on health and wellbeing

Launch of BEAM Plus Existing Buildings Volume Certification

BEAM Plus Family

BEAM Plus Neighbourhood V1.0 is used at the master planning stage of building development projects.

BEAM Plus New Buildings V2.0 is applied to new building projects and major renovation/alteration works on existing buildings.

BEAM Plus Existing Buildings V2.0 evaluates the operation and maintenance performance of existing buildings.

BEAM Plus Interiors V1.0 is applied to fit-out works of non-domestic premises.

Setting the Standards for Hong Kong's Construction Industry

Building Competence of Green Building Experts

The HKGBC has taken the lead to strengthen the industry's competence and ensure the latest green building standards and practices are fully integrated into the daily works of building planning, design, construction and operation.

In collaboration with BEAM Society Limited (BSL), the HKGBC accredits BEAM Professionals (BEAM Pro) and BEAM Assessors (BAS) as green building specialists in various aspects of the entire green building life cycle. The HKGBC also accredits BEAM Affiliates as being competent to support green building in the areas of design, construction, operation, maintenance, as well as the BEAM Plus rating tool. To bring ongoing learning opportunities and qualification maintenance to green building professionals, the HKGBC and BSL hold regular Continuing Professional Development (CPD) events and provide on-demand videos via Online Training Portals that cover a wide range of topics about the latest green building standards and practices.

To drive the development of sustainability in the community, a Green Building Faculty (GBF) comprises a pool of experienced experts who support the HKGBC and BSL by providing expert advice on green building related matters. With the aim of promoting best practices for retro-commissioning (RCx) and establishing it as a key measure of energy efficiency in Hong Kong, the HKGBC likewise provides training for RCx Practitioners and RCx Professionals to elevate their skill levels.

Number of accredited green building professionals (as of August 2020)

BEAM Pro	2914	BEAM Affiliate	480	Green Building Faculty	153		
BEAM Assessor	87	RCx Practitioner (Level 1)	127	RCx Practitioner (Level 2)	162	RCx Professional	193

Green Building Award

Organisers:

Co-organised by the HKGBC and Professional Green Building Council (PGBC) since 2010, the Award is one of the highest accolades in Hong Kong to recognise building-related projects and organisations for their tireless and exemplary efforts in promoting the green building movement, and also 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.

Based on outstanding performance and contributions to sustainability and the built environment, elites from the industry actively compete for Awards in the New Buildings Category, Existing Buildings Category, Research & Planning Category, Building Products & Technologies Category, as well as Green Building Leadership Category. To provide more opportunities to showcase and celebrate their outstanding achievements, Award Winners may be nominated by the HKGBC to participate in the Asia Pacific Leadership in Green Building Awards by the World Green Building Council to compete across the whole of the Asia Pacific region.

Facilitating Market Transformation

Apart from green building certification systems, the HKGBC has launched various industry schemes and initiatives to actively engage different sectors in the green building industry to learn and grow together, thus fostering the long-term development of sustainability in the community.

The **CIC Green Product Certification scheme** was created by the unification of the CIC's Carbon Labelling Scheme (CLS) and HKGBC's HK G-PASS.

To encourage stakeholders in the construction industry to participate in green procurement, this new comprehensive scheme assesses building materials in a wide spectrum of aspects such as carbon footprint, greenhouse gas emissions, and energy / water efficiency, etc., throughout the products' life cycle.

The **Retro-commissioning (RCx) Training and Registration Scheme** aims to elevate the skill levels of RCx professionals to optimise the energy efficiency of existing buildings. This Scheme is also in line with the HKSAR Government's active promotion of RCx as a cost-effective means of enhancing the energy efficiency of existing buildings.

"ACT-Shop" has completed more than 30 public and private projects in Hong Kong since 2016 to demonstrate and promote retro-commissioning (RCx) by using existing buildings as living laboratories. RCx serves as a "health check-up" for existing buildings. It can identify improvement potential to reduce energy consumption by fine-tuning a building's systems and equipment so that they can operate at optimal efficiency, thus reducing operating costs and contributing to energy conservation.

The **Hong Kong Green Shop Alliance** aims to create a platform for the active participation of Developers, Key Partners, Shopping Malls and Shops to foster the world's greenest shopping environment in Hong Kong.

The **Hong Kong Green Shop Alliance Award** was first launched in 2019 to provide recognition to shopping malls and shops for their excellent achievements in green practices and innovations in collaboration.

The **HKGBC Benchmarking and Energy Saving Tool (HK BEST) Series** provides office tenants and owners of commercial buildings an energy benchmarking tool with guidance on how to improve energy efficiency, thus helping to drive the market towards the goal of a more energy-efficient Hong Kong.

The **Eco Product Directory** provides a user-friendly and reliable platform for manufacturers and suppliers to promote their eco-products, and a handy directory for industry practitioners wanting to make smart choices.

Industry and Public Guidebooks

Sharing of knowledge and best practices is vital to driving behavioural changes towards healthier and more energy-efficient developments in the green building industry. The HKGBC has developed a series of guidebooks to introduce green building practices in various significant aspects in hopes of facilitating both the industry and public to make Hong Kong a greener and more liveable city.

In the past, the HKGBC launched a series of guidebooks on building design, construction and management of good practices for different types of buildings, covering schools, shops and offices, etc. In order to further promote green building and living in Hong Kong, the HKGBC has recently expanded the scope of its publications on material waste reduction, urban microclimate designs, and tips for NGOs regarding the transformation of green buildings.

Tips for NGOs to Transform their Existing Buildings (2019)

This Guide summarises the lessons learned from the HKGBC Jockey Club Green and Smart Community Buildings Project by outlining feasible approaches for NGOs to transform their existing buildings into green buildings, and ultimately to get certified under BEAM Plus, Hong Kong's green building rating system.

www

Green Design Guide for Material Resources Optimisation in Building Life Cycle (2018)

This Guide is published to confront the tough situation that Hong Kong's landfills are facing. It also aims to alert the public and building professionals about building material design issues and encourage them to take necessary actions during planning and design stages to optimise the use of building materials in the Hong Kong building industry.

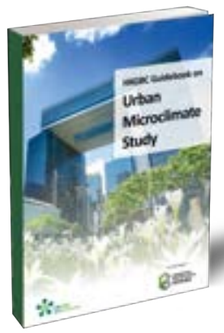
The Guide also encourages building professionals and contractors to take into consideration the life cycle of building materials by adopting green designs for construction, operation, maintenance, and eventual demolition.

www

HKGBC Guidebook on Urban Microclimate Study (2017)

Aiming to provide knowledge and inspiration about urban microclimate design for practitioners in the building industry, and thereby contribute to the improvement of Hong Kong's outdoor environment, this Guide puts forward guidelines and strategies for urban microclimate design that are specifically tailored to Hong Kong, as well as local and overseas best practices for the industry's reference.

Industry practitioners can learn practicable measures which are beneficial to both their own projects and the wider public.



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A Leading Policy Advocate

One of the key missions of the HKGBC is to lead market transformation by advocating green policies on sustainable built environment, green building and environmental protection to the Government. Acting as an important bridge between the Hong Kong Government and related stakeholders in the community, the HKGBC has been a keen advocate of the green building movement through partnerships with key stakeholders across the industry. Since its establishment, the scope of the HKGBC's advocacy work has not only covered BEAM Plus, but also the areas of minimising construction and demolition waste, enhancing energy efficiency, green finance, and the mitigation of climate change, to name just a few. In all its efforts, the HKGBC works to promote holistic approaches towards green and sustainable construction practices.

The HKGBC fully supports the Government's planning in relation to climate change and the creation of a sustainable built environment, including in recent years the organisation of policy forums and briefing sessions, and the signing of a Memorandum of Co-operation on Retro-commissioning of Buildings in the Guangdong-Hong Kong-Macao Greater Bay Area.

Sharing with the Steering Committee on the Promotion of Green Building and Renewable Energy

環境局 Environment Bureau

HKGBC 香港綠色建築議會

As the pre-eminent body that promotes green building in Hong Kong, the HKGBC regularly shares its latest plans, and provides recommendations to formulate effective strategies, with the Steering Committee on the Promotion of Green Building and Renewable Energy, an inter-departmental committee led by the Secretary for the Environment of the Government of HKSAR.

As buildings account for 60% of the city's greenhouse gas emissions, the Government's commitment to lead by example in demonstrating the integration of green features in buildings managed by the Government will provide a driving force for the non-government sector to take positive actions to enhance the green performance of its own buildings. The HKGBC is working closely with the Committee to reinforce the commitment and leadership demonstrated by the Government in order to translate concerted efforts into tangible outcomes.

Supporting the Formulation of New Policies and Strategies of the HKSAR Government

The HKGBC has been an active advocate of green building policies and strategies since its establishment. Through the organisation of briefing sessions and policy forums, members and stakeholders of the HKGBC are constantly provided with platforms to better understand the Government's plans as well as to share their expertise and insights.

A Land Supply – Policy Forum was held by the HKGBC in 2018 to facilitate the Task Force on Land Supply and forge a consensus on the controversial land shortage issue that has been plaguing Hong Kong in recent years. Furthermore, in view of the urge for a low-carbon society, the HKGBC organised a briefing session in 2019 for members and stakeholders to support the formulation of Hong Kong's long-term decarbonisation strategy by the Council for Sustainable Development.

In the future, the HKGBC will continue its close collaboration with the Government and all stakeholders to further the commitment to a greener and more sustainable built environment both locally and internationally.

International Outreach in 2017-2020

World Sustainable Built Environment Conference 2017 Hong Kong

On an international scale, the HKGBC has strived to raise awareness of the importance of green buildings around the globe. The CIC and HKGBC attained the hosting rights of the World Sustainable Built Environment Conference 2017, welcoming 1,800 global green building advocates, policy-makers, academics, and industry practitioners from 57 countries and regions. The Conference was undoubtedly a significant milestone in terms of the green building movement in Hong Kong. As Asia's World city that brings together both East and West, Hong Kong will continue to serve as a bridge to connect the massive scale of sustainable built environment development in the Mainland with the rest of the world.

Themed "Transforming Our Built Environment through Innovation and Integration: Putting Ideas into Action", this renowned conference facilitated the integration and implementation of innovative construction technologies and designs, while at the same time responded to the call for climate change action and addressed various sustainability issues from different perspectives. Furthermore, it embraced the findings from the 20 regional conferences held in different parts of the world throughout 2016.

Appointments to Key Roles in the World Green Building Council

HKGBC has been an Established Member of the World Green Building Council (WorldGBC) since November 2012. The appointments of HKGBC's representatives to the WorldGBC's Board of Directors and the Vice-chair of the WorldGBC's Asia Pacific Regional Network (APN) signified Hong Kong's position as a leader in the green building movement around the globe.

As a keen advocate in the built asset environment, Ms Ada FUNG, BBS, former Director of HKGBC, was appointed Director of the WorldGBC for a two-year term from July 2018 to June 2020, and Board Secretary for a one-year term from July 2019 to June 2020, so as to advise and oversee the WorldGBC's organisational strategy and governance to ensure its effective operation and good delivery of the WorldGBC's mission.

Based on his leadership and championing of sustainability across Asia Pacific, Ir Dr Cary CHAN, JP, Executive Director of HKGBC, was appointed as Vice Chair of the WorldGBC's APN for a two-year term from July 2019 to June 2021 with a vision to strengthen the network of Green Buildings Councils across the region.

Advancing Net Zero Project of the WorldGBC

Accounting for 39% of global energy-related carbon emissions, buildings represent one of the most effective ways to respond to the climate emergency globally. Launched in 2017, the WorldGBC's Advancing Net Zero Project (ANZ) aims to maximise the chances of limiting global warming to below 1.5 degrees above pre-industrial levels, in echo with the Paris Agreement, by calling for business, organisations, cities, states and regions to reach net zero operating emissions in their portfolios by 2030, and for all buildings to be net zero in operation by 2050.

As an active contributor in the global green building network, the HKGBC is closely partnering with the WorldGBC in the ANZ global project to call for action from the local community. In this regard, HKGBC also introduced an Advancing Net Zero Programme to help Hong Kong's building and construction sector on its net zero journey.

International Outreach in 2017-2020

Better Places for People

"Better Places for People" was launched by the WorldGBC to support Green Building Councils worldwide and help their members to facilitate green buildings that are good for the health, wellbeing and productivity of the people within them. A global air quality monitoring campaign, "Plant a Sensor", which runs as part of the "Better Places for People" global project, champions the roll-out of air quality monitoring devices in and outside of buildings and the development of an open data platform showcasing real-time air quality data from across the world. The project is now operating in around 30 countries worldwide and is dedicated to improving human health as part of a sustainable built environment. To support the campaign, the HKGBC has installed air quality monitoring devices in and outside the office building where it is located in Hong Kong. Data is collected and monitored through the QCLEAR data management platform.

Following the publication of the WorldGBC's *"Health, Wellbeing and Productivity in Offices: The Next Chapter for Green Building"* and *"BUILDING THE BUSINESS CASE: Health, Wellbeing and Productivity in Green Offices"* in 2014 and 2016 respectively, the HKGBC commenced its "Health and Wellness in Buildings Study" with the aim of formulating an assessment method for the health and wellness of office occupants. In keeping with the "Better Places for People" concept, the Study comprises indoor built environment studies in 15 office units of commercial and charity buildings. Adopting 24 IEQ parameters under seven environmental aspects, the Study carried out surveys and on-site measurements. Participants also rated the importance of health and wellness in their environment together with their workplace satisfaction levels relating to each of the seven environmental aspects.

BETTER PLACES FOR PEOPLE | PUT WELLBEING AT THE HEART OF YOUR BUILDING

Signing of a Memorandum of Co-operation (MOC) on the Retro-commissioning of Buildings in the Guangdong-Hong Kong-Macao Greater Bay Area

As Hong Kong is part of the Greater Bay Area, the HKGBC's work has potential to benefit the entire region. In this regard, it is exploring opportunities for future collaboration with our counterparts in the Mainland. The signing of a Memorandum of Co-operation (MOC) on the Retro-commissioning of Buildings in the Guangdong-Hong Kong-Macao Greater Bay Area with the Electrical and Mechanical Services Department, together with several important institutions, symbolised the commitment of joint efforts in operation and communication to create a new synergy in promoting retro-commissioning solutions in the Greater Bay Area.

HKGBC Delegations – Learn, Engage and Foster Green Building Development

Knowledge exchange is important to further the development of the green building movement. Therefore, the HKGBC organises various delegations for our members annually to keep up with the latest green building trends. Two delegations to Singapore and Tokyo were held in 2018 and 2019 with the aim of learning about the latest trends and technologies in the Asia-Pacific Region, as well as to engage experts to exchange new trends in smart and green building development.

Around 100 Hong Kong delegates from the public and private sectors, comprising the Development Bureau, Buildings Department of the Government of HKSAR, Construction Industry Council, property developers, contractors, consultants, architecture and engineering firms, and academic institutes, joined the two delegations.

A Driving Force on the Journey to Decarbonisation

CIC Sustainable Construction Award 2020

The CIC launched its first Sustainable Construction Award (SCA) in 2018. More than 300 applicants competed for the award in 2020 – a promising trend that reflects the enthusiasm for adopting sustainability within the local construction industry.

The SCA recognises sustainability best practices by organisations and industry practitioners, particularly among the up-and-coming generation. It acts as a proactive communication platform to promote the continuous improvement of sustainable construction in Hong Kong. Applicants are divided into two main categories, namely Organisations and Industry Practitioners, with a further three sub-categories under the latter: Construction Manager, General Practitioner, and Young Practitioner.

The judging criteria for the Organisations category takes into consideration the applicant's level of engagement and communication internally as well as externally in the wider community, measures and achievements, supply chain management and level of innovation.

In the Industry Practitioners category, judging focuses on the individual applicant's leadership, achievements, collaborations, creativity, skill and workmanship, and the merits of their ideas as well as how well that idea has energised further progress.

Every awardee represents the exciting potential for sustainable construction in Hong Kong. "Excellent Award" winners under the Industry Practitioners category exemplify good team spirit, individual ownership of achievements, and the re-imagining of a green space within Hong Kong's dense urban environment.

CIC Sustainable Construction Certification Scheme

As interest grows in the investment of low-carbon and climate-resilient infrastructure, green financing has emerged as a vital part of building a sustainable world economy. In the Government's *2017 Policy Address*, the Chief Executive lauded Hong Kong's ideal position as a financial hub for raising green capital in Asia. In view of the substantial GDP contributed by the construction sector annually, this industry has high potential to embrace emerging green finance opportunities.

The CIC is developing a Sustainable Construction Certification Scheme that will define green standards and systemisation, uniformly assess and improve the sustainability performance of construction projects, and better facilitate the application of green finance, such as green bonds and loans, within the industry. The Scheme is part of the CIC's wider initiatives to outline, encourage and put sustainable concepts into practice, forming a synergy with its CIC Carbon Assessment Tool, CIC Green Product Certification Scheme, and CIC Sustainable Construction Model.

CIC Carbon Assessment Tool

Hong Kong's built environment accounts for 70% of its carbon emissions, which has prompted the HKSAR Government to commence formulating a long-term decarbonisation strategy to ensure Hong Kong's sustainable future. The CIC Carbon Assessment Tool (CAT) offers a common platform that evaluates the carbon performance of local buildings and infrastructure from raw material extraction to the end of construction. It is the local construction industry's first online carbon measurement tool and has the capacity to develop carbon emission factors for over 300 construction materials.

CAT is designed to calculate the embodied carbon of construction materials and carbon emissions from on-site construction processes, creating an overall analysis of a project's carbon performance. Launched in September 2019 with the support of more than 50 organisations, the e-platform is publicly available for access.

This progressive initiative has already been adopted by 100 pilot projects in the public and private sectors. Future updates are planned to encompass off-site fabrication and add new construction materials. Benchmarks are also being developed for new buildings and infrastructure projects alongside upcoming features such as BIM integration and data automation functions. In addition, training programmes will be held for industry practitioners.

The successful uptake and implementation of CAT may create new green financing opportunities with greater incentives for participating developers and contractors. Eventually, it is hoped that CAT will be adopted by users beyond Hong Kong, such as in the Greater Bay Area, promoting the tool to an even wider audience.

CIC Carbon Assessment Tool
建造業議會碳評估工具

www

CIC GREEN
PRODUCT CERTIFICATION

CIC Green Product Certification Scheme

The embodied carbon within construction materials can account for up to 25% of a building's lifetime carbon footprint. The CIC Green Product Certification Scheme aims to transform Hong Kong into a greener built environment by providing a certification platform for building and construction products and materials. It enables building and construction practitioners to make informed decisions about the selection and procurement of products and materials that have minimal environmental impact.

This is a new certification that unifies what was previously the CIC Carbon Labelling Scheme and the Hong Kong Green Building Council's Green Product Accreditation and Standards. The CIC Green Product Certification is jointly owned by the CIC and operated by the HKGBC. By joining forces, the CIC and HKGBC are both able to maximise their resources and usher Hong Kong into a new era, offering the leading product and material certification standard for the entire building and construction industry.

The certification criteria help measure the carbon footprint, environmental management system, efficiency, performance, human toxicity, eco-system impact and resource consumption of an individual construction product. These criteria are then applied to several different categories of construction products such as cement, ready-mixed concrete, structural steel/reinforcing bars, paint and coatings.

A Driving Force on the Journey to Decarbonisation

CIC Sustainable Construction Model

Created as a guideline for project owners, contractors and suppliers, the CIC Sustainable Construction Model is designed as a framework of sustainable construction for these stakeholders to apply in their practice. In keeping with its name, the model prioritises environmental sustainability and how to achieve it within the construction and building industry.

The Model awards green credit to construction projects, which can lead towards obtaining green financing. The main scope of the Model covers the superstructure construction stage in building and civil projects. Ultimately, the CIC is seeking to develop construction-specific measures, indicators and templates that line up with international Green Bond and Green Loan Principles.

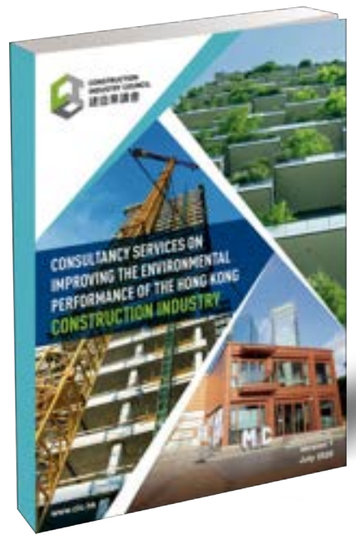
Construction practitioners can use their application of the Model as a reference to support their green finance application process. The second goal of the CIC Sustainable Construction Model is to develop an e-platform and knowledge hub with case studies of sustainable construction, providing real-world examples that other projects can emulate. Not only will this highlight Hong Kong's successes in achieving a green built environment, it will also help spur local innovations by propagating best practices.

Improving the Environmental Performance of the Hong Kong Construction Industry

The CIC initiated a consultancy on ways to boost the environmental performance of the Hong Kong construction industry. This was done in response to the 2015 Paris Climate Conference (COP 21) and the carbon reduction target for 2030 set by the HKSAR Government.

The consultancy report identified four new initiatives that support and help accelerate or scale up carbon reduction measures, and three specific technologies or practices that make up the baseline scenario and are expected to reduce carbon emissions.

Based on these findings, a conference on the CIC's Low Carbon Construction Roadmap Beyond 2030 was organised in September 2019, bringing together more than 250 stakeholders.



Gallery of Sustainable Construction Innovations

CIC-Zero Carbon Park

The CIC-Zero Carbon Park (CIC-ZCP) is home to the first zero carbon building in Hong Kong. It acts as a test bed for state-of-the-art eco-building design and technologies, and aims to promote a low-carbon mentality both locally and internationally. The CIC-ZCP also serves as an exhibition, education and information centre in order to raise awareness of the importance of green-building design beyond the industry in the wider community. Designed to be energy-positive in the tropics over the course of its life cycle, the vision, execution and implementation of design innovations at the CIC-ZCP are all milestone achievements for Hong Kong. Since its opening in 2012, the building's performance has been continually optimised, a process that continues to this day.

In addition to serving as a technology showcase, the CIC-ZCP aspires to boost the neighbourhood's ecological value, and contribute to the area as a living, breathing piece of infrastructure. Home to more than 200 different varieties of flowers and trees, it is hoped that this landmark building can create a paradigm shift towards sustainable living, and function as a "city lung", breathing new life and clean air into Hong Kong.

Electrical & Mechanical Modular Integrated Construction (emMiC) for a Stormwater Air-conditioning System

Due to increased traffic and usage, the air-conditioning system at CIC-ZCP required enhancement, but the existing chiller plant room was too congested for extra loading. In collaboration with BuildKing Construction Ltd. and the HKSAR Government's Drainage Service Department, CIC-ZCP took the opportunity to introduce Hong Kong's first Electrical & Mechanical Modular Integrated Construction (emMiC) stormwater air-conditioning system.

Located at the northeast corner of CIC-ZCP, the emMiC makes use of stormwater as a cooling agent, which is collected inside an underground culvert. The emMiC is the first air-conditioning system in Hong Kong of its type, integrating the electrical and mechanical air-conditioning equipment inside a prefabricated module, echoing the modular integrated construction (MiC) method encouraged by CIC. This innovative solution reduces energy consumption by 50% compared to traditional air-cooled systems. In addition, the system is able to mitigate the urban heat island effect, and eliminates the bacterial contamination commonly found in conventional air-conditioning systems that can lead to health problems such as Legionnaires disease.

The emMiC is a perfect example of "Design for Manufacture and Assembly (DFMA)". The entire module and its associated E&M equipment were prefabricated and commissioned off-site. Cutting-edge lightweight reinforced concrete was used instead of steel to manufacture the module, further lowering the system's carbon footprint.

The emMiC was then delivered to CIC-ZCP, followed by the final connection of pipework and cables. This "plug and play" construction process offered the added benefit of being unaffected by adverse weather conditions, minimising risk for the contractor, and minimising disturbance to CIC-ZCP's operations and the Kowloon Bay neighbourhood. By minimising on-site work, prefabrication also greatly increased productivity, shortened the works period, improved safety, and reduced construction wastage. The success of the emMiC will hopefully serve as a benchmark for similar implementations in the future.

Gallery of Sustainable Construction Innovations

Air Improvement Photovoltaic (AIPV) Glass Canopy

Located in a bustling commercial area, the CIC-ZCP also provides an open green space for the community to enjoy. However, extensive damage was incurred during Super Typhoon Mangkhut in September 2018. The CIC-ZCP seized this opportunity to restore and enhance its facilities.

Working with GreenWalls Bioengineering (HK) Ltd and CanaShield Nano-Technologies Ltd, Hong Kong's first Air Improvement Photovoltaic (AIPV) glass canopy was installed above CIC–ZCP's eco-café.

The AIPV glass canopy generates renewable energy from sunlight using a nano-thin layer of photovoltaic technology. A ground-breaking quantum dot nano surface coating decomposes fine particulate matter (PM2.5) as well as many other harmful organic compounds. This self-cleansing ability of the AIPV glass canopy keeps the glass surface clean, which largely reduces maintenance costs and effort, while also boosting its power generation performance by 5%.

The semi-transparent glass panels can be tailor made to different shapes, sizes, thickness, and colours for better integration into buildings and for greater aesthetic appeal.

Among all major commercialised photovoltaic systems, the AIPV panels have the lowest carbon and water footprint, as well as the least energy consumption during manufacturing. The materials can also be fully recycled, with over 90% of materials able to be reused in new AIPV systems.

The AIPV glass canopy at the CIC-ZCP has become a showcase of innovative technology for construction industry practitioners, and greatly contributes to the building's goal of improving the sustainability of Hong Kong's built environment.

Integration of BIM-AM (Building Information Modelling – Asset Management) with IoT (Internet of Things)

In late 2017, the CIC collaborated with the Electrical and Mechanical Services Department (EMSD) to implement Building Information Modelling and Asset Management (BIM-AM) at the CIC-ZCP, creating an industry and public showcase on the use of BIM in facilitating operational and maintenance management (O&M) throughout the entire life cycle of existing buildings.

BIM models of the building and its Heating, Ventilation and Air-conditioning (HVAC) system were developed by EMSD's in-house staff for the implementation of BIM-AM using the EMSD BIM-AM System platform, which is integrated with the Internet of Things (IoT), a Building Management System (BMS), RFID and CCTV system.

EMSD's BIM-AM Standards and Guidelines were adopted in the project with three major characteristics: standardised asset information (i.e., name, model and catalogue) of all equipment; incorporation with important assets (i.e., maintenance records, repair status and system topology); and interfaces with BMS, RFID/ QR code technology and CCTV.

By implementing BIM-AM, facility management can now quickly locate and identify equipment by scanning the equipment RFID tag/zone QR code using mobile tablets. System faults can be remotely diagnosed by checking the system topology, BMS and CCTV system. For existing buildings without a BMS, wireless battery type IoT sensors can be integrated with BIM-AM to remotely monitor HVAC system operation and space utilisation.

The adoption of CUPIX software for BIM verification together with the integration of 360° camera images offers side-by-side comparison of the physical site and BIM model, enabling real-time quality control.

BIM-AM supports remote monitoring to analyse and fine-tune optimal supply air temperature using BIM (Spatial Data) and BMS Data (System Operational Data) in O&M status. Following the project's completion, the EMSD also conducted a post-occupancy thermal analysis for the building's multi-purpose hall using BIM to formulate thermal comfort-based optimisation controls based on BMS data. Taken in total, these outcomes successfully demonstrate the innovative potential of applying BIM throughout the O&M building life cycle.

An Innovation Hub Showcasing the Implementation of Cutting-edge Construction Technologies

CIC BIM Space

In the digital era, the adoption of Building Information Modelling (BIM) is a paradigm shift in the Architectural, Engineering, Construction, Owner and Operator (AECOO) industry. Usage of BIM generates more accurate data that can improve coordination throughout the design and construction processes, reduce risk and construction waste, and improve cost control and work scheduling. It can also improve site safety, enhance construction efficiency and achieve sustainability in buildings. In the operation and maintenance stage, BIM together with other Internet of Things (IoT) devices can help to monitor and reduce energy consumption, optimise lighting performance, and also improve the effectiveness and efficiency of repair actions.

To build capacity and cope with the growing demand for the use of BIM technologies in the industry, the CIC established a new CIC BIM Space in April 2019 to showcase innovative BIM technologies and applications, collaborate with industry partners and stakeholders to promote adoption of BIM via seminars and workshops, and provide advisory services to industry practitioners, especially Small and Medium Enterprises.

Since the opening of this venue, the CIC has invited various stakeholders, including industry practitioners, government officials, representatives of professional bodies and associations, and teachers and students from higher education institutions and secondary schools, to visit the CIC BIM Space, educating them on the solutions and benefits of using BIM throughout the project life cycle by showcasing real-life examples of different project stages and the latest technologies. It has also cooperated with professional bodies and associations to organise BIM-related seminars and workshops for their members to increase their knowledge of BIM. To raise public awareness of BIM, it likewise frequently organises free BIM Awareness Seminars and workshops to provide a hands-on BIM experience.

By strengthening the adoption of BIM and related technologies, Hong Kong is taking an important step closer towards becoming a greener and more sustainable city.

MiC Display Centre

The construction industry currently faces many challenges. There is a strong demand for better safety, quality, and environmental sustainability.

The modular integrated construction (MiC) method is a potential technology that can ease these construction concerns. It applies the concept of "factory manufacture followed by on-site assembly". Save for the core part of the building, all other parts are fabricated offsite. Upon stacking of the modules, only connections, waterproofing works and final touch up are required on site, which can greatly reduce the need for on-site construction processes.

Since both foundation works and manufacturing of the MiC modules can be carried out at the same time, construction time can be shortened, thus saving energy. Most of the outdoor in-situ construction processes are also transferred into a controlled factory environment, meaning that the chances of delays due to adverse weather conditions can be minimised.

Given that most construction processes can be carried out in a factory, construction-induced dust and noise pollution, both of which can greatly impact a surrounding community, are minimised. Workers, too, are protected from exposure to adverse weather conditions, and the risk of falling from height is reduced.

MiC modules can be designed for future demolition, relocation and reuse. Thus, use of MiC can reduce the demand for raw materials and alleviate landfill pressure.

By applying advanced machinery and innovative technologies, the MiC method improves accuracy and minimises errors in construction, such as through fewer abortive works and less material wastage. Factory warehousing further improves material storage management and provides flexibility in project scheduling.

Through its MiC Display Centre, CIC endeavours to demonstrate these sustainable characteristics of MiC in the context of Hong Kong's built environment.

The MiC Display Centre was the first building in Hong Kong constructed using the MiC method. It contains a two-storey exhibition centre, which comprises ten modules built using the MiC method in conjunction with an in-situ building built using the conventional building method.

The centre provides guided tours offering detailed introductions of various designs and technologies via a showcase of five types of show flats: a hotel unit, a hostel unit, an elderly home unit, a one-bedroom residential flat, and a three-bedroom residential flat, all created using MiC technology.

The MiC Display Centre plays an important role in public education. As at February 2020, the Centre had welcomed over 9,300 visitors since its opening in November 2018.

Dynamic Wellness Programme Connecting the Industry with the Community

Construction Industry Sports and Volunteering Programme (CISVP)

The CIC has a strong commitment to promoting the development of the construction industry and is keen to improve the quality of life and wellbeing of all industry practitioners, especially construction workers. The Construction Industry Sports and Volunteering Programme (CISVP) was established in 2016 with the aim of promoting corporate social responsibility and nurturing a caring culture and healthy lifestyle within the industry.

CISVP offers a Corporate Membership and invites developers, contractors, subcontractors, professional bodies, consultant firms, government departments and industry organisations to jointly motivate practitioners to participate in sports and volunteering activities which benefit both the participants themselves and the wider community. With support from the industry, the result has been impactful. Over 300 sports and volunteering events have been organised since its establishment.

Among the 100 industry-wide events and activities, eight major annual sports events for participants from the industry and the public were organised in 2019, including a 3km/10km run, basketball matches, table tennis competitions, dragon boat racing, a football fun day and league, and sports day together with a carnival.

CISVP's community services cover a wide range of causes from supporting the needy to environmental protection. CISVP organises maintenance services for residential care homes, blood donation drives, flag sales, tree plantings and shoreline clean-ups. Its volunteer initiatives include undertaking visits to the elderly, home repair and moving services for the elderly and low-income families, and volunteering as guides for day-tours. Since 2018, CISVP members have contributed a total of 296,138.75 service hours under the Construction Industry Volunteer Award Scheme.

CISVP also recognises good deeds by construction organisations by honouring them with the "Construction Industry Caring Organisation" logo. A total of 105 construction companies have been awarded with the logo, ranging from contractors, professional bodies and consultant firms to government departments.

In recognition of the importance of sustainability, CISVP incorporates green elements into all of its events, such as the provision of water stations, recycling bins, reusable utensils and the adoption of e-registration forms.

Inspiring Innovation in the Industry

CIC Research and Technology Development Fund

Research and innovation are of fundamental importance to the sustainable development of the Hong Kong construction industry. That is why the CIC is committed to working closely with all industry stakeholders to drive innovation and initiate practical research projects. The CIC Research and Technology Development Fund (CIC R&D Fund) was set up in 2013 to provide financial support for research projects which can benefit the Hong Kong construction industry through practical application of research outcomes in the areas of (i) Building Information Modelling (BIM); (ii) Construction Procurement and Project Management; (iii) Construction Productivity; (iv) Construction Safety, and (v) Green Construction.

Since 2013, 13 research projects related to Green Construction have been funded with a total amount of HK$15.5 million. The projects cover various aspects including renewable energy applications, carbon saving technologies, green construction materials, and recycling construction and demolition wastes, to name just a few. Remarkable research outcomes have been achieved. For instance, a carbon labelling scheme for construction materials was launched by the CIC based on the carbon assessment frameworks compiled by a research team at the University of Hong Kong. In addition, new techniques for enhancing the properties of recycled concrete aggregates are being investigated under a CIC-funded research led by a team at the Hong Kong Polytechnic University through (i) a CO2 curing treatment using waste flue gas, (ii) modified nano-particle treatment and (iii) micro-biological modification treatment. The CIC R&D Fund is open for applications on an annual basis.

www CIC R&D Fund

www CIC-funded projects

Construction Innovation and Technology Fund

The Financial Secretary of the Government of the Hong Kong Special Administrative Region (HKSAR) proposed a HK$1 billion Construction Innovation and Technology Fund (CITF) to encourage new technology adoption in the construction industry. The CITF was launched in October 2018. As at August 2020, the CITF has approved more than 1,200 applications with total funding of HK$274.4 million granted.

The CITF aims to support the adoption of technologies and nurture the capacity and mind-set of construction industry stakeholders. The CITF supports the adoption of technologies with proven effectiveness in boosting productivity, uplifting built quality, improving site safety or enhancing environmental performance. It also supports local and overseas emergent technologies at the initial phases of commercialisation, as well as mature ones which can be adapted for local use. The CITF Pre-approved List provides a platform for technology providers to showcase their products after review by the CITF. Currently, the Pre-approved Technologies List has over 175 items covering Internet of Things, automated machines, robotics and much more. Technologies that reduce sound, dust and energy consumption such as advanced noise barrier systems, solar-powered sign boards, advanced exhaust air treatment systems, electrically-driven demolition robots and battery-type power generators are also included. This allows industry stakeholders to obtain innovation and technology information at their fingertips.

To further assist the industry in its innovative construction journey, the CITF has established an Innovation and Technology Sharing Platform to facilitate the sharing and exchange of experience, to further deploy innovative solutions, and to overcome the challenges faced. Offering practical tips and real-life demonstrations, it is expected that the Platform will lead to ripple effects for the increased adoption of innovation and technology in construction projects throughout Hong Kong.

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Community Engagement

People are at the heart of every sustainable built environment, inspiring the creation of healthy homes and workplaces for all sectors of the community. With a vision to achieve a sustainable built environment in Hong Kong for future generations, many innovative new projects in the community are having a positive impact: arousing young people's interest in energy saving, developing sustainable and replicable models for driving social change, supporting biodiversity and green education, and sharing experience and knowledge to create a valuable model for the implementation of future smart city initiatives. These projects are proof that all walks of life can participate in behavioural changes, paving the way for the creation of a more liveable home for everyone.

BEC Low Carbon Charter




Mobilising Hong Kong's companies across all sectors to set and achieve decarbonisation targets towards the goals of the Paris Agreement

"You can't manage what you don't measure". Targets are key for facilitating and operationalising businesses' decarbonisation to align with the goals of the Paris Agreement. The importance of time-based targets is also emphasised in the Government's 4Ts framework for operationalising Hong Kong's climate action.

To support business decarbonisation, BEC published the *Low Carbon Hong Kong: Supporting Business to Set Targets Report* in May 2017, which describes the business case for setting decarbonisation targets and introduces the methods to do so. BEC then commenced a research and engagement phase, focusing on building the industry's capacity and commitment to set and achieve decarbonisation targets in the property and construction sector.

Between November 2017 and September 2018, one pre-meeting and four workshops were held to strengthen capacity, as well as collectively explore how to set Paris-aligned sectoral targets and achieve significant decarbonisation through smart building design, development, construction, retrofits, and management. More than 80 industry professionals across the property and construction value chain and Government representatives participated.

In October 2018, a Property & Construction Sector C-Suite Roundtable was held, convening more than a dozen C-level business leaders from the sector and senior Government officials to discuss how to raise ambition and collectively confront the climate change challenge.

Harnessing the momentum from the workshops and the top-level support achieved at the roundtable, the BEC Low Carbon Charter was created as a tool to mobilise businesses to commit to set and achieve decarbonisation targets. Launched in March 2019 with support from the Environment Bureau, the BEC Low Carbon Charter saw 34 companies across the property and construction value chain joining as signatories. Since 2020, the Charter has welcomed businesses from all sectors to join, with the number of signatories reaching 69 in July 2020.

No Air Con Night




Turning off the Air Con, Cooling the Earth

The Green Sense "No Air Con Night" is a territory-wide annual energy-saving campaign started in 2010, in order to promote wiser use of air conditioning and low carbon living.

The use of air conditioning has become more frequent and essential in our daily lives. To highlight the significance of energy saving and reduction of greenhouse gases, No Air Con Night was initiated to encourage different sectors in the community to switch off their air conditioners for one night in autumn.

A series of themed activities are designed to engage the community each year. In 2017, these included "Moonlight Orienteering", "Waterfront Stargazing" and "Sports on the Lawn". In 2018, "Night Hiking" and "Parent Child Game Night" were added to echo the theme of air-con-free outdoor enjoyment. "Paper Fan Drawing Competition" and a glacier-themed "Polar Bear Flash Mob" road show were held to arouse public awareness of global warming in 2019.

Moreover, researches investigating air conditioning usage in homes and offices were also conducted in 2017 and 2019 respectively. Public attention was raised about the abusive consumption of air conditioning, as well as the problem of electricity wastage.

Over the past three years, more than 270,000 households have pledged to support the annual event. This translates into an estimated decrease in total electricity consumption of 2160MW, which is a projected reduction of 1,254 tons of carbon dioxide emissions from 7 pm on the No Air Con Night to 7 am the next day for three consecutive years.

With increasing participation in No Air Con Night, we hope more Hong Kong citizens will become aware of the importance of saving energy and low carbon living to achieve a sustainable future.

POWER YOU KINDERGARTEN EDUCATION KIT

POWER FOUR accompany kids to learn electricity, energy saving and low carbon lifestyles

CLP Power implements a comprehensive public education plan on climate change, energy conservation and the power industry, covering the entire education pathway from kindergarten to university.

It strongly believes that encouraging good behaviour and a lifelong interest in learning are core elements of early childhood education. As part of the process, CLP Power launched an innovative electricity-themed POWER YOU Kindergarten Education Kit to arouse kindergarten pupils' interest in energy generation, and to teach them about the safe use of electricity and energy-saving habits at an early age in a fun and engaging way. The Kit provides diversified teaching tools including storybooks with worksheets, finger and hand puppets, a board game, a colouring game and a theme song featuring lyrics with energy-saving messages. The Kit was given free to all kindergartens in Hong Kong and was well received by over 85% of the schools, reaching around 153,000 children.

To maintain this momentum and reinforce its energy-saving messages, CLP Power also introduced new *POWER FOUR* cartoon characters, and launched the Power Kid Channel where a series of 3D cartoon videos have been developed to spread the messages of energy saving and power safety. A Power Kid App, which is an e-version of the Kit, enables parents to teach children about electricity, power safety and environmental protection at home. Following its launch in mid July 2019, the app was ranked as Top 3 in both the App Store and Play Store under the Education category. So far over 20,000 downloads have been recorded.

The kindergarten visitation programme is an extended activity for young engineers to visit kindergartens and introduce children to the power journey, the safe use of electricity, and energy-saving tips. The programme has reached out to more than 41,000 pupils from over 470 kindergartens, which is almost half of all kindergartens in Hong Kong.

Serving as energy-saving ambassadors, *POWER FOUR* are not only popular among young students at kindergartens, they are also adored by children at different outreach activities, such as the Hong Kong Book Fair. CLP Power participated in the Hong Kong Book Fair in both 2018 and 2019, with its young engineers holding storytelling sessions for children and the public to help them learn about energy saving and a low carbon lifestyle through fun and interactive games.

Reducing workplace energy consumption through energy monitoring and behavioural change

Background

Electricity consumption is a major contributor to Hong Kong's air pollution, causing respiratory illnesses and environmental degradation. To encourage energy saving by employees, smart energy sensors were installed at 74 service locations of St. James' Settlement (SJS), one of Hong Kong's most well-established NGOs. SJS serves over 3,800,000 person-times annually, with a staff of some 1,200, making it ideal for the implementation of a large-scale energy engagement programme. By utilising data, transparency and recognition of positive behavioural change, this highly successful programme also demonstrates a repeatable energy-reduction model for the entire NGO sector.

Brief Mechanism

To maximise the outcome, this integrated programme adopted the acronym "SAVE":

"**S**ignal": On the front line, each of the SJS's 50 centres appointed a Blue Sky Ambassador to attend energy data workshops. These 50 ambassadors analysed and learnt about actionable saving opportunities in the day-to-day operations of air conditioning, lighting and socket loading in their service centres.

"**A**ction": Each centre manager encouraged his or her ambassador to be creative and experiment with different energy-saving actions.

"**Ve**rification & Reward": Savings outcomes were summarised and emailed weekly after analysis by the Blue Sky artificial intelligence model. Centres then communicated these energy quick wins with staff to deepen the behavioural change and ownership. At a management level, the SJS Green Committee also evaluated the engagement level on a quarterly basis and devised various rewards and competitions to boost participation. The staff and centres with the most outstanding initiatives, actions, savings and participation received awards from the Chief Director.

Outcome / Impact

Comparing year-on-year, energy consumption was reduced by 308,072 kWh, equivalent to planting around 6,000 trees and avoiding 229 metric tons of air pollutants. Overall, the program engaged around 1,200 staff members across 74 service locations. 65% of units achieved an average energy reduction of 12%, with one gym centre achieving up to 43% savings. In total, over 2,509 energy-saving actions were implemented by staff, and SJS remains firmly committed to the further installation and servicing of energy-efficient solutions in all suitable new locations.

BEC Jockey Club Intelligent Resource Management Programme

Intelligent benchmarking reference of waste reduction and recycling for buildings

Hong Kong's per capita municipal solid waste disposal rate ranks high when compared to other cities in Asia. The Government has taken multiple actions to achieve the waste reduction targets as set in the *"Hong Kong Blueprint for Sustainable Use of Resources 2013-2022"*. However, managing waste in a city requires the collaboration and combined actions of many stakeholders. Funded by The Hong Kong Jockey Club Charities Trust, BEC launched this programme aiming to mobilise the wider community for waste reduction and recycling, and to establish best practices for continuous waste performance monitoring in the commercial, residential and school sectors.

Following the installation of smart waste monitoring systems at 200 participating premises, data can be harvested regarding regular waste and recycling practices. A cloud-based platform and mobile application also enable participating premises to monitor and benchmark their waste intensities and recycling rates. With two years of continuous data collection, BEC will be able to develop an Online Benchmarking Tool for interested parties to easily benchmark their waste performance with counterparts.

Apart from the above, improvement measures have been conducted for participating premises such as the installation of recycling facilities and the implementation of waste audits. A waste audit methodology guide will also be published to provide a useful reference for buildings to understand their waste profile and identify room for improvement. Various educational activities, including promotional booths, school drama shows, a student green ambassador programme and sharing sessions, are likewise organised to further instil a green living culture.

Through continuous monitoring and review of waste performance, it is expected that a reduction of 3-5% total waste intensity can be achieved by the 200 participating premises within two years. The adoption of a "train the trainer" approach with student green ambassadors will further empower the younger generation to influence their peers and families regarding waste reduction and recycling.

Development of Wood Plastic Composite Material by using Local Recycled Wood

Hong Kong's first Made-in-HK Wood Plastic Composite material made from local recycled wood

Background

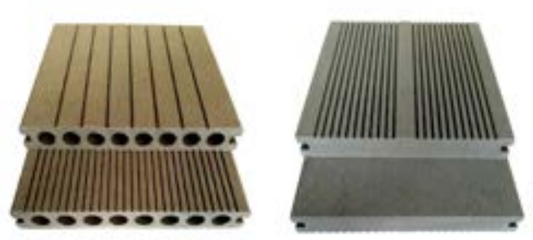
In Hong Kong, over 1,000 tons of wood waste are generated every day, all of which is dumped in landfills. This project aimed to make good use of the material by transforming it into sustainable Wood Plastic Composite (WPC) products. WPC products are widely used in outdoor construction projects, including outdoor decking, garden fences and outdoor furniture. This project sought to further enhance the material in both sustainability and technological aspects in order to provide even better products for the community.

Brief Mechanism

The project developer collected, sorted, processed and recycled wood waste at a local recycling site. This material was then mixed with recycled High-density Polyethylene (HDPE) for the production of WPC through extrusion. The end product was specifically designed to achieve a much lower water absorption rate than existing market products to cope with potential distortion and the high humidity in Hong Kong.

Outcome / Impact of Project

The development of this green and innovative new Made-in-HK WPC product introduces a new perspective on green construction. By working with many different parties across society, including construction sites, shopping malls and properties, it is now commercially feasible to reduce wood waste disposal in landfills. Through this sustainable model of community participation, clients and the public can enjoy green WPC products with a higher quality while also reducing wood waste in Hong Kong.



Glass Beverage Bottle Recycling

3,600 tonne of glass bottles recycled

Funded by the Environment and Conservation Fund (ECF), WGO conducted the captioned project with the goal of providing a one-stop-shop recycling service for the glass beverage bottles generated by the local food and beverage sector (F&B sector).

WGO managed a service provider, who was recruited through an open tender process, to collect glass bottles from the local F&B sector. The collected recycled bottles were processed to glass cullet in a processing plant managed by the service provider. This glass cullet was then delivered to designated government stockpiling sites for the use in public works.

Throughout the project period, more than 200 collection points were developed in the 18 districts across Hong Kong. More than 3,600 tonnes of glass beverage bottles were recycled and processed to glass cullet and sent to designated government stockpiling sites in Tuen Mun and Tsueng Kwan O. Expressed in other terms, the food and beverage sector saved 3,600 tonnes of glass beverage bottles from being disposed of in landfills.

Other than providing a glass recycling service, WGO also conducted different educational activities with the aim of arousing the sector's awareness of glass bottle recycling. WGO representatives visited and talked to the owners and staff of different bars and restaurants in Hong Kong, in order to introduce the service and discuss the details of the project. This face-to-face communication helped WGO to better understand the needs of the sector when it comes to glass bottle recycling, and helped the sector to learn more about the details of glass recycling.

Retired Uniform Upcycling Programme

Cultivating a culture of upcycling

In 2019, Hong Kong Baptist University (HKBU) initiated a retired uniform upcycling programme, which aimed to educate the wider community about waste minimisation and resource maximisation, and to develop a sustainable and replicable model for minimising textile waste.

Developing a responsible approach to handling retired uniforms

Prompted by its observation of the massive quantities of garments and uniforms disposed of every year, HKBU decided to create awareness of this textile waste problem. Its goal was to shed light on the unwanted uniforms discarded after orientations, corporate events and other branding and promotional activities, resulting in a negative impact on the environment. It found an opportunity to tackle this problem by extending the lifespan of uniforms through upcycling; with creativity, they can be transformed into many other useful items.

With a view to starting a conversation around the issue and encouraging the community to handle retired uniforms responsibly, HKBU initiated the Retired Uniform Upcycling Programme (the Programme) in 2019 in collaboration with Hong Kong Aircraft Engineering Company Limited (HAECO). The programme also aims, through a series of events, to inspire innovation, nurture talent and support people in need.

Inspiring innovation and nurturing future generations

The key component of the Programme is the "Upcycling's Got Talent Design Competition", which aims to inspire innovation for change while empowering the wider community.

The competition invited students and members of the public to utilise and transform retired uniforms provided by HAECO into travel accessories. More than a hundred entries were received, from entrants aged between 12 and 81. Talent and creativity were displayed in the variety of upcycled products received, ranging from eye masks, luggage tags and luggage covers to portable baby bassinets and convertible travel bags. The winning products, selected by the judging panel, were replicated and produced by mentally challenged people and women from low-income families for charity sale. The products will soon be made available on online platforms, and proceeds will be donated to support the environmental initiatives of non-profit organisations. In this manner, the Programme plays an important role in providing education and tools for social change.

Hong Kong Green Building Week and Other Community Engagement Programmes

As all human activities are executed in a built space, the built environment greatly influences our daily life. To accelerate the transformation of Hong Kong into a greener and more liveable metropolis, the engagement of the public is fundamental as their participation and behavioural changes are vital to the success of green building development.

As an overarching body for the local green building movement, the HKGBC is dedicated to putting in place specific educational and awareness programmes to promote green building concepts to the public. In addition to collaboration with industry elites, the HKGBC has also initiated cross-sectoral partnerships with external funders, NGOs, schools and shopping malls in recent years to broaden its community engagement work.

Hong Kong Green Building Week

Since its debut in 2013, the Hong Kong Green Building Week (HKGBW) continues to promote the development of green buildings and boost public awareness of a green lifestyle in Hong Kong. As an annual flagship public campaign in the territory, the HKGBW engages the public with exciting happenings. Funded by the Construction Industry Council, the event features a series of educational programmes in relation to green buildings and a sustainable lifestyle. These broaden the public's understanding of green buildings and their unique features, thus accomplishing the HKGBC's key mission to promote green building messages to the mass public.

www

"My Green Space" Student Competition

The younger generation are the future leaders of the green building movement. Since 2011,the "My Green Space" Student Competition (formerly the "My Green Space" Green Building Competition for Schools) has been held to educate students with green building knowledge and nurture them into pioneers who promote green building concepts. In the competition, students are encouraged to envision their ideal green spaces by incorporating creative ideas for the application of green building concepts into real-life built environments.

www

Friends of Green Building

"Friends of Green Building" is a platform established to keep the public updated about the latest green building education initiatives and upcoming activities of the HKGBC. Currently, the platform has successfully engaged over 2,000 Friends who are enthusiastic about green building and can serve as our ambassadors to further spread green building messages to their families, friends and neighbours.

www

HKGBC Jockey Club Green and Smart Community Buildings Project

The HKGBC and the Hong Kong Jockey Club Charities Trust led the "Green and Smart Community Buildings Project" from 2018 to 2019 with the aim of enhancing the knowledge and capacity of NGOs in Hong Kong regarding green and smart buildings, as well as to promote BEAM Plus Rating Tools among the NGO community and the public through community seminars and guided tours, engagement activities and roving exhibitions. After the completion of the Project, the capabilities of participating NGOs in operating and managing their buildings were found to be demonstrably enhanced.

www

HKGBC's Collaboration with External Funders for Community Engagement Projects

In the past few years, the HKGBC has actively extended its collaboration with external funders to launch a wider variety of community engagement projects. In this way, community members from all walks will have access to valuable green building resources and opportunities to contribute to the green building movement.

Jockey Club BEAM Plus in Schools Project

To echo Hong Kong's "Climate Action Plan 2030+" announced in 2017 by the Government, the "Jockey Club BEAM Plus in Schools Project", funded by the Hong Kong Jockey Club Charities Trust, is a project from 2020 to 2023 with the aim of aggressively reducing the carbon footprint of over 100 schools via BEAM Plus certification, and instilling green building concepts into the next generation through a wide range of school engagement activities for teachers and students.

www

ECF Green Building Education Video Series

Educating the younger generation on the importance of green building is always a top priority for the HKGBC. Funded by the Environmental and Conservation Fund, the "ECF Green Building Education Video Series" project from 2018 to 2019 raised P4-S6 students' awareness of green building concepts. Through a lively and interesting approach, the project deepened students' knowledge of the relationship between green building and environmental issues. We are pleased to report that environmentally responsible behavioural change was observed in the participating youths.

www

Hysan Urban Farm

A green community on a Hong Kong high-rise rooftop – Hysan Urban Farm

Hysan Urban Farm supports biodiversity and green education. Three workshops are conducted a year, each workshop lasting for 14 weeks. The starting dates are in January, April and September of each year, and around 55 fields are available for each workshop. Staff members of Hysan's project partner, the Sustainable Ecological Ethical Development Foundation (SEED), conduct hands-on workshops about organic farming on the rooftop of Hysan Place. Participants can choose to attend any workshop on each Tuesday, Friday and Saturday. Farming lots are assigned to each participant (some of whom are in teams with their family or friends). Throughout the workshop, participants learn how to grow different seasonal veggies and enjoy a fruitful harvest after their hard work. NGOs and local schools are also regularly invited to the farm on Tuesdays and Fridays.

The project has successfully promoted a work-life balance to participants, including Hysan's employees, office and retail tenants, community members and shoppers. The programme also affirms Hysan Place's status as one of the greenest buildings in Hong Kong. By promoting organic urban farming and green concepts on the rooftop, it has made a positive impact on the urban environment. Moreover, the workshop has provided an opportunity for people from diverse backgrounds to interact with one another, thus helping to promote social cohesion and inclusion. Communication and mutual help behaviours between different groups have been observed. The workshop has also strengthened the bonds among participating groups, including families, colleagues, the elderly and students with intellectual disabilities, ultimately encouraging reciprocity among participating groups to forge a mutual help network and build up social capital. A number of participants have stayed in touch through different social media channels and some have even become volunteers at the urban farm.

In parallel with these initiatives, a sustainable partnership with collaborating NGOs has been established. Hysan has likewise learnt to evaluate this long-term project from the perspective of its social impact. There is no doubt that the project has helped to promote the company's corporate image and build brand trust.

L&O Inspiring Youth Programme

Passing the torch

Leigh and Orange (L&O) launched its L&O Inspiring Youth Programme to educate a broad spectrum of students about decarbonisation, and green and healthy building designs. In 2017 and 2018, L&O also organised shadowing internship programmes for senior secondary students, which aimed to provide educational support for the growth of the next generation through a hands-on experience of sustainable building design.

In 2018, L&O and the Hong Kong Green Building Council co-hosted a sharing session on sustainable development, introducing a group of junior secondary students to wider social and environmental issues. In the following year, students from HKU Space with an interest in the sustainable building sector were invited to tour L&O's office space – the 'Living Studio' – which had gone through a recent remodelling following relocation. Taking a holistic approach to sustainability, new features such as energy-efficient lighting (light diffusers, occupancy sensors), air quality control (CO_2 sensors) and sustainable construction materials were all introduced in a biophilic design, integrating several facets of sustainability to create a healthy working environment.

In addition to the office visit, participating students received a tour of The Loop, a sustainable development exhibition centre at Taikoo Place which L&O helped to design. The exhibition aspires to foster environmental awareness and community engagement in sustainable initiatives through the provision of recycling facilities, an urban garden and various art installations.

These site visits were all intended to imbue students with a greater understanding of sustainable design, exposing them to environmentally conscious and energy-efficient initiatives around the office and beyond. Indeed, one of the key objectives of L&O is to use the built environment to secure a sustainable future for generations to come, which has profound implications on both a local and global scale. Its ongoing learning initiatives provide young individuals with inspiration to venture into the field of sustainability and to consider a potential path in sustainable urban design.

Using Virtual Reality (VR) Technology to Create Virtual Site Visits

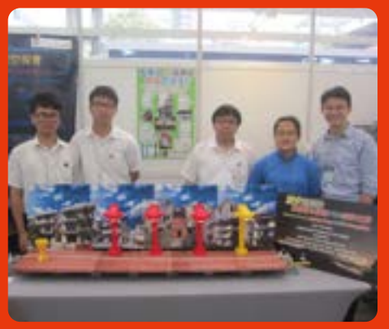



Virtual site visit at Zero Carbon Building

This project was motivated by the idea of creating "virtual site visits" to support courses that involve site visits as a teaching approach. One of the course learning objectives is to enable students to gain knowledge of green building. Site visits to the Zero Carbon Building are organised every year to enable students to interact with the built environment and to learn through observation. Recognising that VR technology is an effective tool in supporting architectural teaching, the project investigator Dr Cynthia HOU developed a project entitled "Using Virtual Reality (VR) Technology to Create Virtual Site Visits" with the support of a courseware development grant from CUHK and the Zero Carbon Building.

The project produced a VR video based on the Zero Carbon Building, showcasing the site environment with illustrations of all the green building features and designs. Two versions of videos were produced: a VR version and a web-based version. Students access each video through a specific online platform. Students can view the VR version with the support of their smartphones and VR headsets. The VR version gives students a 360-degree virtual experience, and students can control the direction and viewing process by adapting their physical movements with the VR video. Text captions and photos with interpretations and narration are combined into the VR video, and students can choose to access the embedded knowledge at their own pace.

Dark-sky-friendly Lighting Fixture STEM Competition



HKU engages students in reducing and promoting adverse effects of light pollution using STEM knowledge

Light pollution is a severe environmental problem in Hong Kong. BEAM Plus addresses this issue by ensuring that exterior lighting does not create unwanted and unnecessary light pollution. HKU researchers organised the Dark-sky-friendly Lighting Fixture STEM Competition in 2019 to raise public awareness of the severe light pollution problem in Hong Kong. Students and teachers were engaged to show how STEM (Science, Technology, Engineering, Mathematics) knowledge can be applied to reduce the adverse effects of light pollution.

In the Competition, students worked on outdoor lighting fixture products which can minimise or reduce the impacts of light pollution using STEM knowledge. The winning entry came from Fanling Kau Yan College titled "Smart Sensing Lamps Array with Progressive Intensity Change." The team visited Sheung Shui Wai and learnt how residents there suffered from light trespass originating from lamp posts. By applying multiple technologies such as 3D printing, programmable microcontrollers, displacement and ultrasound sensors, the students created a smart sensing street lamp array with adjustable light intensity based on the flow of pedestrian traffic, thus leading to a reduction in the intensity and the number of lighting fixtures required.

Winning entries of the Competition were showcased at the "STEM × SCM" event of the HK SciFest 2019 organised by the Hong Kong Science Museum in April 2019. The event was a large-scale outdoor fair and exhibition showcasing STEM project outcomes. Over the weekend, students and teachers introduced their winning entries and promoted light pollution reduction in person to thousands of members of the public, fully achieving the aim of community engagement.

ECF "The Drama of Climate Change and a Low-carbon Future"

Never too early for climate education

Seeing the close connection between our dietary habits and climate change, the Jockey Club Museum of Climate Change (MoCC), The Chinese University of Hong Kong (CUHK), launched the ECF "The Drama of Climate Change and a Low-carbon Future" project in 2018 with the support of the Environment and Conservation Fund (ECF) to educate the public, especially the younger generation, about the importance of making green choices and to encourage them to develop pro-environmental behaviour. The project consists of themed exhibitions, 'theatre-in-education', a social media campaign and other experiential learning activities.

Social media campaign and exhibition

The project began with a six-month informative social media campaign, followed by an "Eating Greener" exhibition (July to September 2019) at the MoCC, to encourage the general public to increase their intake of plant-based meals, thereby reducing the carbon footprint of the carbon-heavy meat industry. The exhibition was visited by nearly 10,000 people.

Drama tour

An educational drama on the theme of Combating Climate Change: Towards a Low-carbon Future was produced and premiered in September 2019. It then toured primary schools in Hong Kong, reaching an audience of over 9,000 in three months. The play appealed to young students and inspired them to adopt a more environmentally sustainable lifestyle to combat climate change.

Other experiential learning activities

To complement and strengthen the students' knowledge gained from the drama, guided tours of the MoCC on the CUHK campus and a series of school-based activities were also offered to the students.

Green Event Campaign

Be a Green Event!

Hong Kong has been named the "Events Capital of Asia". The city hosts different types (such as marketing events, festival events, sports events, etc.) and different scales of events almost every day. The common practice in the event industry is to use a tremendous amount of single-use products, like plastic bottles, cutlery, plastic bags, onsite decorations and souvenirs, all which are treated as waste immediately after the event.

Taking plastic bottles as an example, The Green Earth (TGE) conducted surveys at 15 running events (with 40,000 participants) from October to December 2017. 80% of the observed events distributed bottled water, while only 27% provided onsite recycling facilities. In the survey, half of the waste put into the events' refuse bins was found to be recyclable, including plastic bottles and plastic bags, which will take hundreds of years to decompose in our landfills.

The Green Earth has been promoting its Green Event Campaign since 2016. By providing environmental support and public education, the campaign aims to promote an environmentally responsible Green Event culture and reduce the environmental impact arising from events.

The campaign provides organisers with tailor-made waste reduction measures, which include educational and promotional support, dependable recycling services, a recycling evaluation report and fully trained onsite green event ambassadors.

Since the campaign began, The Green Earth has provided green support to more than 100 events, which scaled from 300 people to 100,000 people, including Oxfam Trailwalker, Pink Dot Carnival, Unicef Charity Run, and Stanley International Dragon Boat Championships, to name just a few. Over 178,000 plastic bottles, 27,000 cans and 5,800kg of food waste were saved from being dumped in landfills, while more than 300 ambassadors were trained to perform education outreach at future events.

Hong Kong Awards for Environmental Excellence

"Environmental Oscar" to Move Local Business Sector

The Hong Kong Awards for Environmental Excellence (HKAEE) is a prestigious annual environmental award that encourages businesses and organisations to adopt green management, and recognises their commitment and achievements in protecting the environment. The HKAEE identifies organisations in a total of 15 sectors from Small and Medium Enterprises (SMEs) and non-SMEs that demonstrate exemplary environmental performance. Competing entries are assessed on three criteria, namely Green Leadership, Programme and Performance, as well as Partner Synergy. All winners have to undergo a robust three-stage assessment mechanism, including initial assessment, on-site assessment and final adjudication, that examines in depth their performance in a wide range of aspects including waste reduction, energy and water conservation, pollution control, green procurement, community engagement, etc.

Since its launch in 2008, this Hong Kong "Environmental Oscar" has kept the entire business sector moving towards sustainable development, and attracted a growing force to join the cause. A record high of 2,524 entries participated in the 2019 HKAEE, more than six times the number in 2008.

Complementary to the award scheme is the Hong Kong Green Innovation Awards (HKGIA) under the HKAEE which recognises innovative, green and practicable ideas that have been turned into tangible gadgets, equipment or systems, resulting in real environmental benefits.

Over the years, the HKAEE has won the support from more than 13,000 enterprises from different business sectors in building a more sustainable Hong Kong. The scheme has not only showcased model enterprises, but also served as an ideal platform for "go green" companies and organisations from all sectors to meet and share their valuable experience in adopting best green practices through activities like seminars, visits and media interviews. During the assessment process, participating companies and organisations also gain free professional advice to help them strive for excellence in environmental performance.

"Mission Green" Series

"Mission Green" – a win-win, green path for all

To uphold corporate social responsibility and promote sustainability, Sino Group initiated "Mission Green" in 2008 to further its CSR efforts to promote green living while also supporting the less fortunate. This multifaceted series entailed a range of green and educational programmes covering urban farming, gardening, plant adoption, recycling, art, hydroponics and education, engaging not only the less resourced, but also staff, tenants and the broader community to create a win-win, green path for all.

Mission Green Top

"Mission Green Top" was the first programme under the Mission Green series. Started at Skyline Tower in collaboration with the Hong Chi Association in 2008, members of the Hong Chi Association are hired to care for the building's 1,000-square-foot rooftop garden in conjunction with the Sino team. The project has created profound benefits thanks to the concerted efforts of all participants. Produce is regularly harvested and sold at marketplaces held in the Group's commercial building lobbies. Over the years, 12 trainees, 130 colleagues and over 3,500 tenants have participated in this meaningful programme. More than 1,000kg of vegetables have been harvested, generating over HK$2 million of sales proceeds for the Hong Chi Association.

Apart from bringing green inspiration to commercial buildings, this programme has helped develop the potential of trainees. In addition to learning gardening, Hong Chi Association members acquire etiquette and social skills under the tutelage of their instructors. Their communication skills, concentration, self-confidence and EQ have significantly improved after joining the programme. Twelve Hong Chi Association trainees have participated in the programme, and half of them have since found jobs in the open market.

Mission Green Thumb

Following the well-received Mission Green Top programme, "Mission Green Thumb", a seedling adoption scheme, was launched in 2009. Combining gardening, social inclusion and community engagement, tenants of selected properties under the Group's management can adopt and name the seedlings tended by trainees from the Hong Chi Association. Sales proceeds, without deduction of costs, are pledged to the Hong Chi Association to support gardening training with the objective of enabling them to take up gainful employment opportunities. Hong Chi Association members also get better prepared for prospective employment opportunities and receive recognition for their gardening know-how. Over the years, over 400 seedlings have been adopted by kind-hearted tenants.

Following the success of Mission Green Top at Skyline Tower, the programme has been extended to Hong Kong Gold Coast, Pacific Palisades, Vision City and The Hermitage. In addition to the plant adoption scheme launched in 2009, the Mission Green series has been expanded to cover recycling, arts and education (2012), hydroponics (2015) and education (2018).

Neighbourhood Kitchen

Providing a safe place for local residents living in cramped sub-divided flats to cook and bond over food

Together with the Caritas Mok Cheung Sui Kun Community Centre, Grosvenor opened its first Neighbourhood Kitchen in Shek Tong Tsui in September 2018. Aimed at residents living in the neighbourhood's sub-divided flats, the purpose of the Kitchen is to improve the living standards of low-income families and to make a positive impact on the local community.

The Kitchen is furnished with professional food storage facilities and all the equipment needed to cook and bond over meals with family and friends. The Kitchen also partners with local wet markets, shops, restaurants, and charities for the daily collection of any unused or leftover resources. This not only helps reduce food waste in the community, but also benefits low-income families who struggle to purchase fresh ingredients, which can be quite costly.

Families who live in the sub-divided flats now come together to cook, share, and enjoy a meal together every day. This has slowly nurtured a support system for these families, encouraging them to help one another and share resources when in need. As a result, the Kitchen has become a safe place for these families that they can rely on, and where they can create happy memories with family and friends.

To support this community placemaking project, Cundall provided pro-bono services to Grosvenor in calculating the Social Return on Investment (SROI). The Principles of Social Value were applied throughout the exercise, and the analysis was conducted using The Impact Map as per the requirements of Social Value International. The study involved engaging with external stakeholders through close interaction (i.e., face-to-face interviews and questionnaires) to determine the material changes relevant to the Kitchen and quantifying changes into monetary values. It is estimated that the SROI of this project is HK$3.50 for every HK$1 of Grosvenor's investment.

Since its opening, the Neighbourhood Kitchen has welcomed approximately 50 registered members and received almost 900 drop-in visitors.

One from Hundred Thousand Symposia Series Season 4: Intergenerational Play Space Co-creation Workshop and Symposium

Play is for everyone! Co-create your ideal Intergenerational Play Space

"Double ageing" refers to the ageing of a place's population and its building stock. Play, being an effective way to promote spending time in outdoor spaces, is a good medium to encourage citizens to be more physically active. Providing an attractive and inclusive environment with suitable facilities can help to promote intergenerational play and improve the health and wellness of both elderly people and children. As such, "play" and "intergenerational interaction" combine to become a powerful mitigative measure to tackle "double ageing".

With the objective to explore intergenerational play as a driver of a new play space design concept in Hong Kong, JCDISI organised a series of co-creation workshops and a symposium in May and July 2019 to better understand the community's needs, concerns and aspirations regarding the planning and design of public open space. Seventy target attendees joined the participatory co-design process to develop their ideal play space designs by reimagining the public square in Prosperous Garden and the Kowloon Park fitness trail. These prototypes were studied and analysed to extract Six Design Considerations for Intergenerational Play Space:

a. Spatial integration
b. Age-neutral design
c. Intergenerational play equipment
d. Use of unique spatial characteristics
e. Use of available technology
f. User-centric management

These considerations are now being further tested. JCDISI will partner with the Hong Kong Housing Society (HKHS) as the Action Project Co-organiser to deliver an International Design Competition to transform Prosperous Garden. The winning proposals from the university and professional categories will provide insights for revamping this public space. On the other hand, as technical input is required for the Kowloon Park Fitness Trail project, a design consultant will be appointed to develop a detailed design scheme to transform the fitness trail. The ASD and LCSD will work with JCDISI as strategic partners to provide technical support for the project.

Smart City @ Kowloon East

Co-creating Kowloon East into a vibrant, smart and sustainable CBD2

Kowloon East is a pilot area in Hong Kong for exploring the feasibility of smart city development. The Energizing Kowloon East Office (EKEO) of the Development Bureau launched the Smart City @ Kowloon East initiative in 2016, engaging stakeholders in co-creating Kowloon East into a smart city district. After going through extensive public engagement exercises, EKEO formulated a framework for smart city development in Kowloon East, developed strategies to focus the efforts of all stakeholders, and set out priorities for smart city proposals.

EKEO adopted a people-centric, technology-focused and proactive approach to community outreach. Various public engagement exercises were conducted at different stages of the project to solicit public views, including public forums, symposiums, community workshops, focus group meetings, briefings to district councils and the media, meetings with IT and business sectors, publication of publicity materials (e.g., digests and advocacy statements), roving exhibitions, online voting, and an interactive online map and study website, all of which were deployed to invite stakeholders to express their views. Exhibitions were also organised to showcase the latest technologies in the market, which provided participants with first-hand experience of Hong Kong's advancement in the technological field.

To further engage stakeholders on a personal level, a mobile application entitled "My Kowloon East" was developed as a platform to disseminate useful real-time data and locational data of the district to drive informed decisions. Schools and universities were invited to participate in research, studies and competitions using Kowloon East as a testbed or case study. Apart from conducting proof of concept trials to address local issues, EKEO has facilitated smart city-related trials in Kowloon East by both public and private sectors, and fostered co-creation and cross-sector collaborations among government departments, industry, academia, research institutes and local/overseas stakeholders to realise the vision of smart city development.

Public and Industry Projects

Over the years, the Government and the industry have endeavoured to construct new buildings and retrofit existing buildings with a vision to create a sustainable built environment. Due to Hong Kong's unique high-rise, high-density and compact environment, there are many challenges to be faced. New and innovative strategies and technologies are constantly being introduced in both the public and private sectors to overcome these challenges. Through joint efforts, it is encouraging to see that the number of buildings being certified by BEAM Plus is steadily increasing - and providing yet further proof of the power of green initiatives.

In this chapter, we review the development of a number of public projects, including Hong Kong's first children's hospital, a columbarium and Garden of Remembrance, and a public housing project, all of which showcase the Government's determination to act as a role model in the green building movement. In industry projects, too, there are outstanding projects that showcase the adoption of innovative technology in design and planning, and also highlight the contribution of retrofitting existing buildings and revitalising historical buildings. It is hoped that the sharing of these successful cases will continue to inspire both the Government and industry players to usher in a new era of green building development.

A 30-Classroom Secondary School at Kai Tak Development (Site 1A-2)

The project has expanded the definition of sustainability to include well-beings, humanity and even equality. We believe the design's typological innovation and design approach are readily applicable to future projects, which will bring greater influence to the urban environment and people's understanding of green architecture.

by ***Joel CHAN Cho-sing***

Project Team

Project Name	A 30-Classroom Secondary School at Kai Tak Development (Site 1A-2)
Team or Organisation Name	Architectural Services Department
Name of Owner / Developer	Architectural Services Department
Project Manager	Architectural Services Department
Architect	P&T Architects and Engineers Ltd
C&S Engineer	P&T Architects and Engineers Ltd
M&E Engineer	P&T (M&E) Ltd
Landscape Architect	Urbis Limited
Quantity Surveyor	Northcroft Hong Kong Ltd
Environmental Consultant	AECOM Consulting Services Limited
Acoustic Consultant	AECOM Consulting Services Limited
Main Contractor	Hanison Construction Holdings Limited

Hong Kong's built environment is known for its density, which poses key challenges in horizontal movement, visibility and interactions. In this high-density urban environment, the captioned project aimed to create a practical, usable and aesthetically pleasing school environment, and endeavoured to achieve long-term sustainability in a holistic manner. Throughout the process, the aligned vision between the client, architect and government departments proved to be fruitful and catalytic.

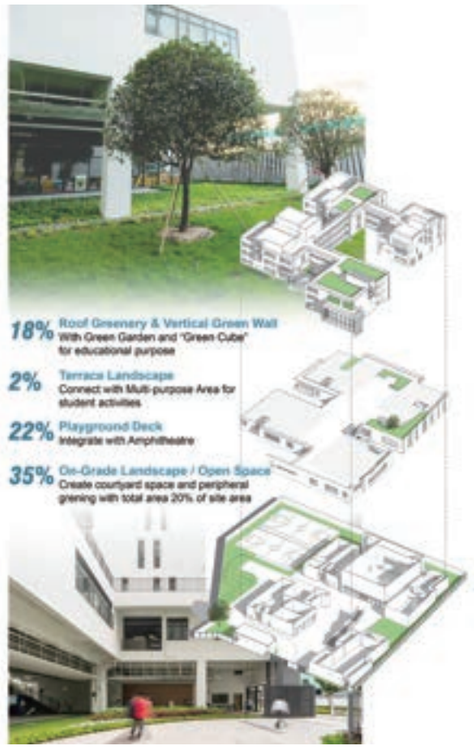
The conventional typology of Hong Kong's secondary school buildings consists of a seven- to nine-storey slab and an open area for a basketball court to fit in. This project challenged that traditional typology by applying critical thinking to achieve better spatial orchestration, including an innovative podium typology and "learning park" concept. A podium deck on the second floor is surrounded by four learning blocks connected by semi-open corridor-bridges. With the masses broken down and the ground raised, it gives a low-rise impression while also creating diverse open spaces in various orientations and locations. The resulting variety of space opens up new social opportunities and greatly enhances the environmental conditions in both interior and exterior spaces.

Passive design, instead of high-cost technologies, is adopted throughout the architecture. Ventilation and visibility are optimised around the podium deck with its surrounding blocks and bridges. Energy savings are enhanced by utilising nearby sea water for a district cooling system and solar panels. Natural lighting is likewise advanced by adopting window typologies that respond to solar angles, as well as multi-side lighting and pocket terraces.

Sustainability is reinforced by green space design, material considerations and encouraging active usage. The adoption of recycled materials includes bamboo signage and woodwool false ceilings, embracing materials that are durable, light and have a natural aesthetic quality. Used in tandem with prefabricated elements, these approaches not only created an ecological and responsible building, but also quality spaces that offer a biophilic and comfortable environment for delightful school lives.

Driven by a belief in "Green architecture beyond building Green", the project advocates a new definition of "green building" by integrating social wellbeing, passive design, sustainability and equality ideas into one. The comprehensive design included contextual and renewable resources, equal accessibility to natural light, social interaction around the podium, and eco software technologies. In recognition of its contextual, inspirational and responsible design and construction approach, the project received the Grand Award in the Green Building Award 2019. It also serves as a resilient and future-proof campus that will doubtless inspire future projects.

Passive design consideration throughout the building



Anderson Road Sites A and B (On Tai Estate)

This area used to be a barren quarry at the urban fringe, and it is now transformed into a sustainable green oasis in a new urban fabric. The greening is so extensive that whenever I stroll around, I can feel the fresh breeze and see the lush greenery in this pleasant and comfortable environment.

by a tenant living in On Tai Estate

The Anderson Road Quarry used to be barren land on the city's urban fringe. The Hong Kong Housing Authority (HA) introduced a series of sustainability initiatives on social, economic and environmental aspects to foster the vision of transforming the land into a sustainable housing precinct as part of a new urban fabric, creating a community that is inclusive, safe, resilient and sustainable.

Social sustainability is an integral part of this project. From project inception, the HA engaged local communities and the public via engagement workshops. Local needs and community aspirations formed the foundation for the planning and design of the project, coupled with a universal design approach to make it more inclusive. The HA also engaged local students, teachers and artists to upcycle the donated quarry machineries into estate artworks that showcase the interesting history of the quarry, creating a unique estate identity and nurturing a sense of belonging for the residents.

Economic sustainability is achieved by adopting an economically viable and cost-effective approach. The HA designed the typical floor with a precast rate of about 90% on plan to enhance buildability and cost-effectiveness. It likewise adopted the Integrated Procurement Approach (IPA), a combined building and foundation contract procured under a three-envelope tendering system considering price, technical and innovation aspects. Besides integrating builders' and designers' expertise at the early design and construction stages, which resulted in a saving of HK$7.7M by optimising the foundation design, the IPA also included the exploration of sustainable and innovative ideas. 5D BIM application, i.e., 3D BIM with additional time and cost dimensions, was explored as an innovative item and proved to be an effective construction management tool. The HA successfully utilised 5D BIM to forecast the extent of delays due to unforeseen obstructions at site access points, and to mitigate a delay of two months by better planning of resources.

Environmental sustainability is materialised by a significant reduction in the consumption of resources. With effective energy-saving measures, the energy consumption of communal services per flat is significantly reduced. On typical floors, over 50% of the concrete volume was prefabricated off site, saving nearly 7,000 trees due to less in-situ formworks, and reducing construction wastage by 70%. An on-site Concrete Batching Plant reduced the gas emissions of the concrete mixer trucks needed for delivery, saving 25,000 tonnes of concrete waste and reducing the carbon footprint by 134.8 tonnes. The incorporation of a W-trap configuration in the drainage system avoided the backflow of foul air in order to make the buildings more resilient to the spread of air-borne diseases via the drainage system. The pilot application of a Zero Irrigation System for tree planting also achieved water-savings of 2.3 million litres annually in a 1,500m^2 planting area.

The achievements of this project in various aspects were recognised by a number of awards including a Final Platinum rating under BEAM Plus, three stars in the China Green Building Label, a CIC Sustainable Award, Asia Pacific Project Federation of Project Management Award, and Hong Kong Institute of Project Management Award.

Project Team

Project Name	Anderson Road Sites A and B (On Tai Estate)
Team or Organisation Name	Hong Kong Housing Authority (HA)
Project Manager	Architectural Section 3, Development & Construction Division, Housing Department
Architect	Architectural Section 3, Development & Construction Division, Housing Department and Chau Ku Leung Architects & Engineers Limited
C&S Engineer	Structural Section 1, Development & Construction Division, Housing Department and AECOM Asia Company Limited
M&E Engineer	Building Services Section 1, Development & Construction Division, Housing Department and AECOM Asia Company Limited
Landscape Architect	Landscape Unit 2, Architectural Section 3, Development & Construction Division, Housing Department and ACLA Limited
Quantity Surveyor	C.S. Toh & Sons & Associates Limited
Sustainable Design Consultant	AECOM Asia Company Limited
Environmental Consultant	AECOM Asia Company Limited
Acoustic Consultant	AECOM Asia Company Limited
Main Contractor	Yau Lee Construction Company Limited

Columbarium & Garden of Remembrance at Tsang Tsui

Located at rural and costal setting, the Columbarium and Garden of Remembrance is designed to avoid sense of intimidation and anxiety, by embracing with the natural environment and dense landscaping. The columbarium is not a place for the death, but rather a space of transition – to reminisce, to forgive and to face the future. Light, Air and Water as the major ingredients of life are the main focus of design elements for this project.

by Architectural Services Department

In response to Hong Kong's Climate Action Plan 2030+ and the Government's call to develop a sustainable and low-carbon city and community, a columbarium and Garden of Remembrance at Tsang Tsui was designed and constructed with the integration of numerous green features and the adoption of green practices, which achieved a Provisional Platinum rating under BEAM Plus for New Buildings V1.2.

The Government is committed to promoting a quality living environment for the community and is actively taking the lead in the promotion of greening. As a government project, an extensive greenery area was provided within the site in terms of green roof, planters along the perimeter of the building, vertical greenery, water features, etc., equivalent to about a 41% greening ratio as defined by PNAP APP-152. In view of the usage of the columbarium, namely a building mainly used during festivals and only in daytime hours, the building was strategically designed with natural ventilation and daylight in mind to enhance its energy efficiency. The open façade, balcony approach, atrium and green features along the perimeter of the building allow free movement of air and light to the niches hall and bring a greater sense of liveliness to the surroundings. The green roof and green open spaces not only soften the man-made environment, but also act as thermal insulation. Landscaped green areas, a plaque wall, and a water feature in the Garden of Remembrance create a comfortable, soft and peaceful environment for visitors to remember their loved ones. The water feature, in particular, acts as a focal point for resting and meditation. A plaza is provided immediately next to the bus pick-up area for waiting and gathering purposes. Together with the water feature, a grand staircase acts as a focal landmark to identify the main entrance of the building. Amenity features, such as benches and shelters, are provided in the Garden of Remembrance and open plaza to maximise the usage of these spaces. The northern ends of the buildings and the Garden of Remembrance feature a panoramic coastal view that creates a linkage to the waterfront. The axis of the internal view likewise maintains visual permeability to the harbour. To discourage the use of private vehicles and taxis, and therefore to reduce air pollution, energy use and noise from traffic, the design only includes a bus drop-off area, bus pick-up area, taxi lay-by and drop-off area for persons with a disability. No private parking spaces are provided.

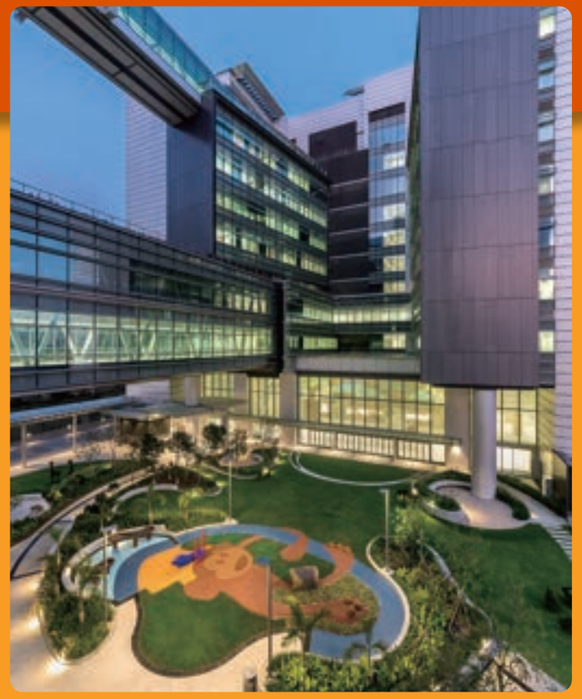
According to Hong Kong's Climate Action Plan 2030+, the Government set a 5% electricity consumption reduction target for government buildings in 2015, to be achieved by 2020. The building service system for this project was designed in accordance with the Building Energy Code 2012 (Rev.1), and has significantly out-performed that Code to achieve about a 26% energy reduction.

The colombarium also features a 600m^3 rainwater storage tank to harvest rainwater for irrigation purposes. It is expected that the annual recycled harvested rainwater will account for about 16.7% of the building's total freshwater consumption.

Project Team

Project Name	Columbarium & Garden of Remembrance at Tsang Tsui
Team or Organisation Name	Architectural Services Department
Name of Owner / Developer	Food and Environmental Hygiene Department
Project Manager	Architectural Services Department
Architect	Simon Kwan & Associates Limited
C&S Engineer	AECOM Asia Co. Ltd
M&E Engineer	AECOM Asia Co. Ltd
Landscape Architect	ADI Limited
Quantity Surveyor	Arcadis Hong Kong Limited
Sustainable Design Consultant	Allied Environmental Consultant Ltd
Environmental Consultant	Allied Environmental Consultant Ltd
Main Contractor	Leighton Contractors (Asia) Limited

Hong Kong Children's Hospital



The design aims to provide a welcoming experience by creating a children-friendly, home-like, comfortable and cozy environment in providing a world class clinical practice under a patient-centered approach to cater the needs of patients and families.

Numerous green technologies and environmental friendly materials are introduced to facilitate HKCH being the first public hospital has achieved Final Platinum rating under BEAM Plus NB V1.2.

The interior design emphasizes on "home-like" atmosphere which alleviate the traditional distressing perception of hospitals. Abstract trees, clouds and birds in lobbies to greet all users once they arrived. Nature lighting and warm coloured material created a calm and comfortable environment.

by Architectural Services Department

Hong Kong Children's Hospital (HKCH) is the first hospital in Hong Kong specialised for children and adolescents up to 18 years old with serious and life-threatening illnesses.

HKCH is sited within a hospital cluster at the South Apron of the Kai Tak Development. Together with a planned new acute general hospital on the adjacent site, it will form a medical hub for the district. Circulation and facilities are built in the completed hospital to cater for future integration with the other hospital blocks within the cluster to create a synergistic effect. It occupies a prominent waterfront location with extra-long frontage facing an unobstructed sea view, an advantage that has greatly contributed towards a positive healing process for patients. The design of the HKCH also caters for the future waterfront promenade to serve as a well-integrated outdoor space.

A 'podium-free' concept was adopted to enhance street-level connectivity with the surrounding neighbourhood and create a wind-corridor for better cross ventilation. The Central Garden between the two towers likewise connects seamlessly with the future waterfront promenade.

A welcoming sense of arrival

The drop-off area opens up to a large lawn area, which offers a direct view of the promenade and harbour, creating a pleasant sense of arrival. Accessible for all age-groups, a direct pedestrian covered walkway links up all the main entrances with the drop-off area and functional area. Abstract trees, clouds and birds are integrated in the architecture to greet all users on arrival.

Generous areas of soft landscape on the ground floor, terraces and roofs, as well as in the form of vertical greening, all have a profound healing effect to help to relieve stress, evoke empathy and balance emotion. A vibrant and dynamic façade composed of coloured patterned vertical glass fins and a touch of coloured cladding likewise lightens the atmosphere.

Each patient floor features a different habitat with animal graphics that provide a friendly and inspirational environment as well as creating storytelling opportunities that help to communicate with younger patients through sensory stimulation. Space is provided on the side of each in-patient bed to accommodate a foldable bed for patients' families to stay overnight, and there are 20 rooms in the parents' quarters for rest and grooming.

Strategic planning

Future link-bridges, as well as service tunnels at the basement level, are planned to connect the new acute hospital (still under construction) to form a medical hub. Visitors, patients and staff can make use of these connections as appropriate, and they also enable the efficient delivery of services and supplies in a controlled environment.

Precise traffic patterns and pedestrian circulation within the hospital ensure patients and supplies can be promptly attended to at all times. A clear and well orientated circulation pattern is achieved through simple and effective planning, with a Central Staff Base close to clusters of single rooms to enable easy staff accessibility. Open counters likewise create a friendly environment for patients and families to seek help. Satellite nurse stations, too, are carefully placed inside each ward to reduce the time required for staff to serve patients in need.

Project Team

Project Name	Hong Kong Children's Hospital
Team or Organisation Name	Architectural Services Department
Name of Owner / Developer	Food and Health Bureau / Hospital Authority
Project Manager	Architectural Services Department
Architect	Simon Kwan & Associates Limited
C&S Engineer	Meinhardt (C&S) Limited
M&E Engineer	J. Roger Preston Limited
Landscape Architect	ACLA
Quantity Surveyor	Rider Levett Bucknall Limited
Sustainable Design Consultant	Cundall Hong Kong
Environmental Consultant	ENVIRON Hong Kong Limited
Façade Consultant	Meinhardt Façade Limited
Acoustic Consultant	Shen Milsom & Wilke Limited
Main Contractor	China State – Shui On Joint Venture

Kowloon East Regional Headquarters and Operational Base-cum-Ngau Tau Kok Divisional Police Station

Farrells is fully committed to 'Place Making' design both in public and private sectors which is responsive to address the climate change challenge and has tirelessly strived to explore and incorporate sustainable elements which combat the impacts of building developments globally. Sustainable design such as enhanced land use and ecology, low carbon footprint, green transport, sustainable water cycle/life cycle, building fabric, renewable energy and use of technology has been strategically coordinated to maximize benefits to the good health and wellbeing of user and community as being easily maintainable and cost efficient. Early design consideration and engagement with stakeholders on the site context with building form and design coordination through to building services systems and fit outs detail is paramount to ensuring all elements of construction are fully utilized to maximize its sustainability.

by ***Mr Felix LI***
Director of TFP Farrells Limited and President of the HKIA

Kowloon East Regional Headquarters (KERHQ) and Operational Base-cum-Ngau Tau Kok Divisional Police Station is located at the north of Kai Tak Development (KTD). The building has varying operational uses, and is home to units with diverse operational hours. The design incorporates building fabric, renewable energy and systems, technologies, and E&M systems and fittings in a coordinated strategy to provide maximum benefit to the Hong Kong Police Force (HKPF) while also being easily maintainable and cost-efficient.

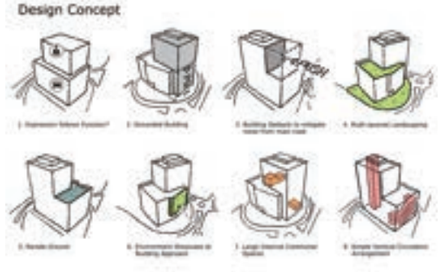
The intended design objective of the KERHQ was to create a welcoming entrance for the public facilities, and to portray a message of robustness and longevity of the HKPF as a key part of HKSAR services.

The building consists of an 18-storey tower above a basement structure with the following design features to compliment the local urban design and maintain its environmental sustainability:

- Energy-efficient envelope with low-E glazed curtain wall to ensure visible light transmittance, reduce light pollution and prevent heat losses. The solar shaded double-glazed curtain wall provides reduced solar gain thus reducing cooling loads. The double glazing also provides improved acoustic attenuation, improving the internal operational spaces and allowing HKPF staff to work comfortably. Vertical fins on the external façade include prismatic glazing, providing deeper penetration of daylight into the office floor plans and improving lux levels.
- In the car park, openings are introduced to facilitate natural ventilation. In particular, the east and north façades are more open, allowing efficient cross ventilation via the prevailing eastern wind flow, thus enabling further energy savings.
- Maximisation of site greenery coverage provides biodiversity and wildlife opportunities. The green roofs provide improved thermal performance and insulation to the roof slab. A vertical green wall is also located on the western façade of the car parking floors to provide visual interest and a softer appearance to that part of the complex. The design specified materials with recycled content or carbon neutrality to reduce the use of natural resources and lower the building's carbon footprint.
- Rainwater and condensate water is harvested and recycled for landscape irrigation.
- Energy-efficient features have likewise enabled a total CO^2 reduction of approximately 6,400,000kg:
    - The District Cooling System (DCS) at KTD is a large-scale centralised air-conditioning system. It utilises sea water to produce chilled water at central plants, and distributes the chilled water to consumer buildings in the KTD through an underground network of pipes. The DCS consumes 35% and 20% less electricity as compared to traditional air-cooled air-conditioning systems and individual water-cooled air-conditioning systems using cooling towers respectively.
    - Further energy-savings measures include demand control ventilation, an air-side heat recovery wheel, and free cooling to primary air handling units.
    - CO-based demand control ventilation helps to reduce car park energy consumption.
    - PV and solar thermal panels provide renewable energy sources.

Project Team

Project Name	Kowloon East Regional Headquarters and Operational Base-cum-Ngau Tau Kok Divisional Police Station
Team or Organisation Name	Architectural Services Department
Name of Owner / Developer	Government of the HKSAR
Project Manager	Architectural Services Department
Architect	TFP Farrells Limited
C&S Engineer	WSP (Asia) Limited
M&E Engineer	WSP (Asia) Limited
Landscape Architect	Urbis International Limited
Quantity Surveyor	C S Toh & Sons & Associates Ltd
Environmental Consultant	BMT Hong Kong Limited
Façade Consultant	HS&A Limited
Acoustic Consultant	MSKA
Main Contractor	Hsin Chong-Build King Joint Venture



Pilot Floating Photovoltaic (FPV) Systems at Impounding Reservoirs

Introducing photovoltaic panels at impounding reservoirs can kill two birds with a stone. It can slow down climate change as well as protect water resources and quality by reducing the evaporation of water and controlling the growth of algae.

by ***Mr WONG Kam-sing***
The Secretary for Environment of Hong Kong SAR Government

The WSD commissioned two pilot FPV systems at Shek Pik Reservoir and Plover Cove Reservoir respectively in 2017. These FPV systems generate electricity for use by the nearby pumping station and air compressors of WSD. Each of the systems is designed for a generation capacity of 100 kilowatts and can generate up to 120,000 kilowatt-hours of electricity annually, which is equivalent to the annual reduction of 84 tonnes of carbon dioxide emissions. Apart from the generation of renewable energy, the PV panels of these systems installed on the surfaces of the impounding reservoirs help reduce evaporation and suppress algae growth, thereby preserving water resources and quality. On the other hand, the cooling effect of the water in the impounding reservoirs improves the power generation efficiency of the PV panels. Most importantly, the FPV systems do not consume Hong Kong's precious land resources.

Project Team

Project Name	Pilot Floating Photovoltaic (FPV) Systems at Impounding Reservoirs
Team or Organisation Name	Water Supplies Department (WSD)
Project Manager **M&E Engineer** **Main Contractor**	CHO Ping Ho CHENG Yui Shing REC Engineering Co. Ltd and CLPe Solutions Ltd

Hong Kong is affected by typhoons in summer every year, including super typhoons in recent years such as Typhoon Mangkhut. The floating platforms for installation of the PV panels of the FPV systems are fixed with an anchoring system comprising heavy dead loads and stainless steel wires. The anchoring system is designed to withstand the waves caused by the typhoons' ferocious winds. The design also needs to cater for the fluctuation in water levels in the impounding reservoir.

Besides, the material of the floating platforms has been carefully chosen and tested to be safe for use in contact with potable water and does not cause pollution to the water in the impounding reservoirs. In addition, effort has been made to ensure that the FPV systems do not cause adverse ecological, environmental and landscape impacts, with due consideration given to the fact that the impounding reservoirs are located in scenic areas of Hong Kong's country parks. To minimise the visual impact, the FPV systems have been designed and located with a view to blending in with the surrounding environment, and the PV panels are made with anti-reflection solar glass.

To promote public awareness of the green initiative of the FPV systems, a display panel is provided at each site indicating the instantaneous power output and the cumulative electricity generated by the FPV systems for visitors' information. Performance information of the FPV systems is also available on the WSD's website.

The successful implementation of the two pilot FPV systems paves the way for the large-scale implementation of FPV systems in impounding reservoirs across Hong Kong, enabling the generation of more renewable energy and hence contributing to the city's sustainable development. Plans are now in progress to apply this FPV technology to other impounding reservoirs as well as a large-scale Floating Solar Farm at Plover Cove Reservoir.

Rank and File Quarters for Customs & Excise Department at Yau Yue Wan Village Road

Surrounded by natural greenery, the Rank and File Quarters for Customs and Excise Department at Yau Yue Wan Village Road promotes the model of Green Living by more than providing dwelling to end-users by encouraging environmental sustainability from spaces to materials; from outside to inside; from active to passive and from ground level to the roof.

by the Architect

Sustainable design was implemented throughout this project, from design and construction to operation and maintenance.

Situated on a sloped hill with a vast amount of natural landscape, it was important to minimise the building's footprint in order to reduce the impact of cut and fill on the surrounding ecosystem. The existing trees in the forecourt and the abundant trees in the natural terrain at the rear were preserved as much as possible so as to achieve harmony between architecture and nature.

In addition to roof greening, vegetation was planted at various locations such as the podium gardens and playground area, which blend in well with the surrounding natural greenery and further enrich the quality of these communal spaces. To facilitate a socially-integrated and harmonious community, the landscape features have been merged with facilities like seating, a play area and fitness equipment.

The project is at close proximity to Yau Yue Wan Village Road, which represents a traffic noise nuisance for the residences. Rather than constructing a solid barrier as a noise mitigation measure, the building is instead designed to be set back from the road, which also allows natural air to penetrate through a perforated fence wall.

The idea of weaving the building into the surrounding nature is encouraged by maximising cross ventilation along corridors on typical residential floors, which dramatically improves the indoor air quality. Together with the sun shading on the building's façade, these passive measures successfully reduce electricity consumption for air conditioning and promote environmentally friendly habitation.

Sustainable and recycled construction materials such as bamboo flooring were adopted in the project to reduce waste, while the use of regional materials further reduced transport cost and time.

By adopting water-efficient sanitary fitments, the overall water and electricity consumption and carbon dioxide emissions have all been successfully reduced. A rainwater recycling system is installed to collect rainwater for irrigation purposes. A total of 57 solar panels are installed on the roof of the building, which generates electricity for the grid, further contributing to the sustainability of the building. Together, the project's many environmental initiatives have enabled a reduction of operating costs while still achieving excellent energy performance.

Project Team

Project Name	Rank and File Quarters for Customs & Excise Department at Yau Yue Wan Village Road
Team or Organisation Name	Architectural Services Department
Name of Owner / Developer	Customs & Excise Department Department
Project Manager	Architectural Services Department
Architect	Andrew Lee King Fun & Associates Architects Ltd
C&S Engineer	Meinhardt (C&S) Ltd
M&E Engineer	J. Roger Preston Ltd
Landscape Architect	ACLA Limited
Quantity Surveyor	C.S. Toh & Sons & Associates Limited
Sustainable Design Consultant	Ramboll Hong Kong Ltd
Environmental Consultant	Ramboll Hong Kong Ltd
Acoustic Consultant	Ramboll Hong Kong Ltd
Main Contractor	Chinney Construction Co. Ltd

Water Supplies Department Tin Shui Wai Building

Setting a new standard for sustainable regional office cum education centre

by ArchSD Project Team

Project Team

Project Name	Water Supplies Department Tin Shui Wai Building
Team or Organisation Name	Architectural Services Department
Name of Owner / Developer	Water Supplies Department, HKSAR Government
Project Manager	Architectural Services Department
Architect	Leigh & Orange Limited
C&S Engineer	Mott MacDonald Hong Kong Limited
M&E Engineer	Aurecon Hong Kong Limited
Landscape Architect	Kenneth Ng & Associates Ltd
Quantity Surveyor	Currie & Brown (China) Limited
Sustainable Design Consultant	Aurecon Hong Kong Ltd
Environmental Consultant	Mott MacDonald Hong Kong Limited
Main Contractor	Chun Wo Construction & Engineering Co. Ltd

Water Supplies Department Tin Shui Wai Building is located at 20 Tin Pak Road, Tin Shui Wai, New Territories. It is a seven-storey building for the Water Supplies Department's regional office and a Water Resources Education Centre, known as the H2OPE Centre, which provides exhibits, live demonstrations and interactive games to enable visitors to gain a thorough understanding of water resources and water conservation in Hong Kong.

The site is bounded by a school to the south, and roads and a flyover on the other three sides. To respond to the proximity of the school, the building has a stepped form and is setback further from the school in its upper storeys.

To screen off the noise and dust from the roads and flyover, the building service core of lifts, mechanical and electrical plant rooms, and staircases are all located in the northern part, whereas offices are located in the southern part, thus maximising views to the gardens and football courts to the south. The building is oriented such that the main façade faces south to reduce heat gain, while the shorter side of the building to the east and west takes advantage of the prevailing wind from the east, enabling a naturally ventilated car park on the lower storeys.

A greywater recycling and rainwater harvesting system is one of the major attractions in the H2OPE Centre. Greywater collected from the wash hand basins and showers is recycled for toilet flushing. Rainwater collected from the roof is also recycled for irrigation. Any left-over fresh water supply from water wagons is recycled for cooling tower make-up water and for irrigation. Showcased to the public for educational purposes, this system effectively reduces the freshwater consumption of the whole building by over 50% while also reducing the amount of water discharged into the local drainage system.

The overall greening ratio of the project is over 30%. Extensive at-grade greening, vertical greening, green roofs and trees are abundantly provided for the enjoyment of staff and visitors. Trees are planted alongside the roads to screen off the traffic noise and provide a green buffer.

To efficiently reduce heat gain without sacrificing the view and natural daylight, Integrated Glass Units (IGU) with double low-e coatings have been adopted in both the curtain wall and the window wall, with sunshades strategically oriented on the external wall.

PV panels are installed on the top roof for generating electricity, and a light pipe is installed on the southern façade which significantly reduces the annual energy consumption of the building's artificial lighting.

Ambient lighting is lowered and supplemented with task lighting, and occupancy and daylight sensors in the office areas. Moreover, LED lights and motion sensors are installed in the car parking areas. This arrangement has achieved an overall energy saving of 5% on lighting alone.

With greening features, energy-saving devices and the application of renewable energy technologies, the project is predicted to save around 27% in electricity consumption when compared with general commercial buildings.

Building Information Modelling (BIM) was adopted in the planning, design and construction stage to optimise the building design and the construction activities. Upon completion of the building, the BIM model was handed over to the maintenance team for sustainable facilities up-keeping.

The project received a Platinum rating under BEAM Plus Assessment (New Buildings) in 2019.

eResidence

It will be an amazing and remarkable experience to have the latest technology in the fingertips of the residents enjoying all the convenience of modern life while the living environment is embraced by greenery and sustainable features like living in an oasis in the city for the Hong Kong residents who buy their first homes under the Starter Homes Pilot scheme in an affordable way.

by ***Zenith CHAN***
Project Director of P&T Architects and Engineers Limited

"eResidence" is a Starter Homes Pilot Project in Hong Kong, developed by the Urban Renewal Authority (URA). Located at 8 Hok Yuen Street, it consists of a one-storey underground car park, a four-storey podium containing commercial / community facilities, and two 29-storey residential towers. In order to soften the podium massing and give a breath of fresh air to the surrounding old city fabric, the podium is separated into two portions, with a footbridge linkage, creating a wind corridor for air movement across the site. The at-grade open space and podium garden provide the public and residents with an enjoyable green environment. Besides, the towers are raised up by transfer plates to further enhance air movement. The provision of low-E double glazing on major façades of the towers, together with a rich variety of green construction materials, provide residents with a sustainable way of living.

URA actively encourages the concept of communal living. Communal laundry and storage are provided in the podium, saving valuable space inside the residential units and introducing a sustainable way of sharing facilities and reducing waste. The residents' clubhouse is also designed with flexible spaces to enhance residents' interactions and promote a co-living spirit.

In addition, a Smart Display System installed in each residential unit aims to encourage behavioural changes by providing the unit owners with near real-time, holistic and long-term data of their energy / water consumption, waste generation and air quality levels. To help unit owners achieve energy-saving targets more effectively, the system offers a pre-set personal alert function on electricity/gas usage and air quality levels together with pop-up tips designed to raise energy conservation awareness. Moreover, the system promotes the smart building concept by making use of various information and communication technologies to improve the efficiency of facility management.

To achieve a green and sustainable building design, the development has maximised the greenery provision to 30% of the site area for the enjoyment of residents and the public. The cascading greenery to the podium offers visual relief among the concrete jungle and promotes a healthy and resilient neighbourhood. A total of 37 photovoltaic panels and 16 building-integrated photovoltaic panels are installed on the tower roofs and above the 3/F covered walkway respectively. Together, these generate some 12.9kW of renewable energy, which is connected to the CLP Power Hong Kong Limited electricity grid.

To reduce carbon emissions and the greenhouse effect, over 20%, 47% and 15% reductions in annual energy consumption have been achieved in the residential towers, car park and retail areas respectively. This has been achieved through the use of intelligent design features such as high-performance and efficient air conditioning, LED lighting in all indoor common areas of the development, occupancy sensors, photocell sensors, and demand control of ventilation fans in the car park, window glazing with a low shading coefficient, and a lift motor regeneration system in all passenger lifts.

BIM was applied throughout the project and won the Autodesk Hong Kong BIM Awards 2018. This eliminated abortive works and streamlined the use of resources thanks to an automatic calculation of the saleable area.

In recognition of all these important features, the development achieved a BEAM Plus Provisional Platinum rating.

Project Team

Project Name	eResidence
Team or Organisation Name	Urban Renewal Authority
Name of Owner / Developer	Urban Renewal Authority
Project Manager	Urban Renewal Authority
Architect	P&T Architects and Engineers Limited
C&S Engineer	Meinhardt (C&S) Ltd
M&E Engineer	Wong & Ouyang (Building Services) Ltd
Landscape Architect	ADI Limited
Quantity Surveyor	Currie & Brown (China) Limited
Environmental Consultant	AECOM Asia Co. Ltd
Main Contractor	Gammon Construction Limited
Others (BIM Consultant)	Vircon Limited

Mount Pavilia

The Artisanal Movement – bearing an artisanal spirit and crafting brand new living cultures MOUNT PAVILIA. Echoing the new sustainability philosophy, MOUNT PAVILIA introduces Sculptural Park Living Concept which perfectly interprets the essence of "We Create, We are Artisans". The project fully reflects the unique character of The Artisanal Movement – bearing an artisanal spirit and crafting brand new Green living cultures.

by ***Dr Adrian CHENG***
Chief Executive Officer and
Executive Vice-Chairman of
New World Development Company Limited

Mount Pavilia is a low-density residential development located on the Sai Kung peninsula, often referred to as "Hong Kong's back garden". It was designed to create a home in nature, with a community that embraces a sustainable lifestyle and provides a blueprint for the future of eco-living under the new concept of "Green & Art".

From the outset, a holistic sustainability framework was adopted covering green issues, wellness, smart living, caring, and contributing to SDGs, all of which were emphasised in the design process. The end result is a development that is well-integrated with a variety of green amenities, landscape features and leisure features.

A wide selection of diverse and native tree and plant species can be found throughout the development, comprising some >1200 trees from >35 species and >300,000 shrubs from >200 species. Care has been taken to re-establish this natural habitat, and species have continued to return even after the building's occupation. Residents are now able to enjoy the biophilic design and co-exist with nature. In order to further interact with nature, residents are encouraged to participate in planting activities, enabling them to experience the joy of urban farming.

Residents at Mount Pavilia can also experience and observe a dazzling micro-ecosystem through Hong Kong's first landscape-integrated aquaponics system. This 145m^2 balanced aquatic ecosystem uses water from a fishpond containing fish waste as plant nutrients in hydroponic farming. The effluent from the hydroponics is then filtered and fed back to the fishpond. Much more than an educational facility, this system demonstrates the potential of integrated farming systems in future built environments, where water and fertilizer are used intelligently for sustainable farming.

The building's climatic-responsive, cascading profile with intermittent breaks in the building mass is specifically designed to enhance air flow into the development. Residents can also enjoy cycling along a 950m cycle track through a bike-sharing system, and walking on a curb-less and barrier-free street in the gentle breeze, all of which encourages an active lifestyle and promotes low-carbon transportation.

Mount Pavilia is likewise home to the largest renewable energy generation system in a Hong Kong residential development. A total of thirteen 3kW wind turbines and 80m^2 of PV panels installed on the roof contribute 100% of their energy back to the building's common areas and main lobby lighting. In addition, 30m^2 of solar hot water panels provide enough hot water for 50 showers per day.

Apart from renewable energy, resource conservation is a key element in the creation of a sustainable community. A food waste conversion unit and reverse vending machine enable waste to be reused and recycled on site. A local circular economy is also being realised at Mount Pavilia, with residents' organic food waste decomposed to fertilizer that is then used in the urban farm for food production.

This commitment to sustainable and wellness-oriented design extends to the residential flats, including cross ventilation, daylighting and solar heat gain control, promoting a sustainable lifestyle that embraces the natural environment. Maximum daylight penetration and fresh air for all floors are achieved by a stepped terrace garden and corner windows. As a consequence, daylight performance meets international standards (sDA 300,50%, US WELL Building Standard), which means at least 55% of the floor area receives at minimum 300 lux of sunlight for over 50% of the year. An in-house conservatory is also provided for home farming to echo the theme of eco-living.

Project Team

Project Name	Mount Pavilia
Team or Organisation Name	New World Development Limited
Name of Owner / Developer	New World Development Limited
Project Manager	New World Project Management Limited
Architect	Wong Tung & Partners Ltd Mass Studies (Retail & Clubhouse)
C&S Engineer	C.M. Wong & Associates Ltd
M&E Engineer	WSP Hong Kong Ltd
Landscape Architect	Adrian L. Norman Limited Axxa Group Limited
Sustainable Design Consultant	Arup
Environmental Consultant	Arup
Main Contractor	New World Construction Company Limited

Victoria Dockside

My vision is to reinvigorate the district (Victoria Dockside) together with 100 Creative Powers hailing from different disciplines and cultures, to inject art, architecture, design, sustainability and all forms of cultures into the new consumer's daily life.

by ***Mr Adrian CHENG***
Executive Vice Chairman & CEO,
New World Development and Founder, K11

Victoria Dockside (VD) is Hong Kong's first purpose-built art, design and cultural district, situated in a historic harbourfront site in Tsim Sha Tsui. The district comprises a 65-storey tower (Rosewood Hong Kong and Grade-A office K11 ATELIER), a 21-storey luxury residence K11 ARTUS, and a 10-storey cultural-retail destination K11 MUSEA. Positioned as the Silicon Valley of Culture, VD redefines the traditional modes of life, work and play to propagate a vibrant new culture of art, architecture, design and sustainability.

VD was originally founded as Holt's Wharf in 1910 and its redevelopment began in 2009 to create a culturally enriching district for local and global communities. VD re-energises the waterfront by transforming the promenade into a welcoming public space with design features certified to SITES v2 Gold together with the public display of artworks. The redevelopment echoes the Sustainability Vision 2030 (SV 2030) of its developer, New World Development, which is inspired by the United Nations SDGs to enhance the customer experience through the four pillars of Green, Wellness, Smart and Caring.

VD was the first large-scale mixed-use development to apply the Sustainable Building Design Guidelines of the HKSAR's Buildings Department. Separating buildings along a north-south and east-west direction, the development draws sea breezes into the inland of the Kowloon Peninsula and allows the flow of prevailing wind to create a better microclimate and mitigate urban heat island effects. The development also houses Hong Kong's first urban biodiversity museum – Nature Discovery Park – within K11 MUSEA. Planted with approximately 180 greenery species, the Park offers a nature tour, sustainable lifestyle workshops, and eco education programmes with the Jane Goodall Institute, the University of Hong Kong and other relevant institutes to raise public awareness. The Park also offers farming workshops and farm-to-table catering events. Since opening in September 2019, the Park has welcomed over 26,000 visitors.

K11 ATELIER achieved U.S. LEED (Platinum), whereas K11 MUSEA and K11 ARTUS have attained U.S. LEED (Gold). K11 ATELIER rooftop has one of the largest façade-integrated solar PV systems in Hong Kong. The energy intensity of K11 ATELIER is 1.5 times lower than typical Hong Kong office buildings thanks to its high-performance chiller and high-performance façade. K11 MUSEA sets a new benchmark for green design with an interior featuring natural materials such as limestone and wood. K11 MUSEA also harvests rainwater to provide 100% of its irrigation water, and operates a seawater-cooled and oil-free HVAC chiller system.

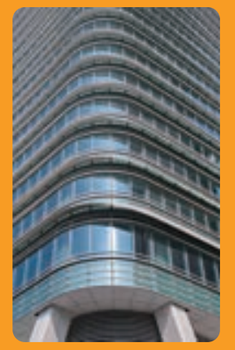
To create a sustainable living environment, the developer considered the long-term integrity of the ecosystem and climate risks in its building design, operations, procurement and commercial offerings. To achieve the SV2030 decarbonisation target, VD's seasoned facilities management team have deployed an intelligent Building Management System (BMS), installed smart meters and invented an "eco diving robot" to clear debris in the heat rejection system of its seawater-cooled chillers. K11 ATELIER and K11 MUSEA have likewise launched Hong Kong's first voluntary Sustainable Tenancy Pledge for office and retail tenants, which offers guidelines for sustainable fitting-out and operations, free smart metering to optimise energy efficiency for offices, bespoke consultations for retailers, and waste and recycling management services to reduce waste.

VD was awarded the Grand Award (Commercial Buildings – Completed Projects) and a Special Citation on UNSDGs by the Green Building Award 2019 organised by HKGBC.

Project Team

Project Name	Victoria Dockside
Team or Organisation Name	New World Development Limited
Name of Owner / Developer	New World Development Limited
Project Manager	New World Project Management Limited
Architect	Design Architect - Kohn Pedersen Fox Associates (KPF) Executive Architect - Ronald Lu & Partners
C&S Engineer	Ove Arup & Partners Hong Kong Ltd
M&E Engineer	WSP (Asia) Ltd
Landscape Architect	Landscape Design Architect: James Corner Field Operations (JCFO) Landscape Design Consultant (Hotel & Special Features): PLandscape Co Ltd Executive Landscape Architect: Urbis Limited
Quantity Surveyor	Rider Levett Bucknall Limited
Sustainable Design Consultant	Ove Arup & Partners Hong Kong Ltd
Environmental Consultant	Ramboll Hong Kong Ltd
Façade Consultant	ALT Cladding Inc
Acoustic Consultant	Shen Milsom & Wilke Ltd (Overall) Ove Arup & Partners HK Ltd (Cinema)
Main Contractor	New World Construction Company Limited

18 King Wah Road



18 KWR is designed to be Intelligent & Green not only for its tenants but for the entire society.

by ***Vincent CHENG***

Working with the local authority, 18 King Wah Road (KWR) was made possible through a change of zoning, revitalising a former industrial neighbourhood on Hong Kong Island. The project combines a sustainable, innovative and aesthetic design with amenities for local people. A dedicated, green public passage connects the community with a waterfront park where people can simultaneously enjoy both the natural and built environment. The building is designed with this in mind. Its aerodynamic shape, large building setback and extensive greenery improve the local microclimate, enhancing the community's enjoyment of the space and building a vision for a sustainable neighbourhood and a sustainable city. The building, for both occupants and members of the community, was built around the idea of "people-friendly sustainable design that goes beyond".

From the outside, the most striking feature of KWR and its vision for sustainability is the Solar Responsive Façade. Extensive external shading and high-performance glazing combine to minimise solar heat gain while maximising daylighting. The depth, angle and orientation of the shading changes across the façade based on extensive glare and daylighting studies. Motorised solar blinds work with daylighting sensors to optimise interior visual and thermal comfort, while light shelves help to diffuse daylight further into the floorplate. To those outside the building, the high-performance façade is evidence of Hong Kong's moves towards a sustainable city, while for those inside the building, it is evidence of KWR's environmentally sustainable operations.

The HVAC system contains several innovations to both improve wellbeing and reduce energy consumption. Solar Desiccant Dehumidification uses solar thermal energy to regenerate the desiccant, using significantly less energy to reduce the humidity of intake air compared to conventional methods. An area of urban landscaping outside the fresh air intake enables the system to take advantage of evaporative cooling, further reducing cooling and dehumidification requirements. Operable windows are available to tenants – linked with the on-site weather stations and the intelligent Building Management System – to provide the option of natural ventilation when outdoor weather conditions allow. This feature is unusual in Hong Kong where office spaces are typically air conditioned year-round. To improve occupant wellbeing, fresh air ventilation provision is 30% above reference, with the operable windows enabling better local ventilation.

Further measures that improve operational sustainability include energy-efficient interior lighting, a PV installation on the roof, and the addition of electric vehicle charging in 100% of the parking spaces which encourages the use of sustainable transport to and from the development.

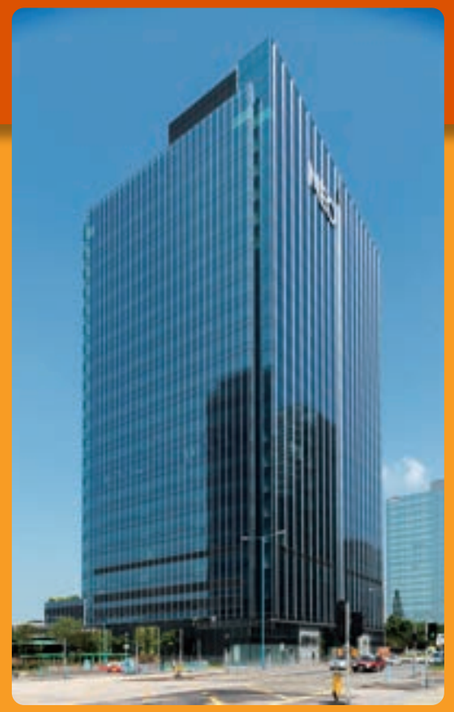
To reduce the quantity of waste being sent to landfill, all paper, metal and plastic is sorted on each floor in a specially designed separation chamber and transferred via a trolley along a dedicated path to a central sorting space in the basement. Food waste is also collected and addressed using a food decomposer, where 95% of the mass is turned into gas and water.

This integrated design and operation system focuses on developing a truly sustainable building. It achieved three prestigious Green Building certifications, namely LEED CS Platinum, BEAM Plus Platinum, and China Green Building Label 3-Stars.

Project Team

Project Name	18 King Wah Road
Team or Organisation Name	Henderson Land Development Company Limited
Name of Owner / Developer	Glory United Limited
Project Manager	Henderson Land Development Company Limited
Architect	DLN Architects Limited
C&S Engineer	Stephen Cheng Consulting Engineers Limited
M&E Engineer	P&T (M&E) Limited
Landscape Architect	ADI Limited
Quantity Surveyor	WT Partnership
Sustainable Design Consultant	Ove Arup & Partners Hong Kong Limited
Environmental Consultant	Ove Arup & Partners Hong Kong Limited
Façade Consultant	Hyder Consulting Limited
Acoustic Consultant	Allied Environmental Consultants Limited
Main Contractor	E Man Construction Co. Ltd
Design Architect and Interior Designer	Pelli Clarke Pelli Architects
Lighting Consultant	Sirius Lighting Office (HK) Limited
BIM Consultant	isBIM Limited
Planning Consultant	Pro-Plan Group

8 Bay East / NEO



Through a holistic planning and well-thought design, 8 Bay East / NEO adopts many green design features and chooses building materials from sustainable sources. The project not only minimizes energy and water consumptions but also delivers outstanding performance to save the long term operational cost. The development has been awarded with dual Platinum certificates (BEAM Plus and LEED), demonstrating Wheelock long-standing dedication to environmental work. Additionally, the readiness of WELL certification provisions is also recognized in this project.

by Wheelock's Project Management team

Located in the heart of Hong Kong's CBD2, 8 Bay East / NEO is a sustainable Grade-A commercial building with a total gross area of approximately 600,000 square feet. The development not only achieved dual Final Platinum for BEAM Plus and LEED certifications, but also features WELL certification provisions for a wellness-based environment.

8 Bay East / NEO is a redevelopment project, which achieved a recycling rate of 100% for building demolition waste and approximately 70% for construction waste throughout the construction period by adopting the '3R' principles, namely Reduce, Reuse, Recycle.

The developer, Wheelock, adheres to a green procurement policy that only accepts contractors with proven records in the implementation of an Environmental Management System (EMS) and satisfactory sustainability performance. By using a Building Information Modelling (BIM) integrated approach, 261 installation clashes were avoided and 1,420 sheets of A0 paper were saved, equivalent to a reduction in carbon emissions of 545kg.

The design of 8 Bay East / NEO boasts a minimised podium with the tower positioned at the north-east site boundary to encourage prevailing winds to reach the pedestrian level. In this way, the air ventilation flow can be improved by up to 400% in Hoi Bun Road Park. Furthermore, a relatively high window-to-wall ratio helps maximise the use of daylight, while highly-efficient solar control façade glass with an ultra-low shading coefficient and low reflective index are in place to reduce solar heat gain and glare.

Over 32% of the development is greenery, including a green roof, podium greenery and vertical greenery. This greenery helps to mitigate the urban heat island effect, thus cooling the surrounding environment, in particular the high-density office area. A photovoltaic (PV) panel system covering an area of 489m^2 is installed on the roof, generating solar power to fulfil 2.5% of the electricity needs of the common areas while still maintaining 491m^2 of green roof. NEO / 8 Bay East features 1,472m^2 of total landscaping area, and its roof area is finished with a high solar reflectance index of 80 to significantly reduce solar heat gain. Through an iterative landscape design, 247m^2 of pervious pavers with 50% recycled content are used for storm water management.

Despite already meeting a high standard – including best-in-class air-conditioning chillers, the market's leading Building Management System (BMS) and an aggressive 70% reduction in lighting power density through the integration of daylighting features – Wheelock went further to reduce the number of lighting systems while still maintaining the same lux level by integrating a nano-technology coating within the office lighting systems. This nano-coating helps to better reflect light waves and fulfil lighting needs. Thanks to all these efforts, the building's overall energy consumption is reduced by 38% compared to ASHRAE Standards.

Electric vehicle charging connections are available, and the car park space is linked to a Smart Parking System mobile app, resonating with the smart city mission of Energizing Kowloon East.

To maintain long-term, environmentally friendly operations, energy and water efficiency are vital. The building's green provisions reduce 4,512 MWh of electricity consumption, which is equivalent to a reduction of 2,455 tonnes of CO_2 emissions, and also save over 8 million litres of potable water and 31 million litres of flushing water, which are enough to fill up 19 Olympic-sized swimming pools.

A life-cycle approach was adopted in the sustainability enhancement analysis. A BMS system is used to control and monitor the mechanical and electrical equipment. By monitoring day-to-day operations and providing a track record for operations improvement, the BMS system enables sustainable operations in the long run as well as identifying extra cost savings.

Project Team

Project Name	8 Bay East / NEO
Team or Organisation Name	Wheelock Properties (Hong Kong) Limited
Name of Owner / Developer	LVGEM / Wheelock Properties (Hong Kong) Limited
Project Manager	Wheelock Properties (Hong Kong) Limited
Architect	Ronald Lu & Partners (Hong Kong) Limited
C&S Engineer	C M Wong & Associates Limited
M&E Engineer	Meinhardt (M&E) Limited
Landscape Architect	Gravity Green Limited
Quantity Surveyor	Rider Levett Bucknall Limited
Sustainable Design Consultant	CO_2nnsulting Limited
Environmental Consultant	CO_2nnsulting Limited
Façade Consultant	AECOM Asia Co. Ltd
Acoustic Consultant	Environ Hong Kong Limited
Main Contractor	Hip Hing Construction Co. Ltd
International Interior Designer	Rottet Studio
Local Interior Designer	ARK Associates Limited
Wind Tunnel Studies Consultant	BMT Fluid Mechanics Limited

AIRSIDE

Situated at the former Kai Tak Airport and at the heart of the upcoming CBD2 of Hong Kong, this iconic development will revitalise and transform the site into a sustainable hub for its community. Exercising in the extensive landscape, enhanced outdoor comfort at the amphitheatre which can double as an event space, automatic bicycle parking to encourage green mobility, automated smart waste sorting and storage, efficient centralised district-cooling and indoor air quality awareness incorporates sustainable living into the daily lives of its community comprising of nearby residents, visitors and businesses in the bustling core of the new Kai Tak CBD2.

by ***Christy CHOW***
Sustainability Consultant

Nan Fung's commitment to sustainable city development is evident in its portfolio of residential, commercial and revitalisation projects. Its recent Grade-A Office and Retail Development in Kai Tak NKIL6556 is at the core of the new CBD in the Kai Tak Development, situated next to Kai Tak MTR Station and Station Square. It will be the tallest development in the area, surrounded by residential and commercial buildings, parks, and sport and cultural facilities. The project incorporates the United Nations' Sustainable Development Goals (UNSDG) into the site's sustainability blueprint and uses CO6 Metrics, targeting to achieve the highest ratings across five major and globally recognised green building certifications, namely LEED v4 Platinum (pre-certified), BEAM Plus New Building V1.2 Platinum (provisionally achieved), WELL V1.0 Platinum (pre-certified), BEAM Plus Neighbourhood V1.0 Platinum (final certification achieved), and China Green Building Label 3-Star (final certification achieved).

Overlooking the Kai Tak River, the future Kai Tak Sports Park, and Victoria Harbour, visitors can enjoy the waterfront view from a podium roof featuring 1,700m^2 of various types of greenery. This podium roof is publicly accessible, providing extensive open spaces with multipurpose areas for various types of activities and a place of respite. There will also be an urban farm on the colonnade roof overlooking Station Square, offering a sustainable food harvesting experience. In collaboration with a local research institute, a designated landscape will also act as a bio-filter by collecting the building's greywater, which will be filtered by the planted areas to improve water quality and reuse for irrigation – an innovative approach to recycling water within the development compared to traditional water purification.

Based on an assessment of the prevailing winds and the local microclimate in the area, an urban window between two towers was designed to significantly improve ventilation of the podium. With thermal comfort a high priority, sitting areas use innovative cooling panels and air induction units will also be installed. PV panels will likewise be installed to provide shading and, from initial studies, will generate enough electricity for the average consumption of 700 residential units in Hong Kong.

The building's orientation is designed to maximise sunlight. Through glare studies and advanced computations, the profiles and sizes of the façade's vertical shading fins have been optimised to reduce solar heat gain while still preserving a fabric-like façade design – a flashback to the Nan Fung Group's founding business and its roots as a textile manufacturer.

Complementing the Government's initiative to encourage the use of green transport in the Kai Tak neighbourhood, bicycle users can enjoy an extensive cycling track network in the area and will, for the first time, gain local experience of using underground automatic bicycle parking facilities, and premium end-of-trip facilities including showers and changing rooms.

The development also has a built-in Automatic Refuse Collection System. Tenants will be encouraged to separate recyclable waste from general waste, which will then be weighed, transported and stored in a centralised and enclosed facility in a hygienic manner. This allows the development to be future-proof as the industry moves towards green leases, and as Hong Kong prepares for its soon-to-be-launched mandatory waste charging scheme.

By passing on the development team's 5D BIM model, the property manager can take full advantage of the embedded network of Internet-of-Things (IoT) devices and sensors. A sophisticated sub-metering network feeds real-time information to a digital platform which consolidates data sourced from disparate building systems and will use machine-learning processes to evaluate and forecast building performance to formulate building operation and maintenance-saving strategies.

Project Team

Project Name	AIRSIDE
Team or Organisation Name	Rich Union Development Ltd (Wholly owned by Nan Fung Group)
Name of Owner / Developer	Rich Union Development Ltd (Wholly owned by Nan Fung Group)
Project Manager	Rich Union Development Ltd (Wholly owned by Nan Fung Group)
Project Architect	Ronald Lu & Partners (Hong Kong) Ltd
Design Architect	Snøhetta Overseas Architecture
C&S Engineer	Ove Arup & Partners Hong Kong Ltd
M&E Engineer	Ove Arup & Partners Hong Kong Ltd (Podium) J. Roger Preston Ltd (Tower)
Landscape Architect	Urbis Limited
Quantity Surveyor	Arcadis Hong Kong Limited
Sustainable Design Consultant	Ove Arup & Partners Hong Kong Ltd
Façade Consultant	Ove Arup & Partners Hong Kong Ltd
Acoustic Consultant	Shen Milsom & Wilke LLC
Main Contractor	Hip Hing Construction Co. Ltd
Executive Interior Designer	Ronald Lu & Partners (Hong Kong) Ltd

Conservation and Revitalisation Works at 600-626 Shanghai Street

Though the innovative and sustainable building design of "618 Shanghai Street", it could be a showcase for the future conservation and revitalization projects in Hong Kong to give new life to the old buildings by integration of old and new elements, and thus continue the roles and functions of historic buildings in the community

by ***Joseph TANG***
Director of Chau Lam Architects & Associates Architects & Engineers (H.K.) Ltd

The combination of old shophouses and new building structures with modern building services creates a unique streetscape. This is particularly evident at 618 Shanghai Street, an Urban Renewal Authority (URA) heritage conservation and revitalisation project that was launched at the end of 2019. The Project bears all the hallmarks of URA's vision, mission and values, best defined by the conversion of historical buildings into a modern community space through custom-built craftsmanship and innovation.

The project covers 14 street numbers, with 10 pre-war shophouses assessed as Grade Two historical buildings by the Antiquities Advisory Board, and four post-war shophouses. The pre-war shophouses are one of the few remaining shophouse clusters within the urban area of Hong Kong. The streetscape of continuous shophouses is an excellent illustrative example of the typical urban culture and lifestyle of Hong Kong's people in the past.

Instead of being solely for commercial consideration, 618 Shanghai Street has created a public community space on the ground floor with free seating and different art walls combined with innovative technology such as 3D holograms, QR Codes and Augmented Reality (AR) to bring to life the historical characteristics and human stories of Shanghai Street for the enjoyment of the public. In addition, URA engaged Dignity Kitchen, a Singapore restaurant operated by social enterprises, to provide job training and opportunities to local differently-abled and disadvantaged people, which is in line with the development's overall concept of social sustainability.

For the green and sustainable building design, the project has maximised the greenery provision to 40% of the site area. This extensive greenery offers both visual and psychological comfort for people's wellbeing, which is especially important in the congested Mongkok district.

To reduce carbon emissions and the greenhouse effect, more than a 30% reduction in annual energy consumption was achieved by providing high performance air conditioning with higher COP, LED lighting in all common areas, daylight sensors, CO_2 sensors, window glazing with a low shading coefficient, and an energy-efficient lift installation.

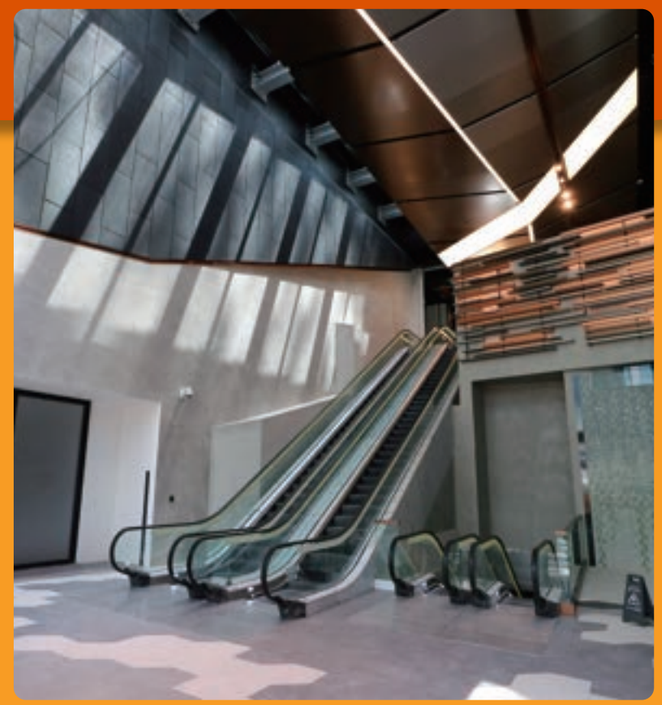
The project has achieved a 78% reduction in annual water consumption by using flow restrictors in all water faucets, and rainwater recycling for irrigation. Also, a water leakage detection system is installed for the potable water system to monitor water loss and facilitate water management.

Last but not least, the project team developed an innovative Building Information Modelling Facility Management System (BIM-FM System) comprising a centralised platform for consolidating the Building Management System and Facility Management System with a BIM model. The system effectively enhances building management through the real-time monitoring of equipment status, analysing energy use, arranging and handling works orders, providing maintenance alerts and reminders, and systemising the maintenance record. This has resulted in a reduction of the operating and maintenance effort in a paperless and sustainable way. It has also optimised the building's performance by analysing the cost savings of various facility improvements. The application of BIM in this project won the international US Autodesk AEC Excellence Awards 2019.

Project Team

Project Name	Conservation and Revitalisation Works at 600-626 Shanghai Street
Team or Organisation Name	Urban Renewal Authority
Name of Owner / Developer	Urban Renewal Authority
Project Manager	Urban Renewal Authority
Architect	Chau Lam Architects & Associates Architects & Engineers (H.K.) Ltd
C&S Engineer	Ben Tse & Associates Ltd
M&E Engineer	Far East Consulting Engineers Ltd
Landscape Architect	Team 73 HK Limited
Quantity Surveyor	Beria Consultants Ltd
BEAM Plus Consultant	BMT Hong Kong Limited
Main Contractor	Wan Chung Construction Co. Ltd

Development of Data Technology Hub, Tseung Kwan O Industrial Estate



Tseung Kwan O Industrial Estate (TKOIE) is being transformed into a cluster of large-scale high-tier data centres with an N+1 arrangement for both the utility electricity supply and backup generator power. This pilot project aims to create an innovative Data Technology Hub (DT Hub) comprising purpose-designed infrastructure for Data Technology, Information and Telecommunications, which enables: dark fibre connections for data exchange; allows service provisions at an Uptime Institute Tier III standard; and provides communal facilities to support 24/7 operations for building users and data centre clusters.

Optimum adaptability and high flexibility

To facilitate the rapid growth of market demand and technology, the design needed to be easily upgradeable and refreshable for future international standards and demand.

To achieve a "concurrently maintainable" standard, the design needed to be scalable, expandable and flexible to facilitate future changes with minimal interruption to normal operation.

Iconic and green building design

The building design of the DT Hub needed to be iconic and yet harmonious with the surroundings to form a place-making gateway to the TKOIE. This was achieved via:

- Meticulous manipulation of building form and orientation;
- Careful selection of appropriate building façade materials;
- Advanced intelligent technologies that reflect the smart and intelligent concept of the Hub; and
- Green building design.

DT Hub facilities

Different types of data technology offices provide various functions such as assembly activities, IT-related operation and disaster recovery.

Communal facilities include a green plaza, exhibition area, showcase arena, retail, F&B, multifunction rooms and a business centre.

Smart and sustainable design

To achieve design sustainability, the team reviewed passive, active and innovative approaches together with a detailed study of energy-efficient performance, capital and life-cycle costing.

- Passive approach - Manipulating the building's form, disposition and orientation
- Active approach – Application of energy-efficient systems
- Innovative approach – Installation of renewable energy systems
- Practical approach to reducing energy consumption

The following three approaches, namely Passive, Active and Innovative/ Renewable Technology, are the key to achieving a 40% or more reduction in energy consumption:

(a) Passive

1. Building mass was carefully dispositioned and orientated to strike a balance between view, solar heat gain and prevailing winds.
2. The building form was designed in multiple inclined layers not purely due to aesthetics, but also to create a self-shading effect for the façades.
3. The double-skin façade and curtain wall with vertical and horizontal projections greatly reduces the solar heat gain and cooling load.
4. A light well was introduced into the heart of the floor plate to provide natural lighting and potential ventilation for occupants.
5. High performance grey tinted low-e IGU glazing was adopted.
6. Lean construction was adopted.
7. Courtyard spaces with water features and semi-outdoor sport facilities on the podium were designed to enhance the micro-climate, and facilitate natural lighting and ventilation in the car park space.
8. Podium roof greenery was installed.
9. Natural day-lighting was utilised in the showcase for additional energy savings.
10. Another design goal was a low OTTV value: the calculated OTTV value for the tower is 13.4 w/m^2 (BD requirement is 21 w/m^2 or below), and for the podium is 37.1 w/m^2 (BD requirement is 50 w/m^2 or below).

(b) Active

1. A water-cooled chiller with oil-free compressor has an extra high Coefficient of Performance (COP).
2. A heat recovery wheel allows sensible heat transfer between the fresh air intake and exhaust air in the air-conditioning system.
3. A mixed-mode ventilation system (jet fan and natural ventilation) has been adopted in the basement car park.
4. CO concentration monitoring is installed for variable speed car park ventilation control.
5. A variable speed chilled pump varies with flow demand to minimise energy consumption.
6. The collection of rainwater for irrigation helps to conserve water resources.
7. Condensate water is recycled as a source of make-up water for cooling towers.
8. Air side free cooling is implemented during autumn and winter.
9. DC motor drive fan coil units have been installed.
10. Fresh air demand control ventilation is implemented, including provision of CO2 sensors.
11. VSD of AHU and VAV provides the flexibility to respond to the continually changing outdoor conditions and occupant activities.
12. Photocell sensor controls for the lighting help to optimise the use of natural day-lighting.
13. The energy-efficient lighting design features LED lighting.
14. Occupancy sensors are used for on/off control of lighting.
15. A solar-energy system has also been applied.
16. A building energy management system works to optimise the energy efficiency of the air-conditioning plant operation.

Project Team

Project Name	Development of Data Technology Hub, Tseung Kwan O Industrial Estate
Name of Owner / Developer	Hong Kong Science and Technology Parks Corporation
Architect	Andrew Lee King Fun & Associates Architects Limited
C&S Engineer	Meinhardt (C&S) Ltd
M&E Engineer	WSP (Asia) Limited
Landscape Architect	ADI Limited
Quantity Surveyor	Rider Levett Bucknall
Sustainable Design Consultant	Ramboll Environ Hong Kong Limited
Façade Consultant	Inhabit Group
Acoustic Consultant	Shen Milsom & Wilke Ltd
Main Contractor	Paul Y. Construction Company Limited

EC Building Project – CLP Sham Shui Po Building

Failure (in trial) is not Fatal and Success (in trial) is not Final, it is the courage to continue (to innovate) that counts

by ***Winston CHURCHILL***
(Improvised by Paul CHAN)

Project Team

Project Name	EC Building Project – CLP Sham Shui Po Building
Team or Organisation Name	CLP Innovation Enterprises Ltd
Name of Owner / Developer	CLP Power Hong Kong Limited
Project Manager	Mannix CHAN
Main Contractor	CLPeS
Others	RnB on Building Energy Management System

Like many buildings in Hong Kong, the Facility Management team at the seven-storey CLP Sham Shui Po building have a challenging job, ensuring the building is operating efficiently for the 1,000+ office staff, preventing faults, maintaining comfort, saving energy and much more. To help simplify their day-to-day activities, CLP deployed the SEC Building Scope on top of its existing Building Management System (BMS).

Building Scope is a software platform that works with existing sensor data. Using AI algorithms, the energy consumption, equipment, temperature, and many more data are processed to identify data patterns, generating actionable insights for facility managers to identify energy savings, failing equipment, and also make predictions of next-day energy demand and settings. Building Scope operates as a 24/7 virtual energy management engineer, which resulted in energy savings of more than 7% and productivity savings of two months in the first year alone.

The existing BMS at the Sham Shui Po building provided system control rather than energy saving, making it difficult for the Facility Managers to achieve their sustainability KPIs. Other issues included:

- Demanding tasks: It was difficult to achieve year-end energy-saving targets while there were facility issues such as broken equipment.
- Limited information: BMS only provides information of the plant/equipment status. Constant monitoring of system faults is needed, as no alert signals were provided.
- Operational costs: Managing equipment failures reactively was costly as it depended on staff raising complaints, and it took time to bring in repair services at the last minute. Energy wasted also resulted in carbon impacts and unnecessary spending. Responding to complaints also meant that staff were working in a reactive operational mode.
- Visibility: BMS alone provided limited visibility of energy consumption. The team required accurate information in the right context (e.g., weather, chiller performance) to make corrective actions.

The capabilities of an AI engine

- Pattern recognition: The system recognises data patterns that represent operating features of equipment or systems.
- Optimisation and decision-making: It identifies optimal settings and configurations for combined machine learning using high dimensional, multivariate, and sophisticated models. The engine's decision-making integrates with domain knowledge and helps users validate a detected outlier or pick optimal choices under given conditions.
- Interpretation: The system interacts with a contained energy and facility management knowledge library that interprets the engine's output in a presentable fashion to users.

Benefits

- The predictive diagnostics feature identified potential faults on fan coil units, allowing managers to proactively manage inspections, saving two months of manpower compared to reactive fault investigation, and increasing system reliability.
- Continuous machine learning energy monitoring produces periodic reports of the chiller operation, including the cooling tower data points. Alerts arose when there were energy spikes due to abnormal cooling loads, helping managers to focus on investigating the cause, and reducing energy consumption by 7% in the first year.
- Prioritised insights help managers see which faults to attend to based on energy-saving potential or severity. The inbuilt workflow ensures that tasks are assigned to the right engineers.
- Action-based insights provide more details about a problem. By switching from condition-based maintenance to preventive maintenance, engineers can now take timely actions.
- Automated reporting saves time and provides visibility.

The building today is also used to host many public events, such as Eco Building Fund Communication Workshops, further demonstrating CLP's leadership in sustainability.

Harbour East

With Innovative system of natural ventilation and carefully moderation of natural lighting, the project successfully integrate design aesthetic with principles of green architecture, demonstrating a new direction for sustainable office tower in Hong Kong.

by GBA 2016 Jury's citation

As regulations surrounding buildings' energy efficiency tighten, traditional energy-saving strategies have become the baseline requirement. An appreciation of the benefits of sustainable thinking, alongside technological developments and a willingness to push the boundaries, must be employed to reach a new level of Green Building.

Beyond saving energy, Harbour East positions itself as a landmark development in healthy building design. Its intelligent Building Management System (iBMS) acts as the 'brain', constantly evaluating data collected by a full range of sensors and providing recommendations to both Facilities Managers and Building Occupants. Paying particular attention to Indoor Air Quality, data is collected on key markers such as Particulate Matter (PM1, PM2.5 and PM10), VOCs, Ozone, Carbon Monoxide and Nitrogen Dioxide. When this data indicates that certain limits have been breached, the iBMS controls the HVAC system to immediately address the problem while informing Facility Managers of its location – enabling a timely and effective inspection.

The indoor environment quality is further improved by a fresh air intake rate 30% above requirements, and 100% smart operable windows. Air purifiers and filters help to remove 99% of pathogens in the air. Tied in with the iBMS, the on-site weather station measures the local outdoor weather conditions. Operable wind-catchers provide the option for natural ventilation to occupants; when outdoor weather conditions permit, a notification is sent to occupants via an app so they can enjoy the refreshing breeze.

Another feature of the HVAC system which demonstrates Harbour East is a leader in the vision of building a sustainable city is the deployment of Liquid Desiccant dehumidification, a first for a commercial building in Hong Kong. This system reduces humidity more efficiently than standard HVAC set-ups. Specific humidity control is also available to tenants, which enables tenants to increase internal temperature set-points and therefore save energy. This system is linked with an energy use display in the lobby to encourage competition in the reduction of energy use.

Harbour East is further contributing to the vision of a sustainable city by integrating some circular economy principles. With careful planning and structural design work, a significant portion of the existing basement structure was retained, reducing both the amount of construction material required and the quantity of demolition waste. Eligible concrete waste was sent to Green Valley for refill on other construction sites.

Water is saved not only through standard features such as flow-restricted sanitary fittings, but also with an extensive on-site water recycling system. Recycled water contributes to 93% of the annual irrigation water demand by reusing water from several sources, namely rainwater, cooling tower bleed-off water and AC condensate. To highlight the effectiveness of this system, the planting area makes up >30% of the total site area.

These achievements have been recognised by a string of Green Building prizes, including the Best Office Development in Hong Kong at the International Property Awards. Harbour East also achieved Green Building credentials at the highest level, namely BEAM Plus Platinum, LEED CS Platinum, and China Green Building Label 3-Star.

Project Team

Project Name	Harbour East
Team or Organisation Name	Henderson Land Development Company Limited
Name of Owner / Developer	Vansittart Investment Limited
Project Manager	Henderson Land Development Company Limited
Architect	DLN Architects Limited
C&S Engineer	Stephen Cheng Consulting Engineers Limited
M&E Engineer	P&T (M&E) Limited
Landscape Architect	Quad Limited
Quantity Surveyor	Aecom Cost Consulting (Hong Kong) limited
Sustainable Design Consultant	Ove Arup & Partners Hong Kong Limited
Environmental Consultant	Ove Arup & Partners Hong Kong Limited
Façade Consultant	Meinhardt Façade Technology (HK) Limited
Acoustic Consultant	AECOM Asia Company Limited
Main Contractor	Build King Construction Limited
Others	BTR (HK) Limited Lightlinks International Limited

Hongkong Land's Central Portfolio - BEAM Plus Existing Buildings Platinum Certification

Hongkong Land's Central Hong Kong Portfolio represents some 450,000m^2 of prime property and consists of six development complexes comprising 12 buildings overseen by the same management. As the very first portfolio of existing buildings awarded the BEAM Plus Existing Buildings V2.0 Final Platinum distinction, it serves as a showcase to Hong Kong's existing building stock on how to adopt a "Portfolio Approach" to assess the sustainability performance of multiple existing buildings of diverse ages. This, in turn, plays a key role in driving the green building movement and making Hong Kong a more sustainable city.

Leveraging on the BEAM Plus for Existing Buildings V2.0 Comprehensive Scheme, the project team conducted a "Green Body Check" by adopting a Portfolio Approach, which saved time and reduced costs while ensuring standardisation of management policies and strategies throughout the portfolio. This has brought about environmental benefits to the whole portfolio. Objectives, policies and operational procedures were reviewed to ensure sustainable operations. This included management for green procurement, ISO 14001, system operation and maintenance, indoor air quality management, pest management, and so forth.

Additionally, resource management was reviewed holistically to set and accomplish short-term and long-term saving targets, while information and strategies were shared amongst the portfolio through taskforce groups. Regarding energy, a Centralised Monitoring Centre was upgraded to further facilitate assessment through central control and digitalisation. Retro-commissioning was also conducted to optimise the operation and performance of existing equipment to maximise energy savings. Water resources and types of water usage were likewise identified during a water audit, while cleaning schedules and washing equipment were fine-tuned to improve the water performance of the buildings. All six development complexes achieved significant water savings compared against the baseline in the BEAM Plus EB V2.0, ranging from approximately 30 to 50%. Furthermore, the results of a waste audit affirmed the portfolio's comprehensive best practices for waste management. The accumulated amount of recyclables reached over 5,700 tons from 2014 to 2019, covering paper, plastic bottles, aluminium cans, glass bottles and fluorescent tubes.

The Portfolio Approach adopted in the BEAM Plus Existing Buildings certification of Hongkong Land's Central Hong Kong Portfolio has brought about numerous benefits. It not only ensures consistency of policies and management plans across the portfolio, but also provides a streamlined and cost-effective approach to certification of existing buildings. Using the rating tool, the Green Body Check successfully identified further opportunities to enhance green building operation and management performance. Operational staff have also been trained to upkeep the sustainable performance of the whole portfolio in future operations. By having this Central Portfolio 100% green-certified, the project is contributing to the low-carbon transformation of Hong Kong's Central business district and is helping to drive sustainability in Hong Kong's entire real estate sector.

Project Team

Project Name	Hongkong Land's Central Portfolio - BEAM Plus Existing Buildings Platinum Certification
Team or Organisation Name	Hongkong Land (Property Management) Limited
Name of Owner / Developer	Hongkong Land Holdings Limited
Project Manager	Hongkong Land (Property Management) Limited
Environmental Consultant	Allied Environmental Consultants Limited
Facility Managers	Hongkong Land (Property Management) Limited Hongkong Land (EXSQ Property Management) Limited

Hongkong Land's One, Two & Three Exchange Square and The Forum

Hongkong Land strives to enhance its sustainability performance in all of its managed properties. One, Two & Three Exchange Square and The Forum are some of its landmark properties in Hong Kong's Central business district, setting the benchmark for prestigious commercial properties. In particular, they are home to many leading international investment banks and financial institutions.

The buildings' sustainability performance has been verified by BEAM Plus Existing Buildings certification with the highest Platinum rating as well as the following green awards and certifications:

- Green Building Award 2019 – Grand Award for Existing Buildings (Facility Management)
- Joyful@Healthy Workplace Best Practices 2019-2020 – Grand Award
- IFMA Excellence in Environmental Stewardship 2019
- IFMA Best Occupational Health & Safety Award in Asia Pacific 2018
- IFMA Best Managed Facility Award in Asia Pacific 2017
- Hong Kong Awards for Environmental Excellence (HKAEE) Sectoral Award - Merit
- HKAEE Green Organisation Certificate
- Carbon Reduction Certificate
- Excellent Indoor Air Quality Certificate
- Water Supplies Department Quality Water Certificate
- ISO 14001 & 45001 certification for environmental, occupational health and safety management

The company's sustainability policy and environmental commitments are based on the nine United Nations Sustainable Development Goals. In tandem with this commitment, numerous sustainable strategies have been implemented to help create a sustainable community.

Carbon and energy reduction

Last year, the buildings' carbon footprint was reduced by 37.5% as compared to 2008. The cumulative carbon reduction was 108,200 tons of CO_2e, which is equivalent to planting more than 4.7 million trees. This was achieved by reducing electricity consumption through operational optimisation, as well as upgrading, retrofitting and modernising energy systems, including lift modernisation, upgrading to more energy-efficient chiller plant and LED lightings, adopting EC plug fans and renewable solar panels, retro-commissioning, and implementing an energy platform with big data analytics, digital twins and IoT technologies.

Material and waste management

In addition, waste management strategies have been adopted to reduce resource consumption. Examples include donations of unused resources to NGOs, reusing materials during renovations, and digitalisation.

Recycling programmes have likewise been implemented for paper, plastics, metal, fluorescent tubes, glass bottles, rechargeable batteries, WEEE, Chinese New Year decorations, Christmas trees as well as onsite food waste treatment. More than 2,000 tons of materials have been recycled over the last six years alone.

Application of innovations and technologies

To further improve the buildings' performance, innovative technologies have been adopted for energy saving, enhancing the indoor environmental quality, and promoting health and wellbeing, as shown below:

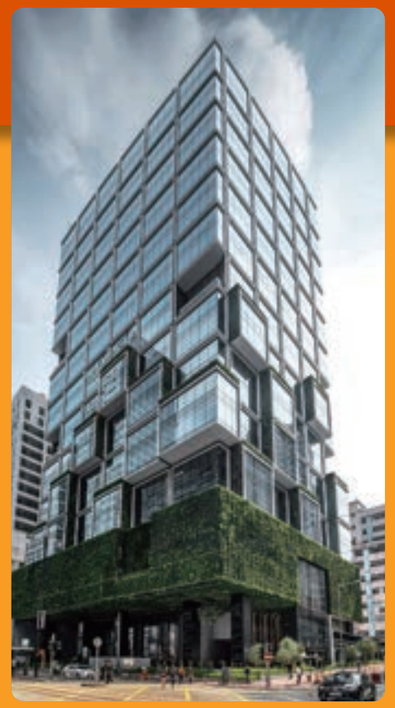
- Centralised Monitoring Centre (CMC) with an energy analysis platform for big data analytics by AI and machine learning to identify energy-saving opportunities.
- Comfy app to enhance occupant control of thermal comfort in offices and improve user satisfaction.
- Real-time display of indoor air quality and building energy consumption to arouse occupants' awareness.
- Ultra-lightweight green roofs on existing roof structures to reduce the heat island effect and improve the community environment.
- A mobile app to promote health, wellbeing and sustainability for tenants and their employees.

Under the leadership of Hongkong Land's Sustainability Committee, innovative sustainability strategies have been implemented in collaboration with key stakeholders, including tenants, contractors, employees, the Government and green groups. It is hoped that the sustainability performance of its managed buildings will further contribute to the creation of an environmentally aware and sustainable community.

Project Team

Project Name	Hongkong Land's One, Two & Three Exchange Square and The Forum
Team or Organisation Name	Hongkong Land (Property Management) Limited
Name of Owner / Developer Facility Manager	Hongkong Land Holdings Limited Hongkong Land (EXSQ Property Management) Limited

K11 ATELIER King's Road



Under the "New World Sustainability Vision 2030" and our aspiration to curate a "Vertical Creative City", K11 ATELIER King's Road transforms the design, purpose and culture of modern workplaces. With smart technologies, art, craftsmanship and user-centric building services, we promote a sustainable lifestyle not only for the building users but also for the neighbourhood.

by ***Edwin CHAN***
Senior Project Director – Project Management, New World Development Company Limited

Offering 70 sustainability features aligned with 11 UN Sustainable Development Goals, K11 ATELIER King's Road is an office redevelopment project designed with sustainability in mind. The building not only creates a sustainable and pleasant workplace, but also brings greenery and wellness to the neighbourhood.

Contrary to conventional commercial buildings, the ground level of K11 ATELIER King's Road is freed up with a 'floating' Green Box – with an exhibition hall on top, the glassy entrance lobby is setback from all the surrounding streets. This particularly improves the streetscape in the neighbourhood with a more transparent and naturally ventilated space for pedestrians.

The massing of the tower portion is broken down into cubes. These cubes project in and out along the façade to create different terraces and surfaces for optimal greening opportunities. The extensive green coverage totalling 6,700m^2 on the building façade, roof garden and Green Box includes an experimental patented design CEILINGREEN®. This enhances the visual comfort of the building occupants as well as pedestrians, and encourages the neighbourhood to embrace a mindful lifestyle.

On the roof garden, a microclimate modifier is designed to purposely enhance the thermal comfort and maximise the usable period of outdoor activity areas according to computational fluid dynamics analysis. By incorporating various seating options, occupants can enjoy the comfortable roof garden in all seasons. An environmental performance dashboard incorporated with various sensors informs occupants about the real-time outdoor comfort.

The building was the first in Hong Kong to achieve the WELL Building Standard and LEED (C&S) final certification at the highest Platinum rating, while also achieving the provisional Platinum rating of BEAM Plus. Holistic sustainable and wellness features are incorporated into the building design, including: indoor air quality; acoustic intrusion; thermal and olfactory comfort; glare preventive lights, etc. Highlighted features include a demand-response ventilation system to ensure a high indoor air quality in both common and tenant areas; a spacious roof garden and terraces providing opportunities for wellness and sustainable lifestyles; a real-grass jogging path with shaded seats on the rooftop to enhance the garden's amenity value; and the promotion of healthy eating and a circular economy concept by including an urban farm and on-site food waste decomposer.

The project design achieves energy savings of 34% against the ASHRAE Standard by bringing together passive and active designs, as well as renewable energy systems. Architectural setback in the recess/projection pattern and large glazing provision as passive design features enable daylighting for circadian health and energy savings. As for active design, the building adopts the use of LED lighting, free cooling, oil-free chiller and more to reduce its energy consumption. The 220m^2 solar photovoltaic thermal panels (PVT) on the roof, which is the largest PVT commercial installation in Asia, supports 1.3% of the building's energy consumption.

In addition to the green building design, various management plans have been created to ensure sustainable operations, including real-time environmental monitoring, greenery irrigation technology, and more. The building's Sustainable Tenancy Pledge is a voluntary programme for all tenants. It features a smart meter with apps and e-platform for effective electricity monitoring and analysis.

Project Team

Project Name	K11 ATELIER King's Road
Team or Organisation Name	New World Development Company Limited
Name of Owner / Developer	New World Development Company Limited
Architect	P&T Architects and Engineers Limited
C&S Engineer	C M Wong & Associated Ltd
M&E Engineer	ARUP
Landscape Architect	P Landscape Co., Ltd
Sustainable Design Consultant	ARUP
Façade Consultant	ARUP
Acoustic Consultant	Westwood Hong & Associates Ltd
Main Contractor	New World Construction Company Ltd

One Hennessy

Be a New Sustainable Life Changer

by ***Mr Martin LEUNG***
District Manager of One Hennessy,
Sources Fame Management Limited

Chinachem Group was eager to create an icon, in terms of both the building's outlook and its spatial quality. A distinctive funnel shape on the podium at the bottom of the tower is designed to facilitate natural lighting and ventilate airflow onto street level. Indeed, One Hennessy is not only a design statement but also serves an environmental purpose by improving local ventilation. It is both functional and symbolic, and indicative of the Group's commitment to sustainable development.

One Hennessy is a LEED Platinum certified office building and one of the finalists of the Green Building Award 2019 – New Buildings Category: Completed Projects – Commercial Building. It was also crowned as the award winner in the category of Commercial High-rise Development in Asia Pacific Region in the globally acclaimed International Property Awards.

One Hennessy has achieved an excellent reduction in energy consumption, and has significantly improved indoor environmental quality. The annual energy saving for the project is about 26% compared to the ASHRAE baseline, and the reduction of carbon emissions is equal to more than 600,000 newly planted trees.

Various sustainable elements were incorporated in the architectural design to maximise energy efficiency. For instance, a low-E curtain wall system reduces the amount of radiation heat gain and allows full use of natural daylight to reduce the energy consumption of artificial lighting. The building façade and the setback zone on the podium roof with the 30m-high funnel shape design allow natural lighting and ventilation to penetrate through to pedestrian level. One Hennessy has likewise made wide use of green building materials in every aspect to create a better working environment and enhance the community's quality of life.

To promote a paperless environment, LED display units are installed at each office floor for displaying notices, promotions and educational materials. Electric vehicle chargers are available in every parking space to encourage the use of electric eco-friendly vehicles. Some 55 bike racks were also installed to encourage the building's users to cycle to One Hennessy, thus reducing the demand for motor vehicle parking and the number of vehicles on the road, easing traffic congestion, and promoting a sustainable lifestyle.

An independent Commissioning Authority was appointed to verify the proper operation of the commissioned systems. This ensured that the building operator keeps the equipment operating under the desired conditions. For instance, metering devices are provided for the building operator to monitor the facility's operational condition. A high-efficiency chiller with variable speed drive motor was also specially adapted for the building, and energy-efficient lighting installations were created, enabling the lighting power density of an ELV room on the roof floor to operate at 40% below the statutory requirement.

System maintenance and security services are provided in a socially responsible manner, and innovative technology is adopted to further enhance operations, such as through the use of computer-aided facility management.

Project Team

Project Name	One Hennessy
Team or Organisation Name	Bonny Ace Limited
Name of Owner / Developer	Bonny Ace Limited
Project Manager	Bonny Ace Limited
Architect	DLN Architects Limited
C&S Engineer	Ove Arup & Partners Hong Kong Ltd
M&E Engineer	J. Roger Preston Limited
Landscape Architect	Earthasia Limited
Quantity Surveyor	Arcadis Hong Kong Limited
Environmental Consultant	Allied Environmental Consultants Limited
Façade Consultant	Ove Arup & Partners Hong Kong Ltd
Main Contractor	CR Construction Company Limited
Traffic	MVA Asia Limited

Pacific Place

Facilities management has a comprehensive and long-term strategy for the building's sustainable development. It is also insightful to spearhead the use of green finance to sustain green projects of the building.

by Green Building Award 2019 jury's citation

Project Team

Project Name	Pacific Place
Team or Organisation Name	Swire Properties Ltd
Name of Owner / Developer	Swire Properties Ltd
Others	Swire Properties Ltd

Since its opening in 1988, Pacific Place has established itself as Hong Kong's premier lifestyle hub, a mixed-used development with office towers and shopping mall. For the past 30 years it has continued to evolve and grow as the ultimate place to shop, dine, work, stay, live, relax and play.

In addition to many years of non-stop system upgrades and replacement works at Pacific Place, the owner Swire Properties (SPL) implemented a comprehensive monitoring-based retro-commissioning (RCx) work on site with Tsinghua University. Beginning in 2017, this project was completed in 2019 ahead of the promotion of Retro-Commissioning by the HKSAR's EMSD.

RCx is an energy-reduction methodology that utilises in-depth data analysis. It can be used to identify key performance indexes for site staff to continuously monitor and ensure operational efficiency for air-side and water-side equipment. At Pacific Place, it identified a potential energy saving of 4,100,000 kWh/ year, with an action plan that is now being implemented. For example, replacing electronically commutated motor plug fans results in a 900,000kWh/year energy saving. In July 2020, Pacific Place received the Outstanding RCx (Implementation) Award 2019 under the "Energy Saving Championship Scheme 2019 – Competition for Organisations (Hanson Retro-commissioning Competition)" which was given in recognition of its achievement in enhancing energy conservation through the application of RCx. The judging criteria included the engagement of an internal team and RCx service provider (Tsinghua University), identification of energy-saving opportunities with an implementation plan and clear description of the technical approach, achievement in energy saving with measurements and verification of RCx works, ongoing commissioning and training of O&M staff in energy saving, and a description of the overall challenges, solutions, benefits and way forward of RCx works.

To complement its comprehensive energy metering system, Pacific Place established a monitoring platform in 2018 to automatically carry out big data analysis and identify optimisation insights. It also enhances operational efficiency with the help of smart technology, helps the management team to achieve greater visibilities in potential operational issues, arranges human resources more effectively and, more importantly, enables higher satisfaction among tenants and customers. It is believed that the use of artificial intelligence (AI) will further optimise the operation, leading to a rough estimation of a ~20% reduction in total building energy consumption. This saving will deepen in future as science-based targets are implemented.

In 2018, SPL received the Regional Technology Award in the Commercial Buildings category from ASHRAE in recognition of its energy management initiatives and retro-commissioning work at Pacific Place.

Among all the kinds of engagement programmes that SPL has introduced, Waste Recycling is also one of its key focuses. In Pacific Place, SPL provides facilities to support the collection of over 20 types of recyclables, and has customised Food Waste Collection Guidelines for its F&B and office tenants. Green Kitchen Technical Guidelines, Sustainable Development (SD) Fit-out Guides and Best Practices Guide for LEED, WELL and BEAM Plus Certifications are also disseminated to tenants for the designing and fitting out of their new retail and office spaces.

Since 2018, for its annual White Christmas Street Fair, Pacific Place has launched Green Guidelines on Event Management and Production of Collaterals, and has implemented a number of green measures such as:

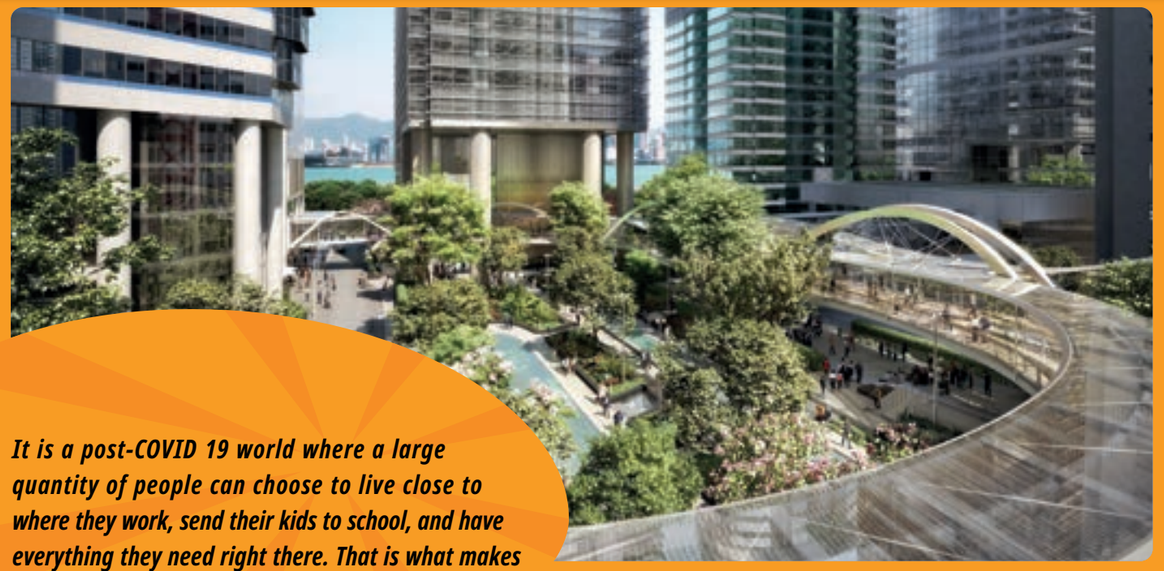
- Engaging all F&B booths to eliminate plastic straws, cutlery, bottles and carrier bags
- Offering tableware rental to visitors
- Making space for recycling bins

Tenants' views are also valued. In 2018, Pacific Place conducted a tenant satisfaction survey of its office tenants. Over 90% of respondents agreed that Pacific Place is easily accessible, has good building specifications and amenities, and said they would recommend SPL as a landlord.

In recognition of the outstanding environmental performance of the site, Pacific Place won the Green Building Award (GBA) 2019 Grand Award in Existing Buildings (Facilities Management), given in honour of its continuous work to improve its base building provisions and tenancy services as well as its deep energy-saving achievements.

In November 2019, science-based targets were officially approved – making SPL the first developer in Hong Kong and the Chinese Mainland to establish long-term decarbonisation goals. This will provide a clear direction for Pacific Place to move forward in the next 30 years.

Taikoo Place Redevelopment



It is a post-COVID 19 world where a large quantity of people can choose to live close to where they work, send their kids to school, and have everything they need right there. That is what makes Taikoo Place quite unique in Hong Kong.

by ***Colin Galloway***
one of the organizing committees of the Urban Land Institute (ULI) 2020 Asia Pacific Awards for Excellence

Project Team

Project Name	Taikoo Place Redevelopment
Team or Organisation Name	Swire Properties Ltd
Name of Owner / Developer	Swire Properties Ltd
Project Manager	Swire Properties Ltd
Architect	Wong and Ouyang (HK) Limited
C&S Engineer	Ove Arup & Partners Hong Kong Ltd
M&E Engineer	J. Roger Preston Ltd
Landscape Architect	Urbis Limited Gustafson Porter + Bowman
Quantity Surveyor	Rider Levett Bucknall Ltd
Sustainable Design Consultant	Ove Arup & Partners Hong Kong Ltd Tsinghua University
Environmental Consultant	Allied Environmental Consultants Limited
Façade Consultant	Hugh Dutton & Associates Ove Arup & Partners Hong Kong Ltd HS & A Ltd
Acoustic Consultant	Campbell Shillinglaw Lau Ltd
SD advisor	Waters Economics Ltd The University of HK Swire Properties Ltd (TSSD)

Taikoo Place, already recognised as one of Hong Kong's best-planned business hubs, currently offers around 6.5 million square feet of prime, state-of-the-art commercial space for local and multinational corporations. Swire Properties' exciting Taikoo Place redevelopment project involves the redevelopment of three techno-centres into two new Grade-A office buildings, namely One Taikoo Place and Two Taikoo Place, together offering 2 million square feet of office space. Another highlight is the introduction of Taikoo Square and Taikoo Garden, comprising a collection of lush greenery, which provide 69,000 square feet of open space for the enjoyment of the entire community.

An impact report entitled "The Creative Transformation of Island East and Development of Taikoo Place" was published in April 2020. The report deployed a tool called the "Places Impact Framework" that helped to showcase how Taikoo Place is a truly unique "place" with specific characteristics that mark it as economically diverse, highly liveable and resilient, and that have helped it become one of the city's most distinctive urban areas.

From 2016 to 2019, Swire Properties worked with Tsinghua University to conduct retro-commissioning (RCx) for all existing buildings in Taikoo Place. RCx is a systematic process to periodically check an existing building's performance and identify operational improvements. RCx starts with the collection of operational energy data followed by on-site verification and data analysis, identification of energy-saving opportunities with an implementation plan, measurement and verification of the RCx implemented, and on-going commissioning and training to O&M staff to enhance the building's energy efficiency.

Consequently, One Island East in Taikoo Place received the Outstanding RCx (Implementation) Award on 31 July 2020 in the "Energy Saving Championship Scheme 2019 – Competition for Organisations (Hanson Retro-commissioning Competition)", affirming its achievement in enhancing energy conservation through the application of RCx. The judging criteria included the engagement of an internal team and RCx service provider (Tsinghua University), identification of energy-saving opportunities with an implementation plan and clear description of the technical approach, achievements in energy saving with measurements and verification of RCx works, on-going commissioning and training of O&M staff, and a description of the overall challenges, solutions, benefits and way forward of RCx works.

From 2017 to 2019, a high-efficiency chiller replacement at Oxford House, Dorset House and Berkshire House was completed, resulting in an energy saving of approximately 3 million kWh per year. Variable speed drives were also installed in the chiller plant water circulation system to optimise the operational efficiency, especially during part load conditions.

More than three hundred electronically commutated (EC) motor plug fans have also been installed since 2018 to replace old belt-driven fans, not only minimising the maintenance needs of air handling units, but also reducing energy consumption by approximately 1.5 million kWh due to better fan efficiency.

Recently, in recognition of these continuous improvement works, Taikoo Place was chosen as a winner in the Urban Land Institute (ULI) 2020 Asia Pacific Awards for Excellence. This awards programme recognises the full development process of a project, honouring those projects in the region that have demonstrated excellence in land use as well as the highest standards of sustainable development and resilience, which impact the surrounding communities.

Furthermore, to demonstrate its support of the newly launched local green building assessment scheme (BEAM Plus Existing Buildings Version 2.0 Comprehensive Scheme) in 2016, Swire Properties submitted all seven of its wholly owned commercial buildings in Taikoo Place for certification, and all achieved a Platinum rating between 2017 and 2018.

In addition to its technical improvement programmes, there are ongoing tenant engagement initiatives and activities throughout the year involving not only the buildings' tenants but also the wider Quarry Bay community. For instance, Discover Taikoo Place was a month-long campaign in May 2019 celebrating everything Taikoo Place has to offer. A series of over 60 events were organised to cover Wellness, Culture, Gourmet and Business. A highlight was the Corporate Wellness Challenge: 8-Hour Charity Spin – engaging 16 teams and over 330 riders from Taikoo Place to spin for a good cause, raising funds for Mind HK, a local mental health charity.

Project After 6 is another annual event. The idea is to engage tenants to showcase their hidden talents after office hours. In 2019, it engaged 40 music groups of 92 performers from all walks of life in the Quarry Bay community, producing eight lunchtime concerts and a Finale Concert for audiences totalling over 8,500 people.

In 2017, Swire Properties also launched an outdoor sustainable development exhibition centre, The Loop, to raise awareness of sustainable development. One popular feature is the urban farm. In 2019, a total of 42 farming workshops were conducted, accumulating 473 engagement hours*.

The company actively engages all tenants to continuously step up their waste recycling efforts, and facilitates the collection of over 20 types of recyclables, from paper and plastic to textiles, electronic waste and glass bottles. Furthermore, in 2019, 50% of Taikoo Place F&B tenants participated in the company's food waste recycling programme, and over 30 tenanted office floors practiced source separation for coffee grounds or food waste recycling. Overall, some 21% of waste generated at Taikoo Place was diverted from landfills.

* Engagement hours are equal to the number of participants multiplied by the number of hours of the engagement activity

Taikoo Place Redevelopment - One Taikoo Place

Integrated design approach with excellent multi-disciplinary team pushes towards the foremost sustainability in exemplarily low building energy use, synergy in high performance and wellness, construction carbon reduction, smart operation and liveable urban oasis.

by ***Christy CHOW***
Sustainability Consultant

One Taikoo Place (1TP), which was redeveloped from Swire Properties' old Somerset House, launched the transformation of the Taikoo Place commercial district into a more sustainable and liveable office campus. Echoing Swire's Sustainable Development Vision, SD2030, 1TP's mission was to build a 48-storey skyscraper employing sustainable innovations for the highest energy performance in a low-carbon manner, while also moving towards wellness and digitalisation.

The multidisciplinary team introduced a 25m-high void underneath 1TP which creates a significant breezeway in the large open space made possible through the 'vacation' of the existing industrial buildings. Dense planting combined with a water feature help to minimise the urban heat island impact. This pleasant urban landscape has improved thermal comfort by 26.7% for residents, workers and visitors, making it a popular place to relax, meet and mingle.

A tri-generation system converts waste heat from electricity generation to drive the adsorption chiller for building cooling. Swire Properties operates a cooking oil recycling programme among its restaurant tenants for local bio-diesel production. As the first commercial building in Hong Kong to adopt this system in normal use, this waste-to-energy loop saves an exceptional 2.5% of total building energy. In conjunction with strategies like implementing chiller optimisation, EC-plug-fan AHU, free cooling and high-efficient lighting, 1TP has achieved a substantial 34% reduction in energy consumption beyond the Hong Kong Building Energy Code Version 2012. In particular, tenants have welcomed the installation of efficient lighting and controls such as adaptive digital lighting, and the use of wireless daylight and occupancy sensors with long-lasting batteries, which have enabled the easier fitting-out of office spaces.

1TP recycled over 75% of its construction waste from demolished concrete for use as paving blocks, and reused 13 existing piles in foundation upcycled material. The embodied energy was reduced by approximately 10000 GJ from these salvaged materials. More importantly, the construction process was accelerated, and the impact of both air and noise pollution on the surrounding community was minimised.

Supporting academic research is an important way of advancing the role of technology in society. 1TP partners with the National University of Singapore and Hong Kong Polytechnic University in a mutual study to integrate a photovoltaic (PV) system and green roof. This research studies how PV performance improves due to the plant cooling effect, with real-time onsite auto-measurements and data analysis still ongoing.

In terms of building management, 1TP is Hong Kong's first-ever AI-enabled smart building which embodies 5G, IoT, big data, cloud computing and AI technology into an innovative Neuron console designed by Arup. This Neuron Digital Platform consolidates data from disparate building equipment to uncover hidden patterns for engineering customised solutions. The AI machine learning model quickly adapts to environmental changes, learns the best operation configuration, and facilitates preventive maintenance. This saves labour input while also improving energy efficiency, without sacrificing the comfort of tenants.

Based on its outstanding performance, 1TP is notably the first project in Asia to achieve WELL V1 Core & Shell Platinum, BEAM Plus New Buildings V1.2 Platinum and LEED V3 Core & Shell Platinum. The project has also garnered industry-wide recognition as Winner of the CIC Sustainable Construction Award 2018, Sustainability Achievement of the Year – RICS Award 2019, and Grand Award for a Commercial Building at the Green Building Award 2019, all of which affirm the team's tireless commitment to sustainability.

Project Team

Project Name	Taikoo Place Redevelopment - One Taikoo Place
Team or Organisation Name	Taikoo Place Holdings Limited
Name of Owner / Developer	Swire Properties Ltd
Project Manager	Swire Properties Ltd
Architect	Wong and Ouyang (HK) Limited
C&S Engineer	Ove Arup & Partners Hong Kong Ltd
M&E Engineer	J. Roger Preston Ltd
Landscape Architect	Urbis Limited
Quantity Surveyor	Rider Levett Bucknall Ltd
Sustainable Design Consultant	Ove Arup & Partners Hong Kong Ltd
Environmental Consultant	Allied Environmental Consultants Limited
Façade Consultant	Hugh Dutton & Associates Ove Arup & Partners Hong Kong Ltd HS & A Ltd
Acoustic Consultant	Campbell Shillinglaw Lau Ltd
Main Contractor	Gammon Engineering & Construction Company Ltd

The Mills

The Mills is a landmark revitalization project by Nan Fung Group, a celebration of shared industrial legacy with Hong Kong, and a step towards a future of applied creativity and innovation. By integrating sustainable and innovative design in the building development, the Mills delivers an excellent indoor environment, effective waste management and sustainable facilities for occupants. Moreover, the Mills acts as a sustainable centre for the community and neighborhood to promote sustainability and eco-friendly initiatives, provide venues for associated exhibitions, tours and workshops to enhance the eco-friendly and sustainability awareness of the society.

*by **Tony YIP***
Sustainability Consultant

Project Team

Project Name	The Mills
Team or Organisation Name	Nan Fung Development Limited
Name of Owner / Developer	Nan Fung Textile Second Mill Limited
Project Manager	Nan Fung Development Limited
Architect	Thomas Chow Architects Limited
C&S Engineer	AECOM Asia Co. Ltd
M&E Engineer	Aurecon Hong Kong Ltd
Quantity Surveyor	Rider Levett Bucknall Ltd
Sustainable Design Consultant	CO2nnsulting Limited
Environmental Consultant	Ove Arup & Partners Hong Kong Ltd
Main Contractor	Paul Y. Builders Ltd

Building a sustainable city and community: The Mills was the flagship revitalization project of Nan Fung Group, situated in the industrial area in Tsuen Wan. It aims to preserve local history and textile-rooted identity of Tsuen Wan, bridging the technology gap between the old and new generations. The Mills involved transforming three former Nan Fung textile factories into a destination consisting of a business incubator, experiential retail and non-profit cultural institution. The Mills marks a significant movement in the preservation of cultural heritage and the transformation of an industrial district into a multi-faceted community.

Since opening in late 2018, the Mills has become one of the hottest social media check-in places in Hong Kong. It has also clinched GBA 2019 Grand Award, LEED Gold certified building, BEAM Plus EB targeted Platinum rating, 2019 UNESCO Asia-Pacific Awards for Cultural Heritage Conservation under the New Design in the Heritage Context category.

Integrating Sustainability into the Mills

From the outset, the project sought to become one of Hong Kong's greenest landmark revitalisation developments. Through mapping the carbon baseline and understanding current design standards, the designer optimised the building's energy use and reduced its carbon emissions. With heritage preservation in mind, the building refurbishment retained 70% of the existing structure, albeit with steel structural strengthening to meet the new standards of the prevailing building codes. The old timber doors, metal gates and equipment were all up-cycled and incorporated back into the various elements of the new interior design. This preserved the building's 60-plus years of history, and leant a distinctive charm to this cutting-edge development. It also significantly reduced the use of new construction materials and minimised the building's overall embodied energy.

Connecting Sustainability to the Society

The complex is integrated with new internal pedestrian lanes that serve as a public connector in the district. Its purpose is to facilitate the future revitalisation of this industrial district by enhancing pedestrian flow. The human connection enabled by this design not only improves users' physical health and emotional wellbeing, but also cultivates creativity. Public art and heritage, rooftops and greenery are all reachable and user-friendly for the public. To further support ongoing community engagement, a range of activities are held in the various open spaces including fashion and textile recycling workshops, environmental education and second-hand clothes fashion promotions. Urban farming and an exhibition atrium for cultural and social connections are available to the public and currently in operation at the Mills seven days a week, creating additional vibrancy in the community

Fusion of Innovation and Sustainability

A high-performance façade, combined with external shading devices, minimize solar heat gain and reduces the need for air conditioning. To achieve further energy-efficiency, perimeter office lighting is automatically controlled by daylight sensors. Large skylights have been integrated in the atrium at the Mills to enhance daylight penetration and reduce the need for artificial lighting. An energy efficient water-cooled air-conditioning system was installed at the Mills to enhance the overall energy efficiency, and the demarcation of air distribution zones was strategically placed to maintain thermal comfort and avoid over cooling. Efficient LED lighting is used in common areas to reduce lighting energy demand. A solar hot water system was likewise adopted to harvest renewable energy for domestic hot water use. These strategies have achieved approximately 20% energy saving in comparison to a standard building.

Migrating Building Intelligent

A building management system (BMS) controls and optimizes the operation of building service systems at the Mills. Energy efficient lighting, day lighting and intelligent controls are used throughout the project. Energy saving efforts including demand control ventilation, thermal sensors and occupancy sensors are implemented to control the ventilation and lighting. An app-based BMS system has been adopted to support real-time monitoring and optimization of the actual air-conditioning consumption. All tenants are encouraged to use the app to adjust their air-conditioning schedule to minimize energy consumption and tailor the operation of their air-conditioning to their individual business hours.

Sustainability Management

Environmental sustainability policy and Post Occupancy Evaluation have been carried out for the Mills. A Green Tenant Design Guideline with a sustainable checklist was introduced as a reference to explain which environmental considerations to look for when designing and operating a tenancy. The benefits include implementing green initiatives of energy, water, waste, purchasing, construction and other continuous improvement with the goal of being environmentally responsible and economically profitable while maintaining this unique landmark for tenants and visitors. As the building owner, we encouraged our tenants to join us in reducing water usage and waste generation via signing Green Leases with us. Nan Fung encourages all tenants to reduce their water usage and waste generation by signing Green Leases. As part of the lease, a reward scheme is in place for tenants who achieve "Best Practice", with the reward subject to review on a bi-annual basis.

The Quayside

It is a welcoming, healthy, and sustainable office architecture in the heart of Kowloon East, where it explicitly illustrates a delightful balance between optimal user experience and community engagement, and a vision of harmonic design between commercial viability and environmental responsibility.

Functionally, the project aims to create a healthily built environment to occupants through appropriate use of shading devices, non-toxic finishes and maximizing views and natural daylight. Socially, the public podium garden for exercises and outdoor relaxation affirms the project's identity as an urban oasis. Environmentally, the variety of green technologies and passive design strategies ensures the building's long-term sustainability, and low energy consumption and carbon emission.

by ***Christy CHOW***
Sustainability Consultant

The Quayside at 77 Hoi Bun Road is a mixed-use commercial development which provides approximately 82,000m^2 of office and retail spaces with a vision of creating a green, sustainable and healthily built environment. The building comprises 17 levels of Grade-A offices and three levels of podium retail separated by a sky garden accessible by both the public and tenants, as well as three basement car park levels, and a roof garden for use by office tenants. The Quayside is located in the heart of the Kowloon East District, considered the up-and-coming second, green and highly liveable Central Business District, also known as CBD2. In line with the district's visionary future, the project has already been pre-certified to the world's most recognised green building labels, namely LEED-C&S Certification Platinum, BEAM Plus Final Platinum and WELL-C&S Pre-certification Gold.

Situated within the Kowloon Bay Action Area, the development is already a pedestrian hub and a public icon of this future low-carbon green community. To mitigate the air and noise pollution from the surrounding industrial buildings and busy traffic network, The Quayside perfectly exemplifies a holistic design approach that integrates sustainability into its building designs, from planning, building façades orientation, architectural design and building systems, to its interiors, such as building setbacks created for public spaces, extensive use of green walls both externally and internally, and lush ground landscaping which serves as an effective buffer between the heavily trafficked road and the development.

To optimise both the building user experience and community engagement, advanced simulation technologies were used to analyse the microclimate conditions, including neighbour daylight impact, traffic glare and solar heat gain. This analysis identified a localised shading requirement, the design of which optimised the building performance and mitigated excessive solar heat gain by varying the sunshade fins with different shapes and depths on the façades. Combined with high-performance glazing, the building design ensures a substantially low building cooling load by achieving an Overall Thermal Transfer Value (OTTV) of about 18W/m^2, exceptionally lower than the 24W/m^2 statutory requirement.

To build a healthy environment, The Quayside incorporates extensive landscaping with the total greenery covering 30% of the site area. The 3/F podium garden acts as an Urban Oasis providing an open area for social gatherings, relaxation and exercise, equipped with pollutant-reducing plants, seating and kinetic exercise facilities that promote the concept of work-life balance in the community. Innovative Air Induction Units (AIUs) are installed with carbon filters to enhance the thermal comfort by inducing and amplifying air movement while also shielding users from the exhaust and pollutants from local highway traffic to enable better air quality in this semi-outdoor recreational area. Healthy stairwells with enhanced lighting and vibrant artworks, such as the 2/F stepped plaza, likewise serve to promote the use of stairs for users' health and wellness purposes.

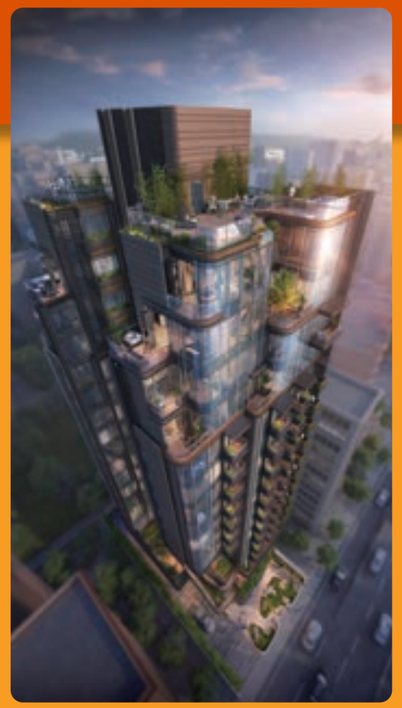
To ensure the building's long-term sustainability, diverse green technologies and passive design strategies are adopted. These include VSD chillers, demand control ventilation (DCV), a highly efficient lighting system, regenerative lifts and rainwater recycling, to name just a few. With the application of all the energy-efficient measures, the building energy use is targeted to be reduced by around 33% when compared to the Building Energy Code (BEC2012) baseline established regionally in Hong Kong. Among its many strategies, the building has integrated an innovative solar hot water system with a dehumidification system for regenerating the desiccant material. This design can address Hong Kong's high humidity conditions and reduces the annual building energy consumption by a further 2%.

To maintain the project's sustainability in the future, screens at entrance lobbies display the building's real-time energy performance. These performance displays also show the environmental quality and share tips on greener lifestyles, with the aim of driving user behaviour change through education and stronger connections to the community.

Project Team

Project Name	The Quayside
Team or Organisation Name	Century Land Investment Ltd
Name of Owner / Developer	Link Asset Management Ltd / Nan Fung Development Ltd
Project Manager	Land Champion Ltd (Subsidiary of Nan Fung Development Ltd)
Architect	P&T Architects and Engineers Ltd
C&S Engineer	AECOM Asia Co. Ltd
M&E Engineer	WSP (Asia) Limited
Landscape Architect	AECOM Asia Co. Ltd
Quantity Surveyor	Arcadis Hong Kong Ltd
Sustainable Design Consultant	Ove Arup & Partners Hong Kong Ltd
Façade Consultant	Buro Happold Engineering Ltd
Acoustic Consultant	Shen Milsom & Wilke Ltd
Main Contractor	Gammon Construction Ltd
Lighting Designer	LIGHTLINKS International Ltd
Interior Designer	CL3 Architects Ltd

Courtyard Residence



Redefining the living standard for Hong Kong by greening every view, every level, and every doorstep in this 'urban courtyard.'

by ***Matt NG, Joyce NG, Jessica CHAN, Howard HO***
Project team from Ronald Lu & Partners

Courtyard Residence

The Courtyard Residence is a unique, green residential tower that stands out in the hyper-dense residential living environment of Hong Kong's Mongkok district. With air and noise pollution-related issues being an ever-present concern for city dwellers, the design team believed that the creation of a real "urban forest building" in Ho Man Tin, on Waterloo Road, could reintroduce nature into the neighbourhood, creating a microclimate shaded by natural barriers and promoting a healthy natural lifestyle in the middle of one of the busiest and most crowded urban districts on the planet.

A vertical urban woodland

The Courtyard Residence was designed to physically connect each of its residents with nature by "greening every view, every level and every doorstep". With over 50% green coverage, this urban forest building has private green balconies, green terraces, courtyards, and a sky garden with over 36 plant species – 70% of which are local species. The design turns individual green elements into an integrated urban ecosystem through linked courtyards that are fully accessible to birds and insects, fulfilling an important aim of the development: to repopulate the biodiversity of Waterloo Road and the wider district. Additionally, the building's substantial greenery helps to filter air pollutants and particles produced by the city environment, and reduces the urban heat island effect – both of which will enhance the microclimate of the entire neighbourhood. The greenery also acts as a natural noise barrier, greatly improving residents' quality of life and psychological comfort.

Improving urban porosity

The building's visual voids and breathing spaces in pedestrian zones are designed to add quality to the urban lifestyle. By providing a 30% void space over the whole building volume, the team simultaneously decreased compactness and reduced the building's bulk. The generous setback further increases permeability and air circulation along Waterloo Road. Additionally, around 25% of the development's greenery is located in the pedestrian zones, creating a lush physical and visual connection to nature.

Biophilic living

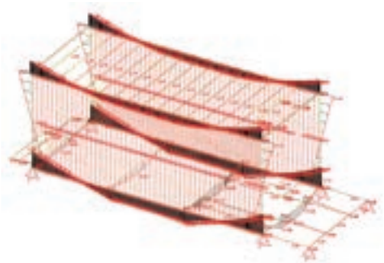
The Courtyard Residence fully integrates sustainability, biodiversity, health and wellness into its design concept. The design nurtures seamless connections with nature through biomorphic forms and patterns, by incorporating natural ventilation considerations into every space, and by strategically providing plant cultivation spaces in both public and private areas, allowing individual residents and the community as a whole to grow, produce and share fresh, nutritious fruits, herbs and vegetables.

The building's outdoor podium staircases also create a constantly dynamic, nature-based relationship with the communal spaces. These can only be discovered by walking, and only perceived when passing through them – creating paths that surprise, delight and, crucially, promote an active, healthy lifestyle.

Project Team

Project Name	Courtyard Residence
Team or Organisation Name	Ronald Lu & Partners (Hong Kong) Ltd
Name of Owner / Developer	Well Smart International Holdings Ltd
Architect	Ronald Lu & Partners (Hong Kong) Ltd
Structural Engineer	JMK Consulting Engineers Ltd
Building Services Engineer	PineBridge Consulting Ltd
Landscape Architect	Colem Group Ltd
Quantity Surveyor	AECOM Asia Co. Ltd
Sustainable Design Consultant	BMT Hong Kong Ltd
Environmental Consultant	BMT Hong Kong Ltd
Façade Consultant	Meinhardt Façade Technology (HK) Ltd
Acoustic Consultant	BMT Hong Kong Ltd
Main Contractor	Aggressive Construction Engineering Limited
Land Surveyor	Sam Mak & Associates Surveyors (HK) Ltd
Green Certificate Consultant	BMT Hong Kong Ltd

HKSTP InnoCell Residential Institution



The adoption of the use of MiC at InnoCell improves construction productivity, safety and sustainability. It certainly helps achieving an innovative and sustainable construction environment by means of waste reduction and quality control while solving the aging problem of the local labour market. However, to maximize the advantages it brings, professional structural engineers should be able to integrate the concept with other innovative ideas such that the benefits will be maintained in the long run.

*by **Ir W L CHAN***
Senior Associate, WSP

In the schematic design stage, HKSTP compared conventional reinforced concrete construction and the use of modular integrated construction (MiC) technology. It selected MiC because the connection detail between modules can be released non-destructively, which allows for the modules to be relocated and reused to suit a new layout if needed. Based on its experience, transportation of MiC modules with proper fixing of loose furniture would also pose no risk to the interior design or E&M services. In other words, if the interior is maintained in a good condition, not only the structural frame but the whole module could be reused in the future.

The advantage of any innovative idea can be further maximised when integrated with other innovations. In this project, the overall weight of the structure was significantly reduced, and the thickness of the pile cap could be made thinner than for a conventional reinforced concrete building. This resulted in a reduction of the overall foundation works. It also made it possible to optimise the extent of excavation for the basement and the depth of the pile cap, so that open cut excavation could be used exclusively. This eliminated the need for lateral support systems such as sheet piling or pipe piling, which cause significant disturbance in terms of noise and vibration to the surrounding structures, particularly the subway adjoining this site.

A flat slab system was adopted in the common areas of the building for typical floors. Being different from the traditional beam-slab structure, the flat slab construction helped to minimise timber waste resulting from the use of formwork during construction. This also facilitated the use of MiC, which aims to construct in a faster way and with better quality. In terms of long-term usage, the flat slab construction provides a greater spatial perception of common areas, as the headroom is not controlled by a beam. This enables more effective communal spaces for gathering.

The skylight on the Roof Floor also enhances daylight penetration from the 17/F down to 16/F, and reduces the need for artificial lighting in the common area. In addition, a large landscaped area on the ground floor is available to the public, offering a comfortable communal space for the benefit of the entire neighbourhood.

Project Team

Project Name	HKSTP InnoCell Residential Institution
Team or Organisation Name	WSP Hong Kong Limited
Name of Owner / Developer	Hong Kong Science & Technology Parks Corporation
Project Manager	Leigh & Orange Ltd
Architect	Leigh & Orange Ltd
C&S Engineer	WSP Hong Kong Limited
M&E Engineer	Ove Arup & Partners Hong Kong Ltd
Landscape Architect	Adrian L. Norman Ltd
Quantity Surveyor	Currie & Brown (China) Limited
Sustainable Design Consultant	Allied Environmental Consultants Limited
Environmental Consultant	Allied Environmental Consultants Limited
Façade Consultant	WSP Hong Kong Limited
Acoustic Consultant	Allied Environmental Consultants Limited
Main Contractor	Hip Hing Engineering Co.

Mount Anderson

Explore and implement new possibilities as practical as possible for the benefit of the occupants, facility management and the community and set new standards for building developments.

by ***Marcus LEUNG***

Project Team

Project Name	Mount Anderson
Name of Owner / Developer	Chinachem Group
Project Manager	Chinachem Group
Architect	DLN Architects Limited
C&S Engineer	AECOM Asia Company Limited
M&E Engineer	AECOM Asia Company Limited
Landscape Architect	ADI Limited
Quantity Surveyor	ARCADIS Hong Kong Limited
Sustainable Design Consultant	CO2nnsulting Limited
Environmental Consultant	CO2nnsulting Limited
Main Contractor	Paul Y. Builders Limited

Energy & Towards Zero Carbon

To support the movement towards zero carbon, this project adopted a number of passive and active strategies such as cool façades with hanging greenery, best-in-class air-conditioning equipment (COP of 3.2 for SAC and 3.7 for VRF), low-E glazing, ample daylighting in all units, naturally ventilated common lobbies, kitchens and bathrooms, a daylit basement, green roofs and low-carbon transportation.

Environmental Quality and Wellbeing

- Monitoring devices for temperature, relative humidity and air quality are installed in clubhouse areas to ascertain the indoor environmental quality.
- To optimise natural lighting whilst minimising solar gains, large fenestrations and balconies were strategically located. All bathrooms in residential units and lift lobbies in residential towers are provided with windows.
- Natural ventilation and daylighting is provided in the basement car park.
- The design and location of building blocks and landscaping are derived from wind and sun path simulations calculated at the beginning of the project.
- An excellent acoustic environment has been enabled in each dwelling by selecting building service equipment and glazing with an STC of 35.
- UVGI water sanitation ensures that the best quality and best tasting drinking water is delivered to every dwelling, which reduces the use of plastic bottled water.
- The project has only used low-VOC materials with limited perfluorinated compounds (PFCs) and halogenated flame retardants.
- Touchless and self-sanitising UV door handles help to minimise the spread of bacteria.
- Healthy living is provided according to the WELL Gold standard.
- The provision of a community farming garden encourages healthy food production.
- The provision of pedestrian amenities further enriches the quality of life, including seating benches, outdoor lounges and drinking fountains.
- The provision of space for bicycle storage encourages seamless low-carbon transportation.

Site, neighbourhood, landscape and ecology

- The landscape design was maximised to achieve greenery of more than 30% of the site, providing over 1,600m^2 of planted area.
- To maintain visual connections with the peripheral natural scenery and soften the building's façades and boundary, the project uses vertical green walls, and sun shading devices with hanging greenery on the façades.
- The seamless integration between interior space (clubhouse/ entrance lobby) with the exterior landscape maximises the open landscaped area for the enjoyment of all residents and offers an experience of 'garden living'.
- Pedestrian routes are laced with lush landscape treatments and pocket gardens. Early coordination with the structure enabled lush tree-planting opportunities on top of the basement structure.

Elderly friendly and multi-generational living

- In collaboration with CUHK, the project developed Hong Kong's first comprehensive inter-generational living concept and inclusive principles.
- The low-rise residential tower provides the following:
  - Widened corridors in common areas and a wide entrance door for better accessibility by wheelchair users.
  - A larger service lift to accommodate a stretcher in case of emergencies.
  - Generous circulation width in bedrooms, easily accessible light switches/socket positions, adaptable kitchen worktops and lavatory design, special unit entrance identification plates, stepless entry to balconies and utility platforms, and special anti-slip and cushioned flooring in the units to accommodate elderly people's needs.

O'EAST Portfolio

Sustainability is at the heart of O'EAST development strategy. O'EAST development adopts a holistic approach that embraces construction, design and management best practices. True sustainability is achieved by understanding the close relationship between "people" and "property".

by ***Mr Calvin CHIU***
Senior Manager of Ramboll Hong Kong Limited

Located at LOHAS Park in Tseung Kwan O district, the O' EAST Portfolio (O'EAST) comprises the residential developments of MALIBU, MONTARA, GRAND MONTARA, MARINI, GRAND MARINI and OCEAN MARINI, all of which have been awarded BEAM Plus New Buildings Provisional Gold rating. O'EAST is built with the aim of inspiring sustainable and healthy lifestyles, and improving the surrounding environment by integrating various environmentally friendly and climate-resilient design throughout the project's life cycle.

Covering an area of 35,062m^2, O'EAST makes up around 11% of the entire area of LOHAS Park. Not only do these communities offer 20% of the overall number of residential units and 19% of the residential gross floor area of the entire LOHAS Park – which accommodates 30% of the vicinity's population – O'EAST alone provides 13,953m^2 of greenery, which is equivalent to 10% of the overall greenery available in LOHAS Park. The irrigation to the greenery is supported by centralised grey water, mainly coming from bathtubs and basins of residential bathrooms. It is one of the first such applications in a residential project in Hong Kong, resulting in a reduction in potable water consumption of over four million litres annually.

Through holistic site planning, O'EAST integrates elements of sustainable living, working and playing, including a shopping mall offering an extensive range of entertainment to support a low carbon and healthy lifestyle. Furthermore, O'EAST has strategically reintroduced the delight of walking. All the facilities are conveniently connected with covered walkways, so that residents can access a wealth of amenities on foot. Door-to-door cycling is also possible thanks to an extensive network of segregated bicycle lanes. Easy access to a cycling lane on the waterfront promenade with over 450 bicycle parking spaces is another exemplar of the healthy and low carbon lifestyle that O'EAST represents.

Generous greenery, water features and abundant access to sea breezes have been incorporated into the holistic planning. Microclimate studies were conducted to optimise the natural ventilation and daylight in every dwelling and open space. The multi-layered greenery design from the ground to roofs and vertical surfaces creates a cocoon for the residents, strengthening their connections with nature. By offering a total of 13,953m^2 of multifaceted greenery and water features, O'EAST not only helps reduce the urban heat island effect, but also improves the comfort of residents by providing an aesthetically pleasing view.

Recognising the extreme weather patterns of increasingly frequent typhoons and rainstorms – and the spread of epidemics – the developer, Wheelock Properties, understands that scientific studies are essential in the design process to deliver a resilient community. This is why climate-resilient designs and materials have been used to reduce the impact from extreme weather. Pervious paving is used in 51% of the hard-paved areas to better manage stormwater and reduce the risk of flooding. Physical wind tunnel tests covering the whole of LOHAS Park were also conducted to ensure that O'EAST can stand up to everchanging weather patterns. This not only underscores the safety of all residents, it also enables the creation of a healthy environment in which thermal comfort and fresh air have been optimised.

Project Team

Project Name	O'EAST Portfolio
Team or Organisation Name	Wheelock Properties (Hong Kong) Limited / MTR Corporation Limited
Name of Owner / Developer	Wheelock Properties (Hong Kong) Limited / MTR Corporation Limited
Project Manager	Wheelock Properties (Hong Kong) Limited
Architect	Ronald Lu & Partners (Hong Kong) Ltd (MALIBU, MARINI & GRAND MARINI & OCEAN MARINI) P&T Architects and Engineers Ltd (MONTARA & GRAND MONTARA)
C&S Engineer	AECOM Asia Co. Ltd (MALIBU, MARINI & GRAND MARINI & OCEAN MARINI) Ove Arup & Partners (Hong Kong) Ltd (MONTARA & GRAND MONTARA)
M&E Engineer	Meinhardt (M&E) Ltd
Landscape Architect	ADI Ltd (MALIBU, MONTARA & GRANDMONTARA) AECOM Landscape Co. Ltd (MARINI & GRAND MARINI & OCEAN MARINI)
Quantity Surveyor	Arcadis Hong Kong Ltd (MALIBU, MONTARA & GRAND MONTARA), Rider Levett Bucknall Ltd (MARINI & GRAND MARINI & OCEAN MARINI)
Sustainable Design Consultant	Ramboll Hong Kong Ltd (MALIBU), WSP (Asia) Ltd (MONTARA & GRAND MONTARA, MARINI & GRAND MARINI & OCEAN MARINI)
Environmental Consultant	Ramboll Hong Kong Ltd (MALIBU), WSP (Asia) Ltd (MONTARA & GRAND MONTARA, MARINI & GRAND MARINI & OCEAN MARINI)
Façade Consultant	Meinhardt Façade Technology (HK) Ltd
Acoustic Consultant	Ramboll Hong Kong Ltd (MALIBU), WSP (Asia) Ltd (MONTARA & GRAND MONTARA, MARINI & GRAND MARINI & OCEAN MARINI)
Main Contractor	Hip Hing Construction Company Ltd (MALIBU), China Overseas Building Construction Ltd (MONTARA & GRAND MONTARA), Gammon Engineering & Construction Company Ltd/China Overseas Building Construction Ltd (MARINI & GRAND MARINI & OCEAN MARINI)

PARK YOHO

"In keeping with the spirit of Building Homes with Heart, we have placed considerable emphasis on sustainable development. We are delighted to see that this project could serve as a role model to demonstrate a harmonious balance between project development and wetland conservation, which is a win-win situation for all parties."

by ***Rebecca WONG***
Planning Director - Project Planning and Development of Sun Hung Kai Properties Limited

Developed by Sun Hung Kai Properties Limited (SHKP), PARK YOHO is a large residential project in Yuen Long's Kam Tin North, covering a 500,000-square-foot private wetland called Fairyland. Formerly abandoned farmland, it has been successfully transformed into a vibrant semi-natural wetland with careful restoration carried out by the planning team. This project, the first-of-its-kind to integrate wetland conservation with a residential development in Hong Kong, earned a Certificate of Merit at the Hong Kong Institute of Planners (HKIP) Awards 2018 in recognition of its unique and innovative character, a clear testament to the significance of the harmonious co-existence between environmental conservation and urban development. SHKP hopes that this successful example will serve as a role model, demonstrating how to strike a harmonious balance between both project development and wetland conservation.

The Fairyland was a barren site before work started on the residential development. It was later found that the land was once a wetland habitat for dragonflies, butterflies and birds. SHKP then decided to restore this wetland habitat. After multiple procedures, hillside streams and seawater returned to the land and the wetland was gradually restored back to life. As a semi-natural brackish marsh, which is rare in Hong Kong, the Fairyland is now home to over 180 species of dragonflies, butterflies, birds and other wildlife, including near-threatened four-spot midgets, which is considered an endangered species by IUCN, rated as a Global Concern.

During the planning stage, PARK YOHO's building density, height, location and orientation were thoughtfully designed to ensure that the wetland would be interwoven with the residential environment. Reeds were planted outside the residences to provide owners with expansive natural greenery while also offering a buffer area to the wetland. To ensure the sustainability of the Fairyland, long-term management and wetland conservation measures have been implemented along with regular on-site inspections by ecology specialists and data submissions to relevant government departments. Since residents first moved in, the number of ecological species in the Fairyland has continued to increase.

Fairyland is open to PARK YOHO residents and their guests, which is also a means to educate residents regarding the harmonious co-existence between their homes and the natural environment. PARK YOHO management organises regular guided eco-tours to let participants enjoy a closer look at the precious ecology of the brackish marsh. These guided eco-tours have proven highly popular, with more than 2,000 people participating to date. Appreciation has been received from many residents that PARK YOHO has successfully achieved low-density green living blended into the surrounding environment, all enabled by SHKP's meticulous project planning.

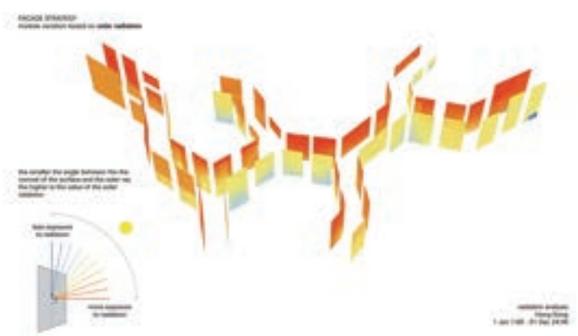
Project Team

Project Name	PARK YOHO
Name of Owner / Developer	Sun Hung Kai Properties Limited
Project Manager	Sun Hung Kai Properties Limited
Architect	Ronald Lu & Partners (Hong Kong) Limited
C&S Engineer	Sun Hung Kai Architects and Engineers Ltd, Ove Arup & Partners Hong Kong Ltd
M&E Engineer	J Roger Preston Limited
Landscape Architect	Belt Collins International (HK) Limited
Quantity Surveyor	Sun Hung Kai Properties Limited
Sustainable Design Consultant	Ramboll Group
Environmental Consultant	Ramboll Group
Façade Consultant	Alpha Consulting Limited
Main Contractor	Chun Fai Construction Co. Ltd

Proposed Student Residence Development at the Hong Kong University of Science and Technology

The new Student Resident Development includes the ""co-live", "co-learn" and "co-play" spaces, which has highly adopted sustainable and smart technology on the campus development, forms a new hub in the south side of HKUST dedicated to creativity, innovation and global engagement.

*by **Ivy LEE***
Managing Director



The Student Residence Development (SRD) is located in the southeast area of The Hong Kong University of Science and Technology (HKUST) campus, sandwiched between a number of academic and residential buildings on a sloping site with approximately a 25m level difference. Four eight-storey residence halls with a total of 1,551 bed-spaces in a hexagonal configuration hug the hillside, creating four courtyards terracing along the slope. The accommodation includes "co-live", "co-learn" and "co-play" spaces of approximately 35,000m^2 in total. Together with its neighbouring buildings (Global Graduate Tower, LSK Business School and Institute of Advanced Studies), SRD forms a new hub on the south side of HKUST dedicated to creativity, innovation and global engagement.

To promote the utilisation of new design and construction technology, Building Information Modelling (BIM) and computational design simulation were adopted in the design development process to optimise the effectiveness of design coordination and material selection. For instance, a full application of BIM was adopted to study the precast façade modulation and optimisation of the sun-shading fin design. Design for Manufacture and Assembly (DfMA) technology was highly incorporated in this project, such as precast façades, toilet pods and landscape elements, all of which enabled the identification, quantification and elimination of waste or inefficiency in product manufacture and assembly. Other advantages of adopting DfMA in this project was to potentially enhance the efficiency, shorten the construction period, improve site safety performance, and enable better building quality, which inevitably contributes to the sustainable built-environment by easing some of the local construction industry challenges we face today. In this development, more than 90% of the façade elements in the hostel area are prefabricated. The depth of sun-shading devices varies based on the terrain, orientation, surrounding buildings and levels of the façade, as determined in computational design simulations. The variation of façade moulding was optimised in the design stage through careful analysis in order to strike a balance between cost effectiveness and sun-shading effectiveness.

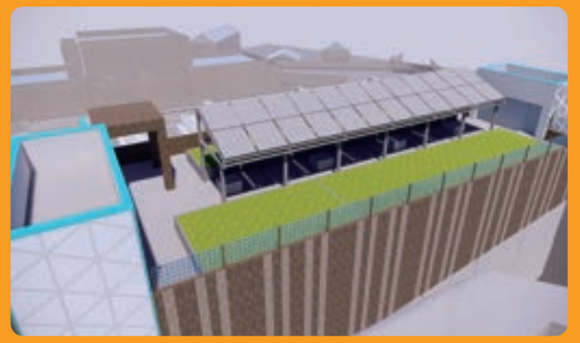
A 50-year life cycle analysis study of the cooling and water heating system, including the cost of construction, operation, maintenance and replacement, was executed during the design process to review the overall performance and effectiveness of different systems. Unlike traditional residence projects, the centralised air-conditioning and hot water system are incorporated into the development using a combination of a solar water heating system and heat recovery pipe works in order to optimise energy use.

Furthermore, numerous sustainable and smart technologies have been adopted to provide an environmentally friendly and smart campus development, such as a rainwater catchment system and BIPV. Insulated Glass Units (IGU) and a thermal insulation layer are integrated into the room design in order to optimise the energy performance of the living accommodation. Three types of ceramic tiles used on the façades diminish the intake of solar heat gain. Furthermore, a smart room control system allows students to remotely control their bedroom via their smartphone, as well as record and review the energy performance of their day-to-day lifestyles. The project is targeting BEAM Plus New Buildings V1.2 – Platinum Rating.

Project Team

Project Name	Proposed Student Residence Development at the Hong Kong University of Science and Technology
Team or Organisation Name	The Hong Kong University of Science and Technology
Name of Owner / Developer	The Hong Kong University of Science and Technology
Project Manager	Gleeds (Hong Kong) Construction Consultant Company Ltd.
Architect and Lead Consultant	Leigh & Orange Ltd.
Design Consultant	Zaha Hadid (Hong Kong) Ltd.
C&S Engineer	WSP Hong Kong Ltd.
M&E Engineer	WSP Hong Kong Ltd.
Landscape Architect	Earthasia Ltd.
Sustainable Design Consultant	WSP Hong Kong Ltd.
Environmental Consultant	WSP Hong Kong Ltd.
Façade Consultant	Inhabit Asia Ltd.
Acoustic Consultant	WSP Hong Kong Ltd.
Traffic Consultant	MVA Hong Kong Ltd
Quantity Surveyor	Rider Levett Bucknall Ltd.
Main Contractor	Paul Y. Construction Company Limited

CLP Queen's Hill 132kV Substation



We are committed to integrate environmental protection concepts and innovative technologies into our newly developed substations to provide customers with a greener, smarter electricity supply.

by ***Mr Alex WONG***
Director - Engineering Projects
CLP Power Hong Kong Limited

CLP Power Hong Kong Limited (CLP Power) is committed to providing customers an electricity supply delivered with world-class safety and reliability. By integrating new technologies and sustainable concepts in its daily operations, CLP Power is able to offer greener and smarter energy services to the communities it serves and support Hong Kong's development towards a smart city.

Its Queen's Hill 132kV substation (QUH) was built to provide electricity to support the development of a host of new residential areas and public infrastructure facilities in a rapidly developing rural area in the northeast New Territories of Hong Kong. The low-rise two-storey substation hosts a series of sustainable and community-oriented elements that help it blend into the surrounding countryside. New technology was also deployed to improve its operational performance and overall cost effectiveness.

Green Design

- Applying the design concept of "Urban-Rural-Nature Integration", the structure integrates photovoltaic panels in a greenish colour together with over 300m2 of greenery on the building façade to harmonise with the surrounding countryside..

Energy Efficiency and Conservation

- The architectural design enables natural ventilation of major power units
- Grid-connected photovoltaic panels to output renewable energy
- A two-level lighting control system and LED lighting system improve energy savings.
- Specially designed circuits have been installed in the substitute batteries of the emergency lighting system.
- Rainwater is harvested in an underground rainwater storage tank for drip irrigation.

Conservation of Natural Resources

- About 12% of the substation outside surface is built by recycled building materials
- About 96% of all building materials are manufactured within 800km from the site
- Green construction management was adopted to minimise construction waste and reduce the impact on the surroundings.

Smart Features

- A remote monitoring system and e-lock system help ensure a safe and reliable supply of electricity.
- A Building Management System (BMS) has been adopted to real-time monitor the operational and energy performance of the substation building. The energy consumption profile and history can also be analysed with ease.
- The installation of electric vehicle chargers supports green motoring.
- The integration of Building Information Modelling (BIM) and Virtual Reality (VR) technology in project management further enhance the operational performance and safety.

By embracing CLP Power's core values of innovation and caring for the environment, the Queen's Hill 132kV substation is a showcase of green building and sustainable development. The project achieved a BEAM Plus Provisional Platinum rating, and was awarded the Gold Award in the Transmission and Distribution of the Year category at the Asian Power Awards 2019.

Project Team

Project Name	CLP Queen's Hill 132kV Substation
Team or Organisation Name	CLP Power Hong Kong Limited
Name of Owner / Developer	CLP Power Hong Kong Limited
Project Manager	Ms Arras Yeung
Architect	David S.K. Au & Associates Ltd
C&S Engineer	David S.K. Au & Associates Ltd
M&E Engineer	David S.K. Au & Associates Ltd
Landscape Architect	Terra Studio Limited
Quantity Surveyor	Beria Consultants Limited
Sustainable Design Consultant	Ramboll Environ Hong Kong Ltd
Environmental Consultant	Ramboll Environ Hong Kong Ltd
Main Contractor	Hip Hing Construction Co Ltd

Development of IE 2.0 Project C, Advanced Manufacturing Centre

AMC is truly an 'Advanced Manufacturing Centre' which promotes re-industrialization of innovative manufacturing in Hong Kong; built with advanced construction technology creating a benchmark for new era of smart factory industry in a responsive & sustainable environment.

by ***Ms Angela KO***
Wong Tung and Partners Ltd

Project Team

Project Name	Development of IE 2.0 Project C, Advanced Manufacturing Centre
Team or Organisation Name	Hong Kong Science and Technology Parks Corporation
Name of Owner / Developer	Hong Kong Science and Technology Parks Corporation
Project Manager	Hong Kong Science and Technology Parks Corporation
Lead Architectural Consultant	Wong Tung and Partners Ltd
Industrial Architectural Design Consultant	Nikken Sekkei Ltd
C&S Engineer	Meinhardt (C&S) Limited
M&E Engineer	Wong & Ouyang (Building Services) Ltd
Landscape Architect	ADI Ltd
Quantity Surveyor	Rider Levett Bucknall Ltd
Logistic Design Consultant	Ove Arup & Partners (HK) Ltd
Sustainable Design Consultant	Ramboll Environ Hong Kong Ltd
Façade Consultant	Inhabit Asia Ltd
ICT & Acoustic Consultant	Shen Milsom & Wilke Ltd
Traffic Consultant	MVA Hong Kong Ltd
BIM Consultant	Build.IT Ltd
Graphic & Signage Consultant	VL Design & Consulting Ltd
Lighting Consultant	Steensen Varming Ltd
Main Contractor	Gammon Construction Ltd

Background

The Advanced Manufacturing Centre (AMC) is a world-class project to promote the re-industrialisation of smart technology and strengthen innovative production in the global market. Benchmarked against the Industry 4.0 Standard, AMC is the first pilot project in Hong Kong to showcase the emerging trend of smart factories in a multi-storey environment for multi-tenants in five focused industries (Medical Equipment, Biomedical Engineering, Semiconductor & Optical Equipment, Robotics-Electronics, and Smart Power devices).

Designing the smart factory

AMC is designed for maximum flexibility with the provision of Vibration Class B in 12m grid molecular production providing a 15 and 25 kPa floor loading capacity, thus catering to a diversity of industrial requirements. The large floor plates are enclosed with concrete structures and cladding panels to maintain thermal comfort. The major curtain wall façade faces north with a low-E coating and shading coefficient of 0.24 on glass panels that minimise heat gain through solar radiation. Chimney shafts on the east and west elevations act as buffer zones with solar shading to deflect heat gain away from the building structure. The central atrium of the building together with the chimney shafts on both sides creates a 'stack effect' which promotes passive cooling by natural ventilation and reduces energy consumption.

Automated Logistics Centre and robotic systems

AMC is equipped with cutting-edge technology for a fully automated Logistics Centre which provides 'just in time' delivery supported by IoT technologies. By enabling a reduction of labour, the smart factory achieves greater energy savings through less demand for air conditioning, lighting and transportation. The AI technology of the Warehouse Management System likewise enables a paperless environment.

Green and sustainable features

AMC is equipped with diversified green and sustainable features aiming to achieve a 'Gold' rating in BEAM Plus certification, including:

- Photovoltaic panels to produce 130MWh of electricity per year. The solar energy will be converted and connected to the Electrical Grid System for direct power consumption.
- 27m^3 of rainwater to be collected, filtered and stored in a water tank for irrigation. The water saving for irrigation will be around 4.1% of the approximately 6,440m^3 consumed annually.
- Generators powered by bio-fuel (B-100) enable the provision of backup electricity to non-FSI equipment. This environmentally friendly fuel consists of vegetable oil and does not contain diesel content, thus eliminating the by-products of smog, ozone, and sulphur emissions.

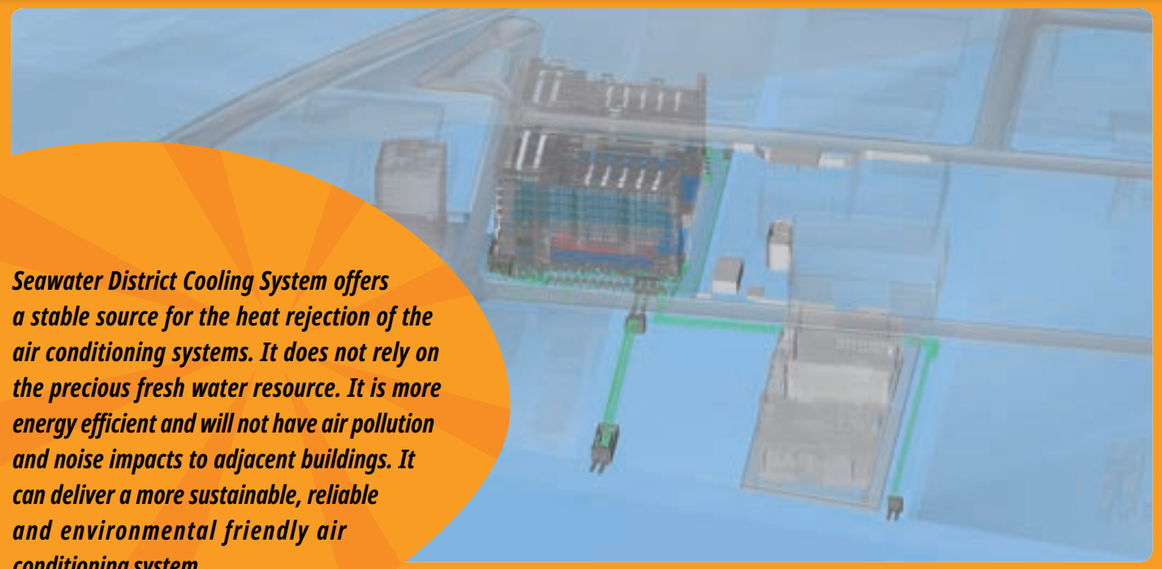
Sustainable construction

Guided by the Design for Manufacture and Assembly (DfMA) methodology, modular construction was adopted in the structural works, external façade and E&M installation, thus minimising transportation of raw materials to site resulting in a reduction of CO_2 emissions while also increasing the efficiency and accuracy of the construction process. System formwork and precast double tee slabs adopted for typical floor construction reduced timber consumption by 1,600m^3 and enabled a 15% reduction in labour on site.

A vision for the future

AMC is a pioneering project that delivers a vision for the future of manufacturing industries in Hong Kong. The concept of innovation is continuously implemented throughout the life cycle of the building, from design and construction to facility management. The application of Building Information Modelling (BIM) provides interactive control of the efficiency of building services against live environmental changes to minimise everyday energy wastage and enable greener, sustainable smart factory operations.

Development of IE 2.0 Project C, Seawater District Cooling System



Seawater District Cooling System offers a stable source for the heat rejection of the air conditioning systems. It does not rely on the precious fresh water resource. It is more energy efficient and will not have air pollution and noise impacts to adjacent buildings. It can deliver a more sustainable, reliable and environmental friendly air conditioning system.

by ***Mr C.H. LAI***
Wong & Ouyang (Building Services) Ltd

Project Team

Project Name	Development of IE 2.0 Project C, Seawater District Cooling System
Team or Organisation Name	Hong Kong Science and Technology Parks Corporation
Name of Owner / Developer	Hong Kong Science and Technology Parks Corporation
Project Manager	Hong Kong Science and Technology Parks Corporation
Lead Architectural Consultant	Wong Tung and Partners Ltd
Industrial Architectural Design Consultant	Nikken Sekkei Ltd
C&S Engineer	Meinhardt (C&S) Limited
M&E Engineer	Wong & Ouyang (Building Services) Ltd
Landscape Architect	ADI Ltd
Quantity Surveyor	Rider Levett Bucknall Ltd
Logistic Design Consultant	Ove Arup & Partners (HK) Ltd
Sustainable Design Consultant	Ramboll Environ Hong Kong Ltd
Façade Consultant	Inhabit Asia Ltd
ICT & Acoustic Consultant	Shen Milsom & Wilke Ltd
Traffic Consultant	MVA Hong Kong Ltd
BIM Consultant	Build.IT Ltd
Graphic & Signage Consultant	VL Design & Consulting Ltd
Lighting Consultant	Steensen Varming Ltd
Main Contractor	Gammon Construction Ltd

Construction of a Seawater District Cooling System (SDCS), which takes advantage of the natural water resources at Junk Bay, is one of the strategic initiatives led by Hong Kong Science & Technology Parks Corporation to drive re-industrialisation, commercialise innovation, and drive sustainable development on the Tseung Kwun O Industrial Estate. The SDCS offers an energy-efficient and economical cooling infrastructure of 32,000Tr cooling capacity to support the future industrial development of the district.

The SDCS involved the construction of underground maintenance chambers with seawater pipes and chilled water pipes across and along Chun Yat Street, connecting a basement chiller plant room at the Advanced Manufacturing Centre (AMC), a seawall water pump house near the seawall of site C5 as the seawater intake, and a water chamber near the seawall of site C6 as the seawater outfall. The SDCS system not only serves the AMC, but can also be extended to future tenants in the district.

Environmental benefits of SDCS

By adopting a Seawater District Cooling System strategy, it is envisaged that carbon emissions can not only be reduced by 4,200 tonnes, but there will also be a synergistic effect on the overall cooling loading when compared with traditional individual freshwater cooling chiller plant systems.

Pipe jacking method for SDCS pipe works

To overcome the congestion of existing underground services on Chun Yat Street, a pipe jacking method for SDCS pipe works installation was adopted instead of traditional open trench excavation. This not only improved productivity, but also reduced adverse environmental impacts during the construction stage, including impacts on road traffic, dust emissions from open trench excavation, noise from plant and equipment, and minimised C&D waste disposal.

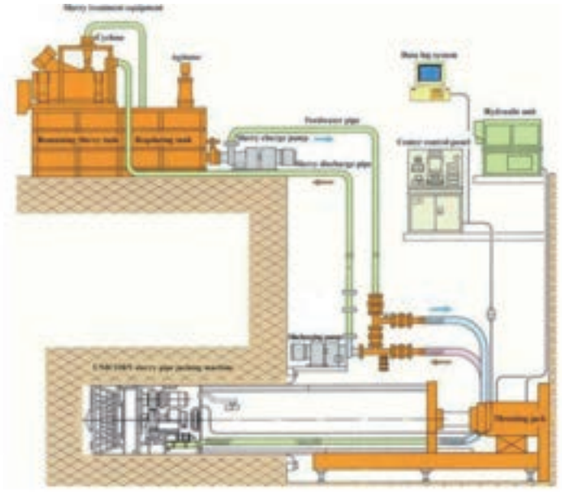
The overall length of the pipe jacking work was approximately 1,340m.

Seawall modification

Construction of seawater intakes and outfalls on the existing seawall was subject to a number of challenging constraints, including the marine working environment, the structural stability of the existing seawall and adjacent structures, and the limited working space.

To minimise disturbance to the existing seawall and eliminate the inherent risks of a marine working environment, an excavation and lateral support (ELS) system consisting of a pipe pile wall was adopted, such that wailings and struts below the sea level could be avoided. This method provides a better and safer working environment. Vibrations and ground settlement surrounding the construction works were also monitored closely to ensure the structural stability of the existing seawall and adjacent structures.

Having considered the narrow working space and fluctuating seawater level, a construction method using precast concrete box culverts was adopted for the seawater intakes and outfall. By installing the precast box culverts using a float and sink construction method, the numbers of workers required to work in the marine environment, and the potential for water pollution, were greatly minimised when compared with a traditional in-situ concreting construction method.



TYPICAL ARRANGEMENT OF PIPE JACKING EQUIPMENT AT JACKING PIT

Chai Wan Campus for the Technological and Higher Education Institute for Hong Kong

The newly-completed Chai Wan campus offers an innovative learning environment for 21st century professional training in the areas of design and environment, as well as management and hospitality.

by ***Dr Roy CHUNG***
VTC Chairman

The new THEi Chai Wan campus was designed to foster the exchange of ideas – a crucial ingredient of an open, community-centric learning environment.

Sustainable neighbourhood-centric planning

The new campus has created several new multi-dimensional community space networks. These integrate well with the surrounding public realm, promoting social interactions between "the town, the gown and the industry." At street level, the previously fragmented community space network has been reconnected, allowing the public to enjoy improved access and walkability through the campus to the harbourfront. The building permeability in the pedestrian zone has been enhanced by 15% by raising the tower blocks along core pedestrian pathways on V-shaped columns, thus reducing visual and physical obstructions along air and view corridors underneath the towers.

Connections to the neighbourhood's all-weather covered walkway system and public transport network were planned from the earliest design stages. Structural piers and linked bridges connecting to the existing elevated walkway system are provided on the second floor, connecting and extending the public realm to the campus plaza on the first floor.

Multi-level skyrise greenery

Communal green spaces account for about 40% of the site greenery coverage, excluding partially-covered vertical skyrise greening on various floors of the campus. The skyrise greenery provisions go beyond local sustainable building design guidelines, which primarily focus on pedestrian zone greenery. The greenery's configurations, locations and species choices were informed by solar irradiance studies of the built forms and other studies of the site and surroundings, all of which provided a scientific, performance-based approach to compact urban skyrise greening.

Sustainable landscaping strategies were employed to enhance the site's urban biodiversity, including the introduction of over 120 trees and 33,000 shrubs – 60% of the trees, 90% of the shrubs and 53% of the ground cover are native species. This not only created habitats for birds and wildlife, but also enhanced the campus microclimate.

Lean architecture: towards high performance and greater adaptability

Through various means, the campus has achieved a greater than 20% reduction in energy consumption and over 80% daylight penetration into the habitable space. These measures include a twin-block design, north-south building orientation, high building permeability, a shallow plan depth, a cross-ventilated layout, external shading and light shelves, a well-insulated building envelope and energy-efficient active systems. To promote environmentally-positive user behaviour, a real-time building energy dashboard was designed to provide information to the facilities management team as they work to control resource consumption, disseminate resource saving tips and collect user feedback. Despite having many green features, the overall project budget was comparable to other tertiary education institutes, illustrating the success of this high performance, lean architecture approach.

This "lean design" is also an effective way of reducing the unsustainable use of materials over the building's life cycle – avoiding the use of decorative materials, mandating the routine inspection and maintenance of exposed building services installations, and minimising the need to frequently replace decorative finishes. Finally, to create flexibility for change and future expansion, the structural grid, foundation loadings and architectural layout take into account various possible alterations and expansions to the campus.

Project Team

Project Name	Chai Wan Campus for the Technological and Higher Education Institute for Hong Kong
Team or Organisation Name	Ronald Lu & Partners (Hong Kong) Ltd
Name of Owner / Developer	Vocational Training Council
Project Manager	Vocational Training Council
Architect	Ronald Lu & Partners (Hong Kong) Ltd
C&S Engineer	Ove Arup & Partners Hong Kong Ltd
Building Services Engineer	WSP (Asia) Ltd
Landscape Architect	Earthasia Ltd
Quantity Surveyor	Rider Levett Bucknall Ltd
Acoustic Consultant	Shen Milsom & Wilke Ltd
Main Contractor	Unistress Building Construction Ltd

Chung Chi Student Development Complex

The core of this project is to explore the way to encourage walkable campus, adopt natural and existing resources, and promote co-living and co-studying styles; as a new prototype of educational buildings for the future.

by ***Ivy LEE***
Managing Director

The Chung Chi Student Development Complex is a redevelopment of the existing Old Chung Chi Campus to cater to the incremental needs of student facilities in the future, implemented in a student-oriented and environmentally friendly way that preserves the traditional values of the campus.

The new Student Development Complex is designed to encourage walkability in the campus by forming a new connection between the Chung Chi Campus and Main Campus, thus minimising the use of the shuttle bus within the campus area and providing more interaction with the existing green campus. A journey-like internal circulation has also been adopted to create a garden-type journey inside the building itself, with enjoyment enhanced by natural lighting and ventilation. More than 40% of the project site is enhanced with soft landscaping.

The overall building orientation was selected to optimise the summer prevailing wind from the south-west and natural lighting from the east and south. The service core and mini-theatre is strategically allocated on the western side of the building to act as a thermal mass and passive sun-shading, while the functional block faces to the east and south in order to achieve maximum indirect sunlight without requiring additional sun-shading devices. In short, natural ventilation is the primary source of ventilation in all circulation and communal spaces, with the support of energy-efficient low-speed fans.

A major communal space is placed in the middle part of the building in order to enhance the visual and spatial connectivity between the surrounding functional rooms. This is designed to optimise the stack effect in the summer and cross ventilation on the eastern side. In order to reduce the wind temperature in the summer, an innovative and energy-efficient misting cooling system to cool the wind by evaporation is installed on the side where the summer prevailing wind comes from.

For the staff quarters, the unit layouts are arranged so that cross ventilation can be easily achieved within the unit. Two architectural light wells are designed among the units in order to facilitate cross ventilation and allow sufficient sunlight to the rear part of each unit as well as the common corridors. A multi-storey communal space is likewise arranged in the middle of the staff quarters for leisure and resting purposes, and also to allow good cross ventilation in the common space.

Computational simulation indicates that the project will achieve a 13% reduction in energy consumption annually, in comparison with the standards in the local Building Energy Code. Furthermore, a green roof and insulated glass units have been adopted to achieve effective thermal and acoustic insulation. To further enhance buildability and reduce waste, the project adopted a modular and standardised design for more than 50% of all building components, while a total of 2.5% of all building materials were rapidly renewable materials. The project is targeting a BEAM Plus New Building V1.2 – Platinum Rating.

Furthermore, re-adoption of memorial materials such as rubble and lattice façades enable the redevelopment to inherit some symbols and memories of the old campus. In this respect, a special feature wall and perforated façade design have been created to showcase the spatial dimensions and atmosphere of the early campus.

Project Team

Project Name	Chung Chi Student Development Complex
Team or Organisation Name	The Chinese University of Hong Kong
Name of Owner / Developer	The Chinese University of Hong Kong
Campus Planner & Project Manager	Campus Development Office, The Chinese University of Hong Kong
Architect and Lead Consultant	Leigh and Orange Ltd.
C&S Engineer	Greg Wong & Associates Ltd.
M&E Engineer	J. Roger Preston Ltd.
Landscape Architect	Urbis Ltd.
Sustainable Design Consultant	Telemax Environmental and Energy Management Ltd.
Acoustic Consultant	Shen Milsom & Wilke Ltd.
Traffic Consultant	MVA Hong Kong Ltd.
Quantity Surveyor	K C Tang Consultants L Ltd.
Main Contractor	Unistress Building Construction Ltd.

JCDISI "Operation SoInno" Action Project: Transitional Social Housing

Adaptive reuse of old buildings for Transitional Social Housing will not only support heritage preservation and sustainable construction, it also supports vertical land use mix to provide housing for the inadequately housed, reconnects the urban fabric and reintroduce services missing in the local community to meet the sustainable communities objective.

by ***KK LING***
Director JCDISI

In Hong Kong, idle sites pose a variety of physical and technical challenges for the Government and developers wanting to utilise the land effectively. Exploring land resources for the provision of Transitional Social Housing (TSH) can trigger the reimagination of idle sites and dilapidated but robust buildings. The Jockey Club Design Institute for Social Innovation (JCDISI) organised a social innovation symposium in October 2018 to explore how built environment professionals and social workers can join hands to expedite TSH provision through five selected sites and one topical flat conversion case. With the advice of 42 experts from various fields, seven conceptual design schemes were produced by the 86 co-creation participants through the participatory co-design process.

Making effective use of idle land resources to provide TSH is seen as an effective way to tackle the challenges brought by "Double Ageing" – namely an ageing population and ageing building stock – and to create a more resilient, sustainable city. As such, careful considerations need to be given to deliver TSH in a community undergoing rapid transitions.

To illustrate this, a temporary work site in Sham Shui Po, a vacant school site in Stanley, and the deserted Ma Wan Old Village were all taken forward as Action Projects to develop implementable prototype schemes to systematically document the technical solutions and community building considerations that need to be taken into account in the planning and designing of TSH. This includes issues such as site formation, heritage and conservation considerations, land use mix, infrastructure upgrades and adaptive re-use of existing buildings for future use. Attention must also be paid to creating sustainable, socially-inclusive communities, reconnecting the urban fabric, providing adequate room for social services for the tenants, and effective property management for TSH developers and operators' reference to ascertain TSH's sustainable operation. As most of the TSH schemes are on short-term tenancy sites, modular integrated construction (MiC) is widely adopted to accelerate delivery and to accommodate different household sizes and tenant mixes. This methodology is also more flexible to respond to the specific physical environment of each site, the social environment of the community, and the objectives of the operating NGO in providing the required services and ancillary facilities for the tenants.

TSH is a type of housing that will doubtless be required in Hong Kong for a relatively long time. To ensure environmental sustainability in all future operations, ten principles have been consolidated through an R&D-based prototyping process as a guide for the Government, NGO operators and managers to increase TSH's functionality and resilience:

1) Principle of functionality
2) Principle of practicality
3) Principle of aesthetics
4) Principle of decency
5) Principle of inclusive neighbourhoods
6) Principle of community integration
7) Principle of cohesive effort
8) Principle of sustainability
9) Principle of flexibility
10) Principle of relocatability

Designing and operating a TSH project with the principle of sustainability in mind demonstrates Hong Kong's efforts in pursuing sustainable development. JCDISI hopes that its prototype schemes will be useful for other countries providing transitional housing or considering employing MiC technology for housing development.

Project Team

Project Name	JCDISI "Operation SoInno" Action Project: Transitional Social Housing
Team or Organisation Name	Organiser: • Jockey Club Design Institute for Social Innovation (JCDISI) Design Consultant Team for Action Project: • Ronald Lu and Partners (Sham Shui Po & Stanley) • c-lab Limited (Ma Wan Old Village) • WSP (all three sites)
Name of Owner / Developer	JCDISI
Project Manager	Calvin Luk, Project Manager I (Spatial), JCDISI Karen Lee, Project Manager II (Spatial), JCDISI
Architect	Anthony Cheung, RLP Alvin Kung, RLP Victor Lai, RLP Eric CM Lee, c-lab Anika Poon, c-lab Jennifer Lu, c-lab Carla Lung, c-lab
C&S Engineer	Henry Wong, WSP Thomas Tong, WSP/CIC
M&E Engineer	Patrick Lau, WSP

Jockey Club Environmental Building

The successful renovation of the auditorium and exhibition hall is the conclusion of our BEC Building Transformation Project. Benefitted from the Project, BEC's environmental performance with significant decreases in our building's greenhouse gas ("GHG") emissions and building energy consumption by 43% and 31%, respectively, since the baseline year (FY 2012/13).

We position the BEC building as a 'green lab' – a space where environmental excellence is encouraged and celebrated. BEC invites our members and partners to showcase innovative technologies, share the newest ideas and demonstrate the best practices at our building. We also illustrate BEC's environmental commitment through our own building's green features and performance.

by ***Mr Richard LANCASTER***
BEC Chairman

BEC is committed to raising environmental awareness and expanding environmental knowledge in Hong Kong. This building transformation project implemented a number of resource efficiency initiatives, including the retrofitting of building services equipment and encouraging behavioural changes of the occupants, which together helped the building to attain a BEAM Plus Platinum Rating for Existing Buildings. While this is a notable accomplishment, in the spirit of continual improvement and the vision of being a green lab in Hong Kong, BEC actively sought further opportunities to advance the building's environmental performance and improve the health and wellbeing of its occupants. These include:

1. Installation of 36 PV panels with a capacity of 9.71kW. This system is connected to the utility grid to echo the Government's Feed-in Tariff scheme. The installation of PV panels is easy and required no supporting steel frames. The solar energy harvested can be used to offset the building's carbon footprint.
2. In partnership with a social enterprise, a rooftop urban farm was established. This rooftop urban farm promotes a healthy and sustainable lifestyle by offering opportunities for the building occupants to plant and enjoy fresh food. Other benefits also include biodiversity enhancement and a reduction of the heat load underneath. Urban farming educational courses are organised for the public to better appreciate nature, and to learn about the process and procedures for managing urban farms as part of a property management value chain.
3. Renovation of the auditorium. The preliminary aim of the renovation was to upgrade the spatial arrangement and general performance for current operational needs. Through the team's efforts, the overall design also showcases sustainable ideas. The new auditorium layout allows a more flexible seating arrangement and facilitates various functional modes. Large glazing was introduced at the upper part of the entrance partition wall, which cleverly allows diffused daylight from the adjoining exhibition hall and hints at natural circadian rhythms. A carpet made from abandoned fish nets was also installed.
4. Upcycled, recycled and recyclable materials for enhanced performance and aesthetics have also been provided in the renovated exhibition hall. For example, 100% natural cork acoustic absorptive panels have been installed to provide a better acoustic environment. The side-benches and the stage are made from bamboo, a fast-growing and rapidly renewable material. Two high-volume low-speed fans are also installed to enhance the thermal comfort and reduce the air-conditioning load. Two feature walls made from upcycled discarded plastic beverage bottles likewise help to raise awareness of Hong Kong's waste problem.
5. While upgrading the circulation staircase in the atrium, the team introduced translucent stickers on the glass railing and blank-off plates on the treads. Graphics featuring educational biodiversity themes were proposed for the glass railing, while gamified stickers are used to promote the use of the stairs. By promoting a more active working environment, these smart changes help to further nurture the health and wellbeing of the building users.

Project Team

Project Name	Jockey Club Environmental Building
Team or Organisation Name	Business Environment Council Limited
Name of Owner / Developer	Business Environment Council Limited
Project Manager	Tony Ip Green Architects Ltd (For the renovation of the auditorium and exhibition hall)
Architect	Tony Ip Green Architects Ltd (For the renovation of the auditorium and exhibition hall)
Main Contractor	Ming Hing Development Co., Ltd (For the renovation of the auditorium and exhibition hall)
Property Management	Jones Lang LaSalle Limited

Tai Kwun – Centre for Heritage and Arts

Create a locally loved, regionally respected and internationally admired culture and leisure destination.

by Tai Kwun

Tai Kwun – Centre for Heritage and Arts is Hong Kong's largest ever historic building revitalisation project, transforming the city's former Central Police Station compound, with its 170 years of history, into a new art and cultural centre. After more than a decade in transformation, the centre opened to the public in 2018.

Tai Kwun, or Big Station, is the colloquial name of the once-closed compound. The name has been adopted as a reminder of the historical importance of the site. Standing in sharp contrast to the surrounding commercial towers, Tai Kwun today provides a rare 'courtyard' in the middle of one of the densest cities in the world where the public can freely enjoy scenery, tranquillity and the city's heritage.

In a city where heritage has largely disappeared over the years, Tai Kwun is a showcase for adaptive re-use with an innovative response in various respects to minimise the visual and physical impact on the historic fabric while still maintaining current code requirements or their equivalent. The historic fabric was meticulously repaired and strengthened such that it complies with modern safety standards while maintaining its authenticity, setting a benchmark for future revitalisation projects in Hong Kong. Visitors are encouraged to learn more about the heritage in the dedicated visitor centre, the heritage storytelling space or by taking a self-guided walking tour.

Besides renovating the old, two iconic new buildings have been carefully placed into the compound, adding space for exhibitions and performing arts. The new blocks rise above the historic boundary walls, creating pleasant and breezy gathering spaces below. A bespoke cast aluminium brick façade wraps the new buildings. The bricks were made from 100% recycled alloy wheels and echo the scale of the existing granite perimeter wall.

A new footbridge directly connects the compound to the Mid-Levels Escalator, creating a seamless and safe pedestrian connection to the vibrant and bustling surroundings. New entrances were also established at the revetment walls to connect people in the east-west direction and from north to south. Public circulation within the once-segregated compound is strongly improved by new link bridges between the buildings and featured openings in the prison walls.

To achieve a fully inclusive destination, the design features barrier-free access through new ramps and lifts, and includes accessible toilets, baby-care benches and a nursery. In addition, new open spaces have been created within the compound for the wellbeing of the public and as a venue for hosting exhibitions and performances. New trees have been planted to provide additional shading, and seating can be found across the site for people to gather and interact. Furthermore, the lighting design is intrinsically integrated with the architecture and finishes to help weave together the various forms and spaces, providing a safe and feel-good environment for all.

Due to its remarkable history and new lease of life for the benefit of society, Tai Kwun is sure to become a precious legacy for Hong Kong's future generations.

Project Team

Project Name	Tai Kwun – Centre for Heritage and Arts
Team or Organisation Name	Tai Kwun
Name of Owner / Developer	The Jockey Club CPS Limited
Project Manager	The Hong Kong Jockey Club
Architect	Executive Architect - Rocco Design Architects Associates Limited Conservation Architect – Purcell Architect & Master Planning - Herzog & de Meuron
C&S Engineer	Arup
M&E Engineer	J. Roger Preston Ltd
Landscape Architect	Aecom
Quantity Surveyor	Rider Levett Bucknall Limited
Sustainable Design Consultant	Arcadis
Environmental Consultant	Environmental Resources Management
Façade Consultant	Arup
Acoustic Consultant	SM&W
Management Contractor	Gammon Construction Limited

The Green Hostel Village – Jockey Club Postgraduate Halls 2 and 3, The Chinese University of Hong Kong

The overall design of the buildings are trendy and modern, including the external appearance and interior design of the facilities;
The smart meters installed facilitate residents to check the electricity consumption;
The motion and light sensors installed help saving the electricity consumption of the whole building;
The views at the function rooms on every 2 floors are very good, the function rooms look spacious which make people feel comfortable;
The sky garden on each floor provides residents a space for relaxation, green plants also make residents feel like closer to the nature;
The function rooms, e.g. gym room, music rooms, snooker room, table tennis room, etc., cater the needs of the residents.

by ***Mr James NG***
Manager of the Jockey Club Postgraduate Halls 2&3

The CUHK Jockey Club Postgraduate Halls 2 and 3 are designed to embrace nature and a "green living village" concept. Students are encouraged to share knowledge, interact with each other and create an inspiring community life. The two 12-storey buildings provide nearly 700 bed-places and a number of communal facilities, allowing postgraduate students to enjoy the surrounding natural environment and build a young intellectual community.

A coherent Campus Master Plan and sustainability policies

As an elaboration of the core values of CUHK's Green Campus Master Plan and sustainability targets – namely a 25% per capita energy saving from 2005-25 – the planning and construction of the student hostel adopted green building and biophilic design approaches to develop innovative eco-habitats for student living and experiential learning.

Promoting UN Sustainable Development Goals

The green village design and lifestyle echo the UNSDGs to promote good health and wellbeing, climate action, quality education, affordable and clean energy, industry innovations and infrastructure, sustainable cities and communities, and responsive consumption and production. In this manner, the project plays an important role in building a strong institution and a solid partnership with the community to transform the world.

Green living village concept

Set in the ecologically-diverse campus of CUHK, the hostel design takes advantage of the topography and vistas by infusing the surrounding nature into the buildings and creating landscaped nodes and pathways for students to convene and enjoy. A variety of amenities and communal facilities are planned in a village-like setting on the ground and podium levels to form a collaborative hub, while penetration of natural lighting and ventilation are promoted with the skilful planning of buildings, landscaped areas, breezeways and sky gardens to create an environmentally friendly eco-habitat.

Technological innovation for a sustainable built environment

Various technologies have been adopted to maximise energy efficiency in the new hostel developments. Solar panels are installed all over the rooftop to preheat water for the shower rooms. A rainwater recycling system uses the water collected for irrigation. Through the greywater treatment system, wastewater from washing basins and shower rooms is turned into flush water.

An innovative system of Smart Metering is installed in all bedrooms and common areas so that energy usage can be checked using display panels in the hostel corridors. This helps to promote users' behavioural change towards sustainable living. Instead of relying on the air conditioner, they may use an electric fan in autumn, or take advantage of the communal lounges to study in summer.

These eco-friendly facilities can help each building save up to 38% of its annual water consumption and over 30% of its energy usage during the peak electricity demand in June. At the end of the day, all the green hardware is designed to facilitate changes in users' behaviour.

Innovative acoustic windows in all bedrooms are designed to promote natural ventilation while mitigating any undesirable noise impact from the nearby railway. Experiential farming using fertilizers from reprocessed food wastes are facilitated by the green roof above the canteen and hall block, thus further contributing to the promotion of green living and sustainable development.

Project Team

Project Name	The Green Hostel Village – Jockey Club Postgraduate Halls 2 and 3, The Chinese University of Hong Kong
Team or Organisation Name	Campus Development Office, CUHK
Name of Owner / Developer	The Chinese University of Hong Kong (CUHK)
Project Manager	Campus Development Office, CUHK
Architect	Andrew Lee King Fun & Associates Architects Ltd
C&S Engineer	Meinhardt (C&S) Limited
M&E Engineer	WSP (Asia) Ltd
Landscape Architect	ACLA Limited
Quantity Surveyor	Rider Levett Bucknall Limited
Sustainable Design Consultant	Ramboll Hong Kong Limited
Environmental Consultant	Ramboll Hong Kong Limited
Acoustic Consultant	Ramboll Hong Kong Limited
Main Contractor	Chinney Construction Co. Limited

The Hong Kong Jockey Club University of Chicago Academic Complex | The University of Chicago Francis and Rose Yuen Campus in Hong Kong

The campus has successfully incorporated adaptive reuse strategies for a number of the heritage buildings. Former officer mess (Block A) and detention block (Block B) were repurposed as classrooms. Existing wood flooring and timber-framed steel windows were salvaged and reused as possible, and other character defining elements were restored carefully.

Environmental Impact Assessment was carried out including a study of the bats habitat. Foundation works were not carrying out during periods when bats are sensitive to impacts. The existing drainage channel which collect rainwater from Mount Davis and drain to downstream via the site was relocated. The removal of existing trees were minimized and provided new landscape deck and green roofs at different levels to preserve as much wildlife and nature as possible

by Arup

The Chicago University Hong Kong Campus has married old and new by repurposing heritage buildings that were built in the 1930s and combining these with contemporary architecture. Inspired by the challenging topography, the magnificent sea-view panorama, and the site's intrinsic heritage value, the design adopted the concept of a floating "Treehouse of Knowledge". The result is a connected, flowing space and a landmark academic hub that elegantly celebrates the University of Chicago's international presence and its partnership with the wider Hong Kong community. The project is also an exemplar in its environmental and cultural sustainability.

The original site consisted of four building blocks – A, B, C and Block B Annex – sprawling across the coastal slope. Block A was a two-storey reinforced concrete building used for accommodation. Both Blocks B and C were two-storey reinforced concrete buildings which served as detention blocks. Lastly, a one-gun battery with supporting amenity blocks (e.g., magazine, kitchen, vaults) was constructed close to the coastline.

Extensive alterations and additions works were carried out to convert Blocks A and B into functional buildings for the business school while retaining and protecting elements of significant historic importance. Block B Annex was converted into a Heritage Interpretation Centre for exhibition to the public. Block C and the kitchen buildings were demolished, with the remaining ruins left for exhibition purposes, while the magazine block was left intact for display. The Interpretation Centre is currently open and free to the public, and access to the heritage buildings and historical ruins can be obtained through guided tours booked at the campus.

A new three-storey academic building with a curved ribbon profile floats above the site linking with the existing heritage buildings. Built over a steep slope, it is supported on 600mm slender columns up to 17m in height that emulate the surrounding forest of trees. Located just above existing Grade-3 historic buildings, non-percussive mini-piles were used for the foundations to minimise intrusion and environmental impacts.

Despite the budget constraints, the project successfully fulfilled the University's desire to create a sustainable environment for learning. To enhance the performance within both the new and existing buildings, innovative sustainable technology has been carefully applied, yet without compromising the older building's historic character. The wide range of sustainable features includes a high-performance façade, high-efficiency air-conditioning system with heat recovery, reduced lighting power density, daylight responsive controls, increased fresh air flow rate and a demand-driven fresh air supply system. These sustainable integrations have not only enhanced the indoor environment quality, but also made the building greener and more energy efficient – helping to cut energy consumption and CO^2 emissions by approximately 20%. Water-saving fixtures were also adopted throughout the campus to reduce freshwater consumption by 62.3% and consumption for sewage by 58.3% annually.

Project Team

Project Name	The Hong Kong Jockey Club University of Chicago Academic Complex | The University of Chicago Francis and Rose Yuen Campus in Hong Kong
Team or Organisation Name	The University of Chicago
Name of Owner / Developer	The University of Chicago
Project Manager	Arcadis Consultancy Hong Kong Ltd
Architect	Revery Architecture Inc.
C&S Engineer	Arup
M&E Engineer	Arup
Landscape Architect	SWA Group | Urbis Ltd
Quantity Surveyor	Rider Levett Bucknall Ltd
Sustainable Design Consultant	Arup
Environmental Consultant	SMEC Asia Limited
Façade Consultant	Front Inc
Acoustic Consultant	Arup
Main Contractor	Paul Y. Builders Limited
Others	Revival Heritage Consultants Ltd

Tsimshatsui Waterfront Revitalisation

The Avenue of Stars is part of an ambitious revitalization project, through which we are transforming this heritage site into a world-class waterfront, and a cultural destination for the Hong Kong people and the world. By bringing in internationally acclaimed landscape architect James Corner and a group of international and local collaborators, we are able to introduce new elements of surprise in the Avenue of Stars, from architecture and culture, to sustainability and technology. We also dedicate ourselves to creating shared value, optimizing the corporate value for our stakeholders while offering benefits to the community. By doing so, we are not only reinventing the public space, but also promoting local culture and celebrating the achievements of Hong Kong's filmmaking professionals.

by ***Dr Adrian CHENG Chi-kong, JP***
Executive Vice-Chairman and Chief Executive Officer
New World Development Company Limited

The revamped Salisbury Garden, located on Hong Kong's stunning Tsim Sha Tsui waterfront, is a unique urban space that encourages social interaction and inspires cultural exchange. The design concept embraces simplicity, greening and a public orientation. The refurbishment transforms an under-utilised and enclosed garden into an open, welcoming multi-functional public space, creating a new harbourfront destination for visitors and locals alike with a rich cultural and artistic ambience. The garden's design incorporated SITES v.2, a pioneering system used to design and construct sustainable open spaces and parks.

People-centric connectivity

Located in the heart of the Tsim Sha Tsui waterfront, Salisbury Garden is a place where culture, commerce, landscape and hospitality converge. Several connectivity improvements were made during the revamp: a previously-blocked pedestrian crossing on Salisbury Road was reinstated, providing better connectivity to the garden from the Nathan Road thoroughfare. The new design also created a visual connection to the garden, opening up a vista of Victoria Harbour from Nathan Road. Previously opaque handrails were replaced by modular designed cladding with translucent metal bars and wave-shaped passageways to reinforce the waterfront promenade experience.

A magnet for urban place-making

Anchored by a large elliptical lawn, tree bosques, and broad waterfront seating steps, the new garden offers numerous social gathering places for active and passive activities. A diversity of plants with different colours, shapes and forms creates contrast both horizontally and vertically at every corner. Shaped by extensive input from various stakeholders, the design is highly responsive to the site's complex constraints while also setting a new standard of excellence for public realm design. Including the walkable hardscape, 60% of the garden's open space is available for public enjoyment, while extensive greenery mitigates the urban heat island effect and creates social benefits – providing seven times more shaded areas compared to the pre-renovation promenade. The garden's permeable metal steel trellises integrate shading, greenery and a mist cooling system, delivering thermal comfort and ideal ambient temperatures for people to enjoy views of Victoria Harbour.

Sustainable use of resources

The structural design of the revamped garden maximised the lifespan of existing site materials, with over 95% of supporting structures and 100% of lift shafts being reused for the garden, and more than 85% of existing piles and 100% of columns with footing supports reused at the Avenue of Stars. These measures significantly reduced construction impacts on the seabed and the marine ecosystem. The Avenue of Stars was repaved with light-coloured upcycled glass pavers, and the hand-prints of famous film stars were relocated from the boardwalk into the upcycled handrails, which are made from a timber-free product comprising 60% rice husk, 22% salt and 18% mineral oil to create a material that is 100% recyclable.

Low-impact landscape design

The plant species and furniture pieces in the revamped garden were carefully selected for easy maintenance and management. The plants chosen all require infrequent watering, while other green features conserve water and energy. These features include rainwater collection for irrigation, an automatic drip irrigation system, solar PV panels and LED lamp posts.

Project Team

Project Name	Tsimshatsui Waterfront Revitalisation
Team or Organisation Name	Ronald Lu & Partners (Hong Kong) Ltd
Name of Owner / Developer	Client: Leisure and Cultural Services Department Developer: New World Development Company Ltd
Project Manager	New World Project Management Ltd
Architect	Design Lead Architect: James Corner Field Operations Project Architect & Authorized Person: Ronald Lu & Partners (Hong Kong) Ltd Design Architect for Kiosk, Mobile Carts and Garden Restroom: LAAB Architects
Structural Engineer	Avenue of Stars: CM Wong & Associates Ltd Salisbury Garden: Ove Arup & Partners Hong Kong Ltd
M&E Engineer	WSP (Asia) Ltd
Landscape Architect	URBIS Limited
Quantity Surveyor	Arcadis Hong Kong Limited
Sustainable Design Consultant	Ove Arup & Partners Hong Kong Ltd
Façade Consultant	Façade Consultant for Special Features: Eckersley O'Callaghan Ltd Precast Facade Consultant: Green Engineering Consultant Company Limited
Acoustic Consultant	Avenue of Stars: Shen Milsom & Wilke Ltd
Main Contractor	New World Construction Company Ltd
Lighting Consultant	Speirs and Major Associates Ltd

Xiqu Centre

"As the eastern gateway of the West Kowloon Cultural District, the Xiqu Centre is designed with a lively Atrium that invites visitors to come in and explore the rich heritage of Cantonese opera and other genres of xiqu. The design details of its facilities have been created in response to the practical requirements and aesthetic features of the art form. Audience and xiqu troupes from around the world love this well-equipped world-class arts venue, which is tailored to the needs of xiqu performances, while offering a comprehensive venue solution for various forms of performing arts and cultural events."

by ***Mr Jeremy STOWE***
Chief Projects Officer of
West Kowloon Cultural District Authority

The Xiqu Centre is a world-class facility for the preservation, development and promotion of the important Chinese art forms of Cantonese opera and Xiqu. This centre for Chinese cultural heritage is located in Hong Kong's West Kowloon Cultural District. The seven-storey building houses a 1,075-seat Grand Theatre, a Tea House Theatre with a capacity of around 200 seats, eight professional studios and a seminar hall.

A bioclimatic and biomorphic public realm

Stepping through the main entrance, visitors enter a mesmerising circular atrium with a raised podium space for presenting the rich and ancient art of Chinese traditional theatre. This spectacular, naturally ventilated courtyard plaza not only serves as the eastern gateway to the West Kowloon Cultural District, it also invites the public to enjoy the exhibitions, browse the shops, listen to music or watch the ongoing Xiqu performances, making this highly traditional Chinese art form more accessible to new audiences and younger generations.

In both the design analysis and evidence gathered from the finished space, the ambient temperatures in the plaza are significantly different from external temperatures. Correspondingly, without the use of any mechanical devices, this large atrium provides people passing through with a comfortable space that protects them from the outside elements. The strategically designed passive ventilation chimney also creates a wind stack effect in the courtyard plaza, further boosting air circulation in the atrium.

Ultra-high-performance modular envelope system

The Xiqu Centre's dramatic glowing curvilinear façade, which reimagines theatre drapes and the swaying folds of Xiqu performers' magnificent costumes in architectural form, is comprised of a modular system of scaled fins CNC-cut from untreated marine-grade aluminium pipe. The materials were selected both for their alluring aesthetic and their enhanced average window-to-wall performance ratio of 0.08. This design ensured that the amount of waste generated during the façade system's installation was near zero.

Interchangeable modular systems were widely used for finishes in the public space. The ceilings of all public circulation areas were made from repeating modules, resulting in more efficient manufacturing and reduced waste during site installation. The building's striking design was inspired by traditional Chinese lanterns and blends traditional and contemporary elements to reflect the evolving nature of the art form.

Reviving and sustaining traditional Chinese Opera culture

In 2009, indigenous Chinese opera was included on the United Nations Educational, Scientific and Cultural Organization's Representative List of the Intangible Cultural Heritage of Humanity. Dedicated to the conservation, promotion and development of the rich cultural heritage of this art form, the Xiqu Centre is designed to foster the discovery and appreciation of Chinese opera among new generations of Hongkongers and international guests alike. With Qi, meaning "flow", actively expressed throughout the interior design of the Centre through smooth and energetic curvilinear paths and forms, the Centre visually recreates the spirit of Chinese Opera for the people of the world. This iconic venue will undoubtedly attract talent and nurture this art form, making significant contributions to the future of Hong Kong.

Project Team

Project Name	Xiqu Centre
Team or Organisation Name	Ronald Lu & Partners (Hong Kong) Ltd
Name of Owner / Developer	West Kowloon Cultural District Authority
Project Manager	West Kowloon Cultural District Authority
Architect	Ronald Lu & Partners (Hong Kong) Ltd Revery Architecture
Building Services Consultant	Buro Happold International (Hong Kong) Ltd
Structural Consultant	Buro Happold International (Hong Kong) Ltd
Civil & Geotechnical Consultant	Atkins China Ltd
Landscape Architect	SWA Group
Quantity Surveyor	Rider Levett Bucknall Ltd
Theatre Consultant	Fisher Dachs Associates Inc.
Façade Consultant	Front Inc.
Acoustic Consultant	Sound Space Vision
Interior Design Consultant	Ronald Lu & Partners (Hong Kong) Ltd Revery Architecture
Traffic Consultant	MVA Hong Kong Ltd
Lighting Consultant	Horton Lees Brogden Lighting Design Inc.
Main Contractor	Hip Hing Engineering Co., Ltd

Cloud-based Building Analytic System for MVAC Operation, Maintenance and Optimisation

Big Data Intelligence is one of the key enabling technologies in developing HKIA into a sustainable smart airport. Building Analytics System for Terminal 1 is an example project that demonstrate AAHK's bold new step into the era of sustainable development and digital transformation.

by ***Joseph LAM***
Senior Manager,
Electrical & Mechanical, Technical Services,
Airport Authority Hong Kong

The Airport Authority Hong Kong (AAHK) is responsible for the planning, operation and development of Hong Kong International Airport (HKIA). In recent years, AAHK has collaborated with its business partners to incorporate various innovative technologies into airport operational processes in order to develop HKIA as the world's greenest smart airport. CLPe Solutions (CLPeS) is an end-to-end energy solutions provider in Hong Kong. It offers a comprehensive range of the latest energy management applications, including energy analytics, forecasting and fault diagnostics. The common goal of exploring technological energy applications drives the cooperation between AAHK and CLPeS.

HKIA has been the world's busiest airport for nine consecutive years since 2010. In order to achieve a balance between thermal comfort and energy efficiency at such a fast pace of passenger expansion, a traditional Building Management System (BMS) which only provides centralised control and monitoring features is far from enough to support the airport's current operation. To cope with this situation, AAHK adopted a Building Analytic System (BA) provided by CLPeS in Terminal 1 of HKIA.

BA is a cloud-based analytic system which utilises big data analytics to detect and diagnose operational irregularities and potential equipment health issues. Real-time information and data collected from the existing BMS is transferred to the cloud-based servers for analysis. With the synergy of artificial intelligence (AI) and machine learning as the core of the analytics processes, the BA system is able to provide predictive warnings and suggestions that help to improve building energy efficiency, reduce equipment downtime and increase equipment life cycles.

BA also enables the ongoing performance optimisation of the building services systems, and delivers immediate reductions in energy use and costs by giving energy advice with the help of AI analytics. The key AI algorithm includes the following:

- Diagnose energy-inefficient operational behaviour and control mechanisms;
- Compare device output and operational needs to identify over-provisioned conditions;
- Compare operational data of different devices to identify energy waste under specific conditions;
- Diagnose energy-inefficient equipment and advise proper maintenance activities to improve the situation;
- Diagnose the performance of each equipment and system according to its ability to be an energy-saving opportunity while still maintaining the operation within the desired service level; and
- Diagnose unnecessary manual override controls.

Predictive maintenance suggestions are another crucial benefit of BA. Using the Fault Detection and Diagnostics (FDD) module, preventive maintenance can be replaced by condition-based maintenance, allowing resources to be better utilised to identify weak points.

The essence of the project is to create an AI algorithm with domain know-how on airport operation. This correlates various data sets and identifies abnormal or adverse issues. The system is able to continuously accumulate user requirements to form a growing knowledge base, and upgrade user interfaces with other features and systems. The BA at HKIA enables specific value-added features such as freight information, heat maps and other API interfaces, etc. As such, BA is proving itself to be a flexible solution that will continue utilising the latest smart technology to meet the changing needs and demands of HKIA long into the future.

Project Team

Project Name	Cloud-based Building Analytic System for MVAC Operation, Maintenance and Optimisation
Team or Organisation Name	Airport Authority Hong Kong
Name of Owner / Developer Main Contractor	Airport Authority Hong Kong CLPe Solutions Limited

Research and Planning

Research programmes form the foundation of sustainability development. Drawing on a global network of academics, scientists and stakeholders, the exchange of scientific and technological knowledge for building a sustainable built environment continues to accelerate. In this section, we take a look at projects focusing on Hong Kong's unique sub-tropical conditions to demonstrate the effectiveness of related policies and strategies, the development of infrastructural projects, and also the connection between the built environment and the wellbeing of the community. Moreover, we review active areas of research in carbon assessment tools, modular integrated construction, and green building materials, all comprising another key aspect of Hong Kong's research into sustainable construction and a sustainable value chain.

Development of a Common Spatial Data Infrastructure – Built Environment Application Platform

The Built Environment Application Platform (BEAP) is part of the effort to facilitate the application of ICT in city planning, infrastructure, engineering, and environmental works by taking forward the Common Spatial Data Infrastructure (CSDI) development strategy. It supports Hong Kong's Smart City Blueprint, Hong Kong 2030+, and other related studies through application and data / information sharing, and knowledge building for mutual benefit, extending to businesses, academia and the public.

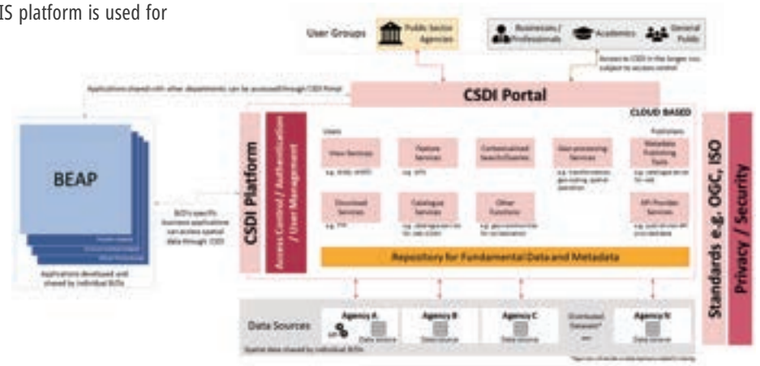
The BEAP developed a set of territory-wide information products – actionable datasets – to enable applications to work responsively and seamlessly across the territory. It takes common spatial data from the CSDI to produce built-environment-specific spatial data. Prototype applications were distilled from a list of 30 applications through various engagement activities with more than 40 stakeholder groups, including government departments, research institutes, academia and professional bodies. The BEAP has been prototyped with 10 basic applications spanning four thematic areas: Planning & Land Use; Infrastructure & Engineering; Landscape, Environment & Conservation; and Others.

Hosted in a virtualised environment, the BEAP makes use of a multiple server architecture on a cloud platform to accommodate all the different components, avoid a single point of failure, and enable future expansion. The architecture consists of a web server, application server, database server, file server, and GPU server. AI and machine learning, developed through Python, is used for brownfield site recognition and change detection using photos to enable land use analysis. A web-based GIS platform is used for most of the applications to enable visualisation and analysis of spatial information using maps. An automation function for compliance checking was developed, in accordance with local assessment criteria, enabling BIM to be integrated into local machines to efficiently assess building plans. A digital twin was also created for selected areas to enable scenario generation and impact analysis.

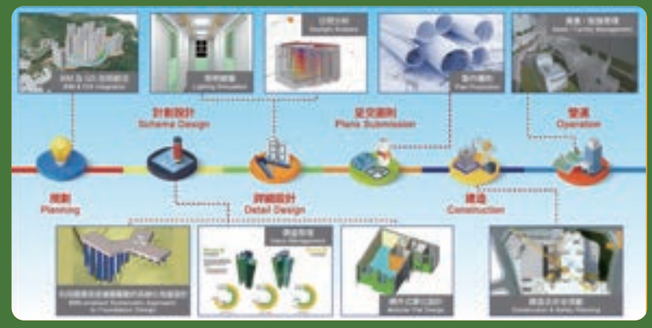
The development of the BEAP and its applications is a timely and strategically important CSDI initiative as Hong Kong embarks on its journey to become a liveable, competitive, innovative, sustainable and smart city. The benefits reaped from the development of spatial data and the application platform are not limited to internal savings. They also include improved service delivery and policy outcomes, which in turn lead to the realisation of wider societal and economic benefits. Whilst societal and economic benefits may take time to materialise, they have been found to be of a high order of magnitude when compared with benefits arising from internal savings.

Project Team

Project Name	Development of a Common Spatial Data Infrastructure – Built Environment Application Platform
Organisation Name	Hong Kong Planning Department
Collaborating Parties Members of Research / Planning Team	Ove Arup & Partners Hong Kong Ltd The project is government funded by Hong Kong Planning Department. Partners in this project included Ove Arup & Partners Hong Kong Ltd as the lead consultant, and Dassault Systèmes, GeoSys Hong Kong Limited, The Hong Kong Polytechnic University as sub-consultants



Integrated Use of Advanced Technologies for Sustainable Public Housing Development



The Hong Kong Housing Authority (HA) has been proactively and successfully applying multi-disciplinary advanced building and information technology to the planning, design and construction of its affordable public housing projects. These technologies are helping to support and complement its core objective, namely the timely delivery of quality public housing in a sustainable manner. To date, initiatives have included:

Acoustic balconies (AB)

Road traffic noise is a challenging issue for public housing development, particularly at sites close to heavily trafficked roads. AB, comprising solid parapet walls, sliding screens, sound absorption materials and inclined panels, can achieve a noise reduction of up to 10-12 dB(A). The HA now integrates this innovative noise mitigation feature into its optimum building design, while also balancing other needs such as natural ventilation and lighting.

Precast concrete components

The HA has been adopting precast concrete components in its developments, including precast façades/ staircases, semi-precast slabs, volumetric precast bathrooms/ kitchens, precast ground floors and roof water tanks, precast roof parapets, and precast acoustic balconies. To further enhance productivity and reduce on-site labour demand, it has extended the adoption of semi-precast slabs and precast structural walls with pre-installed conduits, and precast lift shafts with pre-installed lift guide rails.

BIM-enabled Systematic Approach to Foundation Design (BIM-SAFD)

BIM-SAFD enables the 3D visualisation of the spatial arrangement of piles, drill-holes and complex underground geological conditions. It can generate the total pile length automatically with respect to different dispositions of the domestic blocks, thus achieving the most efficient foundation design. It also expedites drawing production, enhances design accuracy and facilitates quantity measurement for the preparation of tender documents.

Development and Construction Site Mobile System (DCSMS)

Site inspection records must be properly maintained and traceable. Since mid-2014, HA has provided smart phones with DCSMS mobile applications to its site staff, moving progressively from traditional hard copy mode to digital mode. The system enables site staff to carry out site inspections and communicate quickly and directly with contractors, streamlines workflow, improves productivity, and strengthens the traceability of the site inspection process.

Integrating BIM for sustainable planning, design and construction

For a decade already, HA has adopted BIM in the entire building development life cycle through the integrated use of BIM with Geographic Information System (GIS), site-specific design, value management, engineering analysis, cost estimation, space programming, sustainability evaluation and construction planning. This has demonstrably enhanced its design efficiency, improved environmental performance, and advanced the quality and safety of its work.

Project Team

Project Name	Integrated Use of Advanced Technologies for Sustainable Public Housing Development
Organisation Name	Hong Kong Housing Authority
Members of Research / Planning Team	Development & Construction Division, Housing Department

Study of the Sponge City Concept in Hong Kong

The widespread destruction in Hong Kong brought by Typhoon Mangkhut was the most serious in the last three decades. As a result of climate change, a warming ocean will provide more energy to fuel storms in the future. The number of intense tropical cyclones and the associated precipitation rate will increase. Sea level rise caused by global warming will likewise raise the frequency and threat of severe storm surges. Mangkhut is indeed a wake-up call, reminding us of the powerful force of nature and the many challenges of climate change. We must stay vigilant and be fully prepared to face the even bigger threats of tropical cyclones and extreme weather in the future.

In view of this, the Architectural Services Department (ArchSD) conducted a study on the Sponge City Concept (SCC) to review its design and implementation for Hong Kong public works to tackle urban water management and the need for better climate adaptability.

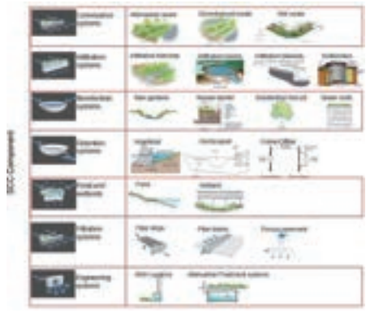
To continue building ever larger and more extensive stormwater drainage systems to cope with these growing risks is not affordable. Given the climate predictions, it makes sense to effectively slow down the peak runoff flow while gaining further benefits through greater greening of the city and buildings, which will also enhance biodiversity, reduce the incidence of odorous waters, mitigate the urban heat island effect, and improve wellbeing and liveability in the dense urban environment of Hong Kong.

This study reviewed the legal and regulatory frameworks of different countries, and researched a technical and design review of common SCC strategies and techniques. Consequently, a SCC design guideline was formulated to recommend the steps for design, planning, construction, maintenance and control.

Various SCC features such as conveyance, retention, storage, infiltration and treatment were also investigated in the study, together with their technical requirements, key design considerations, construction and maintenance requirements.

In recent years, urban stormwater management has radically transformed from a conventional grey drainage system to a holistic green infrastructure. The goal of this study is to move towards a more comprehensive understanding of these underlying concepts contributing to the eco-friendly environmental strategy in Hong Kong.

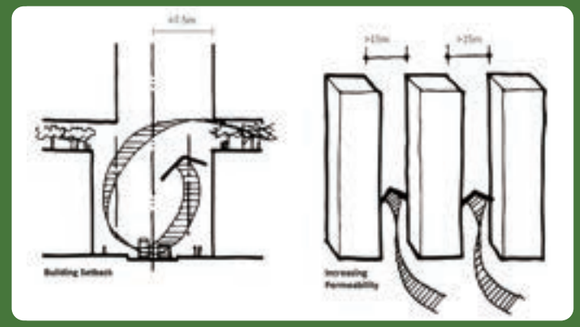
To demonstrate the design approach and strategy of SCC in Hong Kong's public open spaces, ArchSD selected two open space projects in urban areas as a trial. Town Park in Tsueng Kwan O and Station Square in Kai Tak will be used to showcase the sustainable impact of SCC strategies.



Project Team

Project Name	Study of the Sponge City Concept in Hong Kong
Organisation Name	Architectural Services Department
Collaborating Parties	Ronald Lu & Partners (Hong Kong) Limited (Consultant)
Members of Research / Planning Team	Mr Thomas WAN, Chief Architect Mr Billy LAW, Senior Architect Mr Jacen LO, Senior Architect Ms Jane AU YEUNG, Senior Project Manager Ms Iris LAU, Senior Building Services Engineer Ms Eva LEE, Senior Landscape Architect Mr Eddie CHAN, Senior Structural Engineer Mr K Y CHIU, Senior Property Services Manager Ms Rosalie KWAN, Architect Ms Wendy YIP, Architect Ms Kathy CHAN, Quantity Surveyor Mr T M MAK, Principal Technical Officer Mr C N TUNG, Chief Clerk of Works

HKGBC Guidebook on Urban Microclimate Study



In Hong Kong's high-density and sub-tropical environment, comfort is an important factor in people's use of outdoor space. The HKGBC Guidebook on Urban Microclimate Study provides the knowledge of, and inspiration for, urban microclimate design. It focuses on how the outdoor environment affects the physical aspects of wellbeing and comfort. In the Guidebook's easy-to-understand chapters, the science and principles of urban microclimate studies are introduced, strategies to optimise the microclimate conditions are stipulated, and good practices – both local and overseas – are reflected on. Recommendations for further studies and policy adjustments are made at the end of the Guidebook.

The Guidebook first defines the audience, scope and need of urban microclimate studies. Urban microclimate design is taken as a set of practices aiming at improving the outdoor environment where people spend their everyday lives. The scientific understanding of urban microclimate and its relationship with climate change are introduced, covering the scale and components of urban climate, the role of different factors in urban microclimatic processes, and typical climatic phenomena in the urban areas. The benefits of good urban microclimate design are also elucidated in terms of human thermal comfort in the context of high-density living environments.

Based on the review of previous scientific studies, the key parameters in urban microclimate design, namely wind, thermal radiation, temperature, and precipitation, are identified and 31 design strategies are introduced through graphical illustrations and numerical values that are applicable in design practices. The Guidebook also discusses the timing of the implementation of urban microclimate design strategies, and defines when the strategies should be implemented at different design stages. Furthermore, linkage to the BEAM Plus rating system is also investigated in order to provide safer, healthier, more comfortable, more functional and more efficient buildings and neighbourhoods.

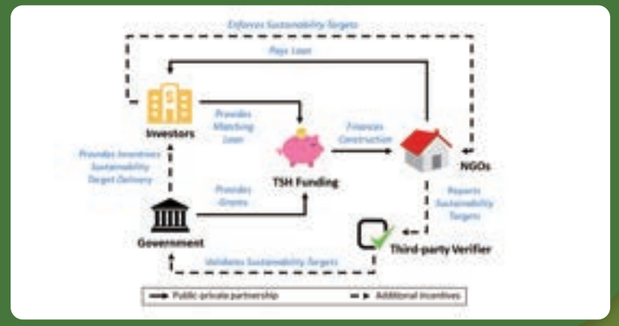
Good practices in overseas contexts are also introduced and explored for the feasibility to adopt these strategies in Hong Kong. Development projects with good microclimate considerations in Hong Kong are likewise presented for different construction scenarios in Hong Kong in terms of density and plot size.

The study provides suggestions in the areas of science and technology development, policy, practice and design, and public awareness and education. The Guidebook in general calls for concerted efforts by the Government, industry and public to improve the city's urban microclimate and hence tackle the issues of health and comfort in the outdoor space, which will undoubtedly become even more complicated and challenging under future climate change.

Project Team

Project Name	HKGBC Guidebook on Urban Microclimate Study
Organisation Name	Hong Kong Green Building Council The Chinese University of Hong Kong
Collaborating Parties	Ove Arup & Partners Hong Kong Ltd Ronald Lu & Partners (Hong Kong) Ltd
Members of Research / Planning Team	Prof. Edward NG (School of Architecture, The Chinese University of Hong Kong) Dr Chao REN (School of Architecture, The Chinese University of Hong Kong) Prof. Justin HO (Institute of Environment, Energy and Sustainability, The Chinese University of Hong Kong) Ms Ada LEE (School of Architecture, The Chinese University of Hong Kong) Dr Vincent CHENG (Ove Arup & Partners Hong Kong Ltd) Dr Tony LAM (Ove Arup & Partners Hong Kong Ltd) Mr Ricky LI (Ove Arup & Partners Hong Kong Ltd) Mr Tao LI (Ove Arup & Partners Hong Kong Ltd) Mr Andy LEUNG (Ronald Lu & Partners (Hong Kong) Ltd) Mr Tony YIP (Ronald Lu & Partners (Hong Kong) Ltd) Ms Margie TAM (Ronald Lu & Partners (Hong Kong) Ltd)

Vitality Housing – A Total Solution to Service Transitional Social Housing in Hong Kong



The shortage of affordable housing coupled with the scarcity of developable land has long been a social, health and wellbeing issue in Hong Kong. Currently, over 200,000 persons are living in substandard, subdivided units, suffering from inadequate housing conditions, lack of proper sanitation and high housing costs. The Hong Kong Government has recently committed to building a total of 450,000 flats by 2029 to meet the pressing housing demand, 116,000 of which are expected to accommodate inadequately housed low-income families. In this connection, the Government has introduced Transitional Social Housing (TSH) and has partnered with various non-profit organisations and local building councils in the past few years to devise an appropriate solution to expedite and scale up the delivery of TSH.

TSH is a new type of social housing service operated by non-government organisations (NGOs), aiming to provide decent and transitionary shelter for the underprivileged until they can secure more long-term housing. While the merits of TSH have increasingly been recognised in recent years, the NGOs' lack of professional knowledge and expertise in housing provision and management has hindered a prompt supply of TSH. To empower NGOs with the necessary knowledge to operate TSH, this research study proposed a 'Vitality Housing' model, an innovative total solution that aims to relieve NGOs from the technical burden of commissioning and delivering TSH. This also ensures that NGOs can better focus on their forte in providing proper social services to the underprivileged group, thus maximising the social benefits of TSH as a form of social welfare.

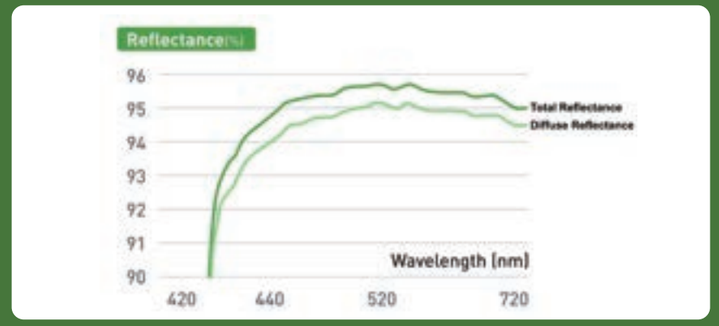
This 'Vitality Housing' model leverages a modernised software interface, construction databasing, and capacity building from professionals of multiple-disciplinary groups. The model provides NGOs with the capacity to engage stakeholders, design low-carbon modular integrated construction (MiC) housing units, manage construction progress, seek sustainable financing, and obtain operation and maintenance knowledge within a centralised digital platform. A standardised task list with different best practices and guidance are also provided to assist NGOs in making effective decisions on managing the delivery and operation of the TSH.

The study model attends to various United Nations Sustainable Development Goals (SDGs), including SDG 3 on Good Health and Well-being, SDG 9 on Industry, Innovation and Infrastructure, SDG 11 on Sustainable Cities and Communities, and SDG 13 on Climate Action, with the aim of formulating partnerships with different stakeholders to create a more inclusive and resilient living environment for the underprivileged.

Project Team

Project Name	Vitality Housing – A Total Solution to Service Transitional Social Housing in Hong Kong
Collaborating Parties	Tembusu Asia Consulting Pte. Ltd (Singapore)
Members of Research / Planning Team	Mr Tim LO and Ms Emily ROSE (LEAF Sustainability Limited) Ms Karen LEE (Jockey Club Design Institute for Social Innovation) Dr SEO Bo-kyong (Department of Applied Social Sciences at The Hong Kong Polytechnic University) Mr Icarus AU (BeeXergy Consulting Limited)

A Case Study of a Lighting Retrofit Using a Nano Optical Reflective Material LampMate™ to Enhance Indoor Lighting Quality and Energy Efficiency in a Typical Office Building



LampMate™ is a nano optical reflective material that improves a building's lighting quality and lighting energy efficiency. It is an innovative product based on research collaboration with the Nano and Advanced Materials Institute (NAMI) in Hong Kong to replace conventional reflector materials in indoor lighting luminaires with:

1) Higher illuminance and illuminance uniformity
2) Less discomfort glare
3) Truer colour rendering
4) More lighting energy efficiency
5) Similar economic budget

Conventional reflector materials utilise specular reflection only to reflect light rays, but LampMate™ uses both specular and diffuse reflection to reflect light rays from lamps to the surroundings. This breakthrough results in a > 95% total reflectance in LampMate™ and better illuminance from a luminaire without significant added cost.

To ensure its compatibility with indoor building environments and building safety guidelines, it has been tested for:

1) Fire safety (BS 476 Standard)
2) Absence of hazardous materials (RoHS Standard)
3) UV resistance (ISO 11341 and ISO 11507 Standard) over a 10-year ageing period

To date, the technology has been granted four patents. For its practicality in real buildings, a trial lighting retrofit with LampMate™ was implemented in a typical office building in Hong Kong to verify its capabilities to simultaneously improve indoor lighting quality and lighting energy efficiency.

In this trial, the existing recessed mounted luminaires using three light tubes and conventional aluminium metallic finish reflectors in a typical office were replaced by recessed mounted luminaires with LampMate™ on their reflectors. The pre- and post-retrofit illuminance level, illuminance uniformity, discomfort glare and lighting energy consumption were all measured. Some light tubes were also dismantled to examine if LampMate™ can be used to satisfy the illuminance level in an office environment with fewer lamps and less energy consumption. The measurement results show that:

1) LampMate™ enhanced the illuminance uniformity of the office by 14.5% to 20.6%.
2) LampMate™ helped to maintain illuminance levels in the office above the required level with two-thirds of the original lamps only.
3) Luminaires with LampMate™ prevented discomfort glare in more locations in the office than conventional luminaires.
4) LampMate™ reduced lighting energy consumption in the office by 37.5% without degrading the indoor lighting quality to an unsatisfactory level.

These results show that LampMate™ is a practical, safe and economically feasible material that simultaneously enhances indoor lighting quality and building lighting energy efficiency.

Project Team

Project Name	A Case Study of a Lighting Retrofit Using a Nano Optical Reflective Material LampMate™ to Enhance Indoor Lighting Quality and Energy Efficiency in a Typical Office Building
Organisation Name	Carbon Exchange (Hong Kong) Limited
Collaborating Parties	Technological and Higher Education Institute of Hong Kong
Members of Research / Planning Team	Ir. Tony HO Ms Nancy WONG Mr Jeffrey CHENG Mr Hiu Fai KWONG Dr Roger T. H. NG

Adapting Cities to Ageing Societies

The design of the built environment has a critical role to play to adequately respond to the phenomenon of ageing societies. As urban plans are often made decades in advance, urgent action is needed to meet the magnitude of the problem. While Western solutions rely heavily on institutional and communal services, Asian cities require an approach that is more suitable to their culture, and their often dense and vertical built environment.

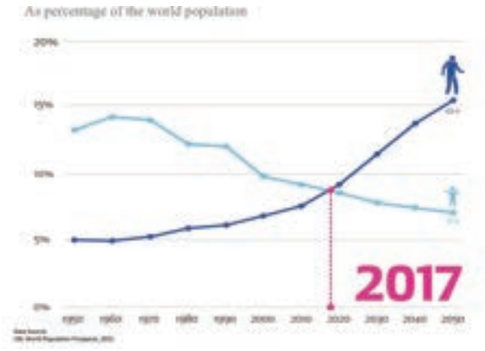
Stage 1

The first stage of this research focused on identifying the most effective levers available to planners and designers in the preparation of East Asian cities for a rapidly ageing population. It compared four major cities, namely Hong Kong, Tokyo, Shanghai and Seoul, to identify effective examples and related implementation mechanisms. Aligned with the strategic framework of the WHO, three focus areas of city structures and systems were adopted: living environment, mobility, and social life. Twelve indicators were used to derive the most effective levers for improving inclusion of the older community into the design process.

The research identified four key areas to improve Hong Kong's built environment. Firstly, the door-to-door accessibility from home to community facilities needs to be optimised, including guidelines on elderly-proof road crossings and improvements to barrier-free access. Secondly, it was found that people of age in Hong Kong feel relatively less safe in their neighbourhoods than in the other evaluated cities. Improvements range from increasing the number of 'eyes on the street' to optimising vibrancy, especially in larger housing estates, and avoiding backstreets. Thirdly, Hong Kong's built environment should include more suitable activity facilities, for example air-conditioned communal gathering spaces or active lifestyle spaces dedicated to the older community. Finally, fourthly, on a building level, the design of existing and new living environments needs to be elderly friendly and adaptable. Meaningful interventions range from the installation of motion-activated lighting, to avoiding narrow spaces and passages, thus catering to changing mobility impairments while still cherishing the values of ageing in place. Additionally, the research findings indicate that the young elderly in Hong Kong are eager to try modern technologies to improve accessibility and wellbeing, such as route search apps, ride-hailing apps and so forth.

Stage 2

The next stage of the research will focus on translating the identified areas for improvement into proposals for implementation and dissemination. Anticipated outcomes include the recommendation of updates in Hong Kong's local planning policies, the optimisation of design standards, and the transfer of knowledge between all four analysed cities.



Project Team

Project Name	Adapting Cities to Ageing Societies
Organisation Name	Ove Arup & Partners Hong Kong Ltd
Members of Research / Planning Team	Wilfred LAU Theresa YEUNG Matthew GEVERS Barton LEUNG Cyrus CHAU Johnny CHO Atlas CHAN

AI-driven Smart Energy Optimisation Platform

Empowering facility management with big data analytics can unlock many energy-saving opportunities for smart buildings. ATAL's Smart Energy Optimisation Platform was a silver-award-winning solution at the Hong Kong ICT Awards 2019 in the category of "Big Data & Open Data Applications". This platform is an all-in-one intelligent system leveraging big data analytics and machine learning to achieve building energy efficiency and sustainable development. Buildings can achieve up to 30% energy savings on air-conditioning operations with the use of the platform, depending on the building type and the building's current energy performance.

Technologies: Physics-guided Machine Learning (PGML)

ATAL's Dynamic Optimisation is built upon the basis of self-trained physics-guided machine learning (PGML) models using actual operating data. Governed by the physical principles in PGML, this combined approach provides a basis towards self-adaptive machine learning while ensuring physically consistent and interpretable results.

Core functionalities

- **Dynamic optimisation**
  The platform adopts an algorithm developed in-house to determine the optimal control setting in real-time, based on the latest cooling load and the corresponding weather conditions. A key feature of the algorithm is that in determining the optimal control setting, it is able to evaluate all possible combinations of equipment and adapt to any changes in equipment status as well as its respective constraint settings. Once the optimal control setting is found, it is sent back to the building management system (BMS) for immediate implementation so as to continuously minimise the energy consumption of the entire air-conditioning systems.

- **Automated Fault Detection and Diagnostics (AFDD)**
  ATAL's AFDD is an in-house developed, model-based algorithm for automatic detection and diagnosis of abnormal operations, equipment deterioration, as well as sensor biases. Unnoticed faults in air-conditioning systems can escalate into complete failure in energy performance, control stability and thermal comfort. AFDD is an essential function because optimisation and energy analytics rely on normally functioning equipment and sensors to measure system performance.

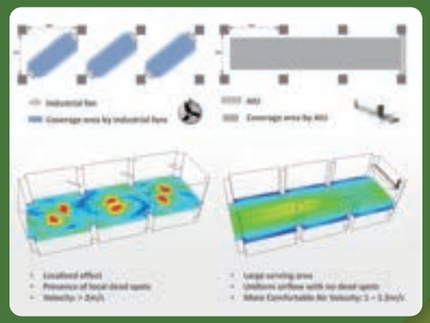
- **Energy analytics and data visualisation**
  The interactive dashboard enables users to visualise energy use and the performance of different equipment over a selected time interval, from the whole system level down to individual equipment. Various key performance indexes and descriptive statistics are also provided for better understanding of actual energy performance.

Prestigious property developers have subscribed to these services for some of their Grade-A office buildings with BEAM Plus Platinum and LEED Platinum ratings. The subscribed buildings have benefitted from the platform and achieved significant energy savings even though they were constructed according to the highest standards of building sustainability.

Project Team

Project Name	AI-driven Smart Energy Optimisation Platform
Organisation Name	ATAL Building Services Engineering Ltd
Members of Research / Planning Team	Ir Dave CHAN Chi-hung (Director) Ir Dr Francis YIK Wai-hung (Technical Consultant) Mr Kenneth LEE Ka-yu (Technical Manager) Dr LEE Pan (Senior R&D Engineer)

Air Induction Unit



An Air Induction Unit (AIU) is a patented displacement ventilation device designed to provide stable moving air for comfort. The device, which has a minimal and aesthetically pleasing aerofoil shape, works using the principle of induction. When connected to a ventilation system, the device generates a small jet of air, which entrains a large volume of surrounding air to flow with it.

Seedling

The concept of an AIU at The Green Atrium originated from a simple question: How to create a thermally comfortable semi-outdoor space in Hong Kong? Sustainability is not only a design for greener living, but also for wellness and health. In a hot and humid place such as Hong Kong, air conditioning is widely adopted in indoor spaces, however it is not energy-efficient for semi-outdoor environments. Although mechanical fans are an alternative, they can only provide cooling in a localised area, with the drawback of having "dead spots" and unbalanced air distribution.

Growth

Drawing on their knowledge and experience, a group of experts in building physics and fluid dynamics believed that efficient ventilation could be achieved through air induction. To create an air entrainment effect, a low-pressure zone was needed. With the aid of computational fluid dynamics (CFD), a prototype of AIU with an aerofoil-like profile was designed utilising the Coanda Effect, whereby a fluid jet stays attached to a convex surface. This prototype started with a pair of fins featuring single-sided outlets facing each other jetting air between. A single fin with double-sided outlets was further developed for simplification. To enhance the air induction effect, the profile of the AIU was further fine-tuned, including its aspect ratio, tip curvature, size of jet, etc. After the profile and air jet design were confirmed, a cavity was designed for the desired flow pattern of air distribution.

Ripening

Finally, the AIU was successfully developed and installed at The Green Atrium as a pilot project. On-site performance tests confirmed its excellent air distribution and ability to provide comfort in a quiet manner. Indeed, it has proven itself to be a better solution than conventional industrial fans:

- **Replicating natural breeze** – Inducing a gentle and uniform airflow without "dead spots" even in large spaces, moving ten times the amount of air.
- **Bladeless** – The absence of moving parts facilitates minimal maintenance.
- Simple, streamlined design – Easily integrated into architectural designs.
- **Energy-efficient** – 65% less energy consumption than conventional industrial fans.
- **Quiet in operation** – Fans can be located far from air outlets.

Since this pilot project, AIUs have also been installed at The Quayside and Harbour East. In response to a lot of positive feedback, more AIUs will be adopted, and a new generation of AIUs is now under development featuring yet further enhancements.

Project Team

Project Name	Air Induction Unit
Organisation Name	Arup
Collaborating Parties **Members of Research / Planning Team**	REC Green Technologies Co., Ltd Tony LAM Tony TANG Kennis CHAN Carmen WONG

BEAM Plus Existing Buildings Volume Certification

The green transformation of existing buildings is a key aspect of the global agenda for decarbonisation. In Hong Kong, there are over 42,000 existing buildings in a densely built environment, where activities in buildings account for over 60% of the city's total carbon emissions.

In recent years, multiple drivers for retrofitting existing buildings into green, smart and healthy buildings have arisen in the marketplace. First, the United Nations' Sustainable Development Goals stress the importance of sustainable cities and communities, good health and wellbeing, and climate action. Second, more investors are jumping onto the bandwagon of green finance and are actively supplying capital to finance green and sustainable buildings. Third, financial regulators and property investors are becoming more conscious of the sustainability performances of buildings in their portfolios, as well as the quality of their environmental, social and governance data disclosed to the public.

To cater to all these drivers, the BEAM Society Limited (BSL) and Hong Kong Green Building Council (HKGBC) have discussed with different stakeholders to accelerate the sustainability transformation of existing buildings. It has been noted that most facility management companies manage their properties in portfolios, and thus certification of corporate building portfolios would help to better communicate the building sustainability performances to relevant stakeholders.

In view of the above, BEAM Plus Existing Buildings (EB) Volume Certification was introduced in October 2019. This new model of certification assesses multiple existing buildings that share common characteristics. New assessment mechanisms, namely a pre-approved credit mechanism and portfolio assessment mechanism, have been introduced by BSL and HKGBC, to streamline and accelerate the assessment process. The benefits of using these mechanisms include:

- Lowering the certification cost and effort needed for each building
- Shortening the overall certification process
- Creating new branding and marketing opportunities

BEAM Plus EB Volume Certification has already received favourable feedback from the industry. At its initial roll out, more than 100 properties were registered for certification. Furthermore, several company representatives have signed Memoranda of Understanding with both HKGBC and BSL committing to volume certifications of their properties.

With the BEAM Plus EB Volume Certification programme, it is hoped that the number of certified existing buildings will escalate, and that buildings can be certified in a shorter lead time. To enhance the adoption rate of green building certifications, both the HKGBC and BSL will further integrate BEAM Plus EB with other sustainability assessment frameworks and match the certification with the interests of investors' portfolio management companies.

Project Team

Project Name	BEAM Plus Existing Buildings Volume Certification
Organisation Name	Hong Kong Green Building Council (HKGBC) and BEAM Society Limited (BSL)
Collaborating Parties	Signing Parties of Memoranda of Understanding (MoU): Hong Yip Service Company Limited & S.H.K. Real Estate Management Company Limited, Kai Shing Management Services Ltd, Nan Fung Property Management, New World Development Company Limited
Members of Research / Planning Team	MAN Expert Panel Chairperson: Mr KM SO MAN Expert Panel Member: Ir Martin WAN, Ir Alan HUNG, Sr Bill MAN, Ir Dr CS WONG, Sr Dick KWOK, Dr Joseph LAI, Mr Ray NG and Ir Timmy KWAN BSL Secretariat: Ir CS HO, Mr Tim LO, Ms Emily WONG, Ms Vicky NG, Ms Karin CHIU, Ms Mona LEE, Mr Raymond LIU and Ms Cherry CHU HKGBC Secretariat: Ir Dr Cary CHAN, JP, Mr Harris CHAN

Construction Industry Council Carbon Assessment Tool Development

To usher in a new era of sustainable development in the construction industry, the CIC Carbon Assessment Tool (CAT) aims to raise the awareness of embodied carbon in Hong Kong and drive change towards decarbonisation in the industry.

This online tool is publicly available and designed to be used across the industry, from public owners, developers and designers, to contractors and suppliers. CAT encourages carbon reduction in both the design and construction aspects of projects in two main ways:

1. Low Carbon Design

   At the design phase, CAT can compare material options and calculate carbon savings in order to encourage the use of low carbon materials in the project.

2. Construction

   CAT captures as-built materials quantities and the impacts of site operations to demonstrate savings generated through re-design and/or good site management, and to report the actual carbon performance of the project. The carbon performance can be compared to the design inputted for the project prior to construction.

CAT collects data from projects, ultimately enabling carbon benchmarks for multiple typologies, e.g., commercial, residential, tunnel, highway, etc. Users can then compare their performance against the benchmark. The data also assists the CIC with its annual reporting for the industry against Hong Kong's carbon reduction targets.

Project Team

Project Name	Construction Industry Council Carbon Assessment Tool Development
Organisation Name	Cundall Hong Kong Limited
Collaborating Parties	Construction Industry Council (CIC), Niron, The Hong Kong Polytechnic University
Members of Research / Planning Team	CIC Environment & Sustainability Departmentt: Grace LAM, Rex CHAN, Kate LAM Cundall: Jonathan YAU, Helen AMOS, Tianyang CAI

Working closely with suppliers and academics, the project team has created a carbon factor database for more than 500 construction materials as part of the tool. CAT considers the impact of these materials from extraction and manufacture to transportation to Hong Kong, as well as the carbon emissions generated through the site operations.

CAT focuses on two areas where embodied carbon can be measured:

1. Materials used in permanent and temporary works for a building's core and shell:
   - Steel
   - Cement
   - Aggregates
   - Concrete
   - Façade
2. Site impacts based on the Hong Kong Greenhouse Gas Emission Guidelines:
   - Electricity / Gas
   - Water
   - HFC/PFC emissions
   - Tree planting
   - Fuel
   - C&D Waste
   - Fugitive emissions from welding and cutting

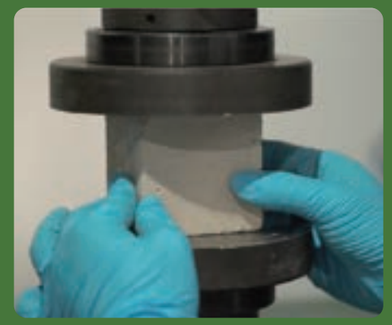
Two key focuses for the CIC in the development of CAT are the usability of CAT and the suitability of the carbon emission factors for Hong Kong. It was therefore important to engage with end-users throughout the development process to ensure their feedback was evaluated. Suggestions from users were considered in order to get their buy-in for using CAT. Numerous stakeholder engagement workshops with public owners, private developers, contractors, and material suppliers were also hosted throughout the development process.

In order to measure the carbon footprints of these materials, the team used Hong Kong trade statistics and worked closely with materials suppliers to understand the materials' source locations, and developed the database to reflect this. Representative data sources were collected to develop a database reflecting the material type, recycled content, manufacturing process and source location of these materials. Generic numbers are also included for each material type in case users do not know the source location or specification of the materials used.

It is anticipated that CAT will be integrated into BEAM Plus Certification, and drive industry buy-in as the scheme is widely used on building projects in Hong Kong. CAT users can generate automated reports through this platform to aid other sustainability reporting, such as ESG reporting and carbon audits.

It is hoped that the launch of CAT will drive the industry forward on its decarbonisation journey and facilitate the industry to realise the savings that can be made.

Development of Innovative Self-compacting Backfilling Material for Pavements in Hong Kong Road Network



In Hong Kong, footpath and carriageway pavements are normally built on soil support. According to the Highway Department's standard practice, when maintenance of the pipes and cables below the pavement is carried out, the soil is excavated and filled back (backfilled). The compaction of the backfilled soil needs to be conducted at 100mm intervals, which is often performed with a vibrating plate or a power rammer depending on the size of the backfilled area. This compaction is often not easy, and spreads dust in the surrounding area. Improper soil compaction leads to pavement defects, and subsequent repair works are often required. Furthermore, the works are governed by the weather as they cannot be performed in rainy conditions.

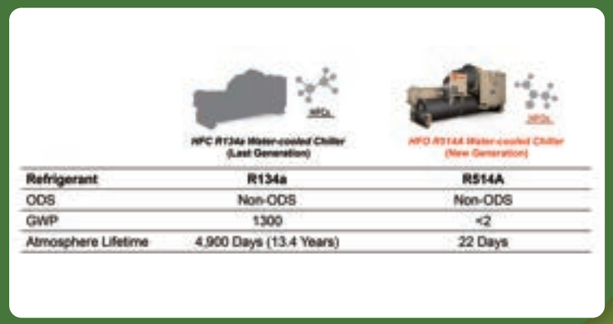
To resolve the issue of easy maintenance and void-free backfilling without compaction, NAMI developed a new type of self-compacting backfill material in collaboration with the Research and Development team at the Highways Department. The motivation was to develop a new formulation, which can be placed easily into congested utility trenches and yet would be excavatable like conventional soil-based compacted backfill. In addition to the self-compacting nature and easy excavatability, the thermal performance was also a key consideration. The desired performance was translated to quantifiable technical properties of flowability, hardening time, final strength and thermal conductivity. The formulation consists of thermally conductive fillers with polymeric plasticizers, which can deliver thermal conductivity of 1.1 W/mK and increase the slump value to no less than 200mm. Simultaneously the compressive strength is maintained below 1 MPa to make future excavations possible using only manual tools.

NAMI's backfill formulation was tested at different site applications on both large- and small-scale filling operations. The backfill material was mixed on-site with a drum-type concrete mixer. In larger operations starting from approximately 3m^3, the material was pre-mixed in a concrete mixing plant and delivered to the site. The operation was tested by pouring the self-compacting material into the trench directly from the truck or the mixer. Due to the material's high flowability, a single truckload of approximately 5m^3 of backfill material was poured into a trench in less than 15 minutes. This is compared to several hours using conventional methods. In a separate trial the backfill was also placed successfully under rainy conditions. After initial site trials, the feasibility of the new type of self-compacting backfill was successfully proven on a commercial scale.

Project Team

Project Name	Development of Innovative Self-compacting Backfilling Material for Pavements in Hong Kong Road Network
Organisation Name	Nano and Advanced Materials Institute Limited
Collaborating Parties	Hong Kong Highways Department Construction Industry Council
Members of Research / Planning Team	Dr Tomi NISSINEN Dr Ivan SHAM Mr Eric CHEN Xian-rui Ms Carmen QIU Jia-wen

Energy-saving Strategy for Adopting Emerging Innovative Technology of Ultra-high Performance New HFO Refrigerant R514A Trane CenTraVac Chillers in Hong Kong



Refrigerant	R134a	R514A
ODS	Non-ODS	Non-ODS
GWP	1300	<2
Atmosphere Lifetime	4,900 Days (13.4 Years)	22 Days

Hong Kong is a densely populated city with more than 42,000 commercial buildings. Chiller plant energy utilisation is a vital concern for sustainable development as it accounts for more than half of energy consumption in commercial buildings. To follow and support the Government's building energy savings under "Hong Kong's Climate Action Plan 2030+", Trane Hong Kong has been offering an innovative ultra-high-performance water-cooled chiller (WCC) since 2018 for enhanced energy efficiency and minimum environmental impacts.

In keeping with the global refrigerant development trend, this innovative chiller was invented with a new-generation hydrofluoroolefin (HFO) refrigerant R514A: non-ODS, ultra-low GWP (<2) and short atmospheric life (22 days). Other excellent characteristics like low leakage and higher operating efficiency (much better than the Hong Kong Building Energy Code) also indicate that it is an ideal replacement for current R134a chillers. This chiller was tested and announced in the US in 2016, but its feasibility in a subtropical region like Hong Kong remained a question.

To investigate the actual performance of this chiller under different operating conditions together with its anticipated energy contribution to Hong Kong, a pilot study with three retrofitting projects was first proposed in 2018. Five sets HFO R514A WCC (400RTon to 1200RTon) were installed in an NGO building, a mixed-used building and an institute complex building. Trane TRACETM 700 (an energy software complying with ASHRAE Standard 90.1 and LEED requirements) and a Building Management System were combined and integrated to create the chiller plant model. With continuing monitoring and calibration, this model can be updated for ongoing energy prediction, retro-commissioning, optimisation, etc. By using this methodology, all operating data and models for future projects can be collected and stored to complement the database, which will be used for both retrofitting projects and new building development.

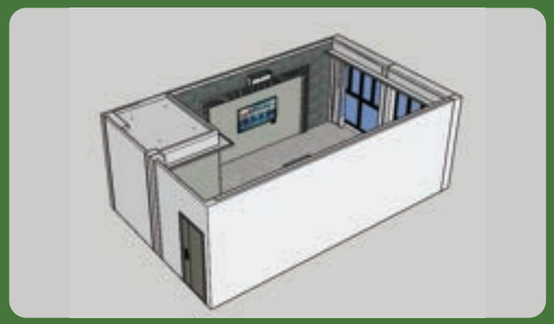
Through this pilot study, the energy saving was predicted and validated as 2,800 MWh/year (equal to 630kWh/RTon). With this encouragement, the sold total tonnage of this chiller in Hong Kong increased to 19,150RTon in 2019. With a conservative predicted sold tonnage for coming years (10% compound annual growth), the energy saving can reach 16,200 MWh/year by 2025 (equivalent to the usage of about 3,400 Hong Kong households) and consequently achieve a CO_2 emission reduction of 11,343 tonnes. This is more than one-fifth of the Government's target in government buildings (CO_2 50,000 tonnes per annum), creating tremendous new momentum for Hong Kong to adopt HFO Chiller solutions.

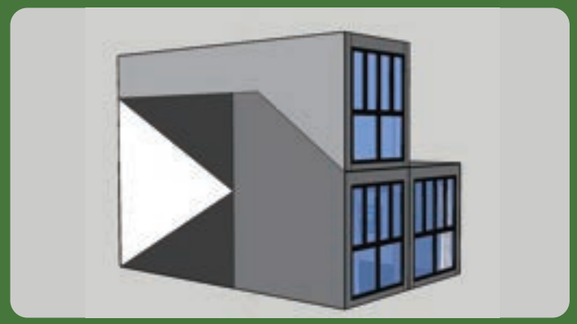
The methodology for adopting New HFO R514A water-cooled chiller in Retrofitting Projects

Project Team

Project Name	Energy-saving Strategy for Adopting Emerging Innovative Technology of Ultra-high Performance New HFO Refrigerant R514A Trane CenTraVac Chillers in Hong Kong
Organisation Name	Trane Hong Kong
Members of Research / Planning Team	Ir CHEUK Kim-tang Dr Jenny BAO Trane Engineering Team

HK MiC Innovations





Modular integrated construction (MiC) is gaining popular in the building industry thanks to an increasing awareness of its safety, construction productivity and sustainability. The off-site manufacturing of MiC modules and on-site assembly can greatly minimise the on-site groundwork and save on-site space, making it a future trend in Hong Kong's construction industry.

To further strengthen the application of MiC systems in Hong Kong, NAMI developed an innovative hybrid MiC system by using high-strength steel as a structural frame, and high-strength lightweight concrete for floor slabs and wall panels. The lightweight concrete wall is as solid as a normal concrete wall with good strength for hanging items, and it is also moisture and fungus proof compared with dry wall panels which are commonly used in a steel MiC system. The total weight of a single module is much lighter than a normal concrete MiC module, thus making it even easier for transportation and construction.

The high-strength steel frame provides excellent strength and stiffness to undertake gravity, wind and other loads during construction and service periods. By using high-strength steel, the size of the structural elements can also be reduced, releasing much needed usable floor area.

To speed up construction and reduce the assembly workload, innovative self-locking connections have been developed to assemble multiple modules together or to form core walls that meet the requirements of even high-rise structures. These connections can be locked automatically once MiC modules are placed in position, without the need for worker interaction. The connections are also reversible, so that constructed modules can be disassembled and re-built in another location.

The lightweight cellular concrete is prepared by mixing pre-formed foam into a cementitious slurry to achieve a porous structure that contains lots of uniformly dispersed air voids. To achieve high compressive strength, advanced material technology and optimised mixing and pre-formed foam generation conditions are employed to reduce the size and narrow the distribution of air voids, and reduce the ratio of the voids' connectivity within the cellular concrete. The compressive strength of this cellular concrete achieves 25 Mpa with a wet density of 1,500kg/m^3.

In addition, an innovative triple-proof stitching joint has been developed and adopted for this innovative hybrid MiC system. By using a highly flexible waterproofing material and fire-resistant material, it achieves excellent waterproof, fireproof and smokeproof performance.

Due to its many advantages, this innovative hybrid MiC system is suitable for various building projects, including hotels, dormitories and apartments. It is hoped that it will inspire yet more design and construction engineers at consulting firms and construction companies, as well as at regulatory agents, to adopt MiC systems in Hong Kong.

Project Team

Project Name	HK MiC Innovations
Organisation Name	Nano and Advanced Materials Institute Limited
Members of Research / Planning Team	Dr Ivan SHAM Dr ZHU Hong-gang Dr Yanmin WU Dr Audrey ZHANG Mr Eric LAU Mr Xinkun LU Dr Garrison CHAU Ms Ruby ZHU

Nanotechnology for Reclaimed Asphalt Pavement

With insufficient supply of natural aggregates and virgin asphalt, reclaimed asphalt pavement (RAP) is attracting much attention since it can be recycled and reused in new asphalt concrete construction. However, single heating rather than parallel heating is commonly used in Hong Kong for fabricating asphalt concrete, which limits the RAP ratio to a low level when used in the absence of a rejuvenator.

In this project, a novel rejuvenator containing nanoparticles (RCN) was developed and applied to asphalt concrete to enhance the ratio of RAP in a nano-modified green asphalt pavement system. This also served to enhance the durability, different from that of other commercial rejuvenators. A rejuvenator containing nanoparticles (RCN) was developed by shear mixing bio-heating oil with nano silica colloid at an optimised ratio. Waste oil can make up for the volatilisation of light components in asphalt binder, while nano silica enhances the anti-ageing, anti-rutting performance of the mixture. Afterwards, a spray method was adopted for adding the RCN into the new asphalt pavement to ensure the RAP surface was well coated. During the mixing procedure, the RAP binder was partially softened when contacting the heated aggregate, which allowed the RCN and nano silica to be dissolved in the virgin binder to further enhance its anti-ageing properties.

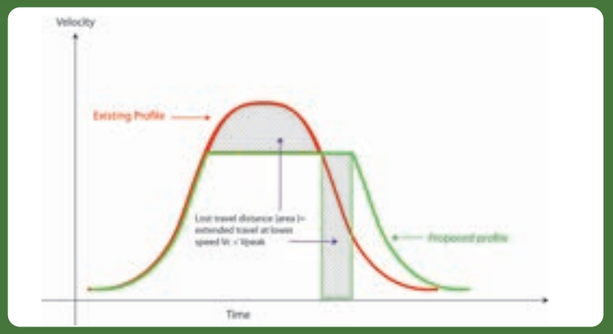
To recover the properties of RAP binder to the original level (Pen 60/70), RCN at 7 to 7.5 wt% of RAP binder was adopted. Results showed that the anti-ageing performance of the binder rejuvenated by RCN was better than that of commercial rejuvenators, while the 35% RAP mixture performed well in water resistance, could pass the relevant standards, and had better small-loads fatigue resistance and rutting resistance than 15% RAP. In addition, the mixing and compacting temperature was 10 to 20 °C lower than 15% RAP and the compact quality of the mixture can be ensured. Road trials further demonstrated that a 35% RAP mixed with RCN can be easily produced and paved successfully. The corresponding Marshall Stability of nano-modified asphalt concrete can achieve 10 kN or above and a flow value of 4.0mm or below, even for mixtures of 40% RAP.

Following the project's successful completion, the industry now has the opportunity to adopt NAMI's technology to manufacture nano-modified asphalt concrete with 30-35% RAP under single heating, which will save more natural resources while also having a positive impact on the environment and landfills.

Project Team

Project Name	Nanotechnology for Reclaimed Asphalt Pavement
Organisation Name	Nano and Advanced Materials Institute Limited
Collaborating Parties **Members of Research / Planning Team**	K.Wah Asphalt Limited Nano and Advanced Materials Institute Limited: Dr Alex CHEN Bin-meng, Dr SHAM Man-lung and Dr ZHU Hong-gang The Hong Kong Polytechnic University: Prof. WANG Yu-hong

Public Health Impacts from Subway Noise: Case Study of Hong Kong MTR



This research quantified the potential noise-induced health risks to passengers riding the Hong Kong MTR subway system with the objective of providing recommendations for reducing noise exposure. Subway noise can range from 80-112 decibels (dB), which greatly exceeds the 70dB level set by the World Health Organization (WHO) and EPA for safe environmental noise levels (Gershon, Neitzel, Barrera, & Akram, 2009). While the effects of noise are rarely detrimental, single events above 110 dB or cumulative exposure above 80-85dB can lead to noise-induced hearing loss (NIHL), and other indirect health impacts such as cardiovascular disease, sleep disturbance, cognitive impairment and hypertension (Basner, Davis, Clark, & Stansfeld, 2014).

The main question answered was: What are the potential public health risks from Hong Kong subway noise? Given that the threshold for environmental noise given by the EPA and WHO is 70dBA, the following hypotheses were tested:

- Average noise exposure during peak-hours (rush hour) is 5dBA higher than off-peak hours (non-rush hours).
- Commuters who ride the subway for two hours or more are being exposed to noise levels of >=80dBA and are at risk of developing NIHL.
- The burden of disease (BOD) from subway noise exposure for the average commuter is 25% of all occupational noise exposure in Hong Kong.

Noise sampling was stratified across all subway lines and stations of the Hong Kong MTR from inside the train car and on the platform. An overall noise map of the subway system and spectral analysis was compiled to understand the direct and indirect health impacts of the noise on the human body and estimate the associated BOD (burden of disease). Finally, a preliminary exploration of the sound-to-speed relationship was carried out to understand the potential for noise reduction.

The results of the study showed that the average Hong Kong MTR train ride had a Leq of 74.1 dBA and Lpeak of 100.9dBA. The Island Line was the loudest, with an in-train noise average of 81.7dBA and peak of 108.1dBA. Underground and enclosed tunnel sections were significant contributors to high noise levels, by about 10dBA, due to reverberation, and low frequencies accounted for the majority of the sound pressure.

The average MTR commute can add 8dBA to environmental noise exposure, and bring the overall noise level exposure in a day from 59.5-75.2dBA to 67.5-75.6dBA. Passengers riding for two hours a day on the MTR have an increased risk of developing NIHL, as at L10 the exposure is above 85dBA and the estimated BOD can be up to 99 DALYs (disability adjusted life years) from direct noise exposure. The risk of indirect health impacts from MTR noise account for the majority of the BOD, such as annoyance, hypertension and increased cardiovascular disease, and can be up to 277,086 DALYs.

The preliminary sound-to-speed analysis showed that reducing the top speed of the train by allowing for a longer cruising time at lower speeds could be an effective way to reduce noise without costly investments in sound absorbing materials. An increase in the overall transit time of 10% could yield a 50% drop in sound pressure.

Project Team

Project Name	Public Health Impacts from Subway Noise: Case Study of Hong Kong MTR
Organisation Name	Greencity (Hong Kong) Architectural Technologies Ltd
Collaborating Parties **Members of Research / Planning Team**	Harvard University, Extension School The University of Hong Kong Author/Researcher: Stephany Y. XU Thesis Director: Professor HUANG Li-xi (The University of Hong Kong) Research Advisor: Mark LEIGHTON (Harvard University) [Remark: This project was a result of a research thesis in the field of Sustainability at Harvard University, Extension School.]

Smart Green Facility Operations

Traditionally, facility operations have mainly focused on BMS alarms and occupants' service request calls to perform corrective maintenance. This standard facility operation has the following problems:

- Reactive approach to equipment health causing inconvenience to occupants and the breakdown of equipment.
- Efficiency of equipment operations is difficult to monitor, leading to energy waste.
- Lack of experts/experienced persons in optimising system operations.
- Shortage of qualified facility management personnel in the market.

Smart Green Facility Operations is an innovative initiative by Hongkong Land (HKL) to redefine facility operations. Its integrated operations aim to reduce reliance on manual labour and instead use artificial intelligence (machine learning), digital twins, intelligent security systems, video analytics, cloud-based control, and big data analytics to perform the necessary analysis and to provide useful insights from the operational and user data, all of which can enhance operational efficiency and allow the implementation of green operations.

This smart system is enabled by the utilisation of HKL's iBMS (a single integrated platform of all BMS systems across 12 HKL buildings), an extensive network of IoT sensors through HKL's own LoRaWAN infrastructure, and smartphone apps exclusively for its tenants to get user preference data.

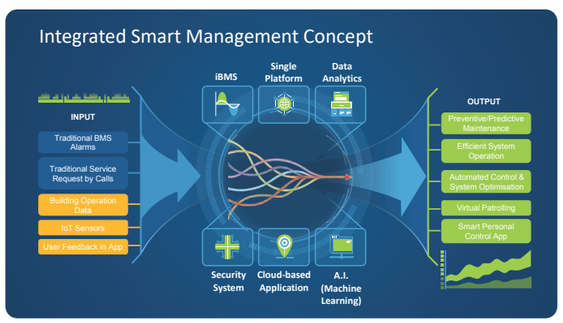
In the initial phase of its Smart Green Facility Operations, implemented throughout the 12 buildings in HKL's Central Portfolio, the following enhanced operations have been achieved:

Project Team

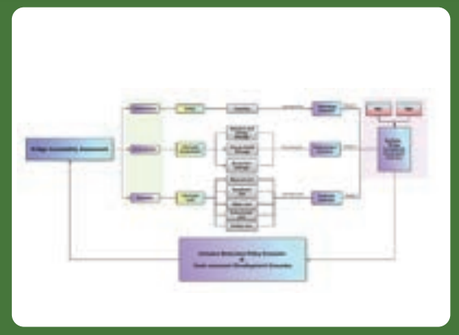
Project Name	Smart Green Facility Operations
Organisation Name	Hongkong Land (Property Management) Limited
Members of Research / Planning Team	Andy YEUNG Don TSE Derek CHAN

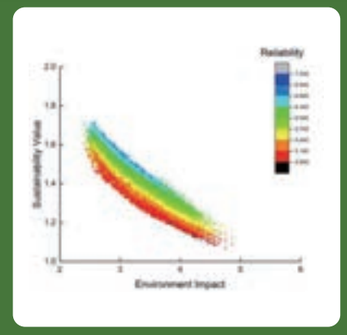
- Predictive maintenance enabled by big data analytics (machine learning) with the data from iBMS and IoT sensors resulted in equipment life being prolonged, while waste was reduced.
- Efficient system operations enabled by big data analytics (machine learning) with the data from iBMS and IoT sensors enabled the identification of energy-saving opportunities.
- Automated control and system optimisation enabled by digital twins through the optimised chiller operations achieved significant energy savings. It was established that an estimated 10% saving of chiller plant energy can be made by adopting chiller optimisation.
- Virtual patrolling and video analytics with HKL's Intelligent Security System reduces the reliance on physical patrols by security guards, thus enhancing operational efficiency.
- A Smart Personal Thermal Comfort Control App with A.I. learning to automatically adjust the indoor thermal environment according to occupants' preference was found to improve occupants' thermal comfort and satisfaction. This resulted in over a 60% reduction in air-conditioning service request calls from tenants.

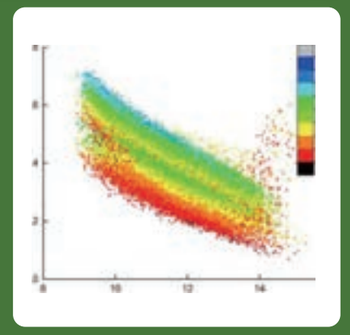
HKL's Smart Green Facility Operations enhances environmental sustainability by improving each building's energy efficiency, embraces sustainable operations by continuously optimising and automating operations, and enables ongoing automatic enhancement insights to increase operational efficiency. This has revolutionised traditional facility operations and introduced endless new possibilities.



Sustainable Bridge Design - Considering Climate Change Effects by Using Big Data and Social Network Methods







This research evaluated the comprehensive sustainability of small-span bridges based on big data analysis methods, in search of a sustainable design methodology for new bridges. It further investigated the adaptability of bridge designs to achieve 2040 carbon emission reduction targets under different scenarios, and looked for expansion of the research outcome to other types of bridges around the world.

The study selected one of the bridge types in the General Atlas of China's Highways and Bridges for evaluation. This type of concrete viaduct is also widely adopted in Hong Kong. By changing its geometric and physical parameters, 142,500 different variations of the design were tested, of which 120,085 proved effective. The Maximal Information Coefficient (MIC) and Social Network Analysis (SNA) methods that involve big data were used to quantitatively analyse the correlation between design parameters and reliability, environmental performance and cost. This enabled the identification of essential parameters for designing sustainable bridges. The results show that the strength of steel bars and the effective height of beams have the strongest correlation with reliability, whereas the section area of beam and first-stage load have the strongest correlation with both environmental performance and cost.

The researchers further evaluated the adaptability of the bridge design to meet 2040 carbon emission reduction targets by using CO_2 emission reduction policies scenarios and socio-economic development scenarios. The results show that not all bridges designed according to China's current bridge design specifications and codes meet the reduction targets. Implications of these findings are that the designers of typical viaducts in Hong Kong and mainland China should refine their designs by adjusting the relevant parameters. The Government should also focus on fully implementing existing sustainable development policies, refine and implement carbon reduction policies in the construction sector, and make the efficiency of emission reduction standards more stringent in the future.

Driven by a commitment to provide a professional judgement based on theoretical evidence rather than empirical data, the study's evaluation model successfully integrates reliability, environmental performance and costs for assessing the sustainability of bridges. The method it has developed enables the development of quantifiable and feasible designs that comply with current design specifications and codes.

Through the results of this research, the researchers assert that moving towards digitisation, informatisation and artificial intelligence are essential for engineers to design bridges that promote sustainable urban development and that also align with carbon reduction targets.

Table 1 | Targets of CO_2 reduction in different scenarios in future

Target of CO_2 reduction	2025	2030	2040
CPS-SSPs	10-15%	20-28%	39-51%
NPS-SSPs	14-18%	27-35%	51-60%
SDS-SSPs	23-27%	47-52%	82-85%

Project Team

Project Name	Sustainable Bridge Design - Considering Climate Change Effects by Using Big Data and Social Network Methods
Organisation Name	Arup
Collaborating Parties Members of Research / Planning Team	Beijing Jiaotong University (BJTU) Arup Team: Steve KITE, Ngai YEUNG, Michael TIMAJO BJTU Team: WANG Yuan-feng , LIU Yin-shan, SHI Cheng-cheng

The Role of Governments and Green Building Councils in Cities' Transformation to become Sustainable: Case Studies from Hong Kong (East) and Vancouver (West)

The transformation of older cities in order to mitigate the climate change phenomenon is now a global trend. Collaboration of multidisciplinary professionals, advancement of technological innovation, socio-political participation, public education, and governments' leadership are all needed to enhance the quality of life of urban dwellers. In particular, government policies play critical roles to advance cities' sustainable goals. However, the role of Green Building Councils is also undeniably critical to facilitate such changes. Two advanced sustainable cities: (i) Hong Kong (a representative city from Eastern countries) and (ii) Vancouver (a representative city from Western countries) were selected as case studies to understand the roles of local governments and Green Building Councils in leading cities' transformation to achieve sustainable cities goals. Related official documents such as: "Energy Saving Plan for Hong Kong's Built Environment 2015 – 2025+", "Hong Kong's Climate Action Plan 2030+", and "Greenest City 2020 Action Plan" of the City of Vancouver were analysed to identify the governments' visions, goals, and strategies in greening their cities.

A series of expert interviews were conducted to understand the direction of these institutions in driving the changes in policy and practices which included: (i) government officials and leaders from Green Building Councils in both cities to understand their perspectives and goals in the aforesaid transformation; (ii) leaders from the World Green Building Council; (iii) a Director of Environment and Development at the United Nations, ESCAP, and (iv) observations of prominent green buildings in both cities to understand the effectiveness of the implementation of climate-change policies. Meta-analysis of both cities' Action Plan documents were conducted to understand the consequences and future direction of each city's evolution to become a Green City leader, and their respected unique approaches were analysed in their own cultural context. Activities of stakeholders (e.g., developers, investors, town planners, architects, and many others) in the built-environment industries were likewise observed to assess the success and set-back of the policies. Implications, recommendations and future directions of this research will be discussed.

Project Team

Project Name	The Role of Governments and Green Building Councils in Cities' Transformation to become Sustainable: Case Studies from Hong Kong (East) and Vancouver (West)
Organisation Name	Philia Earth Limited
Collaborating Parties	Sr Bay WONG (Chairman of HKGBC 2017) Mr H W CHEUNG (Chairman of HKGBC) Ir Conrad WONG (past Chairman of HKGBC) Professor John NG (Chairperson of Beam Society Ltd. 2016) Mr SIANG Tai-lee (President of WGBC 2017) Ms Christine LOH (Under Secretary for the Environment HKSAR in 2016) Mr Thomas MUELLER (ex President and CEO of Canada Green Building Council) Ms Andrew REIMER (Councillor of City of Vancouver in 2016) Dr Stefanos FOTIOU (Chief of Environment & Development Division, UN-ESCAP, 2016)
Members of Research / Planning Team	Mr Kenneth POON K Y Dr Ailin IWAN

A Novel Indirect Evaporative Cooler for Enhanced Energy Recovery in Central Air-conditioning Systems

Indirect evaporative cooling (IEC) is recognised as an alternative air-cooling solution with low carbon potential and considerable energy efficiency, but this technology has been mainly used in dry and hot regions like the west areas of China. Through a few years' R&D activities, an Indirect Evaporative Cooling Energy Recovery System (ERIEC) has been developed for application in hot and humid areas like Hong Kong. Exhaust air from buildings is used together with water evaporation behaviour to pre-cool the fresh air before air handling units (AHU) for primary air supply. The researchers not only developed this novel ERIEC system, but also proposed corresponding control strategies and a performance prediction model for this novel energy recovery system.

In a simple ERIEC, the water evaporates from the wet surface of the secondary air channels owing to the vapor pressure difference. The sensible heat will transfer from primary air to secondary air, thus the fresh air can be cooled without simultaneously adding moisture. In Hong Kong, the high moisture content in fresh air can lead to condensation during the cooling process in the dry channel. Consequently, condensation was considered, and detailed heat and mass transfers were analysed when conducting this research.

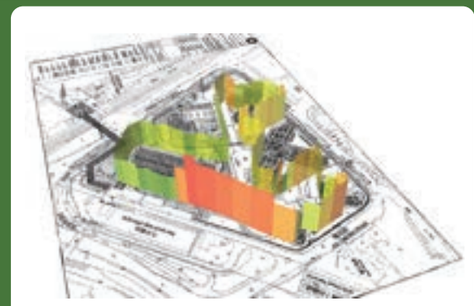
In the energy recovery system, an IEC is arranged before an AHU to pre-cool the fresh primary air by harvesting energy from the exhaust air (cool and dry exhaust air) from air-conditioned spaces in a building. This enhances the evaporation process in the wet channels, which facilitates the primary air-cooling process in the dry channels. In addition, this system operates according to the proposed novel high-low control strategy. A statistical model has been developed to predict the performance for building energy assessments. Field measurements have likewise been carried out on an experimental ERIEC system in Hong Kong to validate the practical predictive model under varying outdoor climates. The annual energy saving for fresh air supply is 21% and the peak load was reduced by 27% in this project.

Meanwhile, the project has also investigated the new wick medium in the IEC, aiming to improve the wettability and evaporation process in the wet channel. The research results can promote this technology for applications in governmental buildings in Hong Kong, as well as benefit the local and Greater Bay Area with energy savings, carbon emission reductions and greater environmental protection.

Project Team

Project Name	A Novel Indirect Evaporative Cooler for Enhanced Energy Recovery in Central Air-conditioning Systems
Organisation Name	The Hong Kong Polytechnic University
Members of Research / Planning Team	Prof. YANG Hongxing Dr CHEN Yi Ms MIN Yunran Mr SHI Wenchao

A Practical Application of Integrated Micro-Environmental Monitoring Systems for Construction Sites



Workers are easily exposed to a wide variety of hazards on construction sites, such as heat, noise, UV radiation and dust. Overexposure to these environmental hazards may lead to injury, chronic illness, or even death, and thus safety and health management are essential for construction projects. This project developed a real-time, automated, and Integrated micro-Environmental Monitoring System (IEMS) which can significantly facilitate the screening of health risks and hazards on construction sites. A low-cost Integrated micro-Environmental Monitoring Device (IEMD) was designed for monitoring localised site conditions with different sensors for environmental monitoring (e.g., temperature, humidity, UV radiation, noise level, and dust intensity), positioning (GPS), and communication (3G/4G networking). A monitoring platform with visualisation (web interface and Android App) were also embedded to provide prompt alerts to workers to avoid unfavourable working environments, thus aiming to achieve real-time environmental monitoring in construction sites.

The project team used a progressive approach to develop a robust alarm and warning system by integrating the classification and parameters related to health risks from the HKEPD and USEPA. The designed health risk index was categorised into three working condition classes, including “Good”, “Unhealthy” and “Hazardous”, which conveys simple and convenient messages to the workers for each class. “Good” class indicates an overall acceptable condition of work; “Unhealthy” class describes a situation where workers with health risks should reduce their workloads or take precautionary measures; and “Hazardous” class indicates a critical situation in which workers with health risks should stop working while healthy workers should reduce prolonged exposure in the affected sites. This alert and warning system is integrated with a mobile application and will generate a warning notification if any of the environmental parameters exceed the defined thresholds.

Safety officers and site managers can monitor and evaluate the on-site environmental conditions from the system, so that appropriate preventive measures can be enforced. The system also provides an analysis tool for environmental impact assessments during various stages of the construction process. This project is to (i) provide an effective service platform for environmental monitoring on construction sites, with the ability to incorporate real-time environmental information (ii) enhance the current risk assessment on-site; and (iii) raise awareness of environmental quality in the working environment. The system can also be modified for other applications (e.g., in bus terminals, shopping malls, factories, and even in household apartments).

Project Team

Project Name	A Practical Application of Integrated Micro-Environmental Monitoring Systems for Construction Sites
Organisation Name	The Hong Kong Polytechnic University
Members of Research / Planning Team	Project Coordinator: Dr Charles WONG Man-sing Project Members: Prof. Esmond MOK Chi-ming Mr LOW Hon-wah

Developing a Community Resilience Assessment Framework for Sustainable University Towns

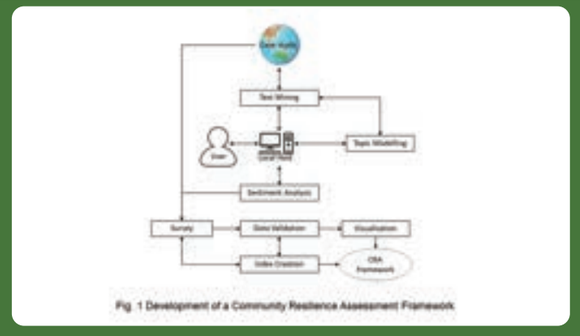


Fig. 1 Development of a Community Resilience Assessment Framework

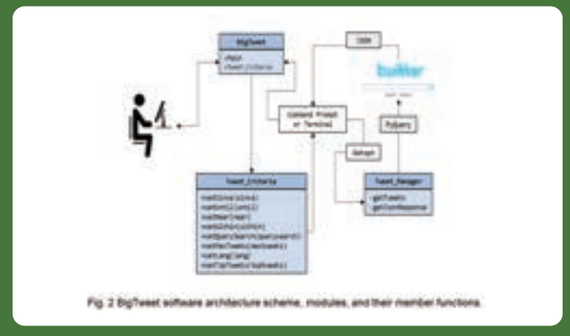


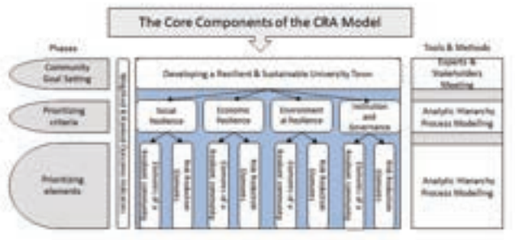
Fig. 2 BigTweet software architecture scheme, modules, and their member functions

Due to rapid urbanisation, land resources have become scarce. Universities, as one of the highest consumers of land in cities, can no longer accommodate the increasing number of students within their walls. Therefore, most students, as transient residents, live off-campus within the university town in houses not traditionally built for students. This so-called studentification, which refers to the contradictory socio-cultural, economic, and physical changes resulting from students' dominance within neighbourhoods of university towns, also known as a “town-gown” relationship, poses challenges and affects the structural transformation and sustainability of university towns globally.

To make university towns resilient and more sustainable, this project aims to contribute a tool to assess community resilience of such studentified towns, by identifying risks and vulnerabilities associated with students' dominance in such neighbourhoods to build resilience and peaceful co-existence between the students and non-student residents.

Critical literature reviews enabled the researchers to ascertain the challenges and evaluate the adequacy of existing Community Resilience Assessment (CRA) tools, and to build conceptual and theoretical frameworks. The established factors were used to develop both the Composite Vulnerability Index (CVI) and the Composite Resilience Index (CRI) for university towns, which contributed to developing the overall CRA framework. Hong Kong, the United Kingdom, the United States, and Nigeria were strategically selected as primary case studies. Extending from them, a global survey with experts snowballed into 23 other countries. From this study, a BigTweet Programmatic Algorithm (BTA) was developed to legally mine backdated text from social media (Twitter) within university towns over a 10-year period. This Python-based open-source software (v1.0) for big data mining is available for free use under the GNU General Public License v3.0 via this link: https://github.com/marquisvictor/BigTweet

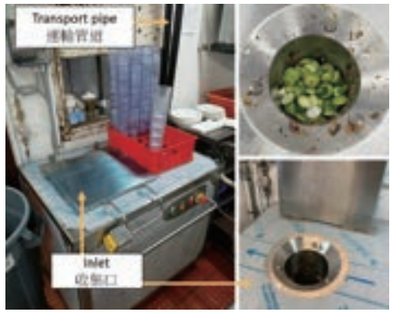
The findings relating to Hong Kong show that major studentification challenges in Hung Hom, the home to PolyU in Hong Kong, include noise from student halls, congestion in shops and footbridges linking the campus to students halls, illegal conversion of apartments by landlords to suit the student market, and high rents and living costs. Further assimilating data collected from other countries will contribute to validate the CRA framework. The project will help decision-makers in Hong Kong and other countries to utilise the latest technologies such as big data, natural language processing, and machine learning integrated under the CRA framework to assess existing university towns for trouble spots and to develop strategies that improve the resilience and sustainability of both old and new university towns.

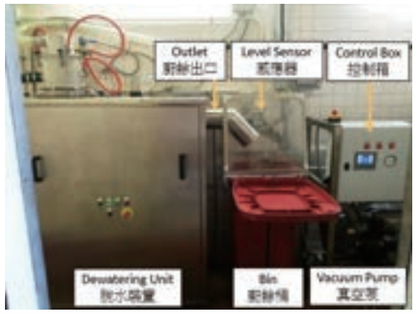


Project Team

Project Name	Developing a Community Resilience Assessment Framework for Sustainable University Towns
Organisation Name	The Hong Kong Polytechnic University
Members of Research / Planning Team	Professor Edwin CHAN H. W. (Department of Building and Real Estate, and RISUD) Dr Charles WONG Man-sing (Department of Land Surveying and Geo-Informatics, and RISUD) Mr Mohammed Abdul-Rahman (Department of Building and Real Estate, and RISUD)

Implementation of a Food Waste Collection System for Catering Services



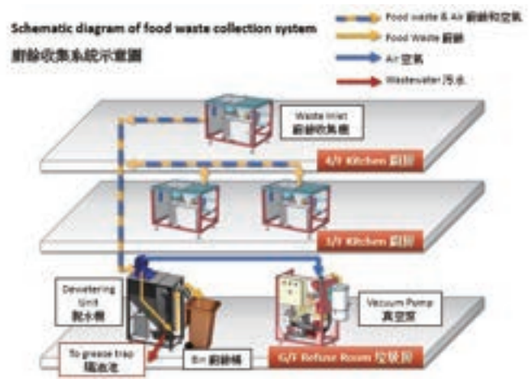


Funded by the Recycling Fund of the HKSAR Government, which aims to promote the recovery and recycling of waste, PolyU installed a small-scale automatic food waste collection system coupled with dewatering functionality at a catering complex on campus. This small-scale food waste collection system, which is the first-ever in Hong Kong and East Asia, started operating in July 2019. The project aims to evaluate the outcomes and benefits resulting from the adaptation of a centralised food waste collection facility through life-cycle costing analysis, as well as to analyse behavioural changes of users due to implementation of the system.

The system is divided into three components, namely waste inlets, a vacuum pump, and a dewatering unit. Food waste is first collected at inlet benches located in kitchens. Water is added to the waste while an internal mincing machine breaks the waste into smaller pieces. Suction force is then created by the vacuum pump to transport food waste from the upper floors to the dewatering unit on the ground floor via pipes. Finally, the dewatering unit reduces the volume and water content of the food waste by pressing it up against a screw chamber. The system is equipped with a level sensor, which will notify staff to replace the collection bin when it is more than half full.

Study results showed that daily collected food waste from the canteens increased from 199kg to 217kg after system operation, while the average number of bins required to dispose of the waste reduced from 3.8 to 2.9 bins per day. The grinding and dewatering processes also reduced the volume of food waste by around two-thirds and the water content by 12%. Overall, the 10-year cost for manual collection was estimated to be around HK$27/kg while system collection was HK$21/kg, indicating roughly a 20% per unit cost saving through the adoption of a collection system under the studied premise.

This food waste collection system is more than a showcase of functionality and performance testing. The researchers expect that it can replace manual collection practices in the long run and maximise food waste recycling by reducing the volume of collected food waste through waste compaction processes. In turn, this will help reduce the collection and transportation costs to food waste recycling facilities. It is hoped that the project experience will help the Government determine and promote cost-effective food waste recycling practices for local catering businesses, and relieve the pressure on landfills.



Project Team

Project Name	Implementation of a Food Waste Collection System for Catering Services
Organisation Name	The Hong Kong Polytechnic University
Collaborating Parties **Members of Research / Planning Team**	Recycling Fund, HKSAR Government Dr MUI Kwok-wai, Associate Professor Dr WONG Ling-tim, Associate Professor Mr CHIU Yin-hei, Research Assistant Ms TSANG Tsz-wun, PhD Candidate

Increasing Resilience to the Health Impacts of Extreme Weather among Elderly People under Future Climate Change

Extreme hot weather is expected to be more frequent and intense in Hong Kong under future climate change. The impacts will be exacerbated due to the presence of the urban heat island effect in our high-density city. In particular, elderly people are more vulnerable to the impacts of extreme hot weather because of their decline in physiological functions and their behaviour and responses. As such, plans for mitigation and adaptation actions are urgently needed.

Numerous studies have proved that excess mortality and morbidity are associated with extreme hot weather. It is important for different sectors of the society to take necessary actions. However, there are three issues to be addressed for successful responses, including (a) a lack of data for understanding the extreme hot weather in our city; (b) a lack of evidence-based mitigation action plans; and (c) a lack of evidence-based adaptation response plans.

This ongoing study aims to contribute by: (1) downscaling global climate data to the urban scale for weather information services and health impact assessment; (2) developing a mitigation action plan with better urban planning and building design for extreme weather; and (3) developing an adaptation response plan for supporting services to increase the resilience of elderly people to extreme weather. This study will provide a methodological framework for incorporating the scientific knowledge of extreme weather and its associated impacts on elderly health and wellbeing into a comprehensive plan for response actions.

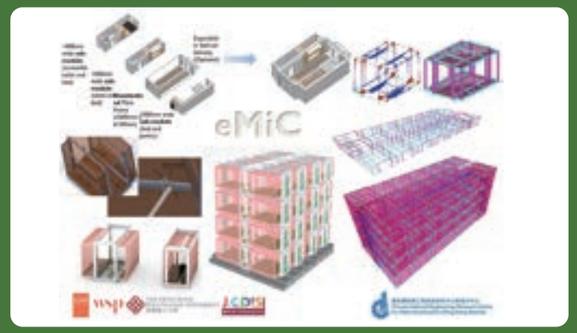
This study has great significance:

(1) The findings of the study will help the Hong Kong Observatory transform its current simple weather information system into a more comprehensive one that is capable of reflecting the timely conditions of different districts.
(2) Guidance will be developed for urban planners, architects, developers and other professionals in the field to help the industry fully unleash its potential in building towards a sustainable and healthy city under the vision of Hong Kong 2030+. These practitioners will then fill the current knowledge and awareness gap in the industry.
(3) Current services will be improved by incorporating information provided by the new weather warning system. Housing protocols will also be developed to better cater to the elderly's need under extreme weather. Social workers and volunteers will likewise be trained to take better care of the elderly under such conditions.

Project Team

Project Name	Increasing Resilience to the Health Impacts of Extreme Weather among Elderly People under Future Climate Change
Organisation Name	The Chinese University of Hong Kong
Collaborating Parties	The University of Hong Kong The Hong Kong University of Science and Technology The City University of Hong Kong
Members of Research / Planning Team	Prof. Edward NG (School of Architecture, The Chinese University of Hong Kong) Prof. Kevin LAU (Institute of Future Cities, The Chinese University of Hong Kong) Prof. Gabriel LAU (Institute of Energy, Environment and Sustainability, The Chinese University of Hong Kong) Prof. Jimmy FUNG (Division of Environment and Sustainability, The Hong Kong University of Science and Technology) Prof. LI Yu-guo (Department of Mechanical Engineering, The University of Hong Kong) Prof. REN Chao (Faculty of Architecture, The University of Hong Kong) Prof. CHOW Tin-tai (Division of Building Science and Technology, The City University of Hong Kong) Prof. Square FONG (Division of Building Science and Technology, The City University of Hong Kong) Prof. Helene FUNG (Department of Psychology, The Chinese University of Hong Kong) Prof. Jean WOO (CUHK Jockey Club Institute of Ageing, The Chinese University of Hong Kong) Prof. William GOGGINS (Jockey Club School of Public Health and Primary Care, The Chinese University of Hong Kong) Prof. Patsy CHAU (School of Nursing, The University of Hong Kong)

Relocatable Housing Using Modular Integrated Construction



The rising demand of transitional social housing has become "third sector housing" in Hong Kong, strategically situated in the gap between the dominant public rental housing and private/ownership-based residences (nearly half-half). Due to repetitive and relocatable requirements, modular integrated construction (MiC) is used predominately to deliver housing in a speedy and systematic manner. To further enhance the sustainability of this new housing type, this study was undertaken to optimise occupants' wellbeing, as well as further optimise community services and the innovation of construction technology.

As the provision of transitional social housing is delivered mainly through non-government organisations (NGOs) and statutory bodies (e.g., Urban Renewal Authority, Hong Kong Housing Society), a high degree of standardisation in design (unit types and layout) with an appropriate level of customisation (private and communal features) is urgently needed to suit different organisational missions and service targets. Through intensive community engagement and technical consultation with the building industry, a design prototype based on MiC technology was proposed in an attempt to meet these multi-sectoral expectations. Peer review of the prototype was also conducted using a homogenous small-size focus group approach to evaluate the prospect of universal application and the possibility of industrial scale-up production.

The design prototype was based on a main module (2.5m wide to allow restriction-free road transportation) which was expandable on site on both sides via different side modules (1m and 1.4m wide side modules, to a total width of 4.5m to 4.9m wide). The side modules allow different internal provisions and are therefore able to generate a series of layout configurations which can satisfy different NGOs' requirements. The MiC modules were conceived in steel framed structurally with modularised staircases, corridors, façades, roofing and precast reinforced concrete foundation blocks. The proposed building system optimised buildability, material sustainability and full reusability. The expected service life of the modules was estimated to be not less than 50 years and could be deployed at least six times (based on comparable projects overseas).

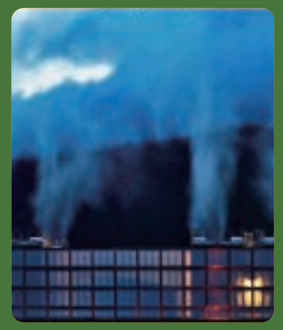
The significance of the research-generated prototype includes:

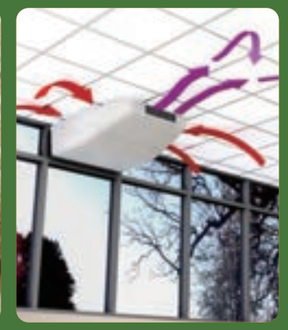
- The standardised design of modular units with appropriate customisation to suit operational goals, thus further maximising the benefit of MiC in a larger scale of economy;
- The alleviation of poverty through the timely supply of transitional social housing at speed and with a decent design/quality (SDG#1 End Poverty);
- The infusion of much-needed social services to enable healthy living and neighbourhoods for disadvantaged members of the community (SDG#3 Good Health & Well-being);
- The exemplary application of MiC to establish a resilient and innovative construction technology (SDG#9 Industry, Innovation & Infrastructure)
- The creation of an inclusive, safe and sustainable building system for the benefit of society (SDG#11 Sustainable Cities & Communities).

Project Team

Project Name	Relocatable Housing Using Modular Integrated Construction
Organisation Name	Jockey Club Design Institute for Social Innovation, The Polytechnic University of Hong Kong
Collaborating Parties	Chinese National Engineering Research Centre for Steel Construction (Hong Kong Branch) Construction Industry Council (Hong Kong) Leigh & Orange Architects WSP Engineers
Members of Research / Planning Team	Calvin LUK W, CHUNG Kwok-fai, Thomas TONG YN, Ivy LEE, KK SHING, Samuel LEE KK, Michael SUNG, Jiang HAO, Aria YANG CH

Study of Design Considerations for Government Infrastructures in Hong Kong under Extreme Temperatures





The warming trend due to climate change will continue for the rest of the 21st century. It is necessary for Hong Kong to strengthen the resilience to the warming climate with increasing heat extremes and reduce the impacts on the population and physical structures. This study covers the impacts of extreme weather on eight focus areas including:

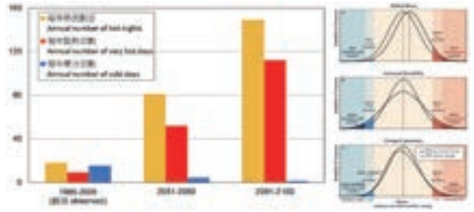
(a) energy use, comfort and building design;
(b) urban built environment;
(c) building materials;
(d) highway structures and the associated elements;
(e) road pavements;
(f) coastal structures and facilities;
(g) waterworks structures and facilities; and
(h) stormwater drainage, sewerage and associated facilities.

This study adopts a scoping approach based on existing literature and data in order to provide a generic and scoping understanding via (a) review, (b) impact understanding, and (c) initial recommendations and further work required.

The study team reviewed 14 international studies addressing the impact of climate change on infrastructures, including studies conducted in Australia, the United Kingdom, the United States, France and European Union. There are few studies specifically related to extreme temperatures and infrastructures and not readily applicable to Hong Kong due to climatic differences. Over 300 guidance notes, standards, specifications, code of practices, manuals, and regulations were also reviewed with only 20 of them considered to be relevant.

Projected absolute maximum and minimum temperatures for different emission scenarios were obtained from the Hong Kong Observatory. The impact understandings were developed based on RCP8.5 scenario but the measures and recommendations are equally applicable to RCP4.5 and RCP6.0 scenarios. The effects of increasing temperature on the energy consumption, thermal comfort, and corresponding building design were evaluated. Moreover, the impacts on the physical structures and their operations were also assessed. As this study is literature-based, directional and qualitative recommendations were provided for the eight focus areas.

This study concluded that climate and field monitored data are urgently required to allow more precise, accurate, fit-for-purpose studies and assessment of the impacts of extreme temperatures on the infrastructures in Hong Kong. In particular, future projection and field monitoring of solar radiation, which is currently lacking in Hong Kong, are particularly important to the understanding of energy use, comfort and performance of surface materials.



Project Team

Project Name	Study of Design Considerations for Government Infrastructures in Hong Kong under Extreme Temperatures
Organisation Name	The Chinese University of Hong Kong
Collaborating Parties	The University of Hong Kong Ronald Lu & Partners (Hong Kong) Ltd.
Members of Research / Planning Team	Prof. Edward NG (School of Architecture, The Chinese University of Hong Kong), Prof. REN Chao (Faculty of Architecture, The University of Hong Kong), Prof. Kevin LAU (Institute of Future Cities, The Chinese University of Hong Kong), Ir Prof. Francis AU (Department of Civil Engineering, The University of Hong Kong), Dr Jing ZHANG (Department of Civil Engineering, The University of Hong Kong), Dr Dong YANG (Department of Civil Engineering, The University of Hong Kong), Mr LEUNG MK, (Ronald Lu & Partners (Hong Kong) Ltd) Ms Carolina A SANCHEZ (Ronald Lu & Partners (Hong Kong) Ltd)

Conclusion

Conclusion

Excellence in fostering a green built environment in high-density, high-rise contexts

We hope you have enjoyed this Hong Kong Report on the State of the Sustainable Built Environment 2020. It has been our great privilege to showcase Hong Kong's commitment to excellence in fostering a green built environment in a high-density, high-rise context.

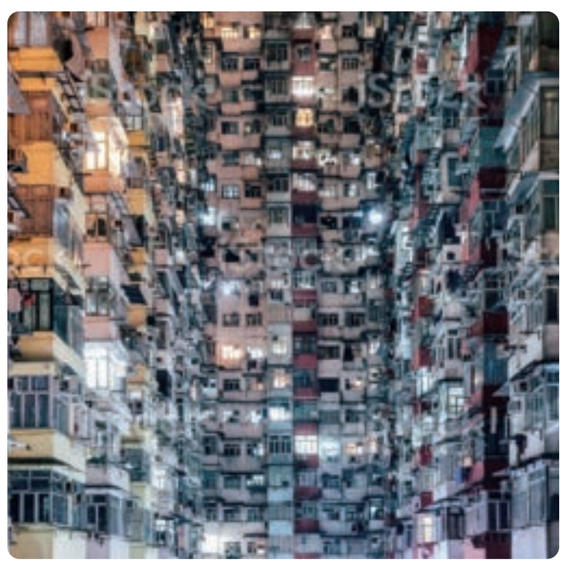
Like other compact cities across Asia, Hong Kong faces pressing challenges from climate change and the global call for sustainable development. Nevertheless, despite these complex challenges, joint efforts by the Government, industry and the community are paving the way to a brighter and greener future. By moving beyond green buildings, Hong Kong is demonstrating the power of adopting a holistic approach to sustainability, balancing the development of infrastructure, open spaces, public facilities and housing to create successful communities where health and wellbeing are the birth rights of all people.

Each of the projects in this Report illustrates the effective use of technology, new materials and physical space, all of which are key elements to fostering a green built environment and creating sustainable cities. As we look to the future, Hong Kong is poised to take its efforts to the next level by meeting the targets of *Hong Kong's Climate Action Plan 2030+* and ultimately contributing to China's high-profile goal of carbon neutrality by 2060.

Ways ahead

Challenge 1 – Ageing buildings, ageing population

Across Hong Kong, there are about 20,000 buildings aged 30 years or above, each of which embodies the lower energy and environmental standards of the times in which they were built. In parallel with this, a growing yet ageing population will soon pose substantial challenges on both an economic and societal level. Revitalising and retro-commissioning existing buildings - including the careful conservation of historic buildings - will be vital to Hong Kong's long-term success. Through a thoughtful approach to layout and design, place-making will also play a key role in creating sustainable communities for people of all ages.



Challenge 2 – Health and wellbeing

The second challenge facing Hong Kong is health and wellbeing. There can be no better demonstration of this than the current COVID-19 outbreak, which has fundamentally impacted communities around the world and highlighted the importance of preparing for future pandemics. As a high-density city, Hong Kong was expected to have a higher disease risk, and yet its experience with COVID-19 is proof that its urban planning is already showing benefits in this regard. After our experience of fighting Severe Acute Respiratory Syndrome (SARS) back in 2003, the built environment in Hong Kong already features a number of anti-epidemic initiatives, including disease-specific measures for the design and management of high-rise buildings.

To meet future challenges, Hong Kong not only continues to invest in research and planning to develop new technologies, new construction methods and new materials, it is also committed to a planning framework in which development capacity goes hand in hand with environmental capacity, carefully integrating conservation and biodiversity considerations into all new planning and decision making.

Challenge 3 – Climate Urgency

The third key challenge facing Hong Kong is climate change. China is aiming to hit peak emissions before 2030 and achieve carbon neutrality by 2060, setting the standard for all other countries worldwide. Locally, *Hong Kong's Climate Action Plan 2030+* is guiding Hong Kong in the creation of a smart, green and resilient city. In this regard, the HKGBC will continue to focus on upgrading BEAM Plus, Hong Kong's unique rating tool for green buildings, to ensure that it is always optimally promoting a green and sustainable built environment in Hong Kong. We also expect that an

increasing number of property developers will make use of green finance to improve the environmental performance of their premises and implement green building initiatives in new developments. This has the potential to be a powerful catalyst in the transformation to urban sustainability, both in Hong Kong and cities around the world.

In addition, we are embracing Advancing Net Zero, the global project by the World Green Building Council that calls for businesses, organisations, cities, states and regions to reach net zero operating emissions in their portfolios by 2030 and for all buildings to be net zero in operation by 2050. To echo this call, we are actively encouraging at least 40% less embodied carbon in new buildings, infrastructure and renovations by 2030, and advocating for net zero operational and embodied carbon by 2050.

For all communities worldwide, it is also a fact of life that the future can bring unknown and unanticipated challenges. In this respect, too, we have full confidence in Hong Kong's capacity, flexibility and commitment to leadership. Through the collective efforts of our local community, and working collaboratively with neighbouring countries and global partners, we will continue fulfilling our mission to build a greener and more sustainable world, proudly creating a more liveable home for future generations.

World Sustainable Built Environment Online Conference 2020

World Sustainable Built Environment Online Conference 2020

BEYOND 2020 NOV 2-4
WORLD SUSTAINABLE BUILT ENVIRONMENT ONLINE CONFERENCE

Co-organisers of Hong Kong's Participation:

CONSTRUCTION INDUSTRY COUNCIL 建造業議會

HKGBC 香港綠色建築議會

The World Sustainable Built Environment Online Conference 2020 (WSBE 2020), with the theme of creating clear links between the most relevant UN Sustainable Development Goals (SDGs) and the built environment, was successfully held on 2 to 4 November 2020!

The Construction Industry Council (CIC) and Hong Kong Green Building Council (HKGBC) continued their official support as Gold Sponsor and organised several prime speaking opportunities for Hong Kong's leading representatives, including keynote sessions, panel discussions and a Hong Kong session.

Keynote and Panel Discussion

On Conference Day 1, Mr Michael WONG, Secretary for Development of the Government of the HKSAR, together with Mr CHAN Ka-kui, Chairman of CIC, and Mr CHEUNG Hau-wai, Chairman of HKGBC, were the Speakers in Keynote Session 2, in which they shared the latest insights on the state of the sustainable built environment in Hong Kong. Mr WONG Kam-sing, Secretary for the Environment of the Government of the HKSAR, also joined a high-level panel discussion with other city representatives on the same day.

Mr Michael WONG
Secretary for Development of the Government of the HKSAR

Mr CHAN Ka-kui
Chairman of Construction Industry Council

Mr CHEUNG Hau-wai
Chairman of Hong Kong Green Building Council

Secretary for the Environment of the Government of the HKSAR, Mr WONG Kam-sing joined the panel discussion with other city representatives on Conference Day 1.

Hong Kong Session

The Hong Kong Session was also held on Conference Day 1. Using the theme of "Leading Hong Kong case studies: Advancing Net Zero in a high-rise high-density built environment", the session showcased to the world Hong Kong's contribution and exemplary projects in Advancing Net Zero.

Mr Donald CHOI, Moderator of the Hong Kong Session and Director of HKGBC, introduced three pioneers to share their unique experiences in three informative presentations, namely "Sustainable Built Environment & Lifestyle in InnoCell" by Mr Simon WONG of Hong Kong Science and Technology Parks Corporation, "Fostering Harmony Among Urban, Rural and Nature Through Sustainable Infrastructure - The Sai Sha Road Widening Works in Sai Kung" by Mr Eddie TSE of Gammon Construction Limited, and "Creative Transformation of Taikoo Place Redevelopment" by Dr Raymond YAU of Swire Properties Limited.

Mr Ivan FU, Chairperson of the CIC's Committee on the Environment, and Mr CHEUNG Hau-wai, Chairman of HKGBC, also joined the speakers in a panel discussion to explore the challenges faced in Advancing Net Zero in Hong Kong's built environment, which was streamed to delegates around the world.

Panel discussion Co-organised by Hong Kong Green Building Council and BEAM Society Limited

On Conference Day 2, the HKGBC and BEAM Society Limited (BSL) co-organised a panel discussion on the subject "Accelerating the Sustainability Transformation of Existing Buildings in Hong Kong".

The session started with Mr CHEUNG Hau-wai, Chairman of HKGBC, delivering the opening remarks. Mr Andy YEUNG from Hongkong Land, Ms Tracy WONG Harris from Hong Kong Green Finance Association, Dr Calvin Lee KWAN from Link REIT, Prof. KK LING from Jockey Club Design Institute for Social Innovation at the Hong Kong Polytechnic University, Ir Dr Cary CHAN, Executive Director of HKGBC, and Ir CS HO from BEAM Society were all invited to join the panel discussion. These panellists shared their views on how to accelerate the sustainability transformation of existing buildings with the aid of BEAM Plus, especially the initiative of volume certification, and how BEAM Plus can serve as an external certification for the financing of green retrofitting. The session ended with closing remarks by Ms Ivy LEE, Chairperson of BEAM Society.

Several key players in Hong Kong also presented sessions or papers at the Conference to jointly showcase the local industry's contributions to driving a sustainable city and community.

Acknowledgements

Acknowledgements

Funding Support

CONSTRUCTION INDUSTRY COUNCIL 建造業議會

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Member	Ms Diamond CHENG	Hong Kong Green Building Council
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Overall Content

Construction Industry Council

Hong Kong Green Building Council

Development Bureau, The Government of the Hong Kong Special Administrative Region

Environment Bureau, The Government of the Hong Kong Special Administrative Region

Community Engagement

- Blue Sky Energy Technology
- Business Environment Council Limited
- CLP Power Hong Kong Limited
- Cundall Hong Kong Limited
- Development Bureau - Energizing East Kowloon Office
- Environmental Protection Department - Environmental Campaign Committee
- Green Sense HK Limited
- Grosvenor Asia Pacific
- HM Environmental Technologies Limited
- Hong Kong Baptist University
- Hysan Development Company Limited
- Jockey Club Design Institute for Social Innovation
- Jockey Club Museum of Climate Change
- Leigh & Orange Limited
- Ove Arup & Partners Hong Kong Limited
- Sino Group
- The Chinese University of Hong Kong
- The Green Earth
- The University of Hong Kong
- World Green Organisation

Public Projects

- Architectural Services Department
- Hong Kong Housing Authority
- Water Supplies Department

Industry Projects

- Airport Authority Hong Kong
- Bonny Ace Limited
- Business Environment Council Limited
- Century Land Investment Ltd
- Chinachem Group
- CLP Innovation Enterprises Limited
- CLP Power Hong Kong Limited
- Henderson Land Development Company Limited
- Hong Kong Science and Technology Parks Corporation
- Hongkong Land (Property Management) Limited
- Jockey Club Design Institute for Social Innovation
- MTR Corporation Limited
- Nan Fung Development Limited
- New World Development Company Limited
- Rich Union Development Limited
- Ronald Lu & Partners (Hong Kong) Limited
- Sun Hung Kai Properties Limited
- Swire Properties Limited
- Tai Kwun
- Taikoo Place Holdings Limited
- The Chinese University of Hong Kong
- The Hong Kong University of Science and Technology
- The University of Chicago
- Urban Renewal Authority
- Wheelock Properties (Hong Kong) Limited
- WSP Hong Kong Limited

Research and Planning

- Architectural Services Department
- Arup
- ATAL Building Services Engineering Limited
- BEAM Society Limited
- BeeXergy Consulting Limited
- Carbon Exchange (Hong Kong) Limited
- Cundall Hong Kong Limited
- Greencity (Hong Kong) Architectural Technologies Limited
- Hong Kong Green Building Council
- Hong Kong Housing Authority
- Hong Kong Planning Department
- Hongkong Land (Property Management) Limited
- Jockey Club Design Institute for Social Innovation
- LEAF Sustainability Limited
- Ove Arup & Partners Hong Kong Limited
- Nano and Advanced Materials Institute Limited
- Philia Earth Limited
- The Chinese University of Hong Kong
- The Hong Kong Polytechnic University
- Trane Hong Kong

Editorial Team

- HKGBC Secretariat

Information and data of the projects and researches submitted by contributors are believed to be reliable and has not been further verified. Construction Industry Council and Hong Kong Green Building Council do not guarantee the accuracy and completeness of the submissions.

Our Journey to Sustainable Built Environment

- Launch of standards / guidelines / important documents / regulations
- Important events
- Establishment of important organisations or milestone projects
- Milestone achievements

Hong Kong Milestone

1990
- Establishment of HK-BEAM Society (currently BEAM Society Limited)

1992
- Launch of HK-BEAM New & Existing Offices Buildings (Version 1/96 & 2/96)

1993
- Launch of IAQ Certification Scheme

1996
- Launch of HK-BEAM for New & Existing Buildings (Version 4/04 & 5/04)

2000
- Establishment of Construction Industry Council

2001
- Establishment of Hong Kong Green Building Council (HKGBC)

2002
- Release of "Green Government Building" circular

2003
- Launch of BEAM Plus New & Existing Buildings V1.1
- Launch of BEAM Pro Accreditation Scheme

2005
- Enactment of Building Energy Efficiency Ordinance
- Opening of CIC-ZCP, the first zero carbon building in Hong Kong

2006
- Launch of BEAM Plus New & Existing Buildings V1.2
- Launch of HK2030 Campaign by HKGBC
  Target: To reduce the absolute electricity consumption of buildings in Hong Kong by 10% by 2030, from 2005 level

2007
- Promulgation of Practice Notes on:
  - Building Design to Foster a Quality and Sustainable Built Environment
  - Sustainable Building Design Guidelines

2009
- Launch of BEAM Plus Interiors V1.0

2010
- 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 domestic disposal rate of municipal solid waste by 40% by 2022

2011
- Sustainable Building 2013 Hong Kong Regional Conference
- Hosting of the 1st edition of Hong Kong Green Building Week
  A biweekly public campaign promoting green building and green living

2012
- 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

2013
- Launch of Green Product Accreditation and Standards (HK G-PASS)
  To assess the environmental performance of construction materials or products

2014
- Release of A Food Waste and Yard Waste Plan for Hong Kong 2014-2022

2015
- Launch of BEAM Plus Existing Buildings V2.0
- Launch of BEAM Plus Neighbourhood V1.0
- Opening of T-PARK, the first waste-to-energy plant in Hong Kong
- Launch of Hong Kong 2030+: Towards a Planning Vision and Strategy Transcending 2030
- Release of Hong Kong Biodiversity Strategy and Action Plan
- Launch of Hong Kong Green Shop Alliance
  A platform fostering a green shopping environment
- Launch of ACT-Shop
  To enhance the energy efficiency of existing buildings via retro-commissioning
- Launch of HKGBC Benchmarking and Energy Saving Tool (HK BEST)
  To provide recognition and promote energy efficiency in buildings

2016
- 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
  Welcomed 1,800 delegates from 57 countries & regions

2017
- Signing of Memorandum of Co-operation (MOC) on Retro-commissioning of Buildings in Guangdong-Hong Kong-Macao Greater Bay Area among DBOS, HKGBC & several important institutions

2018
- HKGBC 10th anniversary
- HKGBC committed to participate in WorldGBC's "Advancing Net Zero" project
  Aims to promote and support the accelerated uptake of net zero carbon buildings in HKSAR by 2050
- Launch of CIC Green Product Certification
  Merger of the Carbon Labelling Scheme by CIC and HK's PAS2 by HKQAA
- Launch of BEAM Plus New Buildings V2.0
- Launch of BEAM Plus Existing Buildings Volume Certification

2019
- 10th Anniversary of the launch of the BEAM Plus assessment rating tool
- BEAM Plus Data Centre will be launched
- BEAM Plus Existing Buildings for Schools will be launched

2020
- Release of the next Climate Action

2021
- Release of the next Climate Action

2023

2025

2030

2050

2060

Global Milestone

1988
- Establishment of Intergovernmental Panel on Climate Change (IPCC)

1989
- Montreal Protocol in force

1990
- Launch of BREEAM (UK)

1992
- Rio Earth Summit and the promulgation of UN Framework Convention on Climate Change

1993
- Establishment of U.S. Green Building Council (USGBC)

1996
- Commencement of Kyoto Protocol

1997
- Launched of HQE (France)

1998
- Launch of LEED (US)

2000
- First Sustainable Building Conference in Maastricht, the Netherlands

2001
- Launch of CASBEE (Japan)

2002
- Establishment of World Green Building Council (WorldGBC)
- SB Conference 2002 in Oslo, Norway

2003
- Launch of GreenStar (Australia)

2004
- Launch of BCA Green Mark (Singapore)

2005
- SB Conference 2005 in Tokyo, Japan

2006
- Launch of Green Building Label (China)
- Launch of First Green Building Masterplan by Singapore

2007
- SB Conference 2008 in Melbourne, Australia
- Climate Change Act passed in the UK

2009
- UN climate summit in Copenhagen, Denmark

2011
- SB Conference 2011 in Helsinki, Finland

2013
- Establishment of International WELL Building Institute
- Vatican City became the world's first carbon neutral country
- Launch of the three-year working phase of the Annex 66 by the International Energy Agency's (IEA) Energy in Buildings and Communities Programme (EBC)

2014
- WSB Conference 2014 in Barcelona, Spain

2015
- 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
- Launch of the 2030 Agenda for Sustainable Development by the United Nations

2016
- Ratification of Paris Agreement
- Release of "Advancing Net Zero" project by WorldGBC
  Target: To promote and support the accelerated uptake of net zero carbon buildings in 100% by 2050

2017
- Sweden pledged to cut all greenhouse gas emissions by 2045 through a new Climate Change Act

2018
- COP25: 177 companies commit to set 1.5°C-aligned Science-based Targets across their operations and value chains, as movement doubles in size since September

2019
- WSBE 2020 Online Conference

2020

2021
- First Global Stocktake of Paris Agreement

2023
- WSBE 2023

2025
- According to Advancing Net Zero project's framework of the WorldGBC, new buildings, infrastructure & renovations will have at least 40% less embodied carbon with significant upfront carbon reduction and all new buildings must be net zero operational carbon
- Achieving the 17 Sustainable Development Goals proposed in the 2030 Agenda of Sustainable Development by the United Nations

2030
- Release of the next Climate Action

2050
- According to Advancing Net Zero project's framework of the WorldGBC, new buildings, infrastructure and renovations will have net zero embodied carbon, and all buildings, including existing buildings, must be net zero operational carbon

2060
- Greenhouse gas emissions to reach net zeros for reaching 1.5°C target in Paris Agreement

www.cic.hk

www.hkgbc.org.hk