Published by

CONSTRUCTION INDUSTRY COUNCIL
建造業議會

HKGBC
香港綠色建築議會

Hong Kong Report

On the State of Sustainable Built Environment 2024

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Message From

CHIEF EXECUTIVE, HONG KONG SPECIAL ADMINISTRATIVE REGION

Mr John KC LEE, GBM, SBS, PDSM, PMSM

Chief Executive
Hong Kong Special Administrative Region

It is with great pleasure that I congratulate the Hong Kong Green Building Council and the Construction Industry Council on the publication of the "Hong Kong Report on the State of Sustainable Built Environment 2024". The report, published in conjunction with the World Sustainable Built Environment Conference, spotlights the state of the built environment in Hong Kong, detailing the joint efforts of the HKSAR Government, industry, academia and community, in realising a resilient and sustainable Hong Kong.

The theme of the 2024 Report, published in e-book format, is "Innovations towards Net Zero: Building Sustainable and Resilient Urban Environments". Highlights include a new chapter exploring green building materials and technologies' and their innovative contributions to our sustainable construction practises. A Government public housing initiative, "Well-Being", is one such example. It makes excellent use of existing buildings with economic and socio-cultural value incorporated, rather than building anew and adding more carbon to our environment. This approach also highlights our use of green technologies, from Modular Integrated Construction (MiC) to smart construction and green building design, as well as making use of sustainable construction materials, plants and products. The locally developed BEAM Plus rating system continues to play a central role in promoting green building practices in our high-density built environment. Last year, we established our first offshore, liquefied natural-gas terminal. Earlier this year, our first hydrogen-powered double-decker bus took the road.

Green finance is also crucial in achieving our goal of carbon neutrality before 2050. Hong Kong, long a global financial centre, has taken the lead in arranging the issuance of green bonds. Proceeds raised under the Government Green Bond Programme finance government projects with environmental benefits. These, in turn, contribute to the development of our sustainable built environment. Also, initiatives such as the Hong Kong Stock Exchange's Core Climate and the Hong Kong Monetary Authority's Taxonomy for Sustainable Finance further illustrate our commitment to green finance.

Hong Kong is blessed with the unique advantages given to us under "One country, Two systems", from the rule of law and our market-oriented business environment, to our internationally aligned regulatory regime and free flow of information, people and capital. These strengths, together with our fast-rising prowess as an innovation and technology centre, make Hong Kong the ideal nexus for building partnerships and driving the innovative solutions the world needs to promote sustainability.

Once again, my congratulations on the publication of the "Hong Kong Report on the State of Sustainable Built Environment 2024". My Government is committed to Hong Kong's development as a green, healthy and livable city, as well as contributing to the global agenda on decarbonisation. With government, industry, academia and community at large working together, I am confident we will accomplish this critical mission.

Mr John KC LEE, GBM, SBS, PDSM, PMSM
Chief Executive
Hong Kong Special Administrative Region

Message From

SECRETARY FOR DEVELOPMENT, HONG KONG SPECIAL ADMINISTRATIVE REGION

Ms Bernadette LINN Hon-ho, JP

Secretary for Development, Development Bureau
Hong Kong Special Administrative Region

Climate change affects all countries and places around the world. Extreme weather events are getting frequent. Last year, Hong Kong was struck by two ferocious typhoons and experienced a phenomenal rainstorm, which caused flash floods and landslides across the city. It is expected that extreme weather conditions would become more frequent and severe in future. The need for getting prepared and building up the city's resilience has never been more apparent.

Here in the Hong Kong Special Administrative Region, the joint efforts of the Government and the industry are crucial in developing our city into a green, healthy and livable place. This echoes the overarching focus on innovative pathways and partnerships for sustainable built environments for the World Sustainable Built Environment Conference 2024.

To achieve the goal of sustainable development and carbon neutrality in the long run, we adopt smart, green, and resilient strategies in planning our new development areas including the Northern Metropolis and Kau Yi Chau artificial islands. We are extremely mindful of the continuous adoption of various proactive approaches in these projects, such as formulating green building design, providing district cooling system and improving pedestrian and cycling networks to encourage the use of green transportation, in order to achieve a sustainable built environment.

We have been improving our guidelines and systems to encourage the development of green buildings. For example, we have promulgated the performance-based Gross Floor Area concession mechanism, which requires new private developments to achieve a specific rating under the BEAM Plus assessment. We will enhance the green building performance framework to set the best practicable targets for green government buildings, including the wider adoption of renewable energy.

At the same time, we are actively pursuing Modular Integrated Construction (MiC), so as to drive innovation in the construction industry and enhance green performance. We will also go further to establish the Building Technology Research Institute this year to support the research and development activities for innovative and green materials, construction methods and technologies in the construction industry.

We will continue to work with the community in promoting green buildings and developing Hong Kong into a healthy, low-carbon and resource-efficient metropolis. I look forward to joining hands with our counterparts in different parts of the world in achieving a sustainable built environment which we are all proud of.

Ms Bernadette LINN Hon-ho, JP
Secretary for Development, Development Bureau
Hong Kong Special Administrative Region

Message From

SECRETARY FOR ENVIRONMENT & ECOLOGY, HONG KONG SPECIAL ADMINISTRATIVE REGION

Mr TSE Chin-wan, BBS, JP

Secretary for Environment & Ecology,
Environment and Ecology Bureau
Hong Kong Special Administrative Region

The Hong Kong Special Administrative Region Government (HKSARG) made its pledge to achieve carbon neutrality by 2050. To reach this long term goal, we are committed to reducing Hong Kong's carbon emissions by 50% against the 2005 baseline by 2035 as a medium term target. Our Climate Action Plan 2050 published in 2021 has outlined four major decarbonisation strategies – net-zero electricity generation; energy saving and green buildings; green transport; and waste reduction – which are the main driving force to take forward various carbon reduction measures on different fronts.

Buildings account for 90% of Hong Kong's electricity consumption, and over 50% of our carbon emission is attributable to generating electricity for our buildings. Improving the energy efficiency of buildings will not only reduce carbon emissions, but also lessen the financial burden on the public for the increased use of clean fuels for electricity generation. With "energy saving and green buildings" as one of our major decarbonisation strategies, our goal is to reduce the electricity consumption of commercial buildings by 30% to 40% and that of residential buildings by 20% to 30% from the 2015 level by 2050, with half of these targets to be achieved by 2035.

We are implementing the "energy saving and green buildings" strategy with a multi-pronged approach. On the legislative front, we will amend the Buildings Energy Efficiency Ordinance (Cap. 610) to extend the scope of regulation to more types of buildings, mandate the disclosure of certain information related to energy audit reports, and shorten the interval of energy audits. On the infrastructural level, we are incorporating district cooling systems in new development areas to promote energy efficiency of air-conditioning systems in buildings and mitigate the heat island effect in the areas. We are also enhancing the statutory energy efficiency standard of buildings and household electrical appliances. We have also embarked over 220 renewable energy projects on Government premises to showcase the integration of renewable energy technologies into buildings.

Contribution and support from various sectors of the community to work towards combating climate change is as important as government's efforts. In this regard, we are grateful to the Construction Industry Council and the Hong Kong Green Building Council who have been our close partner in the promotion of green buildings in Hong Kong. I am sure that readers would find their latest achievements in this report inspiring. May I also take this opportunity to wish the WSBE24 every success.

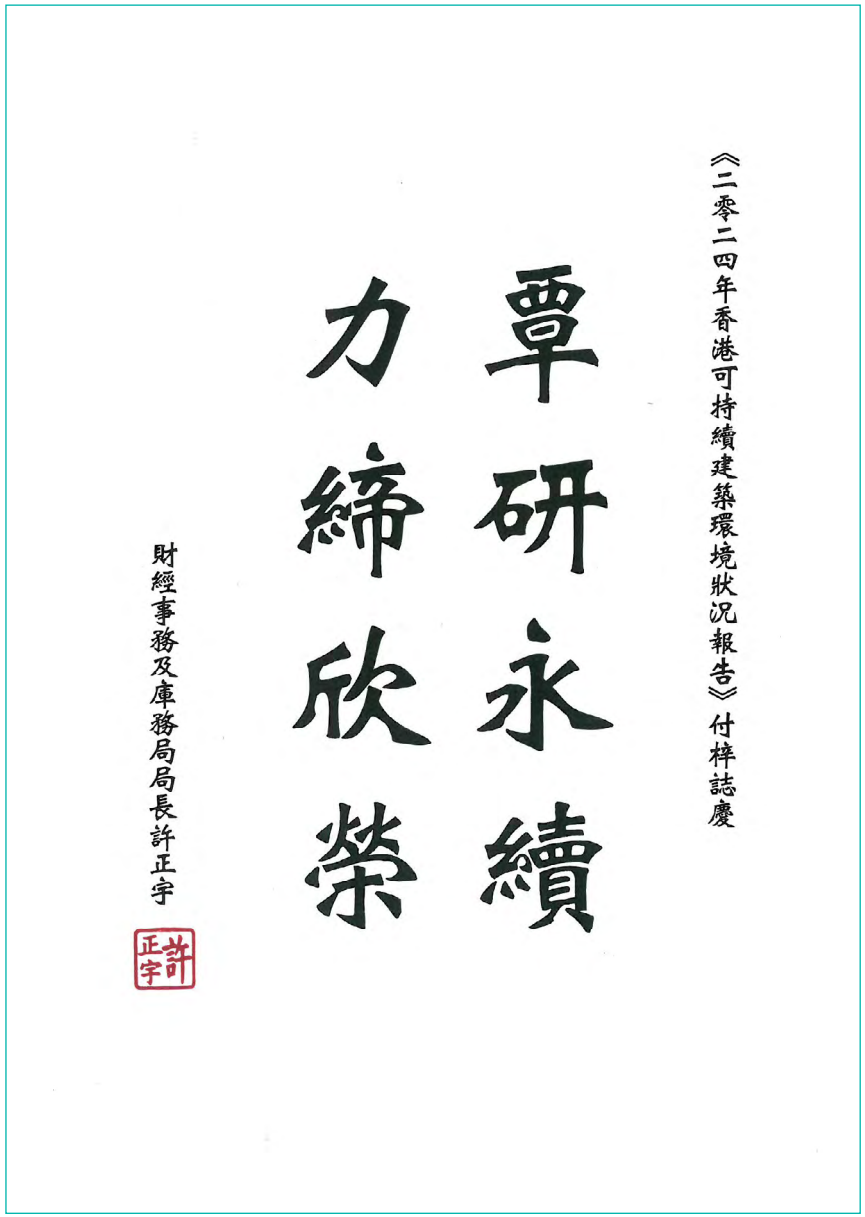
Mr TSE Chin-wan, BBS, JP
Secretary for Environment & Ecology,
Environment and Ecology Bureau
Hong Kong Special Administrative Region

Message From

SECRETARY FOR FINANCIAL SERVICES & THE TREASURY, HONG KONG SPECIAL ADMINISTRATIVE REGION

Mr Christopher HUI Ching-yu, GBS, JP

Secretary for Financial Services & the Treasury,
Financial Services and the Treasury Bureau
Hong Kong Special Administrative Region



Message From

SECRETARY FOR HOUSING, HONG KONG SPECIAL ADMINISTRATIVE REGION

Ms Winnie HO Wing-yin, JP

Secretary for Housing, Housing Bureau
Hong Kong Special Administrative Region

The issue of public housing supply stands as a primary concern in Hong Kong, and the Government has already identified sufficient land for meeting the supply target of 308,000 public housing units over the next decade. Despite the ambitious target, the challenge lies in meeting this demand while minimizing the environmental impact.

Over the past five decades, the Housing Authority has successfully constructed over 1.3 million homes in public rental housing estates and subsidised sale flats, accommodating a population of more than 2.1 million residents. However, the construction industry continues to face challenges such as labour shortages, site safety concerns, and the need to address climate change. The embrace of innovation and technology in construction projects is therefore crucial to improve quantity, speed, efficiency, and quality, without compromising the long-term sustainability of the built environment.

The 2024 Report highlights a range of housing projects, both public and private, that go the extra mile in achieving green housing standards. Innovations such as Modular Integrated Construction, Construction Robotics, Remote Sensing, and Renewable Energy have showcased Hong Kong's capabilities in developing environmentally-friendly and green construction methods.

In response to the "dual carbon" targets set out in the Chief Executive's 2023 Policy Address, there is a collective effort from all stakeholders to advance Environmental, Social, and Governance initiatives in creating a more sustainable built environment. This collaborative approach demonstrates a commitment to building a green international city and fostering a future of sustainable development.

Ms Winnie HO Wing-yin, JP
Secretary for Housing, Housing Bureau
Hong Kong Special Administrative Region

Message From

CHAIRMAN OF CONSTRUCTION INDUSTRY COUNCIL

Ir Prof. Thomas HO On-sing, JP

Chairman
Construction Industry Council

I would like to extend my warmest congratulations on the success of the World Sustainable Built Environment Online Conference 2024 (WSBE2024). On the same occasion, we are pleased that Hong Kong Report 2024 has been published to showcase the excellence of Hong Kong's concerted effort amongst the government, industry, and the community in response to the call for sustainability to shape a greener and more sustainable Hong Kong.

Being one of the world's premier scientific and technical conferences, the WSBE24 brings together leading experts and the latest knowledge and research to support sustainable built environments. To cope with the scale and urgency of the sustainability challenge, WSBE24 is committed to collaborating and partnering with key stakeholders of the built environment value chain across the world. This echoes well with our ongoing aspirations to continuously drive the innovative transformation of our city towards a green, sustainable built environment.

I am confident that our collective effort to make a more sustainable Hong Kong will achieve good results with your active participation and contribution to the WSBE2024.

Ir Prof. Thomas HO On-sing, JP
Chairman
Construction Industry Council

Message From

CHAIRMAN OF HONG KONG GREEN BUILDING COUNCIL

Dr CHEUNG Tin-cheung, SBS

Chairman
Hong Kong Green Building Council

It is with great pleasure that I present the 2024 edition of this report, which showcases remarkable progress in the sustainable built environment. Its wide range of public and private projects reflects Hong Kong's collective efforts towards a greener future, with active participation from the Government, industry, academia and the public.

For this edition we received an increase of some 40% in project submissions, resulting in over 100 shortlisted projects. The Government's strong support for green building is borne out by numerous exemplary projects that promote sustainable infrastructure, research and planning, as well as the use of green materials and cutting-edge technologies.

Taking up the Government's lead, the private and academic sectors have played an equally pivotal role in driving sustainability forward. Their integration of innovative ideas into new landmarks, and their advancements of green building technologies, underlines their steadfast commitment to a greener and more sustainable city.

As an advocator to the industry, the HKGBC has launched timely guidebooks and introduced the Zero-Carbon-Ready Building Certification Scheme, encouraging energy-saving practices and progress towards net-zero emissions. Our green building assessment tool, BEAM Plus, continues to evolve and align with international standards for assessing building sustainability.

We express our deep gratitude to all parties involved for their invaluable support. Together, let us continue and strengthen our efforts to creating a sustainable and resilient future.

Dr CHEUNG Tin-cheung, SBS
Chairman
Hong Kong Green Building Council

Introduction

INTRODUCTION

Welcome to the Hong Kong Report on the State of the Sustainable Built Environment 2024. With the theme "Innovations towards Net Zero: Building Sustainable and Resilient Urban Environments", the Construction Industry Council (CIC) and the Hong Kong Green Building Council (HKGBC) are pleased to present this comprehensive overview of the progress and advancements in green building development in our city.

With a population density that is among the highest in the world, Hong Kong exemplifies the challenges and opportunities of creating a sustainable urban environment in a high-rise, high-density context. While Hong Kong's built-up areas account for only a quarter of the total land area, the entire population resides within this compact space. Our city, nonetheless, remains committed to nature conservation, with approximately 40% of the total land area designated as country parks, and an additional 30% consisting of ecologically sensitive areas. Undoubtedly, tackling the carbon emissions generated by Hong Kong's built environment, which account for over 50% of the city's total emissions, is of utmost importance. Decarbonisation and the adoption of sustainable practices are critical to our transition towards a more sustainable future. The theme of this year's Report underscores the urgency and significance of building resilient and sustainable urban environments that strive towards achieving net-zero carbon emissions.

Hong Kong has set an ambitious goal of achieving carbon neutrality before 2050, demonstrating the city's commitment to align with global climate action. The following pages highlight the robust momentum witnessed since the announcement of this goal in 2020 and explore the innovative approaches and groundbreaking technologies that are driving Hong Kong's transition towards a sustainable future.

One of the driving forces behind Hong Kong's progress is the remarkable success of the BEAM Plus rating system, a green building assessment tool locally developed to address the sustainability issues of high-rise, high-density built environments. BEAM Plus has played a pivotal role in promoting and advancing green building practices throughout the city.

In this edition, we are also excited to introduce new elements to the Report. We have included a new chapter dedicated to exploring green building materials and technologies, highlighting the latest innovations that contribute to sustainable construction practices. Additionally, we present five interviews featuring renowned figures and young advocates with valuable insights on our city's decarbonisation roadmap and strategic planning. Their perspectives shed light on the challenges, opportunities, innovative solutions and the importance of social engagement that are shaping the city's sustainable built environment.

Collaboration between the Government, industry leaders, and stakeholders is paramount to achieving a sustainable future. The Report highlights successful collaborations that have resulted in landmark projects and significant research and planning. By showcasing the integration of green building technologies, biophilic design and resilient infrastructure, these projects exemplify the transformative power of collaboration in creating sustainable and resilient urban environments.

As we navigate the path towards net-zero emissions, it is essential to recognise that sustainability is not a destination but a continuous journey. The Hong Kong Report on the State of the Sustainable Built Environment is published every three years in conjunction with the World Sustainable Built Environment Conference. This edition stands as a testament to the city's unwavering commitment to innovation, collaboration, and sustainable development. We invite you to explore the Report and discover the remarkable progress, inspiring innovations, and visionary leadership that are shaping Hong Kong's sustainable and resilient urban environment. Together, let us build a future that is not only sustainable but also offers a high quality of life for generations to come.

Government Policies

Government Policies

STRENGTHENING THE SUPPLY CHAIN FOR MODULAR INTEGRATED CONSTRUCTION (MiC)

MiC is an innovative construction method whereby freestanding volumetric modules with finishes, fixtures, fittings, furniture and building services installation, etc. manufactured off-site and then transported to site for assembly. MiC contributes very much to the sustainable built-environment as it has the benefits of enhanced efficiency, faster delivery, less manpower demand, less construction waste, better performance in terms of quality, safety, sustainability and cost-effectiveness. The Government of the Hong Kong Special Administrative Region (HKSAR) has been promoting the adoption of MiC in building projects since 2017 with an aim to tackling challenges in Hong Kong construction industry including ageing workforce, manpower shortage and high construction costs etc. A number of public and non-governmental organisations, including the Hong Kong Housing Authority, Hong Kong Housing Society, Urban Renewal Authority, Hospital Authority, etc., have started the adoption or trial of MiC. At present, MiC has been or will be adopted in over 70 projects in both private and public sectors.

The Chief Executive's 2023 Policy Address announced further promoting MiC by formulating and implementing a series of measures to strengthen the supply chain of MiC modules, in order to enhance collaboration with the supply chain in the Greater Bay Area (GBA); and by promoting the adoption of high productivity construction such as MiC by the private sector, with a view to reducing labour demand and expediting housing supply. The 2024-25 Budget also announced that the HKSAR Government will strengthen collaboration with the Guangdong Provincial Government to enhance the manufacturing, import/export facilitation, and exportability of MiC modules, with a view to developing MiC as one of the industries in the GBA that enjoy clear advantages.

To strengthen the MiC supply chain for Hong Kong and further leverage its potential, the following are some examples of relevant government policies:

Promote collaboration with the Mainland

The HKSAR Government is proactively carrying out exchanges and collaboration with the Guangdong Provincial Government to strengthen mutual co-operation in the areas of implementation and regulations, formulate conducive strategies for the MiC supply chain, with a view to establishing a comprehensive ecosystem for the industry.

By organising regular and collaborative activities with the MiC supply chain in the GBA, it would foster communication, understanding, and cooperation with the GBA enabling better connections and thus reliable MiC

Government Policies

STRENGTHENING THE SUPPLY CHAIN FOR MODULAR INTEGRATED CONSTRUCTION (MiC)

supply chain for Hong Kong. The Development Bureau (DEVB), with the support from the Department of Housing and Urban-Rural Development of Guangdong Province and the People's Government of Huizhou Municipality, held the MiC Supply Chain Conference in Huizhou on 23 January 2024. Government representatives from 11 cities of the GBA attended the conference. The conference attracted some 300 participants from the construction sector in Guangdong, Hong Kong and Macao. The conference aimed to promote the adoption of MiC among the GBA cities, exchange views on issues such as strengthening the supply chain, as well as to enhance collaboration.

Facilitate seamless cross-boundary clearance

The current processing trade and export tax rebate mechanisms are beneficial for the MiC manufacturing in the GBA. In addition, MiC suppliers are encouraged to enrol the Mainland / Hong Kong Authorized Economic Operator (AEO) programme to further streamline clearance processes and speed up the import of MiC modules, thus enhancing supply chain efficiency and safeguard project timelines. AEO programme is a partnership programme which is open to all stakeholders such as manufacturers, importers, exporters etc. involved in the international supply chain, under which the company will enjoy appropriate incentives including reduced or prioritised Customs inspection.

Examine the feasibility of investing in the MiC supply chain

The HKSAR Government will engage consultants and universities to commence study to explore investment opportunities in the MiC supply chain, study investment risks and returns, and the benefits that the form and scale of investment would bring to MiC industry development and the economy as a whole.

Reserve land for the development of MiC industry

The HKSAR Government will reserve 15 hectares of lands at Northern Metropolis and explore further land development at Lung Kwu Tan Reclamation mainly for testing and certifications, technical research and developments, production and storage of MiC. These will support the export of MiC modules to overseas, facilitating the national Belt and Road development, and developing MiC as one of the industries in Hong Kong that enjoy clear advantages.

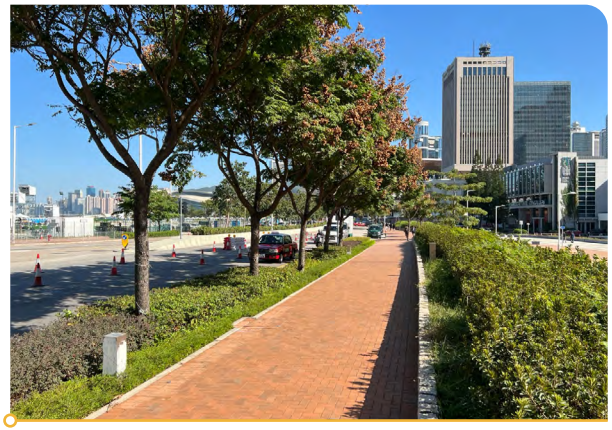
The above policies would deliver tangible results and improvements in a timely manner that can address immediate challenges or gaps in the MiC supply chain to enhance the resilience and efficiency of the MiC supply chain for the building projects. By joining hands with the relevant stakeholders to achieve synergy in enhancing the supply chain of MiC, we can certainly fully utilise the benefits of MiC which is crucial in creating a sustainable built environment.

Government Policies

SUSTAINABLE GROWING ENVIRONMENT FOR A RESILIENT URBAN FOREST

The Greening, Landscape, and Tree Management Section (GLTMS) of the Development Bureau advocates a holistic, sustainable and professional approach to our urban landscapes. The contribution of greenery, in particular trees, is very essential in purifying air, moderating temperature, reducing soil erosion, promoting biodiversity and enhancing sustainable urban living environment; among other environmental, ecological and social benefits it brings.

Urban trees face numerous environmental challenges, including heat, pollution, physical damage, compacted soil and competition of underground space for healthy root growth. Soil is the vital reservoir for urban trees to obtain water, nutrients and air. However, in many occasions, it has been overlooked. To address this issue, it is imperative to provide sufficient soil volume and space for planting during the initial planning stage and ensure the use of high-quality soil during planting, thereby promoting sustainable and healthy tree growth for a resilient urban forest and minimizing the need for soil enhancement in the long run.



Continuous open soil planting area that promotes healthy tree growth

Enhancing soil quality for thriving urban forest

The GLTMS promulgated the *Guidelines on Soil Improvement* in 2022 to promote a better understanding on the key soil parameters affecting plant growth, raise awareness of practitioners on the importance of soil management, and introduce various soil improvement methods for tackling soil problems encountered in urban setting. Techniques such as vertical mulching and partial soil replacement are recommended for established mature trees so as to minimize the impact to existing roots.

In addition, the guidelines promote the use of organic amendments, such as compost, green manure, and biochar, to ameliorate urban soils to foster better tree growth. These organic amendments provide slow-release nutrients, stimulate soil microbial activities, and enhance plant growth. The use of safe and innocuous local organic wastes and composts is also promoted.

Application of Biochar

Government Policies

SUSTAINABLE GROWING ENVIRONMENT FOR A RESILIENT URBAN FOREST

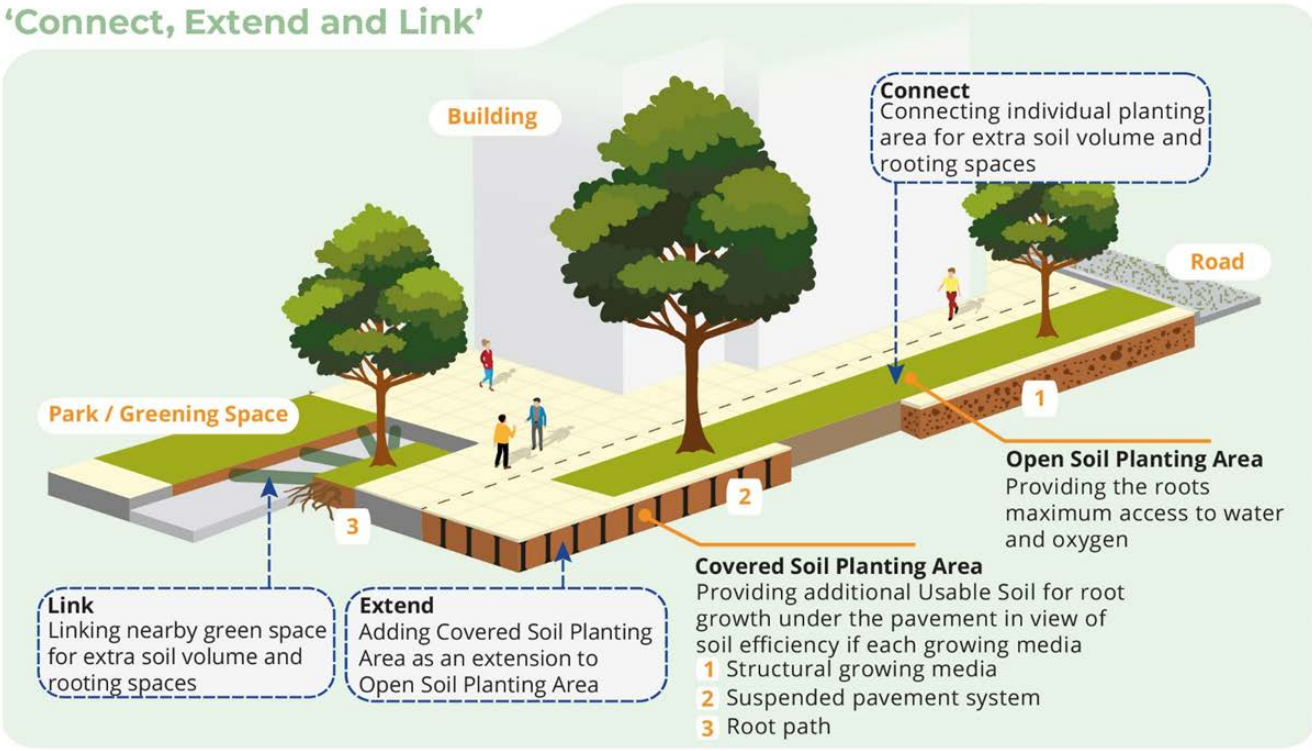
Desirable underground growing space for trees

To facilitate the optimal growth of trees in urban landscapes to reach their full potential, it is crucial to provide adequate underground growing space for loose, moist, well-aerated, and non-compacted soil with good drainage. Sufficient soil volume promotes robust root systems, contributing to the healthy growth and stability of urban trees, increasing their resilience, and extending their lifespan in city environment.

Promulgated by the GLTMS in 2023, the *Guidelines on Soil Volume for Urban Trees* set out the general rule on establishing soil volume and soil depth corresponding to various desired tree sizes for new tree plantings and tree replacements in urban landscapes. Besides, the guidelines incorporate the design approach of "Connect, Extend, and Link" in providing expanded soil volume for tree planting. This approach involves connecting tree planting areas or tree pits for extra soil volume through co-using soil resources; or through extension or linkage to adjacent planting areas or green spaces to allow tree roots to access additional nutrients and water.

In recognising the constraints imposed by limited land resources in built-up areas, the guidelines suggest the use of load-bearing planting systems. These systems provide structural support and load-bearing capacity while ensuring the provision of non-compacted usable soil is available.

With emphasis on the soil quality and provision of sufficient soil volume, the GLTMS aims to create a sustainable growing environment for a resilient urban forest. The guidelines for soil volume and soil improvement facilitate the adoption of these practices, and as a result supporting the long-term health and success of urban trees and promoting greener and more resilient urban landscapes.



Government Policies

SUSTAINABLE INFRASTRUCTURE IN TSEUNG KWAN O NEW TOWN

Green commuting, the practice of utilising environmentally-friendly transportation modes such as walking, cycling, and public transport, has become a cornerstone of sustainable urban living. By minimising carbon emissions, reducing costs, and promoting physical activity, it offers a holistic solution to the challenges of modern mobility. The vibrant Tseung Kwan O New Town in Hong Kong stands as a testament to the Government's commitment to sustainable infrastructure, with two iconic landmarks – the Cross Bay Link and the Promenade Southern Bridge – leading the charge.

The Tseung Kwan O Cross Bay Link (CBL), a marvel of engineering spanning 1.8 kilometres, features a 1-kilometre marine viaduct that gracefully arches across the tranquil waters of Junk Bay. Connecting Southeast Tseung Kwan O with the Tseung Kwan O – Lam Tin Tunnel (TKO-LTT), and providing a vital link to Tiu Keng Leng and the Tseung Kwan O Town Centre, this modern marvel has revolutionised commuting in the district. Since its commissioning on 11 December 2022, alongside the TKO-LTT, the journey time between LOHAS Park and Kwun Tong Town Centre has been reduced by up to 20 minutes during peak morning hours, significantly enhancing connectivity and accessibility.

The CBL is a pioneering multi-purpose marine viaduct in Hong Kong, seamlessly integrating carriageways, a dedicated cycle track, and a pedestrian footway. This innovative design not only promotes low-carbon commuting but also encourages a healthy and active lifestyle. Moreover, it completes a 5-kilometre coastal walkable and cycling loop, advocating for sustainable non-vehicular travel modes while fostering a harmonious blend of urban living and natural surroundings.

Complementing the CBL is the Tseung Kwan O Promenade Southern Bridge, a distinctive footbridge that spans the Eastern Channel, connecting the Tseung Kwan O South Town Centre and the LOHAS Park area with nearby recreational facilities on the east bank. Opened on 2 February 2024, this new footbridge serves as a scenic shortcut for residents, saving valuable time while offering visitors a breath-taking vantage point to admire the captivating views of Junk Bay. From the bridge or the observation deck, one can witness the vibrant atmosphere of water activities held at the Eastern Channel, immersing themselves in the rhythm of this dynamic waterfront community.

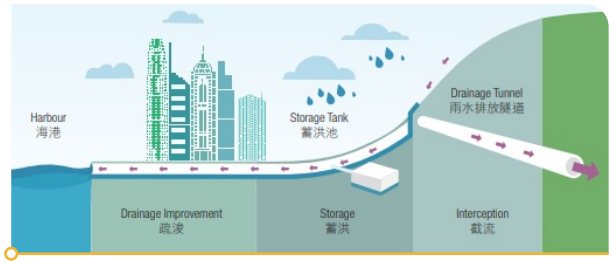
These two remarkable projects exemplify Hong Kong's commitment to sustainable urban development, seamlessly blending functionality, accessibility, and environmental stewardship. By prioritising green commuting and fostering a symbiotic relationship between the built environment and the natural landscape, Tseung Kwan O New Town is paving the way for a more liveable, resilient, and eco-friendly future.

Government Policies

FLOOD PREVENTION STRATEGY AND RIVER REVITALISATION

Overall Flood Prevention Strategy in Hong Kong

Urbanisation, increasing surface runoff, reducing flood plains and frequent extreme weather events would heighten the risk of flooding in low lying or coastal areas. Considering Hong Kong's topographical features, the Drainage Services Department (DSD) has been adopting a 3-pronged approach, including stormwater interception in the upstream, flood storage in the midstream, and drainage improvement in the downstream, to enhance the flood protection capacity across the territory. The design of the stormwater drainage system is comparable to that of the neighbouring jurisdictions which are in face of heavy rain as well. In some cases, some of DSD's facilities might even excel theirs. Over the years, more than 90 drainage improvement projects were completed and have been in operation, including 4 drainage tunnels; 5 stormwater storage schemes; over 100 kilometres of river training works, and 27 village flood protection schemes at low-lying villages in order to cope with extreme weather, such as typhoons and heavy rains.



3-pronged flood prevention strategy

To further enhance the flood prevention and resilience of the city, DSD is currently implementing 11 stormwater drainage improvement projects and will take forward 7 drainage improvement projects in 2024, covering Wong Tai Sin, Hong Kong Island East and other areas hit by severe flooding before. DSD will continue to review the drainage master plans for various districts to assess the flooding risk across the territory, and to allocate resources for taking forward the drainage improvement works.

Happy Valley Underground Stormwater Storage Scheme

In August 2022 and March 2024, DSD updated the "Stormwater Drainage Manual" with the latest design parameters in relation to rainfall increase and sea level rise under climate change, with reference to IPCC AR6, the latest climate change studies as well as the new record breaking extreme torrential rainfall event in September 2023. In the long run, climate change is a challenge across the globe. Hong Kong needs a forward-looking strategy to proactively respond to this challenge. DSD is undertaking "Strategic Planning Study on Flood Management Against Sea Level Rise and Extreme Rainfall". The study will formulate long-term flood prevention strategy for the territory. It is expected that the study will be completed in 2024.

River Revitalisation

In the early days, drainage facilities were mainly designed for flood prevention. Most of them were bleak concrete waterways devoid of life and ecological value to meet the needs of urbanization. Changing times dictate that DSD sets broader goals and adjusts the strategy and practices when managing the network of these stormwater drainage systems located across the urban areas and New Territories with the incorporation of greening and ecological conservation elements into flood prevention improvement works to revitalise rivers. Over the years, DSD successfully transformed some traditional concrete channels into green and ecological rivers with manifold functionality and value of rivers, which were well received by the public.

Kai Tak River

One of the most remarkable milestones in the evolution of river revitalisation is the completion of the revitalisation of Kai Tak River in 2018, which is labelled as Hong Kong's first urban green river corridor. Apart from upgrading the

Kai Tak River

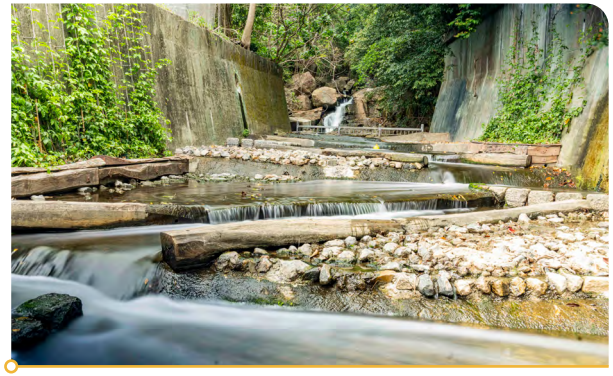
Government Policies

FLOOD PREVENTION STRATEGY AND RIVER REVITALISATION

flood protection standard and mitigating flooding risks in the neighbourhood of Kai Tak River, various greening and ecological elements, such as artificial rock planters, submerged planters, flow deflectors and fish shelters were harmonically injected into the river. The revitalised river fruitfully enhanced the overall living environment of the area and stengthened the connectivity between the neighbourhood and the water body.

Jordan Valley Channel

The revitalisation works at Jordan Valley Nullah completed in 2022 testified the progress DSD made in going beyond flood prevention to do more in fostering biodiversity, integrating rivers into urban communities and encouraging a water-friendly culture. The concrete drainage channel there had been converted into a vivid river flowing amid



Jordan Valley Channel (upstream section)

lush natural surroundings. Considerable revitalisation work had been done to provide habitats such as ponds and fish ladders that attract various wildlife. DSD also brightened

"River Garden" at Jordan Valley Channel

up the water body with an impressive range of flora and fauna, including numerous native species of aquatic plants that were cultivated at DSD's nursery in Siu Ho Wan. Apart from bringing the environmental and sustainability benefits, the project also promoted water-friendly culture, in which a "River Garden" was built above the channel as a viewing platform to allow the public to admire the riverscape from a safe distance.

Tsui Ping River

Tsui Ping River (photomontage)

Revitalisation of Tsui Ping River is an innovative initiative integrating river revitalisation and promotion of water-friendly culture into a single infrastructure project, involving environmental, ecological, and landscape upgrades, plus enhancement of drainage capacity.

Apart from improving drainage facilities to meet development needs, DSD also dedicated unfailing efforts in the project to cultivating a culture of community connection through proactive promotions, education and engagement activities, all in the pursuit of creating a riverside space that is more welcoming, enjoyable and contributing to urban sustainability in the long term.

Looking ahead, public are strongly encouraged to connect with the rivers and appreciate their multiple values as well as the sustainable roles they play in promoting biodiversity and uplifting the liveability in this densely-populated city.

Public engagement activities for Tsui Ping River

Government Policies

STRATEGIC WATER MANAGEMENT FOR SUSTAINABLE FUTURE

Hong Kong is an international financial centre and also one of the most densely populated cities in the world. Without natural lakes and large rivers, Hong Kong faces the daunting task of securing a reliable and adequate water supply to meet its rapid development needs under various challenges. Encouraging enough, Hong Kong showcases its successful experience of applying strategic water management in safeguarding water sustainability for building a sustainable future for the next generations.

Reliable Water Supply Today

With the robust supply portfolio of Dongjiang water imported from Mainland China, local yield from rainwater and seawater for flushing, Hong Kong has secured 99% reliability in water supply without interruption even under a drought of one in 100 years return period.

Challenges Ahead

Hong Kong is facing two acute challenges ahead to water sustainability, namely climate change impact and water demand growth. Climate change has led to dramatic rainfall fluctuations resulting in frequent and severe droughts in many places around the world in recent years. Hong Kong can hardly be an exception some time in future. On the other front, the HKSAR is taking forward a host of infrastructure projects to improve people's livelihood and spur economic development. The Northern Metropolis and the Kau Yi Chau Artificial Islands are the two major strategic growth areas in Hong Kong in the coming decades. The increasing economic activities and population growth will generate higher water demand.

Total Water Management Strategy

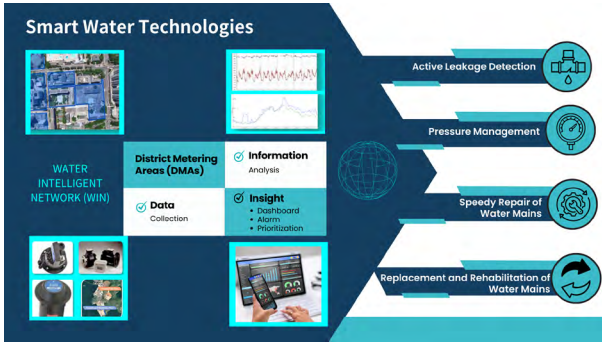
The Water Supplies Department (WSD) of the HKSAR Government has been implementing the Total Water Management (TWM) Strategy to ensure water sustainability and support sustainable development of Hong Kong. To tackle the contemporary challenges, the TWM Strategy currently adopts a two-pronged approach on containing water demand growth and enhancing supply resilience with diversified water resources.

Containing water demand growth

Water loss management

WSD has been making sustained efforts to curb leakage of water mains. A large-scale replacement and rehabilitation programme was launched in 2000 to replace and rehabilitate about 3,000 kilometres of aged water mains. Upon substantial completion in 2015, conditions of the water supply network have been significantly improved with the number of water main bursts dropped to around 40 from 2,500 and leakage rate of government water mains reduced to about 15% from 25%.

Thereafter, WSD has changed to implement risk-based water main asset management strategy with a view to maintaining the healthiness of the water supply network. Through risk assessments taking into account consequences of bursts or leaks, ages and materials of the water mains, past records of bursts or leaks, surrounding environment etc., WSD accords priorities to those water mains of high risks for improvement works. For more proactive monitoring and management, WSD is also establishing a "Water Intelligent Network" (WIN) in which the water supply network is divided into about 2,400 District Metering Areas of manageable sizes where updated data of water flow and pressure can be readily collected and analysed for water loss management. Capitalising smart water technologies, WSD is working towards the target of reducing the leakage rate of government water mains from the current 14% to below 10% by 2030.



Government Policies

STRATEGIC WATER MANAGEMENT FOR SUSTAINABLE FUTURE

Promotion of water conservation

The public participation is crucial to synergise Government's moves in protecting the precious water resources. WSD has been actively raising public awareness on water conservation through school education programmes, opening of a water resources education centre named "H2OPE Centre" and various public campaigns etc. WSD has also been promoting the wider use of water-efficient device by launching the Water Efficiency Labelling Scheme for water-using apparatus and installing flow controllers at water taps and shower heads of the customers.

Enhancing supply resilience

Diversification of water resources enhances resilience in adaptation for climate change. Desalinated water and recycled water have been the new water resources in WSD's supply portfolio.

Desalination

The first stage of desalination plant at Tseung Kwan O adopting the advanced technology of reverse osmosis has been commissioned since December 2023 to produce fresh water of up to 50 million cubic metres each year which can meet about 5% of total fresh water consumption in Hong Kong. Future expansion with extra annual output of 50 million cubic metres has been reserved to cater for more severe conditions.

Recycled Water

Reclaimed water and treated grey water are the two types of recycled water that are adopted by WSD to replace fresh water for toilet flushing and other non-potable uses. The supply of reclaimed water in the north-east New Territories has been effected in phases from March 2024 onwards whereas the treated grey water in the Anderson Road Quarry development site will be supplied progressively starting from end 2024 to tie in with the population intake. Extended supply of recycled water to other new development areas is also under planning up to 2040 or beyond.

Looking forward

With continuous support of the public, TWM initiatives will continue to underpin the sustainable development of Hong Kong. In the era of innovation and technology, WSD will spearhead smart water technologies and digitalisation for more efficient implementation of TWM initiatives to meet the future development needs and overcome challenges for building Hong Kong into one of the most liveable cities in the world with sustainable future.

Government Policies

PROMOTION OF ENERGY SAVING AND GREEN BUILDINGS

Following the release of "Hong Kong's Climate Action Plan 2030+" in January 2017, the HKSAR Government announced the "Hong Kong's Climate Action Plan 2050" (CAP 2050) in October 2021. CAP 2050 outlines four major decarbonisation strategies, namely "net-zero electricity generation", "energy saving and green buildings", "green transport" and "waste reduction", sets out more proactive measures on reducing carbon emission, and pursues more vigorous interim decarbonisation targets to reduce Hong Kong's carbon emission by 50% from the 2005 level before 2035. This brief report focuses on the targets, progress, measures and achievements in promoting energy saving and green buildings in recent years.

Targets

Electricity generation is the largest source of carbon emission (over 50%) in Hong Kong, and buildings account for 90% of Hong Kong's electricity consumption. Promoting green buildings and improving the energy efficiency of buildings, which can reduce the demand for electricity consumption and generation, are therefore important strategies to reduce carbon emissions. As set out in CAP 2050, Hong Kong's goal is to reduce the electricity consumption of commercial buildings by 30% to 40% and that of residential buildings by 20% to 30% from the 2015 level by 2050. The HKSAR Government is working to achieve half of the above targets by 2035.

Meanwhile, the HKSAR Government has been leading by example and strives to improve the overall energy performance of government buildings and infrastructure by more than 6% by 2024-25. With a view to exploring new energy sources while reducing energy consumption, apart from energy saving, the energy performance of renewable energy projects is also taken into account in this target.

Progress, Measures and Recent Achievements

To achieve the above goals, the HKSAR Government has been adopting a multi-pronged approach to promote energy efficiency and conservation in buildings. The measures are set out below.

Building Energy Efficiency Ordinance (Cap. 610)

Since 2012, the Building Energy Efficiency Ordinance (BEEO) has come into full operation by (i) requiring the design of building services installations in certain types of new buildings and major retrofitting works of existing buildings to comply with the minimum energy efficiency standards in the Building Energy Code (BEC); and (ii) requiring owners of commercial buildings to conduct energy audit in accordance with the Energy Audit Code (EAC). Both BEC and EAC are reviewed every three years. The 2021 edition of BEC has uplifted the energy efficiency standards of building services installations to achieve an additional 15% energy saving over the 2015 edition.

As an initiative in the Chief Executive's 2023 Policy Address, to further enhance the promotion of energy saving and decarbonisation in buildings, the HKSAR Government is preparing to amend the BEEO to expand the scope of regulation to more types of buildings, mandate the disclosure of information related to energy audit reports, and shorten the interval of energy audits.

Mandatory Energy Efficiency Labelling Scheme

To facilitate the public in choosing energy efficient appliances, the HKSAR Government introduced the Mandatory Energy Efficiency Labelling Scheme (MEELS) in 2009. MEELS requires energy labels to be shown on the prescribed products for supply in Hong Kong to inform consumers of their energy efficiency performance.

MEELS has been implemented in phases. The first three phases of MEELS covered eight types of products, including room air conditioners, refrigerating appliances, compact fluorescent lamps, washing machines, dehumidifiers, televisions, storage type electric water heaters and induction cookers. On 1 September 2023, the fourth phase of the MEELS covering three additional types of products, namely LED Lamps, Gas Cookers and Gas Instantaneous Water Heaters, commenced with a 15-month transitional period. With the implementation of the fourth phase, the coverage of MEELs in the residential sector has been extended to 11 types of appliances with the total energy consumption substantially increased from about 50% to about 80% in residential buildings.

Government Policies

PROMOTION OF ENERGY SAVING AND GREEN BUILDINGS

Since the implementation of MEELS, more and more prescribed products have obtained Grade 1 and 2 energy labels. The scope and grading standards of MEELS are therefore kept under regular review to cope with technological advancement and the latest developments in international standards. The revised Code of Practice on Energy Labelling of Products 2024 with energy efficiency standard upgrade for refrigerating appliances, washing machines and storage type electric water heaters was published in March 2024 for commencement on 30 June 2024 with a 15-month transitional period. It is estimated that an energy saving of 230 GWh/year, equivalent to the annual electricity consumption of about 70,000 typical three-member households, would be achieved under this round of upgrading.

District Cooling System

District cooling system (DCS) is a large-scale, centralised air-conditioning system which produces chilled water at central chiller plants for distribution to non-domestic user buildings for air-conditioning purpose. DCS is an energy-efficient air-conditioning system which consumes 35% less electricity as compared with traditional air-cooled air-conditioning systems, and 20% less electricity than individual water-cooled air-conditioning systems using cooling towers.

The initial stage of the DCS at Kai Tak Development (KTD), the first DCS in HKSAR, has commenced service in phases since 2013. As at March 2024, the system is supplying chilled water for air conditioning to 14 different user buildings in the district, including the cruise terminal, a hospital, MTR stations, schools, government organisations, and private commercial development projects, etc, with a total air-conditioned floor area of about 540,000 square metres. By the end of 2023, the system had saved a total amount of about 59 million kilowatt-hours (kWh) electricity, equivalent to the annual electricity consumption of about 17,900 typical three-member households.

As announced in the Chief Executive's 2022 Policy Address, the HKSAR Government will accelerate the incorporation of DCS in new development areas to reduce energy consumption. The HKSAR Government will continue to oversee the construction of the DCS projects in Kwu Tung North New Development Area and Tung Chung New Town Extension (East) and explore the feasibility of incorporating DCS in more new development areas, with a view to promoting energy efficiency from the infrastructure level.

Energy Performance of Government Buildings

As at end 2023, the Electrical and Mechanical Services Department has already completed energy audits (i.e. systematic reviews of the energy consuming equipment/systems in buildings to identify energy management opportunities) for about 250 government buildings, and encouraged the government departments to actively implement the energy saving measures recommended in the audit report. Meanwhile, the HKSAR Government promulgates and regularly updates the green building performance framework to set out the best practicable green building targets for existing and new government buildings. The framework includes passive and active energy efficiency features, such as sun shading and requirements on the overall thermal transfer value of the building envelope. To promote the use of renewable energy, the HKSAR Government has also earmarked HK$3 billion for the installation of small-scale renewable energy systems at government buildings and infrastructure since 2017-18. As at December 2023, about 226 projects have been approved, and these projects can generate a total of about 25 million kWh of electricity per annum, equivalent to the annual electricity consumption of about 7,500 typical three-member households. The overall energy performance of government buildings and infrastructure has reached a 5.3% improvement in 2022-23, and the HKSAR Government is confident in achieving the 6% target by 2024-25.

Energy Efficiency Registration Scheme for Buildings

To encourage building owners to achieve better energy performance beyond the statutory requirements, the HKSAR Government introduced the "Energy Efficiency Registration Scheme for Buildings" (EERSB) to recognise buildings which outperform the statutory requirements of BEEO. With effect from 1 January 2018, all types of new and existing buildings/premises with energy performance outperforming the minimum statutory requirements of BEEO can apply for EERSB if they have obtained certificates of good building energy performance through BEAM Plus Assessment System managed by the Hong Kong Green Building Council (HKGBC) or other internationally

Government Policies

PROMOTION OF ENERGY SAVING AND GREEN BUILDINGS

recognised building environmental assessment systems. Capital expenditure incurred on the construction of energy efficient building installations, including Lighting, Air Conditioning, Electrical and Lift and Escalator Installations, registered under EERSB would be eligible for full deduction in the first year of purchase, instead of five years before 2018.

Green Schools 2.0 – Energy Smart and Green Welfare NGOs

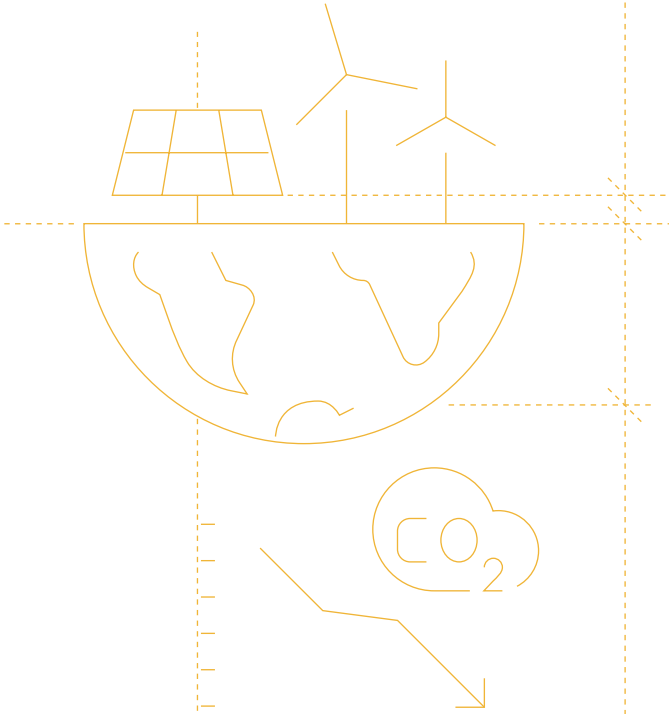
Since 2020, the HKSAR Government has introduced Green School 2.0 – Energy Smart to subsidise and assist primary and secondary schools in upgrading their existing electrical appliances such as air-conditioners and lighting systems. As at end March 2024, the scheme has assisted over 210 schools in enhancing their energy efficiency. In addition to the retrofitting works, real-time energy monitoring systems are also installed, and educational materials are provided for the schools to enhance the students' understanding of energy saving.

Building upon the successful experience of Green Schools 2.0, the HKSAR Government further introduced Green Welfare NGOs in 2021 to subsidise and assist welfare NGOs' premises to conduct energy audit, identifying Energy Management Opportunities to promote improvement in energy performance and best practices in energy management where savings of energy can be made. As at end March 2024, the scheme has received more than 300 eligible applications, and works for around 60 venues were completed, with works in more than 60 venues underway.

Energy Saving and Decarbonisation for All

To mobilise the community to take collective actions to conserve energy, the HKSAR Government has been organising the Energy Saving and Decarbonisation for All Campaign every year since 2022. The Campaign comprises the Energy Saving Charter and the 4T Charter. Participating venues and organisations of the Energy Saving Charter pledge to implement a range of energy conservation measures, including switching off electrical appliances and systems when not in use and promoting building energy saving retrofit, etc. The 4T Charter was established under the "4T framework" of Target, Timeline, Transparency and Together, under which the 4T partners would set their energy saving targets and timelines, and share their existing and planned energy saving measures.

Apart from the Government's policy initiatives, building an energy-efficient and sustainable built environment requires endeavours from all parts of the community. The HKSAR Government will continue its effort in mobilising the community and trades to take forward various energy saving initiatives with a view to realising Hong Kong's goals set out in CAP 2050 to build a carbon neutral future.



Government Policies

SUSTAINABLE GREEN PUBLIC HOUSING

Introduction

The HKSAR Government has identified sufficient land for meeting the supply target of 308,000 public housing units for the coming ten years period from 2024-25 to 2033-34. To meet the huge imminent housing demand for public housing, the Housing Authority (HA) strives to expedite and increase supply, enhance facilities and create an ideal living environment to improve the quality of life of residents. Due to HA's uniqueness of "High Volume", "Standardisation" and "High Repetition", HA provides a good innovation hub for the application of building technology to making public housing greener.

Application of Modular Integrated Construction (MiC) Technology

In order to address the significant demand for public housing, the Housing Department has created an environment conducive to embracing cutting-edge technologies. One such technology, Modular Integrated Construction (MiC), offers substantial benefits such as accelerated construction timelines, enhanced quality control, reduced waste, and improved cost efficiency. By prioritising the adoption of MiC for a majority of projects in the upcoming five years, the Housing Department seeks to drive the advancement of this transformative technology, benefiting not only their own projects but the entire construction industry. More than 150 projects are now in the pipeline for construction in the coming ten years. The HA is actively promoting a reliable MiC ecosystem together with the industry, which includes the aspects of upstream supply chain monitoring, transportation logistics, labour skillset transformation and construction technology advancement to reshape the sustainable development of the HA MiC in the future and to achieve green public housing.

Emerging Construction Technologies that Enable the Development Process

Furthermore, the integration of state-of-the-art technologies such as construction robotics, remote sensing, and reality capture technology through the Mobile Mapping System (MMS) and the Housing Authority Project Information Management and Analytics Platform (HA-PIMAP) signifies a commitment to revolutionise the construction sector. These innovations aim to enhance productivity, safety, efficiency, collaboration, and sustainability in the development of public housing, ensuring that Hong Kong's construction industry remains at the forefront of technological advancement.

Government Policies

SUSTAINABLE GREEN PUBLIC HOUSING

Incorporation of Multi-trade Integrated Mechanical, Electrical and Plumbing (MiMEP) Design

MiMEP is an innovative construction method that involves integrating various building services components into prefabricated modules offsite. These modules are then transported to the construction site for connection and completion of building services installations. The adoption of MiMEP allows for labour intensive works to be migrated to the offsite workshop, resulting in a shorter construction period on site, improved productivity and build quality, enhanced site safety and better performance in environmental sustainability by reducing construction waste.

With satisfactory trial runs on various MiMEP installations in pilot projects, MiMEP is now widely adopted in public housing projects. Reference design guides, specifications, and standard details for MiMEP were developed for application to public housing developments. The Government is working with the industry to overcome any hurdles that may arise during the adoption of this innovative construction method.

Adoption of Renewable Energy

To promote the use of renewable energy, the HA has been installing grid-connected photovoltaic (PV) systems in new public rental housing development projects for over a decade. The PV systems are designed to generate electricity to meet approximately 1.5% to 2.5% of the building's communal area's demand. At the end of 2023, over 150 rental domestic blocks have already installed PV systems with a total system capacity of over 1,300kW.

For existing public rental housing estates, the HA would retrofit flexible PV systems on the rooftops of residential buildings subject to technical viability. By the first quarter of 2024, there would be 25 existing public housing estates installed with the systems. The HA is committed to exploring new renewable energy technologies to reduce the carbon footprint and promote sustainable living in public housing developments.

Participation in Green Building Assessment - BEAM Plus

All HA's new buildings are designed to meet the assessment criteria of the Hong Kong Green Building Council's BEAM Plus for New Buildings (BEAM Plus NB), which provides a lifecycle assessment of the environmental attributes of new buildings. There are four different ratings under BEAM Plus NB, i.e. Bronze, Silver, Gold and Platinum. Public housing projects participated in BEAM Plus assessments starting in 2012. The HA aims for all its new buildings to achieve a Gold rating standard or above. Since participation, 11 projects have achieved Platinum rating and 68 projects have achieved Gold rating, by the end of 2023. In the BEAM Plus Certificate Presentation Ceremony 2023 co-organised by the Hong Kong Green Building Council (HKGBC) and BEAM Society Limited (BSL), the HA received "The Most Active Participation in BEAM Plus New Buildings in Year 2022/23", showing its unwavering effort in green and sustainable building developments.

Driving the Sustainable Built Environment in Hong Kong

LEADING HONG KONG'S TRANSFORMATION: THE CIC AND THE HKGBC

CONSTRUCTION INDUSTRY COUNCIL 建造業議會

HKGBC 香港綠色建築議會

Since the Government of the HKSAR announced in 2020 its mission of achieving carbon neutrality for Hong Kong by 2050, all the city's industries have aligned with this important goal and geared up their operations accordingly. Given that buildings and related activities account for over 50% of greenhouse gas (GHG) emissions in Hong Kong, the Construction Industry Council (CIC) and the Hong Kong Green Building Council (HKGBC) have spared no effort in leading the building sector on this net zero journey for Hong Kong.

As key drivers of Hong Kong's green built environment industry, the CIC and the HKGBC work closely with the Government to develop public policies and initiatives that foster market transformation. They are also dedicated to promoting the industry's adoption of world-best practices and educating the public. Over the next four chapters, beginning with this one, renowned industry experts and young leaders have shared their insights to shed light on Hong Kong's carbon neutrality roadmap. Through collaboration, we can work towards the shared goal of achieving carbon neutrality by 2050 and securing a sustainable future for Hong Kong.

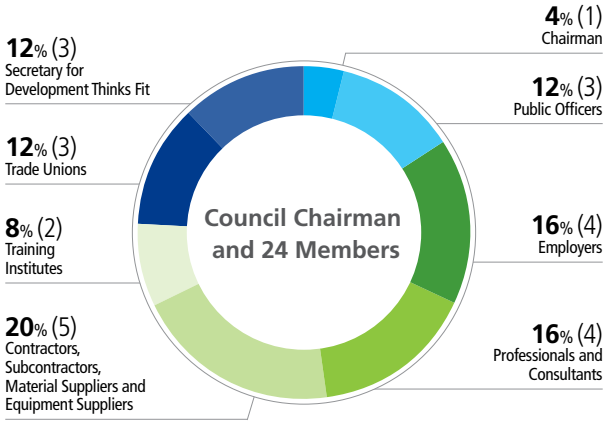
LEADING HONG KONG'S TRANSFORMATION: THE CIC

CONSTRUCTION INDUSTRY COUNCIL
建造業議會

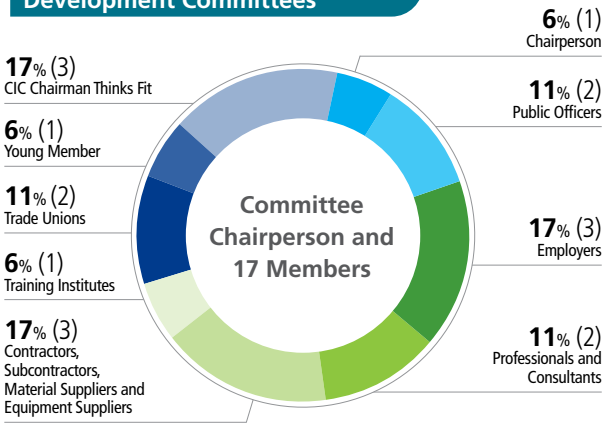
Construction Industry Council

Established in 2007 under the Construction Industry Council Ordinance (Cap. 587), the Construction Industry Council (CIC) is a statutory body for Hong Kong's construction industry. It serves as a vital communication channel between the Government and the construction industry, playing a pivotal role in forging consensus on long-term strategies, and conveying the needs and aspirations of the industry. Placing a strong emphasis on professionalism, development and welfare of the workforce, the CIC also provides professional training, trade testing and registration services to the construction sector. It is dedicated to the mission of strengthening the industry's sustainable development, continually striving to foster innovation, safety, sustainability and productivity. The CIC's aspiration is to create a sustainable future for all and contribute to Hong Kong's pledge to achieve carbon neutrality by 2050.

Composition of the Council



Composition of the Five Industry Development Committees



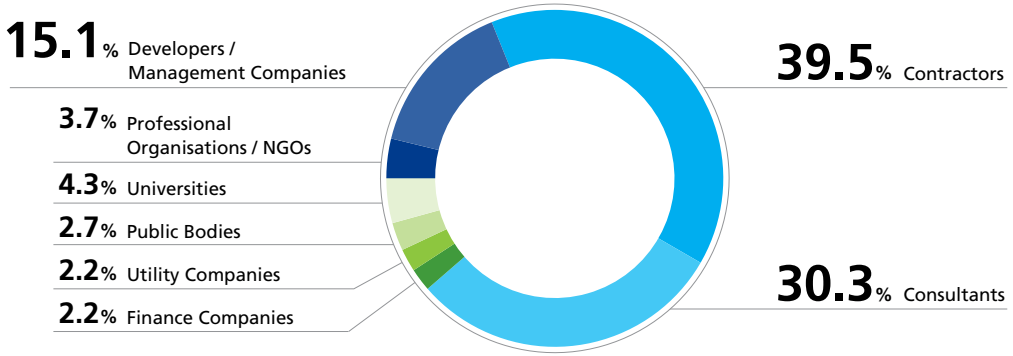
LEADING HONG KONG'S TRANSFORMATION: THE HKGBC

HKGBC 香港綠色建築議會

Hong Kong Green Building Council

The Hong Kong Green Building Council (HKGBC) is a non-profit, member-led organisation established in 2009, and has been a public body under the Prevention of Bribery Ordinance since 2016. The HKGBC strives to promote the standard and development of sustainable buildings in Hong Kong. It also aims to raise green building awareness by engaging the Government, the industry and the public in dialogue, and by developing practical solutions for Hong Kong's unique, subtropical built environment of high-rise, high density urban areas, leading the city to achieve carbon neutrality by 2050 and become a world exemplar of green building development.

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

HKSC 環保建築專業議會

SETTING THE STANDARDS FOR HONG KONG'S CONSTRUCTION INDUSTRY

MoU Signing Ceremony for Applying BEAM Plus to Projects Outside Hong Kong cum Launch of BEAM Plus Existing Buildings (Global Version) V1.0

BEAM Plus Driving Higher Performance

BEAM Plus is Hong Kong's leading initiative to offer independent assessment of building sustainability performance. Its major aims are to enhance the health and wellbeing of building occupants; to reduce the environmental impacts of buildings (and make positive contributions wherever feasible); and to make buildings more efficient, emitting less carbon. Today, BEAM Plus has become the predominant green building rating tool in Hong Kong, with its success hinging upon both Government and industry support.

Year 2024 marks a significant milestone for BEAM Plus development as the Gold rating of BEAM Plus New Buildings has become the nominal rating required for private development projects to obtain gross floor area (GFA) concessions for green and amenity features, starting from 30 June 2024. Projects obtaining Silver or Bronze ratings are required to satisfy additional specific standards set by the Buildings Department if they are to apply for the same GFA concessions. HKGBC's statistics reveal that the percentage of new building projects obtaining Gold or above ratings has increased from about 40% in 2014 to about 65% in 2023, reflecting that the industry is well-prepared to meet the higher standard.

BEAM Plus Becoming More Versatile

As regards the variety of rating tools available under the BEAM Plus family, up to 2024 these have been expanded to include tools tailor-made for data centres, existing schools and fit-out works in domestic apartments, as these kinds of premises are unique in characteristics. Having specific tools helps to make certification more meaningful and user-friendly.

Under the BEAM Plus family, new rating tools will continue to evolve, such as Version 3.0 of BEAM Plus Existing Buildings that features flexible certification options, and a rating tool tailor-made for Food and Beverage (F&B) premises. This will satisfy the industry's needs while also meeting society's aspiration for carbon neutrality.

BEAM Plus Extending Reach to a Global Level

With the support of the Government, the HKGBC and BSL are extending the reach of BEAM Plus to a global level. On 27 May 2024, 13 developers and property management companies, institutions and state-owned enterprises from Hong Kong and the Greater Bay Area, signed Memoranda of Understanding (MoUs) expressing their intent to explore certifying their selected projects or properties outside Hong Kong using BEAM Plus. The geographical locations of potential BEAM Plus applications include the Mainland, Belt and Road Regions and Europe. The BEAM Plus Existing Buildings (Global Version) Version 1.0, which is a modified version of BEAM Plus to facilitate applications outside Hong Kong, was launched during the MoU Signing Ceremony, while a counterpart for New Buildings is expected to be launched in the first half of 2025. With the launch of these two versions, BEAM Plus is establishing itself as a worldwide standard for sustainable building practices.

BEAM Society Limited

BEAM Society Limited (BSL) is a non-profit organisation established in 2010 and the descendant of the BEAM Society founded in 1996. BSL is the owner of the Building Environmental Assessment Method (BEAM) and is committed to developing and implementing the BEAM Assessment Tool – BEAM Plus (formerly 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. BSL has been a public body under the Prevention of Bribery Ordinance since 2016.

Leading Hong Kong's Transformation: The HKGBC

A STRONG GREEN BUILDING MOVEMENT IN NEARLY THREE DECADES

A Strong Green Building Movement in Nearly Three Decades

Strong Market Participation

In 2021, the annual percentage of private sector projects joining BEAM Plus has reached nearly:

57%

HK-BEAM Society 香港環保建築協會
HONG KONG BUILDING ENVIRONMENTAL ASSESSMENT METHOD 香港建築環境評估法

No. of Buildings First Certified: **605**

HKGBC BEAM Plus 綠建環評

No. of Buildings First Certified: **3,439**

1996 Launch of HK-BEAM

2004 Launch of HK-BEAM 4/04 & 5/04

2009 HKGBC established

2010 Launch of BEAM Plus

2011 BEAM Plus becomes a GFA concession prerequisite

2012 Launch of BEAM Plus New Buildings and Existing Buildings V1.2, with passive design route added for new residential buildings

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 and latest health and wellbeing requirements
- Launch of BEAM Plus Existing Buildings Volume Certification

2021
- Launch of BEAM Plus New Data Centres and Existing Data Centres V1.0
- Launch of BEAM Plus-linked green mortgage plans by various local banks

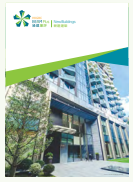
2022
- Launch of BEAM Plus Existing Schools V1.0
- Launch of BEAM Plus New Buildings Traditional Chinese and Simplified Chinese Version

2023
- Launch of BEAM Plus New Data Centres and Existing Data Centres V1.0
- Launch of BEAM Plus Interiors V2.0 (Residential and Non-residential)

Mid-2024
- Completion of development of BEAM Plus Existing Buildings (Global Version)
- New performance-based GFA concession mechanism comes into operation

2025 Anticipated completion of development of BEAM Plus New Buildings (Global Version)

BEAM Plus Brochures


New Buildings (NB)


Existing Buildings (EB)


Interiors - Non-residential (BI)


Interiors – Residential (BI)


Neighbourhood (ND)


Data Centres (DC)


Existing Schools (ES)

LEADING INDUSTRY'S TRANSFORMATION TOWARDS CARBON NEUTRALITY

Commitment of Advancing Net Zero

Taking decisive action, the HKGBC has played a pivotal role in driving Hong Kong's green building movement. In 2019, it committed to the initiatives outlined by the World Green Building Council (WorldGBC), launching a series of impactful initiatives known as Advancing Net Zero (ANZ). These are aimed at transforming Hong Kong's built environment, aligning it with the city's carbon neutrality goals and fostering sustainable development.

The HKGBC has been an Established Member of the World Green Building Council (WorldGBC) since November 2012. This signifies Hong Kong's position as a leader in the green building movement around the globe.

The **International Conference on Advancing Net Zero** initiated by the Council, Hong Kong's first international conference of its kind, was held in November 2021. Taking the theme "Decarbonising High-rise, High-density, Sub-tropical Cities", the conference was aimed at enriching the knowledge of building and construction professionals in Hong Kong and around the globe. On average, more than 2,000 participants tuned in virtually each day of the four-day event.

Organised by the HKGBC with Swire Properties as Principal Partner, Hong Kong's first-ever **Advancing Net Zero (ANZ) Ideas Competition** took place from March to November 2021 and featured two categories: Future Building and Existing Building. The competition encompassed various stages such as Technical Webinars, Final Presentation, Award Ceremony, Roving Exhibition, and a Roundtable Discussion. It attracted an encouraging response from the industry, with 22 entries received from 58 organisations and companies worldwide. The entries proposed innovative and groundbreaking concepts tailored to Hong Kong's unique high-rise, high-density, subtropical city context. An ANZ Ideas Competition e-book was published to summarise the creative ideas generated throughout the process, which will serve as a valuable reference as Hong Kong continues its ANZ journey into the future.

Leading Hong Kong's Transformation: The HKGBC

LEADING INDUSTRY'S TRANSFORMATION TOWARDS CARBON NEUTRALITY

HKGBC Climate Change Framework For Built Environment

The HKGBC launched its **HKGBC Climate Change Framework For Built Environment** (the Framework) in June 2023, providing a practical reference for the industry and building owners to embark on their net zero journey. As of March 2024, the number of downloads had accumulated over 13,000 from 54 regions across the globe. The Framework is intended to assist the building industry in setting net zero carbon goals; reporting environmental, social and governance achievements; justifying green finance requirements; and disclosing climate risk strategies. Version Two of the Framework incorporating a new chapter entitled "Carbon Offsets for Hong Kong's Built Environment" was released in March 2024, providing general guidance for organisations to select their carbon offsets approach based on best practices and international standards.

As part of the Framework, the Council introduced its **Zero-Carbon-Ready Building Certification Scheme** in September 2023. This scheme enables benchmarking of energy performance, setting carbon neutrality targets, and justifying projects for green financing. Within six months, 12 renowned developers and property management companies had received a total of 65 certificates, signifying Hong Kong's progress towards a greener and more sustainable built environment. Encouragingly, the scheme is also attracting interest from the public sector, with the EMSD Headquarters among the inaugural participants. Furthermore, it has been officially incorporated into both BEAM Plus and the Global Real Estate Sustainability Benchmark (GRESB) as a recognised green building assessment tool, underscoring the Certification's wide recognition and acceptance, both at local and international levels.

A **Net Zero Building Certification Scheme** was also introduced in March 2024 as part of the Framework, demonstrating the industry's strong demand and dedication. Alongside BEAM Plus and the Zero-Carbon-Ready Building Certification Scheme, the Net Zero Building Certification Scheme has been incorporated into the Hong Kong Monetary Authority's discussion paper on the Hong Kong Green Taxonomy Framework. This showcases how these certifications can facilitate companies' access to green finance, helping them to raise capital and drive progress.

LEADING INDUSTRY'S TRANSFORMATION TOWARDS CARBON NEUTRALITY

Nurturing & Passing On

The HKGBC's efforts extend to nurture young professionals through programmes such as **Green Building Young Leaders** (GBYLs), offering networking opportunities and mentorship. In 2022, 12 talented professionals participated in the planning and execution of the parliamentary green building initiative. Through this process, they have broadened their vision and contributed to the sustainable development of society.

The HKGBC collaborates with BSL to accredit green building specialists known as BEAM Professionals (BEAM Pro) and BEAM Assessors (BAS) in various aspects of the green building life cycle. The HKGBC also accredits BEAM Affiliates who are competent in supporting aspects of green buildings such as design, construction, operation and maintenance, as well as the use of BEAM Plus rating tools. To provide green building professionals with opportunities for ongoing learning and the maintenance of their qualifications, the HKGBC and BSL organise regular Continuing Professional Development (CPD) events and provide on-demand videos through Online Training Portal.

In addition, the HKGBC provides various training courses for industry practitioners to enhance their expertise in Retro-commissioning (RCx) and Green Product Certification, or become Energy Assessors for the Zero-Carbon-Ready Building Certification Scheme and Net Zero Building Certification Scheme. By being offered regular training, practitioners can stay abreast of the latest developments and pass on this knowledge to a wider audience.

Number of accredited green building professionals (as of 2023)

HKGBC BEAM Pro 綠建專才

BEAM Professionals **3,729**

BEAM Assessors **81**

HKGBC BEAM Affiliate 綠建通才

BEAM Affiliates **959**

RCx Professionals & Practitioners **653**

HKGBC Green Building Faculty 綠色建築專家

Green Building Faculty Members **139**

Certified Carbon Auditor **99**

Energy Assessor-ZCRB **193**

Driving Sustainability through Industry Schemes and Awards

The HKGBC has launched various industry schemes and initiatives to actively engage different sectors of the green building industry, fostering their collective learning and growth. This effort is aimed at contributing to the long-term development of sustainability initiatives within the community.

Retro-commissioning (RCx) Training and Registration Scheme

Retro-Commissioning
Significant Savings at Minimal Cost

This enhances RCx professionals' skills to help them optimise energy efficiency in existing buildings, aligning with the HKSAR Government's promotion of cost-effective RCx for energy enhancement.

CIC Green Product Certification

This scheme assesses sustainable building and construction materials or products to promote green procurement in the construction industry. It assesses various aspects of building materials throughout their life cycle including carbon footprint, GHG emissions and energy or water efficiency. As of March 2024, over 1,000 products had been certified in 28 categories.

CIC GREEN PRODUCT CERTIFICATION

LEADING INDUSTRY'S TRANSFORMATION TOWARDS CARBON NEUTRALITY

Driving Sustainability through Industry Schemes and Awards

Eco-Product Directory

ECO-PRODUCT DIRECTORY

This 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. As of March 2024, over 1400 products had been certified.

Hong Kong Green Shop Alliance (HKGSA)

香港綠建商舖聯盟
Hong Kong Green Shop Alliance

The Hong Kong Green Shop Alliance offers a platform for the active participation of developers, key partners, shopping malls and shops with the aim of creating the world's greenest shopping environment in Hong Kong. It has seen significant growth, with over 1,000 members joining by March 2024 from the various sectors.

A Hong Kong Green Shop Alliance Award was launched in 2019 to provide recognition to shops and shopping malls for excellent achievements in green practices and collaborative innovations.

Green Building Award

To recognise excellence in the sustainable built environment, the **Green Building Award** (GBA), known as the Oscars of the industry, was launched by the Professional Green Building Council (PGBC) in 2006 and has been co-organised with the HKGBC since 2010. This biennial award is aimed at providing recognition to building-related projects and organisations for their outstanding performance and contributions to sustainability and the built environment. The Award covers five categories: New Buildings, Existing Buildings, Research & Planning, Building Products & Technologies, and Green Building Leadership. To provide more opportunities to showcase their achievements, award winners may be nominated by the HKGBC to participate in the Asia Pacific Leadership in Green Building Awards, organised by the World Green Building Council, and compete across the whole of the Asia Pacific region. The last GBA edition in 2023 registered a 47% increase in the number of nominations, signifying the popularity of the Award and the enthusiasm of the industry for shining in the built environment sector.

green building award 環保建築大獎

Organisers: HKGBC 香港綠色建築議會 PGBC

Leading Hong Kong's Transformation: The HKGBC

ADVOCACY FOR SUSTAINABLE BUILDING PRACTICES AND SOLUTIONS

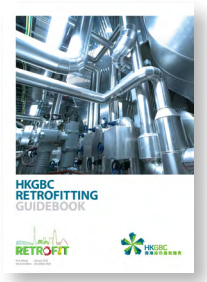
Facilitating the exchange of knowledge and best practices plays a pivotal role in motivating the industry and the public to adopt sustainable approaches. With a focus on empowering stakeholders, the HKGBC is dedicated to developing comprehensive guidebooks that provide valuable insights, practical tools, and successful case studies.

In recent years, the HKGBC has published guidebooks on smart green building design best practices, retrofitting and the sustainable built environment to assist industry players in advancing their knowledge in these areas.

Hong Kong Smart Green Building Design Best Practice Guidebook (2021)

This guidebook was published with funding support from the CIC to facilitate the development of green building design. It presents 32 recommended smart green strategies, categorised into six key themes for different types of new and existing buildings. In addition to showcasing best practices in green building design, the guidebook consolidates research findings into practical approaches.

HKGBC Retrofitting Guidebook (2023) and Version Two (2024)

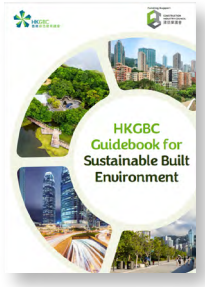


This timely guidebook offers strategies for retrofitting with a view to optimising the performance of existing buildings. It presents various retrofitting options and considerations with case studies for the industry's reference. Other resources such as available funds in the market are also noted to assist building owners performing retrofitting works in their buildings

Following the success of the first edition, Version Two of the guidebook has now been developed to align with the evolving landscape of green building practices. It incorporates new perspectives on kitchen retrofitting, architectural design, and the rating of retrofitting initiatives, in addition to the ten featured themes from the first version. By integrating the latest best practices and technological advancements, the guidebook provides a more comprehensive and holistic approach to retrofitting practices in the industry.

HKGBC Guidebook for Sustainable Built Environment (2023)

This guidebook serves as a comprehensive resource for professionals in the field, containing guidelines, policies, directives and case studies. It provides clear guidance on 8 Key Themes and 48 Strategies for sustainable development.



Leading Hong Kong's Transformation: The HKGBC

COLLABORATION AND SYNERGY

The HKGBC is a strong advocate for the green building movement, serving as a bridge between the Government and industry stakeholders. Besides promoting BEAM Plus, the Council actively engages in green finance and drives decarbonisation in the building sector. Through partnerships and dialogue, the HKGBC accelerates the adoption of sustainable practices for a low-carbon future.

High-level Discussion Opportunities through the Policy Luncheon

An annual Policy Luncheon, organised by the HKGBC, facilitates high-level policy discussions between the Government, senior executives and top management from major players in the banking, building, utilities and other sectors in Hong Kong.

In 2022, Mr Christopher HUI, GBS, JP, Secretary for Financial Services and the Treasury, delivered a keynote speech that shed light on the latest developments in green finance and carbon trading in Hong Kong. In 2024, Mr David LAM, JP, Under Secretary for Development, graced the Policy Luncheon by offering insights on urban development and land supply.

Empowering Sustainability through Partnerships

Over the years, the HKGBC has fostered various types of partnerships with prominent organisers, professional institutes and media organisations such as the Build4Asia trade show, City University of Hong Kong, Hong Kong Metropolitan University, the Global Real Estate Sustainability Benchmark (GRESB), Hong Kong Economic Journal, Hong Kong Economic Times, Hong Kong Green Finance Association, Hong Kong Monetary Authority, Hong Kong Trade Development Council, ReThink HK, and of course with the Council's own Members and Founding Members, delivering many successful events and initiatives.

In addition the HKGBC, in close collaboration with its Patron Members, has co-organised the **Chinachem Group Sustainability Conference** since 2019 and acted as the Strategic Partner of the **Schneider Electric Innovation Summit 2023**.

CROSS-REGIONAL OUTREACH IN 2020-24

Increasing Engagement with the Guangdong-Hong Kong-Macao Greater Bay Area

As one of the Founding Organisations of the **Guangdong-Hong Kong-Macao Greater Bay Area Building Technology Alliance**, the Council attended its Inauguration Ceremony on 6-7 January 2024. The Ceremony was followed by the first Greater Bay Area Architectural Science Conference, which attracted 400 participants and was held at the Baiyun International Convention Centre in Guangzhou. Led by the Guangdong Provincial Academy of Building Research Group, the Alliance comprises 44 institutions from Guangdong, Hong Kong and Macao. Its main objective is to establish a collaborative platform for research and co-operation in architectural technology within the Greater Bay Area, while promoting high-quality development in the construction industry.

The Council has also been part of the **Green Building Industry Alliance in the Guangdong-Hong Kong-Macao Greater Bay Area** since 2019 and maintains close relationships with other Green Building Councils in the region.

Collaboration on Retro-commissioning and Retrofitting in the Greater Bay Area

Additionally, the Council is collaborating with institutions on retro-commissioning (RCx) and retrofitting technology in the Greater Bay Area, leveraging the opportunities presented by the large number of existing buildings in the region.

In September 2023, the Council signed a memorandum of co-operation (MoC) on RCx and Building Energy Saving Retrofitting with the China Association of Building Energy Efficiency (CABEE), and several important institutions in Macao.

Receiving Cross-border RCx Recognition

The HKGBC has for many years been promoting RCx to the industry to align with the Government's goals of reducing the energy consumption and carbon emissions of existing buildings. In 2022, the HKGBC's "Retro-commissioning (RCx) Training and Registration Scheme – From Active Training to In-class Training" project, co-submitted with the Government's Electrical and Mechanical Services Department (EMSD) won the Gold Award in the Smart Jobs and Consumers category of the 2022 Asia-Pacific Economic Cooperation (APEC) Energy Smart Communities Initiative (ESCI) Best Practices Awards Program.

HKGBC Delegations – Learning and Engagement to Foster Green Building Development

In October 2023, the Council organised an HKGBC Delegation to Sydney, giving HKSAR Government officials and the HKGBC Chairman, Directors, Members and staff the

opportunity to visit several renowned local 5 to 6-star green building projects. Fully supported by the Green Building Council of Australia, the delegation engaged with local organisations and project teams to tap into the Sydney's latest developments in sustainable buildings and infrastructure. Diverse projects and topics were covered during the meetings and guided tours, including cutting-edge technologies, urban planning, sustainability policies, design and best practices. This allowed participants to witness first-hand how Sydney is at the forefront of sustainable building development, and exchange knowledge and experience with local experts, with the aim of applying this learning to the development of green buildings in Hong Kong.

Knowledge Exchange with International Experts

The HKGBC regularly organises knowledge exchange events with international experts for HKGBC Members. For instance, the Council hosted an International Expert Luncheon in 2023 with distinguished speakers Ms Lisa BATE and Prof. TAI Lee-siang, both of whom are former Chairpersons of the World Green Building Council. More recently, the HKGBC collaborated with the Business Environment Council in 2024 to organise an enlightening Expert Talk featuring Mr David GOTTFRIED, Founder of the US Green Building Council and WorldGBC.

ENGAGING THE COMMUNITY - GREEN BUILDING EDUCATION

Jockey Club BEAM Plus in Schools Project

Funded by The Hong Kong Jockey Club Charities Trust, the Jockey Club BEAM Plus in Schools Project was launched in January 2020 to promote green building in schools and reduce their carbon footprint. In collaboration with the Business Environment Council and BSL, the 3½-year-long project provided comprehensive green building educational programmes in 125 schools, representing 11% of Hong Kong's primary and secondary establishments. More importantly still, it facilitated retrofitting works and the development of a new BEAM Plus Existing Schools assessment tool for certifying participating schools as green schools.

The two projects together target to certify

over 250 schools

in total under BEAM Plus Existing Schools in 8.5 years, which represent roughly one-fourth of all the Primary and Secondary Schools in Hong Kong.

Building upon this achievement, the Trust has now approved a new phase, the BEAM Plus Energy Saver in Schools Project, focusing on energy-efficient retrofitting works to achieve a 15-20% reduction in electricity consumption. Through the BEAM Plus Existing Schools assessment and certification, the contribution of schools in advocating for sustainable campuses will be recognised. As co-organiser of this project, the Council will introduce new educational activities such as Capacity Building Programmes, Green Building Tours and Student Ambassador Programmes to enhance teachers' and students' knowledge of green building, and to promote the importance of health and wellbeing in schools. Over 200 schools will participate in these new educational activities over the next five years.

The two projects together are targeted at certifying over 250 schools in total under BEAM Plus Existing Schools within 8½ years, representing roughly a quarter of all the primary and secondary schools in Hong Kong.

My Green Space Student Competition

Since 2011, the HKGBC has been organising the My Green Space Student Competition to promote public awareness and concern for green building. The competition encourages students to unleash their creativity and incorporate the concept of green building into real-life scenarios to create ideal green spaces. Through this initiative, the Council aims to impart knowledge about green building to the younger generation, enabling them to comprehend the significance and benefits of sustainable construction. The Council hopes that these students will also become advocates for environmentally friendly buildings in the future.

The 2023 competition, themed "Striving towards Carbon Neutrality - Net Zero Built Environment", garnered participation from over 100 teams and 270 students.

Hong Kong Green Building Week (HKGBW)

Co-organised by the Construction Industry Council (CIC) and the HKGBC, this annual public event is set to enter its 12th edition in 2024. Its objective is to enhance public awareness of green building and encourage a shift towards a more environmentally friendly lifestyle. Since 2021, the campaign has emphasised key messages on combating climate change and achieving carbon neutrality to help accelerate behavioural changes and align with global efforts. It presents a range of highly-acclaimed public activities to invite all citizens of Hong Kong to explore local green buildings and understand their significance and benefits.

With the theme "Unite Green Building Powers, Fight for Carbon Neutrality by 2050!", HKGBW 2023 garnered support from over 200 organisations, with an impressive 270,000-plus participants joining the Biz-Green Dress Day.

Leading Hong Kong's Transformation: The CIC

BUILDING MOMENTUM IN HONG KONG'S CONSTRUCTION INDUSTRY

CIC Global Construction Sustainability Forum and Exhibition

The inaugural Global Construction Sustainability Forum and Exhibition (GCSFE) held in Hong Kong from 20 to 23 November 2023 was **a groundbreaking event aimed at driving sustainable development in the construction industry**. Co-organised by the CIC and the Development Bureau, it attracted widespread attention and participation.

Themed on environmental, social and governance (ESG) performance, the GCSFE brought together industry stakeholders and professionals worldwide. Its comprehensive programme included thematic forums, an exhibition, charter signing ceremonies, award presentations and technical tours. These activities provided a platform for knowledge exchange, experience sharing, collaboration, and a showcase of sustainable solutions.

The forum was a highlight of the GCSFE, featuring renowned speakers who shared their expertise and insights on various sustainability topics. Their presentations sparked engaging discussions and offered valuable perspectives on industry transformation, digitalisation and cross-sector collaboration. It catalysed innovative ideas and initiatives shaping the construction industry's future.

The exhibition itself showcased the latest sustainable technologies, products and services, providing a platform for exhibitors to demonstrate their commitment to sustainability, and for visitors to learn about and explore the latest advancements in green construction. It was a hub of inspiration and innovation, encouraging the adoption of sustainable practices and solutions.

SUSTAINABLE CONSTRUCTION CHARTER

A key outcome of the GCSFE was the launch of the **CIC Sustainable Construction Charter**, which has since received extensive support from 160 organisations across the value chain, underlining the industry's commitment to sustainable development. The charter sets a framework for responsible business conduct and serves as a guide for promoting sustainable practices within the construction industry.

By attracting such a wide range of participants and creating a platform for collaboration and knowledge transfer, the GCSFE showcased the industry's dedication to sustainable development and demonstrated the potential for driving positive change within the construction sector.

CIC Sustainable Construction Award
建造業議會可持續建築大獎

CIC Sustainable Construction Award

In 2018, the CIC launched the Sustainable Construction Award to help **develop a culture of sustainable construction in Hong Kong**. The award recognises the best sustainability practices among organisations and practitioners, including the younger generation in the construction industry. It also encourages continuous improvement and fosters industry collaboration on sustainable construction for Hong Kong.

In line with the evolving digitalisation landscape, a special accolade, the Smart Sustainability Award, was introduced in the 2023 edition. This prestigious recognition pays tribute to organisations with exceptional prowess in leveraging digitalisation to advance construction sustainability. These visionary organisations have showcased outstanding performance in developing smart and sustainable solutions, harnessing the power of technology to create positive environmental and social impacts within the construction industry.

CIC Sustainable Finance Certification Scheme
建造業議會可持續金融認證計劃

CIC Sustainable Finance Certification Scheme

Unlocking the potential of sustainable finance and empowering the construction industry, the CIC Sustainable Finance Certification Scheme (SFCS) is a revolutionary step for Hong Kong and the Greater Bay Area. This innovative scheme is designed to seize the opportunities presented by sustainable finance and propel the industry towards sustainable construction practices, while reaping the benefits of financial incentives and market exposure.

Since the launch of the SFCS in 2021, over 60 engaging and informative sessions have been conducted, targeting

BUILDING MOMENTUM IN HONG KONG'S CONSTRUCTION INDUSTRY

industry stakeholders and professionals from the financial and construction sectors. This initiative has proved instrumental in raising awareness and deepening understanding of sustainable finance among diverse stakeholders. By bridging the knowledge gap, the scheme empowers industry players to embrace sustainable finance and contribute to a greener future.

In a significant step towards promoting sustainable construction and fostering green finance, the CIC solidified its commitment in 2023 by **signing an MoU with the Bank of Communications (Hong Kong)**. This strategic partnership has established a platform for collaboration that will drive sustainable practices and integrate green finance principles into construction projects. It not only signals a strong commitment by the industry but also paves the way for transformative change.

Supported by over 80 organisations, including financial institutions, industry associations and professional bodies, the SFCS enjoys widespread backing from key industry players. It offers financial incentives which encourage the growth of green capital, while independent third-party conformity assessments instil stakeholders' trust in the certification process. It also creates opportunities for businesses to expand their horizons in alignment with Hong Kong and Greater Bay Area policies, opening doors to new markets and projects. Additionally, the SFCS enhances the capability and credibility of companies and their supply chains, positioning them as leaders in sustainable construction.

Carbon Neutrality Directional Guideline

In 2023, the CIC completed a significant undertaking: the **Carbon Neutrality Strategy Study for the Hong Kong Construction Industry**. The study identified three key decarbonisation directions that will guide the industry forwards to achieving carbon neutrality, namely Construction Site Electrification and Clean Energy Adoption; Reduction of Construction and Demolition (C&D) Waste; and Wide Adoption of High Productivity Construction and Digitalisation.

The CIC has committed to taking further proactive steps in 2024 to actively drive the industry's transition towards carbon neutrality. Specifically, the feasibility of implementing Construction Site Electrification and Clean Energy Adoption will be explored and assessed. This initiative is aimed at reducing carbon emissions by transitioning construction sites to cleaner and more sustainable energy sources, providing guidance to the industry on the recommended pace, strategies and actions to realise the transition .

The move towards Construction Site Electrification and Clean Energy Adoption aligns with global efforts to combat climate change and reduce reliance on fossil fuels. Through research, pilot projects and collaboration with industry stakeholders, the CIC will evaluate the technical, economic and operational aspects of adopting clean energy and electrification on construction sites. This assessment will result in the development of reference materials and best practices for implementing these sustainable practices.

Smart Waste Management Tool
建築廢料智慧管理工具

CIC Smart Waste Management Tool

The Smart Waste Management Tool (SWMT) is a web application developed by the CIC over the past two years. Its purpose is to **digitalise the management of construction and demolition (C&D) waste data**. By streamlining the input, analysis, verification and storage of data on waste, the SWMT offers numerous benefits to the industry.

One immediate advantage is the reduction of manpower and paper usage. By eliminating manual data entry and paperwork, the SWMT enhances the efficiency, accuracy and transparency of waste data management. This saves time and resources and contributes to a more sustainable and environmentally friendly approach.

By collecting and analysing data on waste disposal, recycling rates and waste types, the tool provides industry practitioners with a benchmark to assess their waste management practices. This in turn enables the industry to identify areas for improvement and optimise waste disposal processes, ultimately leading to a reduction in carbon emissions associated with waste generation and disposal.

The soft launch of the SWMT in the first half of 2024 represents a significant milestone in further supporting the industry's efforts towards sustainable waste management practices. With its digitalisation capabilities and data-driven approach, the SWMT will become a valuable tool in driving positive change and enhancing sustainability in the construction industry.

BUILDING MOMENTUM IN HONG KONG'S CONSTRUCTION INDUSTRY

CIC Carbon Assessment Tool
建造業議會碳評估工具

CIC Carbon Assessment Tool

The CIC Carbon Assessment Tool (CAT) is a web-based platform launched in 2019 to evaluate the carbon performance of construction projects in Hong Kong. Its primary objective is to provide a standardised method for measuring and assessing the carbon footprints of local projects, enabling practitioners to identify areas for improvement and implement reduction measures.

In 2023, the CAT platform underwent significant upgrades to enhance user-friendliness and expand its database. It also became more accessible and intuitive for industry practitioners, making navigating and using its features easier. Additionally, the CAT database was **expanded to include the local carbon emission factors of nearly 2,000 construction materials**, providing users with a more comprehensive and up-to-date data set.

Expanding the CAT database allows for more accurate and detailed assessments of carbon performance in construction projects. With access to a broader range of carbon emission factors, practitioners can make informed decisions on the best materials to be use.

By utilising the upgraded CAT, industry professionals can effectively measure their projects' carbon footprints, analyse their carbon performance, and establish targets for carbon reduction.

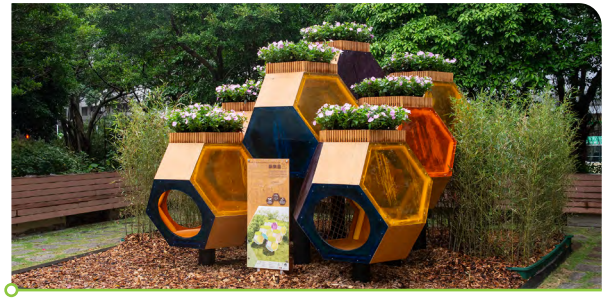
CIC-Zero Carbon Park

Since its opening in 2012, Hong Kong's first zero carbon building, the CIC–Zero Carbon Park (CIC-ZCP), has been serving as a test bed for state-of-the-art eco-building design. Its technologies and functions as an exhibition, education and information centre are continually optimised. The CIC-ZCP raises awareness of the importance of green building design both locally and internationally, with the aspiration of elevating the public's ecological values and promoting a low carbon lifestyle. In 2023, the CIC-ZCP **achieved a Final Platinum rating under the BEAM Plus Existing Buildings V2.0 Comprehensive Scheme**.

The MiC Play Unit 2.0, installed at the CIC-ZCP in November 2022, features the Modular Integrated Construction (MiC) concept which uses component prefabrication technology to provide ready-made components and thus facilitate the installation process. It also showcases the industry's dedication to the application of cutting-edge technology.

A CIC-ZCP STEAM Lab has also now been launched to promote STEAM education and emphasise its importance to future scientific and technological developments, with the aim of inspiring and supporting the development of the next generation. It serves as an educational platform, offering guided tours to explore innovative construction techniques and industry knowledge. It also cultivates future cross-disciplinary talent with essential skills in construction innovation to pursue carbon neutrality.

CIC-Zero Carbon Park



MiC Play Unit 2.0

STEAM Lab

Leading Hong Kong's Transformation: The CIC

ACCELERATING MOMENTUM IN ADVANCED TECHNOLOGIES TO ACHIEVE LONG-TERM INDUSTRY GOALS

CONSTRUCTION INDUSTRY COUNCIL 建造業議會

Digitalisation Roadmap

The CIC is working with experts and key industry stakeholders to promote digitalisation in Hong Kong's construction industry. The Construction Digitalisation Roadmap was launched at the CIC Construction Digitalisation Award Presentation Ceremony in November 2021.

A Construction Digitalisation Dashboard and six high-value digital application areas were introduced during this event, namely Smart Data Sharing, Smart Planning and Design, Smart Submission with BIM, Smart Offsite Fabrication and Delivery, Smart Site Management, and Smart Asset and Facility Management. Each area focuses on leveraging digital technologies to enhance efficiency and productivity in the construction industry.

The roadmap also outlines strategies to support construction digitalisation and sets five Key Performance Indicators (KPIs) that the industry aims to achieve by 2026. These KPIs serve as benchmarks to measure the progress and success of digitalisation efforts within the construction sector.

By launching the Construction Digitalisation Roadmap and setting clear goals, the CIC aims to drive the adoption of digital technologies, improve collaboration, and transform the construction industry in Hong Kong.

CIC Digital Twin Hub

The CIC established a CIC Digital Twin Hub in 2023 to accelerate construction digitalisation and promote the use of digital twin technology – the creation of an exact and permanent digital model of a project – in the industry. A transformation of the previous CIC BIM Space, this hub is a collaborative platform and technological showcase to facilitate knowledge exchange, talent development and innovation in digital twin and construction technology.

The CIC Digital Twin Hub comprises four key areas:

Showcase Area - This features displays and demonstrations of digital twin applications in the construction industry. It showcases digital twin technology's potential and benefits, allowing industry professionals to explore its various applications and gain insights into its practical implementation.

Smart Site Construction Management Corner - Here visitors can learn about integrating digital twin technology with site construction management. It highlights how digital twin models can enhance construction processes, improve project co-ordination, and optimise resource allocation on construction sites.

Multi-purpose Area - This area can host various activities, including digital twin experience discussion forums, group guided tours, and advisory workshops. It provides a platform for industry experts, practitioners, and researchers to collaborate, exchange ideas, and share their experiences using digital twin technology.

Digital Twin Lab - This is a dedicated space for research, development and experimentation with digital twin technology, which allows industry professionals and researchers to explore and test innovative applications, develop new methodologies, and advance the technology's capabilities in the construction industry.

Through the CIC Digital Twin Hub, the CIC aims to promote the adoption and understanding of digital twin technology, foster collaboration and knowledge sharing among industry stakeholders, and drive innovation in the construction sector.

Master Class Series

The CIC has taken steps to promote sustainability and technological advancement in the construction industry. In February 2023, it launched a flagship course called the "Master Class on AI for Construction". This course is aimed at equipping industry professionals with the knowledge and skills to embrace artificial intelligence (AI) and related advanced solutions, including natural language processing, machine learning, computer vision and robotics. By integrating these technologies into construction projects in Hong Kong, the industry can achieve greater efficiency and innovation while reducing environmental impact.

Additionally, the CIC continues to offer highly sought-after Master Classes on Construction Digitalisation. A milestone was marked in April 2023 with the successful completion of the second cohort of the Master Class on Common Data Environment (Project Managers), with over 70 participants having graduated since the programme's launch in 2022. Looking ahead, the CIC plans to integrate this Master Class with the Master Class on Common Data Environment (Digital Twin), thereby providing participants with a comprehensive understanding of the entire process and allowing them to explore the synergies between project management and digital twin technologies.

ACCELERATING MOMENTUM IN ADVANCED TECHNOLOGIES TO ACHIEVE LONG-TERM INDUSTRY GOALS

Construction Digitalisation Charter

Since its launch in late 2022, the Construction Digitalisation Charter has garnered the support of around 200 organisations, all committed to collaborating with the CIC in achieving the visionary goal of "Smart Construction Empowered by Digitalisation". This ambitious vision is aimed at streamlining and digitalising all processes involved in the life cycle of built assets to continuously improve productivity and safety during project planning, design, construction and operation, optimising sustainability for better quality of life. The charter is in alignment with the Government's objectives and sets forth ambitious targets in such areas as Building Information Modelling (BIM), Common Data Environment (CDE), and the use of digital tools for site supervision and monitoring.

Through various formats and events, the Construction Digitalisation Charter actively promotes and encourages the adoption of digitalisation within the industry. One notable example was a Business Matching event organised by the CIC in collaboration with Cyberport, providing a valuable platform for construction organisations to connect with technology innovators and explore potential collaborations. Additionally, coaching sessions were conducted in sponsorship with SBI, enabling participants to tailor and review their company's digitalisation roadmap while gaining insights from global experiences. Regular webinars and discussion sessions are also being hosted to maintain the charter programme as a common ground for pledgees to work collectively towards its set goals.

Construction Innovation and Technology Fund

The Construction Innovation and Technology Fund (CITF) is instrumental in supporting the local construction industry in Hong Kong in its journey towards transformation and improvement in productivity, quality, safety and environmental performance. The fund is focused on promoting automation, digitalisation and industrialisation within the industry. As of 31 December 2023, cumulative funds granted had reached HK$1,109M, surpassing the initial Government injection of HK$1,000M.

In 2023, the annual grant amount reached a record high of HK$313M, indicating the increasing support provided by the CITF since its launch in October 2018. **The fund provides support under six categories, namely BIM, Advanced Construction Technologies (ACT), MiC, Prefabricated Steel Rebar, Industrialised Process – Robotic Welding, and Manpower Development**.

To encourage wide adoption of innovative construction technology, the CITF has approved over 15,304 training places for BIM and other construction-related technologies, benefiting professionals, technicians and students in the industry. The fund has undergone enhancements to facilitate technology adoption, including increasing the per-applicant fund ceiling under the BIM and ACT categories, providing additional funding for innovative and high-rise MiC projects, and simplifying application and disbursement procedures.

RAISING STANDARDS AND NURTURING TALENTS

CIC and Higher Education Institutions Collaborate to Drive Transformation in the Construction Industry

In 2017, the CIC signed a Memorandum of Understanding (MoU) with 12 higher education institutions in Hong Kong to foster a five-year collaboration on introducing BIM content into their education curricula and equipping students with necessary knowledge of BIM and construction digitalisation before joining the construction industry.

Under the MoU, various activities were organised to advance BIM and construction digitalisation education. Task group meetings were held to facilitate the sharing of information and ideas on developing BIM and digitalisation courses. Complementary educational activities, such as a CIC BIM Competition, provided students with practical opportunities to apply their knowledge and skills.

An annual survey on BIM education in universities and higher education institutions was conducted to gather valuable insights into the current state of BIM training. A BIM Training Common Framework has now been developed to provide standardised materials and core subject contents for institutions teaching BIM courses.

These initiatives have significantly contributed to fostering collaboration between the CIC and higher education institutions, improving BIM education, and ensuring that students have a comprehensive understanding of BIM and construction digitalisation concepts. With BIM integrated into their curricula, students are better prepared to contribute to the construction industry and apply digital technologies effectively.

CIC Beginner's Guide on Construction Digitalisation

To assist the industry, particularly SMEs, in enhancing their capabilities and embracing new technologies, the CIC published three English versions of the CIC Beginner's Guide on Construction Digitalisation in November 2022.

- "CIC Beginner's Guide on Construction Digitalisation - Smart Site Digital Platform" provides information on the essential functionalities of a digital platform for managing construction projects. Its aim is to support the industry in adopting smart site technologies.
- "CIC Beginner's Guide on Construction Digitalisation - Adoption of BIM in Small and Medium Enterprises" offers step-by-step guidance for SMEs on adopting BIM, including setting up a BIM team and the hardware and software requirements to satisfy project needs.
- "CIC Beginner's Guide on Construction Digitalisation - Adoption of Common Data Environment (CDE) for Information Management using BIM" provides practical advice on selecting a CDE as an information management and collaboration tool for BIM projects for Clients (Appointing Parties), Lead Consultants, and Main Contractors (Lead Appointed Parties) who have no or little experience in CDE adoption.

To widen accessibility of these publications, the CIC released a Chinese version of the "CIC Beginner's Guide on Construction Digitalisation - Adoption of BIM in Small and Medium Enterprises" in March 2023.

Empowering ESG and Innovation: CIC and Cyberport Join Forces to Transform Construction Industry

The CIC recently formalised its commitment to foster innovation by signing a strategic MoU with Cyberport. This collaboration is aimed at bridging the gap between cutting-edge technology start-ups and the construction sector.

Multi-To-Multi Construction Digitalisation Meet-Up Event in 2023

Leading Hong Kong's Transformation: The CIC

RAISING STANDARDS AND NURTURING TALENTS

CONSTRUCTION INDUSTRY COUNCIL 建造業議會

The CIC proactively conducted an industry-wide survey in 2023, gathering valuable insights into pain points faced by construction professionals. Armed with this data, the CIC engaged with tech start-ups within the Cyberport ecosystem, sharing survey results and seeking innovative solutions. The goal was to revolutionise the way the construction industry operates. In August 2023, the CIC and Cyberport co-hosted the highly anticipated **Multi-To-Multi Construction Digitalisation Meet-up**. Over 30 construction companies and 70 industry experts participated, resulting in more than 100 targeted matchmaking sessions. These sessions connected 35 Cyberport community members, encompassing a diverse array of tech start-ups, with construction industry leaders.

CIC Research and Technology Development Fund

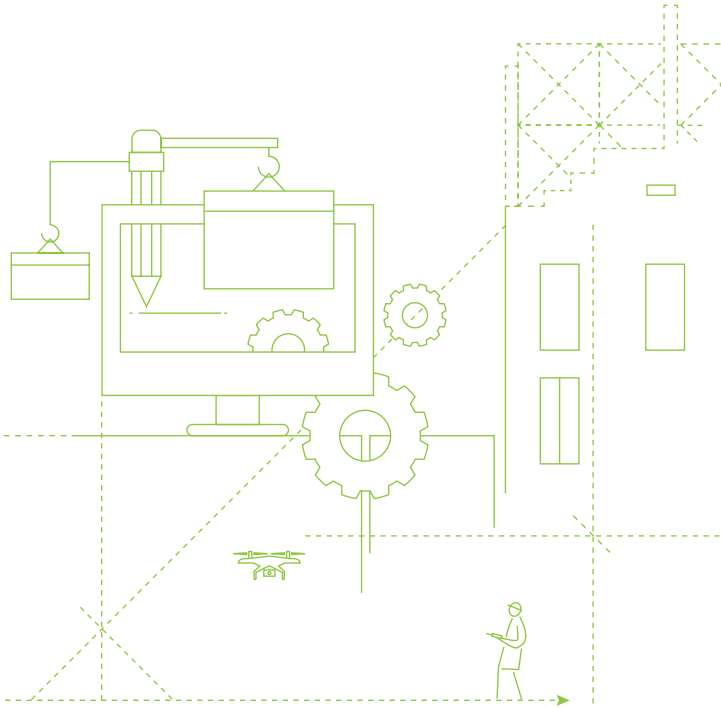
The CIC established the Research and Technology Development Fund (CIC R&D Fund) in 2013 to **provide financial support for research projects, with a focus on practical applications** in key areas such as BIM, Construction Procurement and Project Management, Construction Productivity, Construction Safety, and Green Construction.

Since its inception, the CIC R&D Fund has supported 24 research projects related to Green Construction and Construction Sustainability, with total funding of HK$30.8 million. These projects have covered such diverse areas as renewable energy applications, carbon-saving technologies, green construction materials, construction and demolition waste recycling, high-productivity construction, and construction digitalisation. Some remarkable research outcomes have already been yielded from these projects, and even more impactful results are anticipated in the coming year.

One noteworthy project under the CIC R&D Fund is the development of a unified sustainability platform called the Common Data Environment (CDE). Led by BSL's research team, this platform will integrate green assessment and BIM data, providing a comprehensive solution for sustainable construction practices. It is expected to be completed and launched in the fourth quarter of 2024.

Additionally, the CIC R&D Fund has supported the development of seismic design guidelines for MiC by The Hong Kong Polytechnic University. This initiative is aimed at enhancing construction sustainability by adopting off-site fabrication methods.

To facilitate knowledge sharing and promote project deliverables, the CIC organises an annual R&D Forum, allowing researchers to showcase their accomplished project outcomes. This fosters a culture of construction research knowledge sharing, contributing to the overall enhancement of industry sustainability.



Leading Hong Kong's Transformation: The CIC

SEIZING MAINLAND OPPORTUNITIES

Mainland Liaison Services

The CIC established the Mainland Liaison Services (MLS) Department in 2022 to enhance the integration of Hong Kong's construction industry into the nation's development. The MLS carries out a range of responsibilities to achieve these objectives:

- **Facilitating Business Opportunities**: Assisting the Hong Kong construction industry in establishing connections and expanding business opportunities in the Greater Bay Area.
- **Promoting Exchanges and Co-operation**: Facilitating exchanges, co-operation and field visits between the construction industry in Hong Kong and relevant enterprises and institutions in the Greater Bay Area.
- **Staging Seminars and Exhibitions**: Organising seminars and participating in industry exhibitions to facilitate trade between the two regions and helping practitioners stay updated on the latest industry developments.
- **Providing Policy Information and Advice**: Supplying the Hong Kong construction industry with policy information related to the Greater Bay Area and offering advice on business matters, including company registration.
- **Optimising the Supply Chain**: Assisting Hong Kong's construction industry to optimise the supply chain for enhanced construction efficiency.
- **Strengthening Training Co-operation**: Liaising with construction training institutions in both regions to exchange views, strengthening co-operation on worker training and institutional management, and exploring collaboration on training content. Teacher exchanges between the two locations are also promoted.

The China Con-Tech Development and the Future of Hong Kong Construction Industry forum was hosted in August 2023

Between 1 July 2022 and 31 January 2024, the MLS team successfully organised five forums and expositions. One major event was the China Con-Tech Development and the Future of Hong Kong Construction Industry forum on 9 August 2023, which brought together 23 leading experts from the construction industry in Mainland China and Hong Kong to discuss the latest construction technology in the Mainland and explore development opportunities for the local construction industry. The forum was aimed at facilitating high-level industry exchange, fostering collaboration, and creating new business opportunities.

The MLS team actively organised courtesy visits to over 70 organisations, including institutes, associations and businesses.

Leading Hong Kong's Transformation: The CIC

SEIZING MAINLAND OPPORTUNITIES

The first signature course was held In September 2022

Their aim is to gradually expand the network of liaison with the Mainland and foster stronger connections and collaborations to strengthen talent-matching initiatives, facilitate the exchange of innovative ideas and technologies, and improve the efficiency of the supply chain within the construction industry.

Two signature courses on National Affairs for Construction Young Persons were organised under MLS in September 2022 and June 2023 at the Chinese Academy of Governance in Beijing to deepen participants' understanding of mainland development and cultivate a sense of belonging among Hong Kong construction industry professionals.

A second signature course was held in June 2023 at the National Academy of Governance in Beijing

The Representative Office of CIC (HK) in Guangdong was officially opened on 24 July 2023. It serves as a valuable resource for the Hong Kong construction industry, assisting in establishing business connections, exploring opportunities, and ultimately building a comprehensive construction supply chain in the Greater Bay Area in the future.

The grand opening of the CIC's Mainland Liaison Office

EXPERT INSIGHTS ON HONG KONG'S CARBON NEUTRALITY ROADMAP

ADVANCING HONG KONG'S GREEN BUILDING LEADERSHIP: A VISION FOR THE FUTURE

Ir Dr Conrad WONG

Ir Dr Conrad WONG has been a member of the Hong Kong Green Building Council (HKGBC) since its establishment and served as Chairman for 4 years since 2012. As a successful entrepreneur, Ir Dr WONG has not only been involved in Council's works, but also actively contributed to the Council's efforts in elevating the prominence of green building initiatives on the international arena. In recent years, his contribution has extended beyond the construction sector. As the Chairman of the Council of the Hong Kong Metropolitan University and appointed by the Government to the high-level Green Technology and Finance Development Committee, he recognises the importance of leveraging Hong Kong's talent pool to accelerate the development of specific timetables for the green industry. He also advocates for more industry experts to contribute ideas and support young technology startups, thereby strengthening the entire industry.

LEVERAGING HONG KONG'S GREEN BUILDING ADVANTAGES

The board members of the CIC and HKGBC mostly consist of outstanding professionals from various fields, including architects, engineers, surveyors, and urban planning experts. Their valuable insights have significantly contributed to advising the Government on green building policies. During Ir Dr WONG's tenure leading the HKGBC, Hong Kong achieved significant milestones in green building development, positioning itself at the forefront of the international stage. Moreover, many developing countries and also the Mainland have taken reference from Hong Kong's green building standards. Hong Kong's high standards in green building have therefore positively influenced other regions, such as through the high download rates of the HKGBC Retrofitting Guidebook and HKGBC Climate Change Framework For Built Environment by numerous regions across the globe. These milestones have, to some extent, guided and impacted global development in green building. Drawing from his extensive industry experience, Ir Dr WONG identifies three key factors contributing to Hong Kong's success in green building:

1. Strong foundations in social environment, levels of education and integrity of the legal system: these three pillars provide a solid foundation for green building initiatives, resulting in far-reaching effects.
2. Recognised professional organisations as part of the social infrastructure: many top professionals in the Asia-Pacific region, including management, architects, engineers, surveyors and industry elites, have joined the CIC and HKGBC.
3. Government collaboration: direct communication between the Government and these professional organisations facilitates effective collaboration, driving green building solutions to industry challenges.

Ir Dr WONG encourages the industry to fully utilise Hong Kong's advantages and actively promote green building, thereby empowering the green industry to grow stronger.

> "Strong foundations in social environment, levels of education, and integrity of the legal system are the three pillars that form a solid foundation for green building initiatives, leading to far-reaching effects."

EXPERT INSIGHTS ON HONG KONG'S CARBON NEUTRALITY ROADMAP

FORESIGHT FOR FUTURE TRENDS IN HONG KONG'S GREEN BUILDING

Currently, Ir Dr WONG serves as a member of the Green Technology and Finance Development Committee. Through his involvement he recognises Hong Kong's historical advantages in green building and the mature financial market's ability to channel funds towards environmental projects, including green buildings and infrastructure. However, he also identifies the existence of gaps and pain points in the green building sector, especially in existing buildings.

Ir Dr WONG identifies, "One critical challenge is linking green finance, Environmental, Social, Governance (ESG), and green building efforts to create synergies. It would require joint efforts from the industry and Government to drive green finance development, provide additional support, and implement relevant incentives, making green buildings more attractive."

DUAL APPROACH: RENOVATING EXISTING BUILDINGS AND ENHANCING ENERGY DISCLOSURE

Ir Dr WONG has a bold suggestion to make to the Government, "It can learn from its experience of allocating HK$10 billion to replace diesel commercial vehicles in order to improve air quality in Hong Kong. A similar approach can be applied to enhancing green buildings. Currently, there is a substantial number of existing buildings in Hong Kong that could greatly benefit from renovations to meet green building standards."

He recommends that banks introduce green mortgages specifically for renovations in existing buildings. For instance, if an owner uses their property as collateral for a mortgage loan and completes renovations that meet certain green standards, the interest rate could be reduced by 0.5%. At the same time, he hopes that the banking industry will support sustainable development initiatives.

As a staunch advocate for policies promoting transparency in energy consumption for buildings, Ir Dr WONG emphasises the significance of commercial or residential building owners disclosing information about their energy usage to potential buyers, tenants, or lenders. He believes, "This disclosure plays a crucial role in determining the economic value of the property. In order to identify the energy efficiency status of each building more effectively, it is essential to mandate building owners to collect and provide energy usage data. This serves as a vital step towards prioritising energy efficiency upgrades in buildings." He would suggest starting with commercial buildings and gradually expanding based on building classifications, ensuring a sector-by-sector approach to its implementation.

NURTURING GREEN STARTUPS AND BUILDING A SUSTAINABLE FUTURE

Ir Dr WONG believes that the Government could assist local startups in entering the green building industry through research and development of green technologies. One viable approach is to incorporate elements of innovation, energy-saving, and building maintenance into the project tendering system. This would encourage more startups to develop technology applications for green buildings and boost the industry. Ir Dr WONG enthuses, "The Government can create an environment where green technological startups can successfully list on the Growth Enterprise Market (GEM), demonstrating to Hong Kong's youth that technology can help them achieve their goals and find hope in life!"

Additionally, Ir Dr WONG emphasises that support for the development of the green building supply chain for young startups is essential for their survival. For instance, incorporating Modular Integrated Construction (MiC) and Multi-trade Integrated Mechanical, Electrical and Plumbing (MiMEP) into transitional housing units under the Hong Kong Housing Authority would allow startups to participate in the supply chain, benefiting both parties.

In conclusion, Ir Dr WONG firmly believes that by collectively addressing climate change challenges and providing a platform for experts from various fields to envision a sustainable future, we can integrate sustainable solutions into construction activities. This complex and challenging task requires unwavering determination, innovative solutions, and collaborative partnerships to embrace future opportunities.

Public and Industry Projects

EXPERT INSIGHTS ON HONG KONG'S CARBON NEUTRALITY ROADMAP

THE GOVERNMENT, BUSINESS AND ACADEMIA COLLABORATE TO PROMOTE GREEN BUILDINGS

Prof. Christine LOH

Collaboration among all stakeholders is essential to promote the development of green building practices. The shortlisted projects showcased in this chapter demonstrate many efforts made by the Government, business community, and academic sector to advance sustainable building practices. Among the key figures leading the way is Professor Christine LOH, who not only serves as a "super connector" but also bridges the gap between stakeholders. She helps to facilitate communication and coordination, empowering diverse sectors of society to unite and collectively address climate change and sustainability challenges.

Prof. LOH currently serves as the Chief Development Strategist at the Institute for the Environment at the Hong Kong University of Science and Technology (HKUST). Since the 1980s, she has been active in politics and public policy. She was a legislator, and Under Secretary for the Environment in the HKSAR Government from 2012 to 2017 and was the Special Consultant to the Chief Executive on the Mainland's ecological civilisation policy from 2019 to 2020. With a wealth of experience in business, politics, policy and non-profit work, Prof. LOH believes collaboration across various sectors is essential for Hong Kong to achieve the goal of carbon neutrality by 2050.

ESTABLISHING CROSS-SECTOR COLLABORATION TO HELP STAKEHOLDERS' DECISION-MAKING

As global warming intensifies, extreme weather events such as prolonged heat waves, heavy rainfall, and more frequent typhoons remind us that we must pay greater attention to environmental protection. In response, both the Government and businesses are actively promoting sustainability in Hong Kong. Prof. LOH is a strong advocate for sustainable development locally and globally. She believes decarbonising existing buildings holds an important key to decarbonising highly urbanised cities.

Prof. LOH promotes a cross-sector approach that brings together the Government, businesses, financial services, professionals and non-governmental organisations (NGOs) to explore ways to retrofit Hong Kong's buildings for both socio-economic development and to improve the wellbeing of the people. Recently, Prof. LOH and her colleagues at HKUST developed a 3D visualisation digital tool to help stakeholders make decisions about decarbonising existing buildings. HKUST collected and scraped data to estimate energy utilisation in different types of buildings in Hong Kong to determine what decarbonisation potentials there might be and to stimulate discussion among building owners, built environment professionals, financiers and Government to discuss how capital could be raised for retrofits at scale. Prof. LOH believes the technologies and

> "There's an English saying, 'You are leaving a lot of loose change on the table.'
>
> When you see an opportunity, you should seize it and not let it go to waste."

EXPERT INSIGHTS ON HONG KONG'S CARBON NEUTRALITY ROADMAP

know-how already exist but there must be clear policy support and industry-wide ambition to retrofit Hong Kong's buildings at scale to decarbonise the city. Cooperating with financiers is also vital for private sector capital to be released to implement retrofits, which is why cross-sector dialogue among all stakeholders is essential. She hopes the 3D visualisation tool could help.

THE GOVERNMENT SHOULD USE ITS CONVENING POWER TO ATTRACT TALENT AND SOLICIT IDEAS

Prof. LOH further explains governments have enormous convening power, which should be seen as a policy "freebie". She explains that people are happy to engage with the Government to identify problems and find solutions. She says, "By bringing together experts from different sectors, including policy, business, professionals, financiers, and NGOs, the Government can help all sectors to co-learn and explore collaboration with the aim of making Hong Kong a global green finance and green tech hub." From Prof. LOH's perspective, the Government can use its convening power to identify innovative solutions and build consensus although it does take time and skill to design the right kind of convening platform and dialogue but the time spent is well worth it.

TURNING CRISIS INTO OPPORTUNITY: SOLVING THE RENOVATION DILEMMA & DECARBONISE CONCURRENTLY

A major socio-economic challenge in Hong Kong is ageing buildings that have not been properly maintained. Many of them represent opportunities – retrofit and renovation of existing buildings could spur economic development and improve wellbeing of the people at the same time. The challenge is to find ways to release capital to fix the problem and decarbonise the city concurrently.

Prof. LOH proposes to identify the potential for energy saving in existing buildings and improving the wellbeing of the occupants as drivers for innovating on capital raising for retrofits. Alongside reducing energy usage, retrofits can reduce humidity and improve indoor air quality at the same time, which result in health and wellbeing benefits that have not been included in considering the overall benefits. Moreover, by promoting retrofits, which can also include improving water efficiency, reducing noise, and improving lighting, green tech/green construction could be widely applied, making Hong Kong a true green tech hub as the city has large business potentials in buildings. Creating such an environment would unlock the potential value of the city's existing buildings. Prof. LOH stresses, "This is a pivotal moment as we enter the climate era, and we must seize it!"

ANALYSING ESG DATA FOR BUSINESS OPPORTUNITIES

The disclosure of climate-related risks has become common in more advanced economies. The financial regulators in Hong Kong have already adopted such policies for listed companies and banks. The purpose of disclosure is to inform investors about such risks. Prof. LOH observes that the requirement for Environmental, Social, and Governance (ESG) reporting is also impacting non-listed companies because they are being asked to disclose data by their clients, bankers, and investors. She reveals that Hong Kong's Securities and Futures Commission and Hong Kong Monetary Authority asked HKUST to create a carbon calculator for SMEs, as well as a benchmarking carbon estimator for investors. These tools were launched in February 2024, and they can be seen as part of Hong Kong's green finance toolkit, which includes green bonds, green lending, and carbon credits, plus green leasing in the property sector. Prof. LOH urges the Government to promote the use of the carbon calculator/estimator to SMEs through a campaign to engage SMEs.

HONG KONG TO CULTIVATE GREEN FINANCIAL TALENTS TO EXPAND ITS EDGE

Prof. LOH observes that the pursuit of sustainability in the climate era requires a "revolution" in how we do everything. Saving resources and practising circular economy requires a new mindset backed-up by implementation skills, including in the finance sector because very large sums of capital need to be directed towards green projects. These skills need time to develop. She suggests the Government should allocate resources for green finance research, such as in new intellectual areas like taxonomies, as well as promote local talent to specialise in such areas so that Hong Kong could truly be a hub of new thinking and knowledge. Prof. LOH concludes that continuous investment in talent development and thought leadership is essential to maintain Hong Kong's competitive edge.

Government

CENTRAL KOWLOON ROUTE - BUILDINGS, ELECTRICAL AND MECHANICAL WORKS (CENTRAL KOWLOON ROUTE ADMINISTRATION BUILDING)

Project Team

Project Name	Central Kowloon Route - Buildings, Electrical and Mechanical Works (Central Kowloon Route Administration Building)
Team or Organisation Name	Highways Department
Name of Owner / Developer	Highways Department
Project Manager	Highways Department
Main Contractor	Gammon Construction Limited
Architect	Hassell Limited
Civil & Structural Engineer	P&T Architects and Engineers Ltd
Building Services Engineer	AECOM Asia Company Limited
Landscape Architect	Hassell Limited
Sustainable Design Consultant	Ramboll Hong Kong Limited

https://ckr-hyd.hk/

Background

The Central Kowloon Route - Administration Building (ADB) stands as a testament to the Government's commitment to building a green, sustainable city and community.

Through an integrated design and construction management approach, the ADB embraces smart technologies to consolidate performance data and enhance operational management. Its digital management interface and occupant engagement platform enable the facility management team to analyse data and enhance their connection with building users, ensuring a high-performance, sustainable building that meets the city's built environment vision.

Three Key Features Demonstrating the Sustainability Performance

- Energy-efficient building practices
- Innovative construction management
- Indoor environmental quality enhancements

To combat the challenges posed by climate change and adapt to them effectively, the project team incorporated a variety of measures that will enhance the climate resilience of the ADB. For instance, detailed Life Cycle Costing was conducted to investigate design options for interior lighting and air-conditioning systems. By forecasting operational and maintenance conditions at the 50th year for each option, the team were able to implement the ADB design with the lowest life cycle cost, which will reduce carbon emissions and help mitigate climate change.

Government

CENTRAL KOWLOON ROUTE - BUILDINGS, ELECTRICAL AND MECHANICAL WORKS (CENTRAL KOWLOON ROUTE ADMINISTRATION BUILDING)

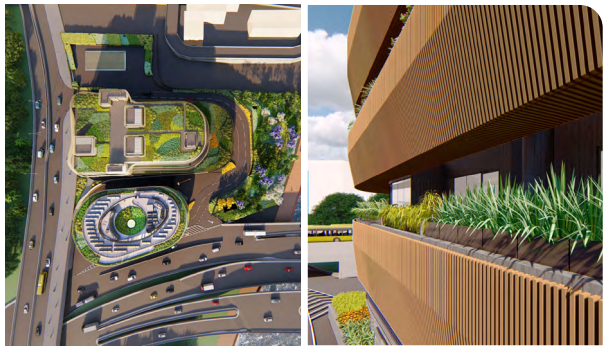
"The Central Kowloon Route strives to reduce its impacts on the environment and improve environmental quality throughout its planning, design and construction stages. We are committed to building a greener and better Hong Kong."

HUI Tung Sing,
Architect, Central Kowloon Route,
Highways Department, The Government of the HKSAR

Green Design

The design of ADB also emphasises building sustainability that extends well beyond the construction phase. To minimise the impact on the surroundings due to building surface reflectance, roof and façade materials with low visible light reflectance have been selected. In addition, noise mitigation measures have been implemented such as selecting air-conditioning equipment with low sound levels and installing silencers in the air duct.

A thorough Life Cycle Assessment was conducted for ADB to study the embodied carbon generated by different building structural design schemes. This analysis helped the project team select a structural design with high efficiency using low-carbon materials, which reduces environmental emissions. Furthermore, sustainable building materials



were selected to minimise the building's environmental impact, including concrete with high recycled content and green products certified under the HK G-Pass.

Energy Efficiency and Conservation

Reducing energy use in buildings is a critical focus area for a sustainable city and community. ADB features high-performance air-conditioning and lighting systems that exceed the prevailing EMSD guideline by over 30% and significantly reduce energy consumption and CO_2 emissions. The use of solar panels further offsets electricity consumption. These active strategies and passive designs, couple with optimised orientation, spatial planning and façade design have together contributed to reducing building heat gain and maximising daylight utilisation.

Water usage is another aspect that requires substantial attention. By installing water-efficient sanitary fixtures, savings of over 30% in potable water and 40% in municipal effluent discharge have been achieved compared with buildings of similar usage. Moreover, a rainwater harvesting system has been implemented at ADB and high-efficiency equipment used to minimise reliance on potable water for irrigation purposes.

Health and Wellbeing

In terms of enhancing the health and wellbeing of building users, ADB prioritises occupants' comfort and safety. Its HVAC system is designed to control relative humidity and prevent mould formation. In addition, a biophilic design has been embraced for ADB's office space, incorporating on-site greenery, indoor furniture designed with biomorphic forms and patterns, and large façade glazing to provide a connection to nature.

Smart Features

To promote sustainable construction practices, an innovative Smart Site Management Hub (SSMH) was implemented at ADB that streamlines project management, construction monitoring, site safety and sustainability. This system was recognised with the 2022 CIC Construction Innovation Award. By eliminating paperwork submissions, it is estimated that over 900kg of CO_2 has been offset, which has helped reduce the environmental impact of the construction process.

ADB stands as a shining example of how sustainable practices can be seamlessly integrated into a project's design, construction and future operations, by prioritising sustainable elements across various areas.

Government

CONSTRUCTION OF SAN SHEK WAN SEWAGE TREATMENT WORKS, ASSOCIATED SUBMARINE OUTFALL AND PUI O SEWERAGE WORKS

Three Key Features Demonstrating the Sustainability Performance

- Adoption of Innovative Construction Method and Enhance Impact Monitoring
- Ecological Conservation
- Waste Upcycling & Recycling

This project on the south of Lantau Island is surrounded by various villages and natural features. With the aim of helping to build a sustainable city and community, one of the main focus areas of the project team was minimising its impact on the surrounding environment by adopting various measures during the implementation phase.

An Innovative Two-way Horizontal Directional Drilling (HDD) construction method was adopted for the 1.4km submarine outfall from the sewage treatment works to reduce the marine and land ecological impact. The HDD method means that if adverse ground conditions are encountered on one side, drilling on the other side can keep progressing. This speeds up construction time and reduces the period of use of the construction plant, in turn reducing carbon emissions.

The marine works were enclosed by a silt curtain to mitigate the impact on marine life, while submersible drones were used for underwater inspection, which is safer than diver inspection and reduces carbon emissions. Additional water quality monitoring at Pui O Beach was carried out while marine works were being conducted to ensure the marine environment would not be greatly affected.

Project Team

Project Name	Construction of San Shek Wan Sewage Treatment Works, Associated Submarine Outfall and Pui O Sewerage Works
Team or Organisation Name	Kwan Lee – Chun Wo Joint Venture
Name of Owner / Developer	Drainage Services Department
Project Manager	Drainage Services Department
Main Contractor	Kwan Lee – Chun Wo Joint Venture
Architect	Binnies Hong Kong Limited
Civil & Structural Engineer	Binnies Hong Kong Limited

https://youtu.be/CO5XRU4FMhY
https://www.sswstw-dsd.hk/

Government

CONSTRUCTION OF SAN SHEK WAN SEWAGE TREATMENT WORKS, ASSOCIATED SUBMARINE OUTFALL AND PUI O SEWERAGE WORKS

"Teaching the next generation regarding sustainability is essential and critical for creating a more sustainable future."

Charles YEUNG,
Site Agent of the project,
Kwan Lee – Chun Wo Joint Venture

The new sewage pumping station is located near a wild cattle habitat. An ecological corridor for the cattle was established to protect them from the construction works. In total, the cattle were recorded as using the corridor 730 times in one year. This measure maintained the ecological connectivity between the village and the natural habitat.

Apart from mitigating the environmental impact of construction activities, the project team actively promoted its ecological significance in the local community. They co-operated with professionals and experts to facilitate the use of advanced technologies, so as to foster sustainable development and arouse public awareness. A seminar was organised at Bui O Public School, led by an ecologist from the Sustainable Biodiversity Conservation of Hong, to raise the ecological awareness of South Lantau residents and project staff. It was attended by more than 40 teachers, client's representatives and staff.

During the site clearance operation, felled trees were upcycled into useful materials like office furniture and souvenirs. Various energy saving measures were also applied (e.g. use of solar panels and electric cars) to minimise energy consumption. Carbon assessment tools were applied to integrate and analyse the carbon emissions of the project and ensure it could adapt effectively to the challenges posed by climate change effectively.

Several research projects have been supported by providing the felled tree samples to researchers at The University of Hong Kong (HKU) and The University of Science and Technology (HKUST). Also, a specialist from GREEN@ COMMUNITY was invited to lead a seminar on waste separation and recycling, which has raised waste recycling awareness among the project staff.

For the future operational phase, an environmental monitoring programme will be put in place to monitor various aspects of its environmental impact, in particular marine water, noise and air quality. This will ensure the effectiveness of the project's environmental mitigation measures and maintain its environmental sustainability.

Government

DESIGN, BUILDING AND OPERATION OF THE FIRST STAGE OF THE TSEUNG KWAN O DESALINATION PLANT

Three Key Features Demonstrating the Sustainability Performance

Enhances resilience of the fresh water supply by using strategic water sources not susceptible to climate change

Uses innovative technologies and renewable energy to reduce the project's energy consumption and carbon footprint

Blends the Tseung Kwan O Desalination Plant (TKODP) with its surroundings and neighbours thanks to detailed site planning

Project Team

Project Name	Design, Building and Operation of the First Stage of the Tseung Kwan O Desalination Plant
Team or Organisation Name	Water Supplies Department
Name of Owner / Developer	Water Supplies Department
Project Manager	Binnies Hong Kong Limited
Main Contractor	Acciona Agua, S.A. – The Jardine Engineering Corporation Limited – China State Construction Engineering (Hong Kong) Limited Joint Venture (AJCJV)
Architect	Binnies Hong Kong Limited
Civil & Structural Engineer	Binnies Hong Kong Limited
Landscape Architect	Binnies Hong Kong Limited
Environmental / Ecology Consultant	Binnies Hong Kong Limited
Others	M&E Engineer: Binnies Hong Kong Limited BEAM Plus Consultant: BeeXergy Consulting Limited

https://www.tkodesal.hk/

A reliable fresh water supply is of vital importance to sustaining Hong Kong's development and economic growth. Currently, Hong Kong's fresh water sources, comprising yield from local catchments and Dongjiang water imported from Guangdong Province, are both susceptible to climate change. Having regard to Hong Kong's increasing water demand resulting from a growing population and economic activities, and the possibilities of extreme dry weather caused by climate change, the city needs to develop a strategic water resource that is resilient to climate variations. To this end, the Government's Water Supplies Department initiated implementation of the Tseung Kwan O Desalination Plant (TKODP).

TKODP was commissioned at the end of 2023 and is the first municipal seawater desalination plant using reverse osmosis (RO) technology in Hong Kong to turn seawater into drinking water. The first stage of TKODP has a water production capacity of 135,000m³ per day with provision for future expansion to an ultimate capacity of up to 270,000m³ per day, which will meet around 5% to 10% of the city's overall fresh water demand.

In line with Government policies to promote sustainable development, the design of the TKODP incorporates various sustainable features, particularly in terms of integrating site planning, water and energy efficiency.

TKODP is located in a remote area adjacent to Clear Water Bay Country Park and the Fill Bank at Area 137 of Tseung Kwan O. It was designed to harmonise with the surrounding landscape, featuring over 30% greenery and a seafront plaza for the public. This thoughtful integration ensures that the plant blends well with the nearby environment.

Government

DESIGN, BUILDING AND OPERATION OF THE FIRST STAGE OF THE TSEUNG KWAN O DESALINATION PLANT

"WSD is committed to protecting the environment and mitigating the effects of climate change in providing its services through a series of energy conservation and green initiatives to enhance sustainability in water supply and environmental performance."

Antonio CHAN,
Chief Engineer/Consultants Management,
Water Supplies Department,
The Government of the HKSAR

"ActiDAFF" for pre-treatment is an integrated structure combining the flotation and filtration processes which minimises the footprint of the plant, thereby reducing its construction scale and maintenance needs. By using the reverse osmosis process, positive displacement energy recovery devices will recover up to 96% of the pressure energy from the brine, thereby reducing the required pumping energy by up to 62%. These technologies have significantly reduced the power consumption of the treatment process, minimising carbon emissions.

Renewable energy produced by solar panels is being harnessed for the operation of TKODP to minimise its domestic power consumption. A total of 1,800 photovoltaic panels are being installed on the building roofs, generating renewable energy equivalent to 16% of total energy usage for the Building Services System. In the longer term, it is planned to install a solar farm with approximately 19,000 solar panels with a capacity of 10 MW at the nearby South East New Territories Landfill, supplying renewable energy to TKODP in 2026 for its treatment process.

In addition, TKODP saves 53% of water consumption through Grade 1 water efficiency devices, as well as 67% of irrigation water from rainwater harvesting and the selection of native plant species. A recycled water system is also provided for toilet flushing.

TKODP has gained recognition for its efforts in implementing a series of green initiatives, innovative and sustainable features through the achievement of green certification and sustainability awards, including Provisional Platinum rating under BEAM Plus New Building, and the Gold Award for Project Owner in the Sustainable Construction Award 2023 organised by the Construction Industry Council.

Government

DEVELOPMENT OF THE CHINESE MEDICINE HOSPITAL IN TSEUNG KWAN O

Project Team

Project Name	Development of the Chinese Medicine Hospital in Tseung Kwan O
Team or Organisation Name	Architecture Services Department
Name of Owner / Developer	Health Bureau
Project Manager	Architecture Services Department
Main Contractor	China State Construction Engineering (Hong Kong) Limited
Architect	Wong & Ouyang (HK) Limited
Civil & Structural Engineer	Siu Yin Wai & Associates Limited
Building Services Engineer	WSP (Asia) Limited
Quantity Surveyor	C.S.Toh & Sons & Associates Limited
Landscape Architect	ADI Limited
Sustainable Design Consultant	WSP (Asia) Limited
Environmental Consultant	WSP (Asia) Limited
Others	Medical Planning Designer: China State Construction International Medical Industry Development Co. Limited Modular Construction Designer: China State Hailong Construction Technology Company Limited Acoustic Consultant: Shen Milsom & Wilke Limited Façade Consultant: Inhabit Interior Designer: ARVA Limited Wayfinding & Graphic Consultant: Graphia International Limited

https://youtu.be/rdQuFFQaIEM

https://www.healthbureau.gov.hk/en/chinese_medicine/index.html

Three Key Features Demonstrating the Sustainability Performance

- Green energy – use of natural daylight and renewable energy, expressing harmony between man and nature (天人合一)
- Green hospital – a journey through and views towards landscape gardens demonstrating Chinese medicine concepts conducive to healing, echoing the expression of harmony between man and nature
- "Green construction" – pioneering adoption of MiC design and methods for a hospital project, enhancing the effectiveness of off-site prefabrication

Located at Pak Shing Kok, Tseung Kwan O, the Chinese Medicine Hospital (CMH) will form a flagship Chinese Medicine Hub alongside its neighbouring Government Chinese Medicines Testing Institute (GCMTI) to promote CM culture in Hong Kong and to the world. The CMH comprises a nine-storey building offering 400 beds for inpatient and day care services, as well as outpatient healthcare services. Being the first dedicated CM hospital in Hong Kong, the CMH will not only provide CM healthcare services to the local community and

Government

DEVELOPMENT OF THE CHINESE MEDICINE HOSPITAL IN TSEUNG KWAN O

"The Chinese Medicine Hospital will be the first of its kind in Hong Kong not only providing Chinese Medicine healthcare services, but also promoting Chinese Medicine culture and showcasing a smart and sustainable hospital."

Architectural Services Department,
The Government of the HKSAR

population citywide, but also serve as the platform for a collaborative network with CM practitioners, research centres and universities. To amplify the collaborative synergy, the CMH forms a CM Hub with its neighbouring GCMTI, which specialises in the testing and scientific research of CM with a view to setting internationally recognised standards.

Entering the CM Hub, visitors are led into greenery and gardens, bringing them close to nature. They are then guided by a CM culture feature screen into the CMH lobby, which provides shading while allowing daylight in. A skylight brings in light and shadow that changes through different seasons and times of day, constantly connecting visitors with nature. This interplay of light and connection with the garden landscape continues up to the ward floors with views out to garden greenery, giving constant reminders of the close co-existence of ourselves and nature. Screens are strategically arranged on the building façade to provide shading and privacy while allowing daylight in. These screens also incorporate maintenance platforms facilitating future window cleaning.

The CMH adopts and showcases smart hospital facilities as well as various energy efficient features and renewable energy technologies, e.g. the use of robots in hospital operations, solar tubes, wind turbines, photovoltaic panels, and a solar hot water system. A water-cooled heat rejection plant with variable speed drive for air-conditioning and demand control for air supply have also been adopted to promote energy saving during the hospital's operations. In line with the CMH's role as a platform for CM collaboration, guided tours will be arranged to promote and educate visitors about CM culture, as well as the smart and sustainable design and operation of the hospital.

The aim of the project is to develop a "Green Hospital" embracing sustainable development by reducing negative environmental impacts throughout its life cycle, from materials selection and construction method to operational strategies. With a large proportion of carbon in the local construction industry generated by reinforced concrete, efforts were made to use low carbon materials, for example concrete with a high percentage of pulverized fuel ash, and reinforcements with a high percentage of recycled content.

As hospital accommodation covers a complex matrix which needs to be grouped according to functional relationships, different MiC designs and methods were developed to suit a variety of room dimensions, locations and settings. At the same time effective use was made of off-site prefabrication, gaining the benefits of factory manufacturing over site construction in reducing waste, and supporting the sustainability of the labour market of the local construction industry.

The project has achieved BEAM Plus New Building V2.0 Provisional Platinum rating.

Government

DISCIPLINED SERVICES QUARTERS FOR FIRE SERVICES DEPARTMENT AT AREA 106, PAK SHING KOK, TSEUNG KWAN O

Project Team

Project Name	Disciplined Services Quarters for Fire Services Department at Area 106, Pak Shing Kok, Tseung Kwan O
Team or Organisation Name	Architectural Services Department
Name of Owner / Developer	Fire Services Department
Project Manager	Architectural Services Department
Main Contractor	Yau Lee Construction Company Limited
Architect	Ho & Partners Architects Engineers & Development Consultants Ltd.
Civil & Structural Engineer	Jacobs China Limited
Building Services Engineer	WSP (Asia) Limited
Quantity Surveyor	Arcadis Hong Kong Limited
Landscape Architect	ADI Limited
Planning Consultant	Planning Team Limited
Sustainable Design Consultant	Meinhardt Infrastructure and Environment Ltd.
Environmental / Ecology Consultant	Meinhardt Infrastructure and Environment Ltd.
Management Company	Savills Guardian Property Management Limited
Others	MiC Fabricator and Supplier : Yau Lee Wah Concrete Precast Co. Ltd.

https://youtu.be/jthQOeFZWas

https://www.archsd.gov.hk/archsd/html/report2021/en/case-study-3-services-quarters.html

Three Key Features Demonstrating the Sustainability Performance

This development takes a holistic approach in demonstrating and implementing the "GREEN" concept in a way that optimises in resource management efficiencies and operational performance across its life cycle.

The adoption of Modular Integrated Construction (MiC) enabled a substantial number of building components to be completed off-site under a factory-controlled environment. This not only improved productivity, the quality of works, site safety and the working environment but also reduced the demand for skilled labour, construction waste, construction energy and water consumption, as well as reducing the construction cost and period.

With modularisation, the project could maximize the percentage of pre-fabricated elements and the benefits of MiC. By transferring the on-site construction process to a controlled factory environment, the impacts of adverse weather, constraints of the site, and disturbance and nuisance to the surrounding environment were significantly reduced.

Contribution to the Sustainable Development of the Community

This Disciplined Services Quarters for Fire Services Department at Pak Shek Kok (PSKDQ) was built using a total of 3,726 concrete modules. The project implements and demonstrates green concepts in a holistic way that optimises construction methodology, resource management and operational performance across its life cycle. From inception, design, construction and completion of the project to its passive design and active use of energy saving devices, all parties involved played important roles at each stage of the development.

Also significant are the project's use of smart technologies such as the MultiTrade Integrated Mechanical, Electrical and Plumbing (MiMEP) approach, Radio Frequency Identification (RFID) and a BIM-enabled Blockchain Multifunctional Platform. These improved the efficiency and traceability of the supply chain to ensure effective and efficient project delivery.

Government

DISCIPLINED SERVICES QUARTERS FOR FIRE SERVICES DEPARTMENT AT AREA 106, PAK SHING KOK, TSEUNG KWAN O

"The first high-rise building project adopting concrete MiC, and first residential building to achieve Platinum rating of BEAM Plus NB v2.0 in Hong Kong, commenced in August 2018 and was completed in March 2021, turning a new page in the construction industry."

WONG On-wa, Edward,
Project Management Branch 2 - Project Director/2,
Architectural Services Department,
The Government of the HKSAR

In line with the study, "Modular Integrated Construction for High-rises: Measured Success" published by HKU in 2020, there was an approximate 53% reduction in construction waste generation. Overall material wastage rate was reduced from 5% to 1%. On-site air pollutant generation was 25% lower. Nearly 60% to 70% of on-site water and electricity consumption was saved. The amount of saved water equals the capacity of ten standard Olympic swimming pools. On-site noise pollution, mainly due to in-situ concreting, formwork erecting and steel bar fixing, was reduced from 73.1dB(A) to 68.3dB(A), a reduction of early 7% in decibel terms. Demand for skilled labour was reduced by 40-50%.

The quality and workmanship of the MiC modules were assured as the production, supervision and pre-delivery checking were carried out in a controlled factory environment. The repetition of work involved in this process also achieves greater consistency and accuracy. Factory fabrication improves the health and safety environment for the workers, while the reduced works on site results in less disturbance and nuisance to the surrounding environment.

Maintaining Environmental Sustainability in Future Operations

In addition to the adoption of MiC, a wide variety of sustainable design and innovative elements was deployed. An energy saving strategy also contributed greatly to the sustainable design of the project, and will help maintain its environmental sustainability in future operations. These are some of its sustainable features:

- Natural cross-ventilation provided in lift lobby of typical floor;
- Solar heat gain minimised in residential units by using high emissivity roofing and tinted window glazing;
- Daylight access maximised by providing windows with glazing size larger than statutory requirement;
- Traffic noise shielded by elevating tower lobbies to 5-6m high;
- LED luminaires used for toilets, lobbies, circulation corridors of communal areas, motion sensor lighting control of BMO, staircase and protected lobby of common area;
- Building Information Modelling (BIM) applied;
- Recycled rainwater used for plant irrigation;
- Lift power regeneration deployed as well as EV-chargers, PV panels and solar-powered lamp poles;
- Life-cycle cost study on choice of interior lighting system and AC system; and
- Life Cycle Costing and Assessment incorporated.

This project is the first residential building in Hong Kong to achieve Platinum rating in the BEAM Plus New Building V2.0 Certification awarded by the HKGBC.

Government

ENHANCEMENT WORKS FOR KWUN TONG SEWAGE PUMPING STATION

Project Team

Project Name	Enhancement Works for Kwun Tong Sewage Pumping Station
Team or Organisation Name	Drainage Services Department
Name of Owner / Developer	Drainage Services Department
Project Manager	Drainage Services Department
Main Contractor	China Geo-Engineering Corporation
Architect	A. Lead Architects Ltd
Civil & Structural Engineer	Atkins China Limited
Building Services Engineer	Atkins China Limited
Quantity Surveyor	Atkins China Limited
Landscape Architect	Atkins China Limited
Project Designer	Atkins China Limited
Planning Consultant	Atkins China Limited
Sustainable Design Consultant	Atkins China Limited

https://www.dsd.gov.hk/EN/Our_Projects/All_Projects/4413DS.html

Three Key Features Demonstrating the Sustainability Performance

This is a pioneer project in Hong Kong that materialises the "single site, multiple use" concept for sewage facilities by transforming malignant sewage facilities into a one-hectare "playful" green deck park. This project has enhanced the liveability of one of the most densely populated urban areas of Hong Kong.

Three skylights were fitted in the pumping station to reduce electricity consumption by utilising natural daylight, while solar panels were installed on the deck to reduce carbon emissions. A rainwater harvesting system is provided on the deck for irrigation use, to aid water conversation.

Paving tiles on the landscaped deck with a 78% solar reflectance index contribute to energy efficiency and reduce heat passing down to the plant house underneath. A pixelated tile pattern was carefully selected to minimise wastage by reducing the number of tiles that needed to be cut during installation. This not only helped conserve materials but also speds up the progress of the project.

Project Information

To deal with an increase in sewage flow from future residential and commercial developments nearby, a 16,000m³ underground balancing tank was built next to the Kwun Tong Sewage Pumping Station (KTSPS). The tank temporarily stores excess preliminarily-treated sewage from the nearby Kwun Tong Preliminary Treatment Works (KTPTW) during peak hours and hence prevents its overflowing into Victoria Harbour. The stored sewage is pumped back to KTPTW and conveyed to the Stonecutters Island Sewage Treatment Works (SCISTW) for further treatment during non-peak hours.

"KTSPS showcased successful implementation of the "Single Site, Multiple Use" concept, aligning with the Hong Kong 2030+ planning strategy, the desire for impactful community projects, and the promotion of sewage treatment and water conservation."

Drainage Services Department,
The Government of the HKSAR

Government

ENHANCEMENT WORKS FOR KWUN TONG SEWAGE PUMPING STATION

Contribution to Sustainable Development

1. Single Site, Multiple Use

To mitigate "not in my backyard" (NIMBY) concerns, an iconic landscaped deck was built above the balancing tank and KTSPS. This project successfully transformed malignant sewage facilities into aone-hectare "playful" green deck park which has become a very popular public spot. This is a pioneering project in Hong Kong that materialises the concept of "single site, multiple use" for sewage facilities, enhancing the liveability of one of the most densely populated urban areas of Hong Kong. The deck features over 60 playground and educational facilities that cater for people of different age groups and physical abilities.

2. Odour Control Measures

To ensure the public is not affected by any odour from the sewage facilities underneath the Deck, rigorous odour control measures have been implemented which effectively eliminate 99.8% of odours by using two-stage deodorising plants comprising a "bio-trickling filter" and an "activated carbon filter".

3. Application of Innovative Technology

The Design for Manufacture and Assembly (DfMA) method was adopted for constructing the deck in order to achieve sustainable design. The implementation of DfMA meant that project progresss could be significantly accelerated by approximately three months. Additionally, the adoption of DfMA resulted in reduced CO_2 emissions owing to the decreased need for formwork.

4. Resource Utilisation

To promote sustainability and help combat climate change, the plant house underneath the deck is illuminated with natural daylight through three skylights to reduce electricity consumption. Solar panels are installed on the deck, resulting in a daily reduction of 56 kg of CO_2 emissions. A Rainwater Harvesting system is provided on the deck for irrigation use, saving up to 860 m^3 of fresh water supplies, and reclaimed local timber was reused to make furniture and park facilities.

5. Landscape and Ecology

The deck has a greening ratio of approximately 30%. Large green terraced buffers are built around the site boundary, acting as a stopover for birds and other insects as well as separating the deck from the busy roads adjoining the site. The landscape design includes around 60 plant species pf which half are native species, to support biodiversity. The plant species were carefully selected based on seasonal beauty, suitability for the play space theme, and ability to thrive in waterfront conditions.

Government

FANLING NORTH NEW DEVELOPMENT AREA, PHASE 1: FANLING BYPASS EASTERN SECTION (SHEK WU SAN TSUEN NORTH TO LUNG YEUK TAU)

Project Team

Project Name	Fanling North New Development Area, Phase 1: Fanling Bypass Eastern Section (Shek Wu San Tsuen North to Lung Yeuk Tau)
Team or Organisation Name	Daewoo - Chun Wo - Kwan Lee Joint Venture
Name of Owner / Developer	Civil Engineering and Development Department
Project Manager	Civil Engineering and Development Department
Main Contractor	Daewoo - Chun Wo - Kwan Lee Joint Venture
Architect	AECOM Asia Company Limited
Environmental / Ecology Consultant	Wellab Limited & Mott MacDonald Hong Kong Limited
Others	The Hong Kong Polytechnic University

https://youtu.be/OnunuJi4lfM
https://www.ktnfln-ndas.gov.hk/en/

This project comprises construction of a 2 km Fanling Bypass, an important part of the development of the Northern Metropolis. Completion of the Bypass will contribute hugely to the logistics of the whole North District. The project also includes construction of a sewage pumping station and drainage system around the Bypass, planned to meet the district's future development needs. The capacity for sewage treatment and storm water collection will be improved and its climate resilience substantially increased.

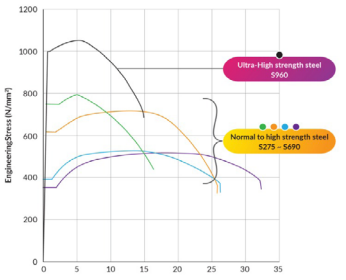
Various cost saving and alternative designs are being implemented in the project, with the use of borepiles, socket H-piles, rebar and concrete all substantially reduced and nuisance to stakeholders also minimised. The bored pile construction method was changed to a rotary method to minimise the water needed for airlifting, namely 36,000L for each pile and approximately 900,000L in total. This reduced CO_2 emissions by 2,412 tonnes. Only 90 borepiles and Socket H-piles need to be used, hence a reduced number of rebars will be needed.

A pilot implementation of S960 ultra-high-strength steel was proposed for construction of the footbridge, which is the world's first application of S960 steel in civil bridge construction and will set a new standard for future projects. The use of S960 structural steel can significantly reduce the weight of the bridge deck by 60% compared with using S355 steel or 30% compared with S690. In addition a lighter crane can be used for lifting on the congested site. To address any technical concerns, Civil Engineering and

Three Key Features Demonstrating the Sustainability Performance

- Various cost-saving and alternative designs applied
- Pilot project using ultra-high strength S960 for footbridge construction
- Modular Integrated Construction (MiC) used for temporary and permanent structures

Adoption of S960 ultra-high strength steel under the Fanling North New Development Area



Structural performance of S960 steel

- ✔ Improved resistance to deformation and fatigue
- ✔ Reduced in steel consumption
- ✔ Reduced carbon footprint
- ✔ Enhanced constructability
- ✔ Lighter structure requiring smaller lifting equipment and enhance site safety
- ✔ Reduced footprint of foundation to reduce risk of underground utilities conflict
- ✔ Enhanced programme & cost benefits
- ✔ Reduced maintenance costs

Government

FANLING NORTH NEW DEVELOPMENT AREA, PHASE 1: FANLING BYPASS EASTERN SECTION (SHEK WU SAN TSUEN NORTH TO LUNG YEUK TAU)

"The concept of sustainability was implemented from the top down and also the bottom up."

Eric WU,
Former Site Agent,
Daewoo - Chun Wo - Kwan Lee Joint Venture

Development Department (CEDD) and The Hong Kong Polytechnic University are collaborating to conduct experiments and literature reviews, then develop technical guidelines, specifications and welding procedures for the use of S960 steel in footbridges and other bridge construction projects.

In this case, the change of material will reduce the carbon footprint during construction by approximately 2,300 tonnes of CO_2. In addition, the smaller substructure footprint will resolve conflicts with underground utilities and minimise the use of concrete trucks and rebar. The use of S960 steel can also minimise safety risks including working at height, lifting operations, and scaffolding. The factory prefabrication of S960 steel components will improve project speed, quality, efficiency and quantity. The construction period can be reduced by three months.

The project also involves reprovisioning of the On Lok Mun Street Playground, public toilet and refuse collection point near Lung Yeuk Tau Interchange; road junction improvement works in North District; and associated ground investigations, geotechnical instrumentation and monitoring, slope and retaining wall works, drainage and sewerage works, waterworks, noise barrier works, traffic control and surveillance system installation, electrical and mechanical works and landscaping works.

Modular Intergrated Construction (MiC) is being adopted for all additional structures such as a public toilet, refuse collection point, On Lok Mun Street Playground Ancillary Block and Services Block and a Community Liaison Centre. With shorter construction time and better manufacturing efficiency, this method will be more environmentally friendly and sustainable. Total carbon reduction achieved by using MiC instead of casting in-situ will be approximately 2,852 tonnes.

These construction works will improve all aspects of the district's environment and reduce waste, water, air and noise pollution. Overall hygiene will also be improved.

Government

FITTING-OUT OF OFFICE ACCOMMODATION AT 19/F, MARINA 8, WONG CHUK HANG, FOR THE TRANSPORT AND LOGISTICS BUREAU

The Fitting-out of Office Accommodation at 19/F Marina 8, Wong Chuk Hang, for the Transport and Logistics Bureau was intended to be a pilot project for BEAM Plus Interiors V2.0 Assessment. and indeed the project has achieved final Platinum rating. With the goal of inspiring stakeholders to embrace sustainability, the project was completed by a collaborative team involving occupants, the building management office and the project team throughout its planning, design, construction and operation stages.

The office is located in Wong Chuk Hang, situated on 19/F with open views on two opposite sides. Over 80% of occupants can enjoy natural lighting and direct sightlines to external views. The biophilic design of the project, together with its glazed feature wall between two office areas using an atomised glass system, achieves a smart office design. The feature walls and energy-efficient building services encourage a quality indoor built environment. Overall energy loading is reduced by the host building's passive design. In addition, high-performance, energy-efficient Intelligent Fan Coil Units (IFCUs) are adopted which can save more than 67% of energy consumption.

Tackling the difficulty of accommodating three individual and separated units within a congested area, a flexible layout and open office were adopted, with most work stations arranged on the perimeter. A common connecting space with a feature wall is designed to provide a comfortable environment for occupants. This connecting space is equipped with various CSR-oriented and sustainable

Three Key Features Demonstrating the Sustainability Performance

- High-performance, energy-efficient Intelligent Fan Coil Units adopted to make the air conditioning system greener, more comfortable and more cost-effective.
- Glazed feature wall between ROU and TCU offices demonstrates enhanced biophilic design of the project.
- Common and connecting spaces equipped with various CSR-oriented and sustainable facilities, encouraging occupants to adopt a sustainable lifestyle.

Project Team

Project Name	Fitting-out of office accommodation at 19/F, Marina 8, Wong Chuk Hang, for the Transport and Logistics Bureau
Team or Organisation Name	Architectural Services Department
Name of Owner / Developer	Architectural Services Department
Project Manager	Architectural Services Department
Main Contractor	Yau Lee Construction Co., Ltd.
Sustainable Design Consultant	BeeXergy Consulting Limited

"By using sustainable and energy-efficient design, a quality indoor built environment has been promoted. The project advocates a smart, modern and green office, and encourages occupants to adopt a sustainable lifestyle."

Architectural Services Department,
The Government of the HKSAR

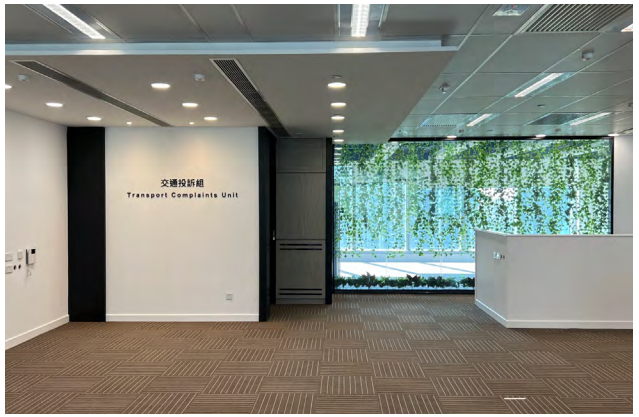
Government

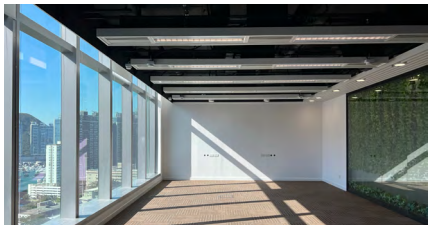
FITTING-OUT OF OFFICE ACCOMMODATION AT 19/F, MARINA 8, WONG CHUK HANG, FOR THE TRANSPORT AND LOGISTICS BUREAU

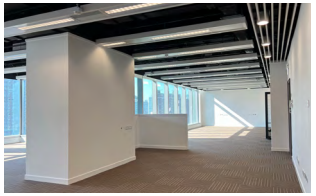
facilities including sharing and education boards, seating and standing areas, as well as recycling facilities. With the support of occupants, electrical appliances and furniture have been reused. A sustainable lifestyle is promoted through the CSR facilities and occupants' commitment.

Throughout construction, existing walls and flooring were mostly retained, while over 79% of the demolition and construction waste was recycled and reused. Effective waste management and pollution control were adopted and certified green products including IFCUs widely used. An Excellent Class IAQ Certificate was obtained by adopting sustainable materials, good IAQ management and post-construction flush-outs and filter cleaning.

In recognition of its comprehensive and sustainable design, green building services and construction approach, the project received the Merit Award in the Green Building Award 2023 and the Hong Kong Institute of Project Management Award. It serves as a resilient and green office that can inspire future projects.







Government

INLAND REVENUE CENTRE DEVELOPMENT, KAI TAK

Project Team

Project Name	Inland Revenue Centre Development, Kai Tak
Team or Organisation Name	Architectural Services Department
Name of Owner / Developer	Inland Revenue Department
Project Manager	Architectural Services Department
Main Contractor	Hip Hing Engineering Company Limited
Architect	Ronald Lu & Partners (Hong Kong) Ltd.
Civil & Structural Engineer	Arup
Building Services Engineer	Arup
Quantity Surveyor	Arcadis Hong Kong Limited
Landscape Architect	ADI Limited
Sustainable Design Consultant	Arup
Others	Interior Designer: ARVA Limited Signage & Wayfinding Designer: Atelier Pacific

Three Key Features Demonstrating the Sustainability Performance

- Blends with the community to create a sustainable environment for both occupants and the general public.
- Integrates green features and renewable energy technologies to enhance its long-term environmental sustainability.
- Adopts innovative construction to elevate buildability, sustainability and site safety.

The Inland Revenue Centre (IRC) is an 18-storey-high Government office building with one storey of basement and ancillary car parking facilities featuring an automated parking system. The project is focused on blending with the community, a modern workplace design, innovative construction and sustainability, all aligning with the planning theme for the Kai Tak Development Area, which advocates integration of the context of the surrounding sites to create a sustainable environment for both the occupants and general public.

The IRC is deliberately set back from the site boundary to free up more ground-level space for use by the general public and to maximise the wind corridors to enhance the environment. Its external landscape design forms a Green Hub at ground level which provides a precious open space to contrast with the surrounding built community. A footbridge connection to the adjacent Trade and Industry Tower forms an above-ground linkage system in the Kai Tak Development Area and enhances connectivity within the area.

Government

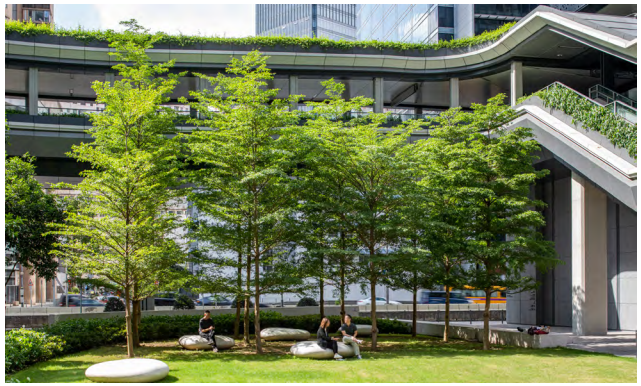
INLAND REVENUE CENTRE DEVELOPMENT, KAI TAK

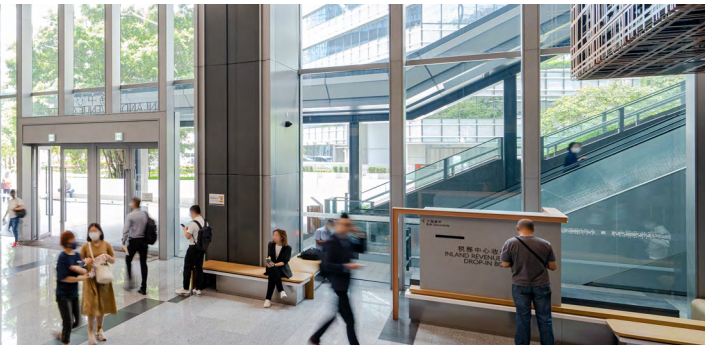
The IRC gives the Inland Revenue Department a dignified identity with the adoption of a modern workplace layout in which the provision of cellular offices in the periphery of the building is minimised to allow penetration of natural lighting into most of the office space. Co-working spaces and communal areas are integrated into the office area to enhance collaboration and facilitate communication. 'Healthy' staircases are provided to encourage occupants to exercise through vertical circulation between floors. This also minimises the use of lifts, thereby conserving energy and enhancing the environmental sustainability of the building's long-term operations.

Car parking facilities are located on the ground floor, with openings to the basement minimised in the design. Durable materials were used in many parts of the external area such as the adoption of a granite seating design for the planter area in the Green Hub, which will enhance its resilience to climate change.

"The project aims to blend with community by adopting green features and innovative construction to achieve quality urban design for continuous improvement and promotion of the city's long-term sustainable development."

Hip Hing Engineering Company Limited





The IRC adopts various renewable energy technologies and green features including the provision of a green roof with modular planters to minimise the heat island effect, and the installation of PV panels on the roof to generate electricity from sustainable solar energy. The whole IRC project features more than 30% greenery coverage. This brings greenery to the urban environment and allows the public to enjoy the building's green and sustainable environment.

In addition, the IRC has made use of the District Cooling System in Kai Tak Development Area to provide chilled water to its air conditioning system. This has enhanced the overall energy efficiency of the building and the sustainable development of the urban area in Kai Tak. Innovative construction methods were widely adopted during the building process, including modular construction, MiMEP, robotics and BIM technology to uplift buildability, sustainability and site safety.

The IRC has been awarded Final Gold certification under the BEAM Plus New Buildings scheme by the Hong Kong Green Building Council, and a Merit Award in the Green Building Award 2023.

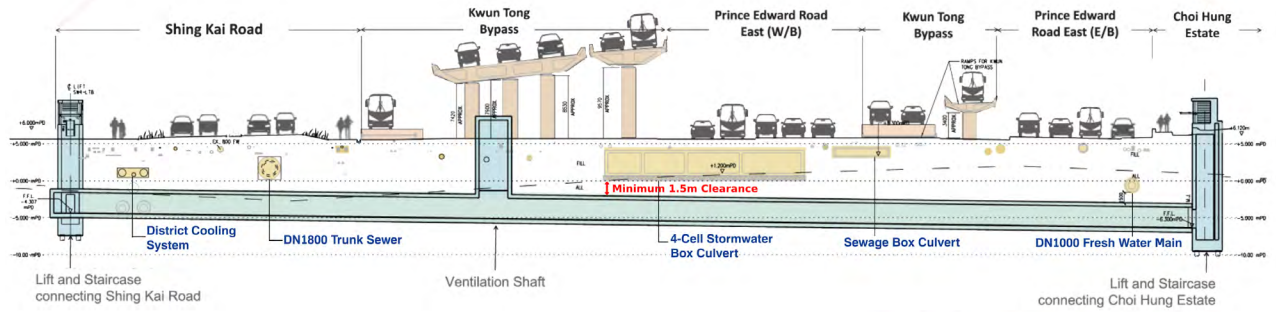
Government

KAI TAK DEVELOPMENT – SUBWAY BETWEEN KAI TAK AND CHOI HUNG

Three Key Features Demonstrating the Sustainability Performance

- Fully-mechanised tunnelling with modularised construction
- Remotely controlled tunnelling
- Zero accidents, minimal disturbance and 15% carbon footprint reduction

Underground rectangular structures like subways and box culverts are ubiquitous, especially in urban areas. Traffic needs and constraints frequently call for trenchless construction. While serving to avoid open excavation, conventional trenchless construction is associated with various impacts owing to the extensive use of temporary underground supports and the in-situ underground structural construction. These works carry significant inherent risks, including instability of excavations, ground loss, inundation, confined space hazards, poor working conditions, and damage to surrounding facilities.



PEDESTRIAN SUBWAY SW4

Project Team

Project Name	Kai Tak Development – Subway between Kai Tak and Choi Hung
Team or Organisation Name	East Development Office, Civil Engineering and Development Department
Name of Owner / Developer	The Government of the HKSAR
Project Manager	Civil Engineering and Development Department
Main Contractor	Build King – Richwell Engineering Joint Venture
Civil & Structural Engineer	Arup

https://youtu.be/bmcZzEqYLzY

Government

KAI TAK DEVELOPMENT – SUBWAY BETWEEN KAI TAK AND CHOI HUNG

"This successful RTBM application breaks new frontiers in underground box-structure construction under complex geologies and settings through modularisation, prefabrication and full mechanisation, which greatly elevates construction safety, productivity and sustainability."

Civil Engineering and Development Department,
The Government of the HKSAR

The 140m long Kai Tak - Choi Hung Subway (Subway SW4) is routed underneath the artery roads of Kwun Tong Bypass Viaduct (KTBV) and Prince Edward Road East, totally across 21 lanes. Clearance between the subway and KTBV pile caps is as small as 2.7m. Vertically the tunnel passes underneath a four-cell stormwater box culvert at just 1.5m clearance, as well as other major water-bearing utilities.

The project team innovatively brought in the first Rectangular Tunnel Boring Machine (RTBM) in Hong Kong to control and minimise the aforementioned risks and impacts.

The RTBM makes tunnel excavation completely mechanical. The subway was constructed through successive jacking of prefabricated tunnel segments, eliminating manual excavation and underground in-situ structural construction. Ground loss was avoided through careful pressure control at the cutter head, which in turn minimised disturbance to adjacent facilities.

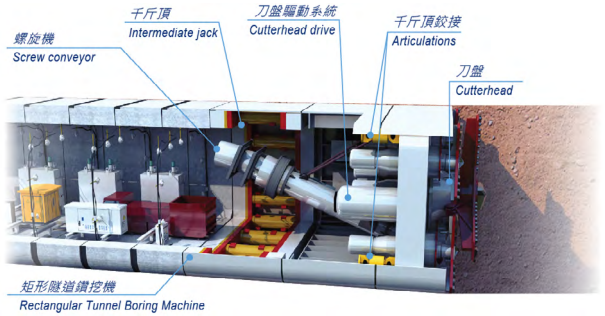
Complicating the case, however, construction of the SW4 had to overcome complicated geology comprising granular soils embedded with vast quantities of boulders. Hitherto, the limited RTBM applications overseas were invariably in clay-type soils. The team thus formulated a set of innovative cutter head designs.

Past RTBM cutter head design for clay-type soils consists of multi-layered small cutter discs to achieve primarily a high face coverage. For SW4, to cope with the much higher soil stiffness, a large central cutter disc was specifically designed. This was further reinforced by special rippers to strengthen its capability to break up large boulders.

Tunnel segments were prefabricated close to the site under well-controlled conditions, handled by a special plant developed on Design for Manufacturing and Assembly (DfMA) concepts. Off-site prefabricated steel reinforcement was adopted to eliminate the need for in-situ cutting and bar bending. The whole tunnelling operation was conducted remotely on ground level.

The SW4 RTBM works achieved a zero-accident safety record. Recorded ground movement was minimal, generally ranging from 1 to 2 mm with a maximum of only 6 mm at one localised area.

This innovative approach substantially shortened construction time, raising productivity by over 50%. Prefabricated steel reinforcement and tunnel segments reduced wastage, giving over 10% savings in materials uptake. Compared with conventional methods, the technology overall achieved a 15% reduction in carbon footprint.This pioneering RTBM project marks a notable advancement from the traditional labour-intensive and nuisance-prone works to modularised, full-mechanisation and sustainable construction, expanding the applicability of the technology to highly-challenging geologies like those impacting SW4. Indeed, based on the SW4 experience, a second RTBM tunnel has been completed recently with equally satisfactory results, demonstrating that this innovative development will transcend the project, sparking wider applications and benefits to the industry.



Government

KWU TONG NORTH AND FANLING NORTH NEW DEVELOPMENT AREA – LONG VALLEY NATURE CENTRE OF LONG VALLEY NATURE PARK

Project Team

Project Name	Kwu Tong North and Fanling North New Development Area – Long Valley Nature Centre of Long Valley Nature Park
Team or Organisation Name	Civil Engineering and Development Department
Name of Owner / Developer	Agriculture, Fisheries and Conservation Department
Project Manager	AECOM Asia Company Limited
Deputy Project Manager	AECOM Asia Company Limited
Project Management Team Leader	AECOM Asia Company Limited
Contract Administrator	AECOM Asia Company Limited
Architect	Ronald Lu & Partners (Hong Kong) Ltd.
Civil & Structural Engineer	AECOM Asia Company Limited
Building Services Engineer	AECOM Asia Company Limited
Quantity Surveyor	AECOM Asia Company Limited
Landscape Architect	AECOM Asia Company Limited
Civil & Structural Engineer	AECOM Asia Company Limited

The New Territories' Kwu Tung North and Fanling North New Development Area project is a major component of Hong Kong's medium-term and long-term comprehensive land supply strategy. A key aspect of the project is the conservation and enhancement of the ecologically significant Long Valley, recognised as the largest contiguous freshwater wetland in Hong Kong.

As part of the development, the government's Civil Engineering and Development Department (CEDD) has allocated approximately 37 hectares of land in the core area of Long Valley to establish the Long Valley Nature Park (LVNP). The park will serve two purposes: preserving and enhancing its ecologically important environment, and compensating for the loss of wetlands due to development in other areas of the project. A Long Valley Nature Centre (LVNC) will also be built near LVNP with the purpose of educating the public about the ecological importance of Long Valley.

RLP Asia's design for the LVNC makes it a priority to ensure that the building blends harmoniously with its surroundings. It adheres to local design standards and guidelines and takes into account the ecological sensitivity of its immediate environment. By meticulously planning the building height, ensuring adequate ventilation and implementing thoughtful lighting design, CEDD will seamlessly integrate the LVNC into its surroundings and protect nearby sensitive areas.

Three Key Features Demonstrating the Sustainability Performance

- Designed for climate adaptation
- Net zero integrated design
- On-site capture and utilisation of resources

Government

KWU TONG NORTH AND FANLING NORTH NEW DEVELOPMENT AREA – LONG VALLEY NATURE CENTRE OF LONG VALLEY NATURE PARK

"The Long Valley Nature Centre will be a green building and a comfortable space where people can learn about the area's unique ecology and agriculture."

Mike CHO,
Chief Engineer / N3, North Development Office,
Civil Engineering and Development Department,
The Government of the HKSAR

The building fully embraces the concept of net-zero architectural design. It maximises the use of non-air conditioned spaces, incorporating bird-watching seating areas and exhibition zones along the building's periphery. Biomorphic natural materials, including indoor planting and biomorphic forms and patterns, are integrated into the building to enhance the experience of "being in nature" for its users. Its core zone to be used as an office area features skylights to maximise natural daylight; these also reduce the need for artificial lighting and minimise energy consumption. Prefabricated, flexible and low embodied carbon building materials have been chosen, aimed at further reducing disruption to nature. The design also embraces the notion of a "zero-waste future" – it will repurpose waste from plant and tree trimming and reuse it for horticultural products, pavers, wall cladding and furniture. On-site water and solar resource capture will contribute to a self-sustaining future for the Centre.

The LVNC also integrates climate resilience into its design and construction processes, so as to effectively combat and adapt to the challenges posed by climate change. Its design prioritises sustainability through green infrastructural elements such as rainwater harvesting systems and solar panels, which in turn reduce reliance on external resources. By capturing and utilising water and solar resources on the site, the Centre minimises its environmental footprint and enhances its resilience to potential future disruptions. The Centre will also involve the community through educational programmes and outreach initiatives, fostering a culture of environmental stewardship and encouraging sustainable practices among visitors and stakeholders.

Government

O·PARK2

Three Key Features Demonstrating the Sustainability Performance

Sustainability throughout the Design-Build-Operate process

Carbon Neutrality during construction phase

Negative Carbon Emissions during operation

The Organic Resources Recovery Centre Phase 2 (O·PARK2) is a green project implemented under the Design, Build, and Operate (DBO) mode, representing the most advanced low-carbon construction features currently available in Hong Kong. O·PARK2 will utilise anaerobic digestion technology to convert food waste into electricity and fertiliser. The green building design philosophy runs through the entire life cycle of O·PARK2, from planning, design and construction to its operational mode, so as to minimise its impact on the environment.

During the design stage, O·PARK2 adopted the BIM-based Integrated Design Process to explore synergies between different carbon reduction strategies and the building system design. The project comprehensively addresses long-term operational and maintenance needs, reflecting the construction characteristics of land saving, materials saving, energy saving, water saving and innovation, leading to its achieving BEAM Plus NB V1.2 Provisional Platinum rating. Sustainable features incorporated in the design of O·PARK2 include highly efficient VRV and absorption chillers, renewable energy installations, rainwater harvesting and grey water recycling.

During the construction stage, the project team were committed to achieving carbon neutrality by investing

Project Team

Project Name	O·PARK2
Team or Organisation Name	AJA Joint Venture
Name of Owner / Developer	Environmental Protection Department
Project Manager	Victor WU
Main Contractor	AJA Joint Venture
Architect	A. LEAD Architects Ltd
Civil & Structural Engineer	WSP (Asia) Limited
Building Services Engineer	WSP (Asia) Limited
Quantity Surveyor	AJA Joint Venture
Landscape Architect	WSP (Asia) Limited
Project Designer	WSP (Asia) Limited
Sustainable Design Consultant	WSP (Asia) Limited
Environmental / Ecology Consultant	Action-United Environmental Services & Consulting
Facility Manager	AJA Joint Venture
Management Company	AJA Joint Venture

https://youtu.be/sR5vID7EK4I
http://csci-opark2.com/en/

Government

O·PARK2

"O·PARK2 is one of the most advanced low carbon construction projects in Hong Kong and has two main focuses: achieving carbon neutrality during the construction phase and waste-to-energy conversion during the operational phase."

Victor WU Yick-nam,
Project Manager,
AJA Joint Venture

in and developing intelligent, low-carbon construction technologies. These included BIM 7D, MiC, DfMA and 3D printing, as well as green building materials such as rebar with 100% recycled content, 60% Ground Granulated Blast-furnace Slag (GGBS) concrete, concrete bricks based on Carbon Capture, Utilise, and Storage (CCUS) technology, Building-integrated Photovoltaics (BIPV) and a passive radiation cooling paint. The project also made good use of digitalisation to achieve sustainable construction. It utilised the "C-Smart" All-in-one Smart Construction Management Platform and the Carbon Neutral Cloud Platform to enhance carbon accounting accuracy, improve data collection and statistics, and ensure transparency. All these measures helped the project achieve reductions of 4,399 tonnes of CO_2e. O·PARK2 has also become the first engineering project to offset the remaining carbon emissions by carbon trading.

During the operational stage, O·PARK2 will process 110,000 tonnes of food waste annually, generating 24GWh of surplus electricity which can meet the electricity consumption of about 5,000 households. The resources recovered from the food waste will help O·PARK2 reduce carbon emissions up to 67,000 tonnes a year.

O·PARK2's commitment to reducing carbon emissions and promoting sustainable development is not only well recognised by its stakeholders through ESG reporting and other media channels, but has also garnered recognition and some prestigious awards. It was winner of the UNIDO Global Call programme initiated by the United Nations Industrial Development Organization and received the Gold Award at the Hong Kong Awards for Environmental Excellence. Moreover, O·PARK2 has been honoured internationally with the prestigious Brunel Medal at the Institution of Civil Engineers (ICE) Awards 2023 in the UK, acknowledging its outstanding contributions to sustainable development.

Looking ahead, O·PARK2 will accelerate its upgrading of digital construction technology, improve its management of a sustainable supply chain and promote social innovation for sustainable development.

Government

PUBLIC HOUSING DEVELOPMENTS AT QUEEN'S HILL, FANLING (QUEENS HILL ESTATE AND SHAN LAI COURT)

Project Team

Project Name	Public Housing Developments at Queen's Hill, Fanling (Queens Hill Estate and Shan Lai Court)
Team or Organisation Name	Hong Kong Housing Authority
Name of Owner / Developer	Hong Kong Housing Authority
Project Manager	Architectural Section 4, Development & Construction Division, Hong Kong Housing Authority
Main Contractor	Hip Hing Engineering Company Limited, Paul Y. General Contractors Limited, Yau Lee Construction Company Limited
Architect	Architectural Section 4, Development & Construction Division, Hong Kong Housing Authority & Wong & Ouyang (HK) Ltd
Civil & Structural Engineer	Structural Engineering Section 1 and Civil Engineering Section 2, Development & Construction Division, Hong Kong Housing Authority & AECOM Asia Co. Ltd.
Building Services Engineer	Building Services Section 1, Development & Construction Division, Hong Kong Housing Authority & J. Roger Preston Ltd.
Quantity Surveyor	Arcadis Hong Kong Limited
Landscape Architect	Landscape Unit 3, Hong Kong Housing Authority & ACLA Ltd.
Planning Consultant	Planning Section 1, Development & Construction Division, Hong Kong Housing Authority
Sustainable Design Consultant	Arup
Environmental / Ecology Consultant	Allied Environmental Consultants Limited
Wind / Air Ventilation Consultant	Allied Environmental Consultants Limited
Facility Manager	Estate Management Division, Hong Kong Housing Authority

https://www.housingauthority.gov.hk/mini-site/queenshillestate/en/index.html

Three Key Features Demonstrating the Sustainability Performance

- Transformation of former barracks into a liveable and sustainable community
- Preservation of trees and recycling of existing materials for green features in open spaces
- Respect for local history and culture through heritage conservation and public involvement

The vision of Hong Kong Housing Authority is to provide affordable rental housing to low-income families with housing needs, and to help low- to middle-income families gain access to subsidised home ownership. Aligning with this vision and with the added aim of building a sustainable city and community, the Queen's Hill project has transformed an abandoned barracks into a vibrant, sustainable home to more than 12,000 families. The linked developments consist of public rental housing, subsidised sales flats and essential supporting facilities that can fulfil the daily needs of the residents, including infrastructural, transport, educational, social welfare, community, recreational and retail facilities.

The central retail and communal green spine forms the heart of this all-embracing community which is well integrated with various play areas and recreational facilities, an open plaza, gardens, artwork displays, and comprehensive covered walkway systems connecting the developments with the surrounding area.

Government

PUBLIC HOUSING DEVELOPMENTS AT QUEEN'S HILL, FANLING (QUEENS HILL ESTATE AND SHAN LAI COURT)

Strategic implementation of climate-resilient design can be seen in different parts of the project. Master planning was carefully conducted to minimise impact to surrounding villages and existing trees, while maximising views. Semi-basement carparks have been adapted to the topography to create a vast podium space with extensive greenery for the enjoyment of residents. Major public spaces and facilities were strategically planned along wind corridors, with the aid of computer simulation, to facilitate natural ventilation. These passive cooling techniques minimise energy use while ensuring human comfort.

Energy saving and harvesting measures have been considered in every aspect of building services design such as hybrid ventilation systems at the public transport terminus and semi-basement car parks, automatic speed reduction of the escalators, motion and photo sensors, two-level lighting control and building integrated PV. So far these have shown very promising performance. For rainwater harvesting, the use of a zero-carbon irrigation system and an automatic drip irrigation system create a self-sustaining system for the garden and extensive greenery on site.

In the interests of conservation, the former officer's mess has been reused as a management office. About 100 existing trees have been retained. Timber and salvaged artefacts from felled trees and the old barracks have been recycled to become artworks and benches for community enjoyment and education. Remaining timber was reused as mulch on site.

The key to integrating climate resilience into the construction process is minimising construction waste and pollution. A balanced cut and fill approach to the site formation minimised soil waste and tree felling. Standardised modular flats, design for manufacture and assembly (DfMA), off-site prefabrication, robotics and on-site concrete batching plant all helped enhance accuracy, efficiency and safety, thereby also minimising materials wastage and greenhouse gas generation.

"We see smiles from residents. The naturally-ventilated shopping centre, open plaza, and gardens with retained trees and artworks are packed with families, the elderly and the disabled, and full of joy. They outperform our expectations."

Wilson TSE,
Senior Architect, Housing Department, The Government of the HKSAR

Environmental sustainability in future operations will be achieved by enhancing the project's adaptability and serviceability. Adaptability can be achieved through the open layouts of the domestic flats, welfare facilities and market, which allow for flexibility to meet future needs along the life cycle, while the project's universal design caters for the needs of residents of different ages and physical conditions. A high level of serviceability is achieved by adopting standardised and durable fittings for easy maintenance, such as UV resistant W-traps.

Public involvement promotes a sustainable lifestyle and enhances residents' sense of belonging. Local students, artists and craftsmen were commissioned to create art works and benches. Activities such as an "Action Seedling" and a community garden programme promote green living to the residents.

Government

REDEVELOPMENT OF KWAI CHUNG HOSPITAL (PHASE 2)

Three Key Features Demonstrating the Sustainability Performance

- Biophilic design
- Permeability optimisation
- Climate-responsive approach

Project Team

Project Name	Redevelopment of Kwai Chung Hospital (Phase 2)
Team or Organisation Name	Architectural Services Department
Name of Owner / Developer	Hospital Authority
Project Manager	Architectural Services Department
Main Contractor	Shui On Joint Venture
Architect	TFP Farrells Ltd.
Civil & Structural Engineer	Arup
Building Services Engineer	AECOM Asia Company Ltd.
Quantity Surveyor	C.S. Toh & Sons & Associates Ltd.
Landscape Architect	Urbis Ltd.
Sustainable Design Consultant	AECOM Asia Company Ltd.
Environmental / Ecology Consultant	Allied Sustainability and Environmental Consultants Group Ltd.

Kwai Chung Hospital, established in 1981, is building a new campus to adopt a hybrid model of psychiatric care. The new facility will offer whole-person care, from hospital to the community, and focus on the patient's journey to recovery and community integration. The overall setting will be relaxing and homely, catering for people of all ages and backgrounds.

Green Healing Village

Developed on the biophilic theme, the Green Healing Village Concept uses the stacking and overlay of gardens, terraces, open spaces, passageways and vertical greening to give the impression of a living, breathing development that reaches out to the natural surroundings, connecting with internal and external spaces. The landscape has been designed to activate all the senses while highlighting and preserving the presence of existing natural elements such as breezes, sunlight and pleasant views. Various types of gardens have been designed to be viewed from the internal spaces, creating a seamless continuation from the indoors to the outdoors. These not only give pleasant views from the various internal wards, but also facilitate clinical monitoring by hospital staff.

Home-Like Environment

Throughout the development, elements of a home can be found to convey a comforting and familiar environment. In this way, attention to human scale and perception is being introduced to provide a familiar experience for patients and visitors, demonstrated by variations in the modules, punch windows, terraces, a palette of materials, and the use of colours and patterns that resemble aspects of a home.

Government

REDEVELOPMENT OF KWAI CHUNG HOSPITAL (PHASE 2)

"The redevelopment of Kwai Chung Hospital will create an advanced patient-orientated facility integrated with nature and the community to maximise patient comfort and recovery."

Felix LI,
Director, TFP Farrells Ltd.

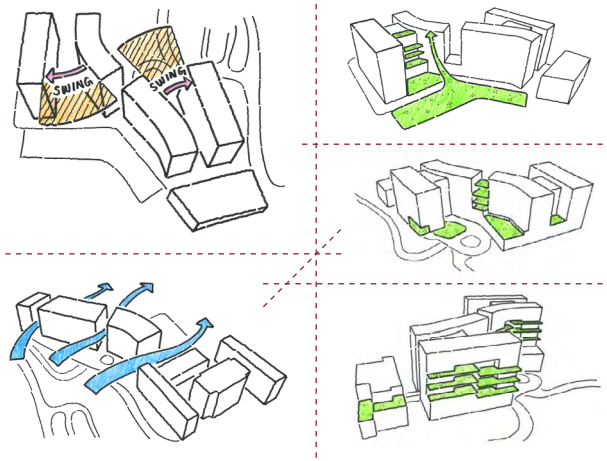
Inpatient wards are surrounded by generous ward gardens and terraces, while living rooms and dining rooms form part of the architectural language that integrates interior design and space planning with the building envelope for a holistic design approach. The combination of well-articulated building form and massing, façade treatment, clear sightlines to activities and a variety of gardens create a patient-centred home environment supportive of recovery and community integration.

Optimising Permeability

The design of the hospital has been influenced by the aim of optimising permeability throughout the development to allow for views, natural light and ventilation. By slightly curving the building away from the adjacent block, the possibility of being overlooked has been minimised, which promotes a sense of privacy for individual wards. The massing of the building has been carefully considered to ensure a positive visual impact and a functional environment.

Climate-Informed Design

Understanding the climatic conditions of a site is crucial in designing sustainable buildings holistically. Proper daylighting in patient and staff areas plays a critical role in aiding recovery times and promoting the well-being of all building users. The design employs a climate-responsive methodology to optimise daylight and ventilation performance while meeting functional requirements and reducing energy consumption based on the sun and building orientation. To develop sustainable design strategies, climatic information such as seasonal temperature variation, solar position, solar radiation, daylight availability and prevailing wind direction have all been carefully studied.



Government

REPROVISIONING OF TRANSPORT DEPARTMENT'S VEHICLE EXAMINATION CENTRES AT TSING YI

Three Key Features Demonstrating the Sustainability Performance

Integrated design to reduce energy consumption and carbon emissions

Boosted indoor-outdoor environment quality to enhance well-being

Optimised buildability and maintainability for long-term cost-effective maintenance and operation

Project Team

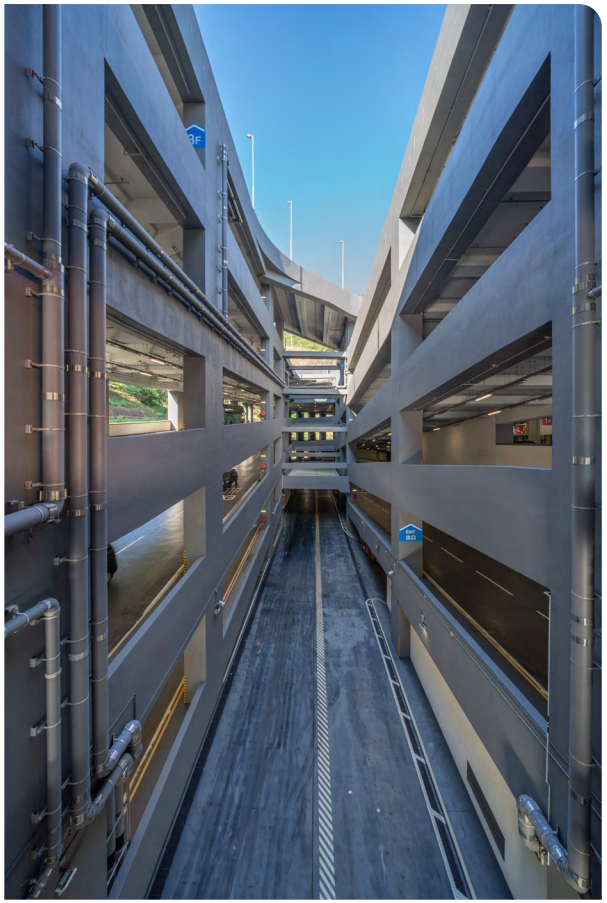
Project Name	Reprovisioning of Transport Department's vehicle examination centres at Tsing Yi
Team or Organisation Name	The Government of the HKSAR
Name of Owner / Developer	Transport Department
Project Manager	Architectural Services Department
Main Contractor	Hip Hing Joint Venture
Architect	Wong Tung & Partners Ltd.
Civil & Structural Engineer	WSP Hong Kong Ltd.
Building Services Engineer	WSP (Asia) Ltd.
Quantity Surveyor	C. S. Toh & Sons & Associates ltd.
Landscape Architect	ADI Ltd.
Environmental / Ecology Consultant	Cundall Hong Kong Ltd.
Facility Manager	Transport Department
Management Company	Transport Department

The Vehicle Examination Centre (VEC) is a newly-built facility designed to handle a maximum capacity of 1,000 vehicles per day. The project comprises a three-storey inspection hall, a seven-storey office block, a vehicular scissors ramp, a 485-metre road widening and slope improvement works. The design and construction of VEC is focused on building a sustainable city and community in the long term.

The main design principle of the building is to maintain efficient use of space. Thorough planning of its roles and the juxtaposition of different functions to facilitate daily operations has helped optimise the building's form and dimensions. In this way the building's cost-effectiveness can be maximised during construction as well as throughout its life cycle, maintenance and operations.

Up to 90% of the main building foundation sits on a rock foundation. Adopting a shallow foundation footing scheme largely reduced the need for excavation, benefiting the environment by reducing the noise generated by rock breaking. In addition, part of the excavated rock was crushed offsite and reused as backfill material.

Adoption of off-site and prefabricated construction also improved cost effectiveness and quality, while economical and durable building materials were applied. This will ease future building maintenance. In addition, the use



Government

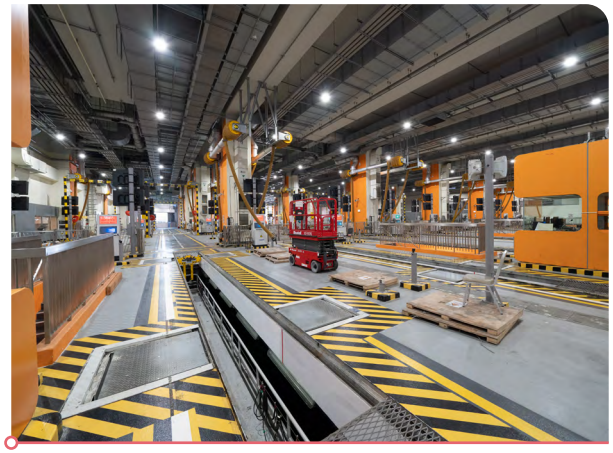
REPROVISIONING OF TRANSPORT DEPARTMENT'S VEHICLE EXAMINATION CENTRES AT TSING YI

"Through the integration of solar panels, rainwater collection for irrigation and aluminium fins to enhance the building's shading coefficient the building exemplifies a sustainable and energy-efficient design."

Clive TONG,
Engineer, Monitoring and Projects,
Transport Department,
The Government of the HKSAR

of prefabricated steel reinforcement improved costs and reduced waste, by minimising the scale of the on-site rebar fabrication yard. Cost effectiveness was also achieved by making use of mezzanine floors as the major plant rooms. The proximity of services and the served, lessening the distance of building service routeing, helped reduce the overall bulk of the building.

To integrate climate resilience into the design, durable and sustainable materials were chosen and strong weather resistant materials such as grade 316 stainless steel used on external features. Heavy duty paint with high UV resistance was applied to mitigate any damage from normal wear and tear and delay natural deterioration. Corner and bumper guards are installed to protect and extend the lifespan of walls and columns.



The VEC serves a huge number of heavy vehicles daily, creating frequent vibration inside the inspection hall and ramp. Consideration was given to easing future maintainability by improving the traditional plaster finishing. In order to prevent plaster falling from walls and ceilings owing to frequent vibration, anti-fungal emulsion paint was applied to upgraded off-site formed concrete surfaces for both the ceiling and walls of the inspection hall. It is expected that this will help reduce potential future repair and maintenance costs relating to frequent heavy traffic flow and vibration from vehicles, s, as well as minimising any disturbance to operations.

Other innovative technology adopted includes the reuse of A/C condensate, integration of PV panels, an NCCO air purifier, an intelligent lighting control system, a side stream separator system for condensing water, and a variable primary flow for the chiller system. This will contribute substantially to energy efficiency, boosting the building's overall performance to achieve long-term environmental sustainability.

Government

RETROFITTING AND OPTIMISATION OF CHILLERS AT QUEENSWAY GOVERNMENT OFFICES

Three Key Features Demonstrating the Sustainability Performance

- Unwavering Commitment
- Pioneering Sustainability
- Exemplary Practices

Project Team

Project Name	Retrofitting and Optimisation of Chillers at Queensway Government Offices
Team or Organisation Name	Electrical and Mechanical Services Department and Trane Hong Kong o/b TYS Limited
Name of Owner / Developer	The Government of the HKSAR
Project Manager	Electrical and Mechanical Services Department
Main Contractor	Trane Hong Kong o/b TYS Limited (for Phase II)
Others	Energy Verification: Hong Kong Green Building Council

The project team conducted two renovation phases for the Queensway Government Building (QGO), of which Phase I involved chiller retrofitting, while Phase II implemented AI-based chiller control. After the Phase I retrofitting, QGO is the first Government office building in Hong Kong to utilise low-GWP refrigerant chillers, which can set a precedent for green and sustainable Government buildings, supporting collaborative industry efforts to achieve net-zero emissions by 2050. With the AI-based chiller control implemented in Phase II, this project stands out for its comprehensive life-cycle design, sustainable technologies, and use of green and resilient products. These initiatives have optimised energy efficiency and will provide environmental advantages throughout the project's lifespan.

In Phase I, the project team implemented sequential and ongoing approaches to boost energy efficiency and operational excellence. A comprehensive energy analysis method was employed to overcome limited historical records and identify potential energy-saving opportunities. Building Information Modelling (BIM) was also utilised to visualise the construction phases and enable advanced chiller plant modelling. The benefits of a sustained approach and economic outcomes throughout the building's life cycle were evaluated with the use of energy simulation software which adheres to ASHRAE and LEED standards. Measurement and verification (M&V) conducted after one year of Phase I retrofitting completion showed significant annual energy savings of 32.8%, equivalent to a reduction of 870 metric tonnes of carbon emissions, as validated by the HKGBC.

The project also prioritised the use of green and resilient products. The newly-installed HFO ultra-high efficiency chillers not only exceeded the minimum statutory requirements but also received Platinum rating under the HKGBC Green Product Certification Scheme. These are the first certified chillers in Hong Kong to use a new-generation, ultra-low-GWP HFO R-514A refrigerant (GWP<2), aligning with international agreements including the Kigali Amendment on phasing down HFCs.

Government

RETROFITTING AND OPTIMISATION OF CHILLERS AT QUEENSWAY GOVERNMENT OFFICES

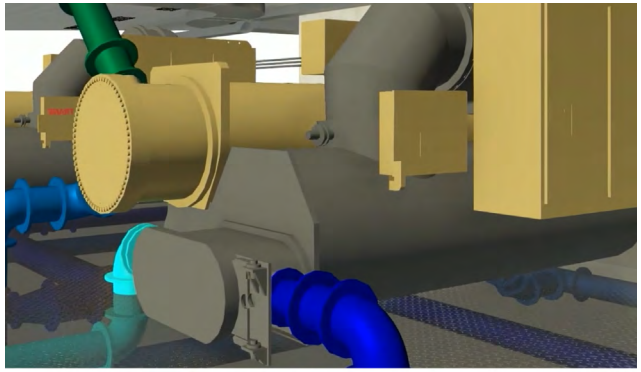
"The QGO project, as the first Government building utilising low GWP chillers, exemplifies the unwavering commitment of the HKSAR Government and stakeholders to pioneering sustainability solutions, and sets an exemplary standard for green building practices, showcasing devotion to a sustainable future."

Project Team,
Electrical and Mechanical Services Department and Trane Hong Kong o/b TYS Limited

This demonstrates the team's commitment to climate and environmental protection through the use of energy-efficient and environmentally friendly air-conditioning alternatives.

In Phase II, following the retrofitting of chillers, the project team implemented an AI-based chiller plant control to enable further enhancement through adaptive commissioning and continuous optimisation. The control framework offers seamless substitution of third-party AI resources, minimises electronic waste resulting from technology iteration, and incorporates exclusive AI algorithms and factory-built features to safeguard a secure and reliable operation of the chiller system. After continuous measurement and verification, a considerable additional energy saving was achieved. The success of this AI control framework further confirmed its feasibility and demonstrates the potential for significant energy savings and long-term reductions in CO_2 emissions.

The QGO project embodies collaborative industry efforts towards net-zero emissions in Hong Kong. It implements comprehensive energy analytics and utilises green products. The project's achievements on the retrofitting of chillers were recognised with three ASHRAE Technology Awards in 2021 and 2022, establishing it as a role model for existing buildings in driving Hong Kong towards carbon neutrality by 2050. The ongoing optimisation of chillers employs an innovative AI framework and will bring further energy savings, solidifying the project's commitment to sustainability.



BIM Modelling

Site Record

Government

SIU LAM INTEGRATED REHABILITATION SERVICES COMPLEX

Three Key Features Demonstrating the Sustainability Performance

A user-centric sustainable care home that prioritises dignity and well-being

Supports the community by providing exceptional care

Connected and intimate garden spaces restore the landscape and encourage rehabilitation

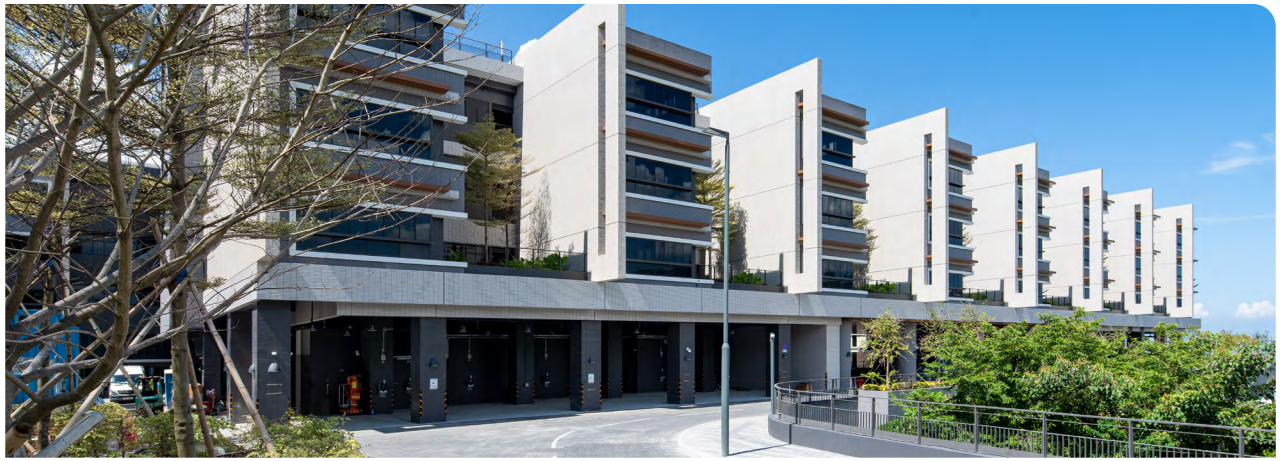
Siu Lam Integrated Rehabilitation Services Complex is a new facility in the New Territories that is designed to support the community by providing exceptional care for individuals with severe to moderate mental and/or physical disabilities and chronic mental illnesses. Built on a site of approximately 30,800m², the complex offers 1,700 places for residential care, day training and vocational rehabilitation services.

The complex is designed in a two-block layout, with a low block and a high block situated on different elevations of the site. This approach minimised site formation work, reduced massing and visually integrated the building with the existing topography. The blocks are seamlessly connected on the ground floor, creating an open landscaped garden that extends the entrance level of the high block. By maximising the space on each floor, the complex optimises movement efficiency and allows more time for essential services and activities to be provided.

In terms of climate resilience, the complex features spacious landscaped gardens and intimate courtyards that are easily accessible from the dormitories and communal areas. These outdoor spaces provide natural daylight and cross ventilation, as well as a connection to nature throughout the facility. Soft landscaping covers 47% of the grounds

Project Team

Project Name	Siu Lam Integrated Rehabilitation Services Complex
Team or Organisation Name	Social Welfare Department
Name of Owner / Developer	Social Welfare Department
Project Manager	Social Welfare Department
Main Contractor	Ronald Lu & Partners (Hong Kong) Ltd.
Structural / Civil / Geotechnical Engineer	WSP Hong Kong Ltd.
Building Services Engineer	WSP (Asia) Ltd.
Landscape Consultant	Urbis Limited
Environmental Consultant	WSP (Asia) Ltd.
BEAM Plus Consultant	WSP (Asia) Ltd.
Quantity Surveyor	Rider Levett Bucknall Ltd.
Traffic Consultant	MVA Hong Kong Ltd.



Government

SIU LAM INTEGRATED REHABILITATION SERVICES COMPLEX

"The two-building low block and high block design integrates the buildings and courtyards with the landscape, while optimal lighting and cross-ventilation create a comfortable environment for rehabilitation and training."

Alex WONG Kwok-chun,
Deputy Director of Social Welfare,
Social Welfare Department,
The Government of the HKSAR

and podium levels, with the planting of over 260 new trees along with an abundance of ornamental shrubs and ground cover. This integration of native species restores the landscape, promotes sustainability, and minimises wildlife habitat fragmentation. The complex also incorporates renewable energy capabilities for climate adaptation, including 370 photovoltaic panels and a 86 kW bio-diesel generator.

The dormitory units are modular and offer future-focused flexibility in allocating and adjusting bed spaces, ensuring high standards of care regardless of the patient mix. Rooms have full-width windows that offer external views of the sea or mountains, while sun-shading features reduce solar gain and improve residents' comfort. The L-shaped dormitories effectively screen traffic noise from the nearby highway while enhancing ventilation and reducing energy costs. The strategically-designed courtyards also serve as internally accessible leisure gardens, catering to the needs of severely mentally or physically handicapped residents.

Other outdoor spaces within the complex include sitting-out courtyards, open leisure decks and small farming areas. These areas stimulate residents' senses and promote a further connection with nature. Indoor biophilic design elements, including greenery and planters along corridors, create a green living and working environment for residents, visitors and staff.

Siu Lam Integrated Rehabilitation Services Complex is designed to prioritise the well-being and dignity of individuals with disabilities and chronic mental illnesses. Through its thoughtful design, efficient use of space, integration with nature, and commitment to sustainability, the complex will provide an inspiring rehabilitation environment for future generations.

Government

TUNG CHUNG NEW TOWN EXTENSION (EAST) - RECLAMATION

The Tung Chung East (TCE) reclamation project incorporates many sustainable measures, including non-dredged methods for reclamation and use of the deep cement mixing (DCM) method. Eco-shorelines are planned along the seawalls to enhance biodiversity. Additionally, construction and demolition (C&D) materials are being utilised as the major source for reclamation filling material.

The TCE reclamation is the first public works project in Hong Kong to use DCM method to speed up the reclamation process. DCM more efficiently solidifies the ground, enabling the reclamation to be completed approximately six months earlier than using the conventional method. The works contract commenced at the end of 2017 and with the use of DCM, the first parcel of land was delivered for public housing development in just 27 months. Furthermore, the demand for fill material to replenish settlement was reduced by around six million tonnes. This in turn reduced the number of vessel trips and thus the project's carbon footprint.

Ground Granulated Blast Furnace Slag (GGBS) is a by-product of the steel industry. Its reuse for reclamation projects is not only more environmentally friendly but also enhances overall durability, improving end-product resistance to alkali-silica, sulphate and chloride reactions. The use of GGBS as a cement substitute in DCM works has reduced cement consumption by 60% in this project, and

Three Key Features Demonstrating the Sustainability Performance

- Sustainable reclamation through the use of advanced deep cement mixing method
- Recycling of C&D materials for reclamation and the use of by-product GGBS
- Eco-Shoreline adds resilient edge and serves as guardian of coastal biodiversity

Project Team

Project Name	Tung Chung New Town Extension (East) - Reclamation
Team or Organisation Name	Civil Engineering and Development Department / AECOM / Build King-SCT JV
Name of Owner / Developer	Civil Engineering and Development Department
Project Manager	AECOM
Main Contractor	Build King-SCT Joint Venture
Architect	AECOM
Civil & Structural Engineer	AECOM
Building Services Engineer	AECOM
Quantity Surveyor	AECOM
Landscape Architect	AECOM
Project Designer	AECOM
Planning Consultant	AECOM
Sustainable Design Consultant	AECOM
Environmental / Ecology Consultant	AECOM

Rocky Eco-shoreline

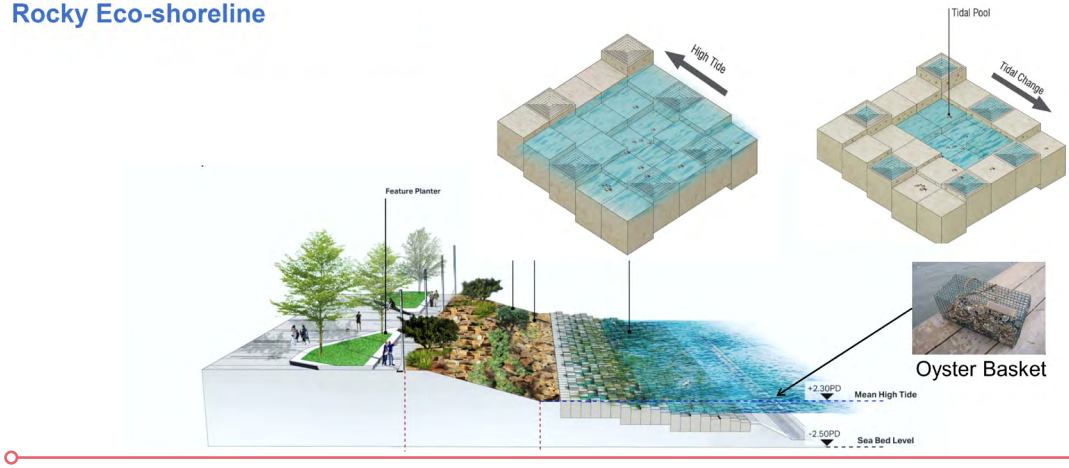


Figure A

Government

TUNG CHUNG NEW TOWN EXTENSION (EAST) - RECLAMATION

"We crafted a climate-resilient site and a future-ready living environment with an eco-shoreline, which will bring a unique and incredible experience to the local community."

Stanley CHENG,
Chief Engineer / Lantau 1,
Civil Engineering and Development Department,
The Government of the HKSAR

achieved a significant reduction of some 600,000 tonnes in greenhouse gas emissions, specifically carbon dioxide.

The reclamation maximises the use of "waste" C&D materials comprising rocks, concrete, asphalt, rubble, bricks, stones and earth generated from other sites, and accounting for over 70% of the total. The remaining portion consists of mechanical sand, a by-product of quarrying which has proved to be an effective substitute for marine sand, serving as the sand blanket.

Eco-shorelines are being adopted as a nature-based solution to enhance biodiversity. Environments have been created that closely mimic the physical conditions of natural habitats, thereby supporting marine life while offering effective shoreline protection. The eco-shorelines are of three different types, namely rocky, mangrove and vertical (Figures A to C). Rocky eco-shorelines are provided in locations that are relatively susceptible to wave actions or have insufficient sunlight. Bio-blocks with varying levels and sizes of cavities are designed and constructed at inter-tidal zones to retain seawater during low-tide conditions, with the aim of creating suitable habitats and shelters for marine species. Mangrove eco-shorelines are provided at inter-tidal zones along seashores that are less susceptible to sea waves. Vertical eco-shorelines incorporate pots, cavities, eco-tiles and similar features to enhance the growth of tiny marine organisms. Nowadays, eco-shorelines become habitats for over 30 types of marine species.

Mangrove Eco-shoreline

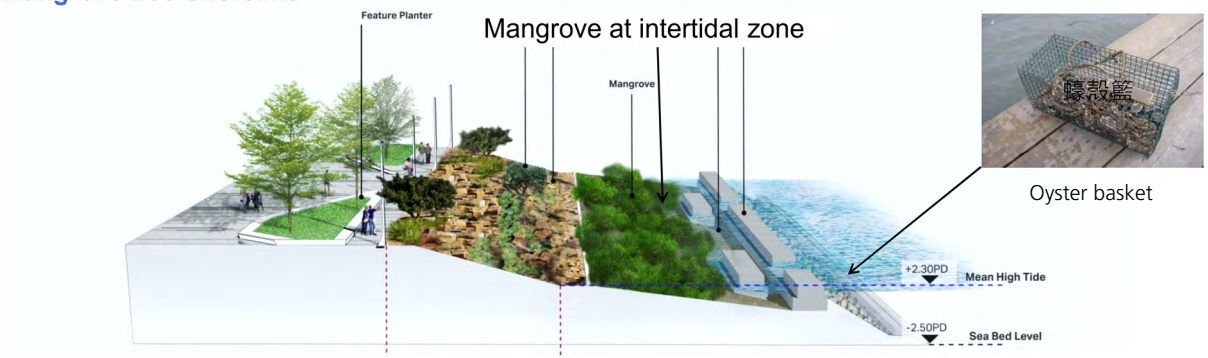


Figure B

Vertical Eco-shoreline

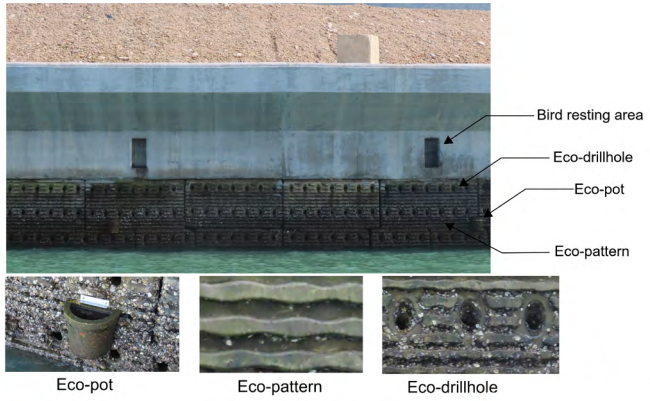


Figure C

Government

TUNG CHUNG NEW TOWN EXTENSION - SITE FORMATION AND INFRASTRUCTURE WORKS: PROMENADE IMPROVEMENT WORKS

Three Key Features Demonstrating the Sustainability Performance

- Placemaking for local residents – transforming the seafront works area to an open space for public enjoyment
- Building together for a better Tung Chung New Town
- Establishing a "L.I.V.E." relationship between the community and the Government

Bird's-eye View of Promenade

Recognising the increasing global demand for sustainable development, the Tung Chung New Town Extension project team is committed to integrating sustainable initiatives into the project, believing this can help build a better future for the community and the environment through the concerted effort of different stakeholders. A wide range of sustainable measures has been implemented with a view to preserving the natural resources, minimising the project's impact on global warming and achieving the goal of sustainability.

A "L.I.V.E." relationship between the community and the Government refers to:

- Linkage between man and environment, and between people and government;
- Interface between people and the community;
- Versatility of activities in all seasons; and
- Experimenting with the talents of local artists by exhibiting their works

Building Façade next to East Entrance

Project Team

Project Name	Tung Chung New Town Extension - Site Formation and Infrastructure Works: Promenade Improvement Works
Team or Organisation Name	Richwell Civil Engineering Limited
Name of Owner / Developer	Civil Engineering and Development Department
Project Manager	Arup
Main Contractor	Build King - Richwell Civil Joint Venture
Management Company	Build King - Richwell Civil Joint Venture

https://www.tung-chung.hk

Government

TUNG CHUNG NEW TOWN EXTENSION - SITE FORMATION AND INFRASTRUCTURE WORKS PROMENADE IMPROVEMENT WORKS

A variety of facilities and sustainable products are being used to reduce indirect emissions and solid waste. Examples include a Zero Irrigation System, which adopts a self-sustaining and passive design to deliver stormwater stored

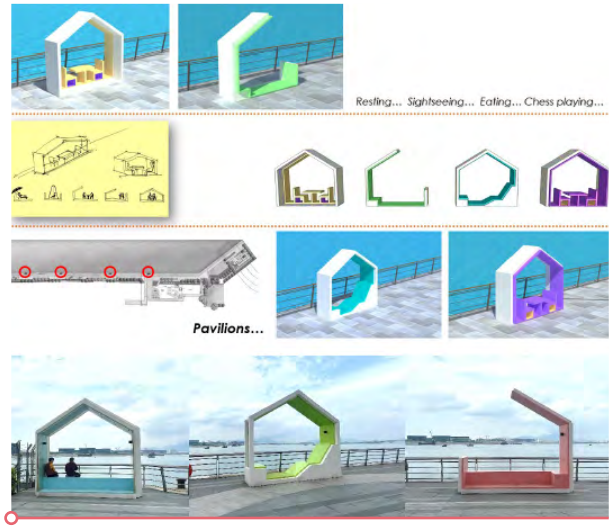
Sculptural Pavilion & Promenade

in the water retention cells to the vegetation through capillary action and minimising topsoil evaporation; and an Aquaponics Zone, where micro-organisms can convert fish wastes into nutrients that can be used by the plants, which in turn cleans the water for the fish. Operating costs and pollution are both minimised by reducing the amount of waste produced and fertiliser needed.

Amphitheatre and Lawn

Another example is the use of Biochar, made from biomass waste and concrete, to reduce carbon emissions. Adding biochar to the soil of planters can help plant growth and increase biodiversity. In addition, the plants in a Rain Garden absorb a portion of the collected rainwater, while the rest is processed and purified to remove chemical pollutants or dirt before being directed to underground drainage. This system serves as an ecologically sustainable means of rainwater control by reducing the demand for irrigation water and alleviating waterlogging problems. In the long run, it can foster effective management of water resources and improve water quality.

The project team has strived to mitigate risks associated with climate change by adopting various environmental policies and measures, and by promoting energy saving measures and habits in the site office. Electrical appliances with high energy efficiency labels were purchased for site equipment including lighting and air-conditioning systems, so as to increase energy efficiency and minimise indirect emissions.



Pavilions in Promenade

Government

TUNG CHUNG COMMUNITY LIAISON CENTRE

Project Team

Project Name	Tung Chung Community Liaison Centre
Team or Organisation Name	Sustainable Lantau Office, Civil Engineering and Development Department
Name of Owner / Developer	Civil Engineering and Development Department
Project Manager	Civil Engineering and Development Department ARUP
Main Contractor	Build King Civil Engineering Limited
Architect	AGC Design Limited
Civil & Structural Engineer	Civil Engineering and Development Department
Quantity Surveyor	AECOM Cost Consulting (Hong Kong) Limited
Facility Manager	Build King – Richwell Engineering Joint Venture
Management Company	Build King – Richwell Engineering Joint Venture

https://www.lantau.gov.hk/en/tung-chung-clc-and-promenade/tung-chung-clc/index.html

To enhance communication with the public, the Sustainable Lantau Office (SLO) of the Government's Civil Engineering and Development Department set up the Tung Chung Community Liaison Centre (CLC) at the end of 2021. The CLC was constructed by renovating and modifying an unused site office.

The "single site, multiple use" revitalisation proposal for the CLC encompasses various facets that actively promote sustainability while enhancing the quality of life for Tung Chung residents. CLC not only serves as a versatile gathering place for Tung Chung residents, but also an office for CEDD projects and an exhibition centre to showcase future development and conservation efforts on Lantau Island. This multipurpose functionality allows the CLC to cater to the needs of the community while fostering a sense of collaboration and participation. The architectural design of the CLC, harmoniously blending with the adjoining Tung Chung East Promenade, showcases a thoughtful approach to preserving the natural aesthetics of the area. By repurposing an unused site office, the CLC exemplifies the principles of adaptive reuse, reducing waste and minimising the need for a new facility.

The project's commitment to sustainability is further exemplified through its implementation of various features that enhance climate resilience. The adoption of skylights throughout the CLC attracts natural daylight, reducing the building's reliance on artificial lighting and lowering energy consumption. The addition of indoor greening not only enhances the overall aesthetics but also

Three Key Features Demonstrating the Sustainability Performance

- Revitalisation of an unused office
- Addition of skylights
- Enhanced connectivity with the neighbourhood

Government

TUNG CHUNG COMMUNITY LIAISON CENTRE

contributes to improved indoor air quality and promotes a healthier environment for occupants. The CLC's design includes a long continuous foldable door to enhance connectivity and ventilation, aligning with its goal of maintaining environmental sustainability. In addition, sustainability features of the adjoining promenade such as a Rain Garden, Bird Nesting Box, Aquaponics Exhibition Area and Zero Irrigation System showcase the project's dedication to preserving the ecological integrity of the surrounding area.

Proactive steps have been taken to ensure the CLC's long-term environmental sustainability. By providing an office facility for CEDD staff, it encourages them to "Work for Tung Chung, Work in Tung Chung". Moreover, by providing shared spaces for community events such as the Lantern Festival, planting workshops, and year-end fun days, the CLC encourages participation by Tung Chung residents and fosters their sense of ownership. This approach not only strengthens social cohesion but can also reduce their carbon footprint by encouraging them enjoy their neighbourhood without travelling.

Recognising the importance of fostering environmental awareness and involving the community in sustainable practices, CLC will continue to organise educational programmes, workshops, and events that promote environmental stewardship, conservation and sustainable living. By empowering community members with knowledge and skills, the project can create a ripple effect of positive environmental actions beyond its immediate sphere.

"Tung Chung Community Liaison Centre promotes green living and sustainability by revitalising an old site office and encouraging community participation."

Kevin WONG,
Property Service Manager,
Build King – Richwell Engineering Joint Venture

Government

YUEN LONG EFFLUENT POLISHING PLANT (YLEPP)

Three Key Features Demonstrating the Sustainability Performance

- Achieves Energy Neutrality and Strives Towards Carbon Neutrality
- Energy Efficient Design
- Enhanced Treated Effluent Quality

Project Team

Project Name	Yuen Long Effluent Polishing Plant (YLEPP)
Team or Organisation Name	Drainage Services Department AECOM Asia Company Limited
Name of Owner / Developer	Drainage Services Department
Project Manager	AECOM Asia Company Limited
Main Contractor	Paul Y. - CREC Joint Venture
Architect	AECOM Asia Company Limited Ida & Billy Architects
Civil & Structural Engineer	AECOM Asia Company Limited
Building Services Engineer	AECOM Asia Company Limited
Landscape Architect	AECOM Asia Company Limited Ida & Billy Architects
Project Designer	AECOM Asia Company Limited
Planning Consultant	AECOM Asia Company Limited
Facility Manager	Drainage Services Department

https://youtu.be/Gf2sqzoAkBA
https://www.ylepp.hk

Yuen Long Effluent Polishing Plant (YLEPP) is a sewage treatment works upgrading project led by the Government's Drainage Services Department. It upgrades the existing Yuen Long Sewage Treatment Works (YLSTW) to a tertiary treatment plant with its original treatment capacity being more than doubled from 70,000 m3/day to 150,000 m3/day in stages within a tight footprint to meet more stringent discharge requirements, thus protecting the ecological environment of Deep Bay.

YLEPP is designed to be an energy neutral and sustainable facility, with various environmentally friendly design features, including selection of a low-energy treatment process; maximisation of renewable energy; and optimised E&M design, hydraulic design and building design. The plant also encompasses water resource management including water reuse and rainwater harvesting to reduce fresh water demand and recycle precious water resources.

YLEPP is the first wastewater treatment plant in Hong Kong, as well as one of the largest in Asia, to adopt the advanced aerobic granular sludge (AGS) technology for biological treatment. The AGS process utilises the unique characteristics of granular biomass working in aerobic conditions to treat the sewage and allow anoxic conditions inside the granules, enabling simultaneous nitrification and denitrification during aeration. AGS is comparatively energy efficient owing to the reduced use of mechanical equipment like mixers and recycling pumps, which helps YLEPP move towards energy neutrality.

YLEPP is designed to maximise its potential to utilise solar energy through the installation of PV panels on the rooftops of most of the buildings, in total 5,000 panels with installed capacity of about 3.0 MW. The waste sludge

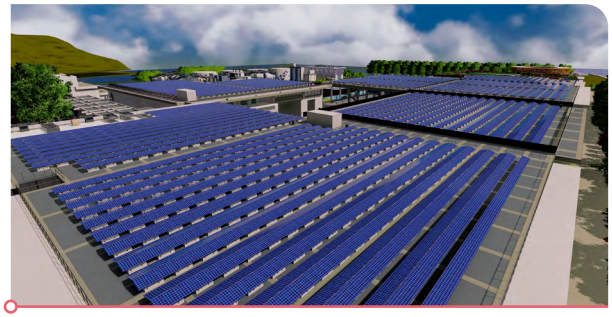
Government

YUEN LONG EFFLUENT POLISHING PLANT (YLEPP)

"With the achievement of energy neutrality at YLEPP, we are committing to support Government's goal of achieving carbon neutrality in 2050 to combat climate change."

YIP Tat-ming,
Chief Engineer, Sewerage Projects, Drainage Services Department, The Government of the HKSAR

from the sewage treatment process will generate biogas in an anaerobic digestion process, which is then turned into electrical energy using highly efficient Combined Heat and Power (CHP) generating sets to support the daily operations of YLEPP. The biogas yield can be further increased by importing food waste and external sludge to co-digest with YLEPP's sewage sludge, generating additional energy that is sufficient to meet the entire annual power consumption of YLEPP, achieving energy neutrality. YLEPP on completion will become the first sewage treatment plant in Hong Kong able to attain energy neutrality at its commissioning.



The project team are continuing to collaborate with carbon management experts to explore and embrace new technologies to reduce carbon footprint and maximise carbon offset, striving for better ways of achieving carbon neutrality in the next step.

YLEPP is not a mere sewage treatment plant, but also a community enjoyment facility with an eco-learning riverside promenade, roof garden and bird bide, as well as an education pathway running through the plant with sustainable education elements and renewable energy installations. This can giving the community an experience of sustainable living and knowledge-sharing on the journey towards energy and carbon neutrality.

The sustainability excellence of YLEPP has been recognised by international and local professionals, demonstrating the team's strong commitment to pursuing the Government's goal of achieving carbon neutrality in 2050 to combat climate change, making Hong Kong a more sustainable and liveable city.

Industry | Commercial

11 SKIES

Project Team

Project Name	11 SKIES
Team or Organisation Name	New World Development Company Limited
Name of Owner / Developer	New World Development Company Limited
Project Manager	New World Development Company Limited
Main Contractor	Hip Seng Builders Limited
Architect	Ronald Lu & Partners (Hong Kong) Ltd. LEAD 8 Hong Kong Limited
Civil & Structural Engineer	AECOM Asia Company Limited
Building Services Engineer	AECOM Asia Company Limited
Quantity Surveyor	Arcadis Hong Kong Limited
Landscape Architect	Adrian L. Norman Limited; BH Architects (Hong Kong) Limited QUAD Limited
Sustainable Design Consultant	Arup
Environmental / Ecology Consultant	AECOM Asia Company Limited
Facility Manager	K11 Concepts Limited
Management Company	K11 Concepts Limited
Design Architect	LEAD 8 Hong Kong Limited
Interior Design	Spiral Architectural Design Limited (K11 Atelier) LEAD 8 Hong Kong Limited (Overall Retail Area) Ronald Lu & Partners (Hong Kong) Ltd. (1 of the Atrium) One Bite Design Studio (1 of the Atrium)
BEAM Plus, LEED & WELL Consultant	AECOM Asia Company Limited

https://youtu.be/tkx-pj8RAVI
https://www.11-skies.com/
https://www.k11atelier.com/hk/11-skies/

11 SKIES on the Airport Island of Hong Kong is set to become the city's largest hub for retail, dining and entertainment (RDE) once complete and will establish one of its largest networks of living green walls. As part of the mixed-use offering, the scheme will incorporate three grade A office towers operated under K11 ATELIER. This premium office network will offer the perfect doorway to the Greater Bay Area (GBA), tailored to companies establishing their GBA business centre at the heart of the region.

Sustainability and innovation have underpinned the design and construction process. The project features one of Asia's largest Photovoltaic-Thermal (PVT) installations, able to generate up to 200,000 kWh of electricity per year, which contributes to about 1.2% of office energy consumption. The project is also one of the first of its kind to incorporate AI technology into its electric vehicle charging system for dynamic load management, providing two of the largest 400kW high power chargers in Hong Kong which enable nearly 100% energy utilisation.

Three Key Features Demonstrating the Sustainability Performance

- Redefining a Sustainable Human-Centric Office Community
- High Performance in terms of Carbon Neutrality and Wellness
- Practical Innovative Smart Technologies

An electrochromic skylight with a total area of 953m² has been installed in the retail centre of 11 SKIES, creating a dynamic natural daylighting space that will automatically tint throughout the day accordingly to the outdoor weather. The smart skylight offers energy-saving opportunities while enhancing occupants' comfort.

To address the challenges posed by climate change, a Climate Exposure Assessment was carried out to assess 11 SKIES' exposure to potential physical climate hazards under future climate change and associated extreme weather. Flood prevention measures have been installed to address the risk of extreme rain, including floodgates at the underground car park entrances, a flood detection system, and elevated MEP equipment The built-form and elevation

Industry | Commercial

11 SKIES

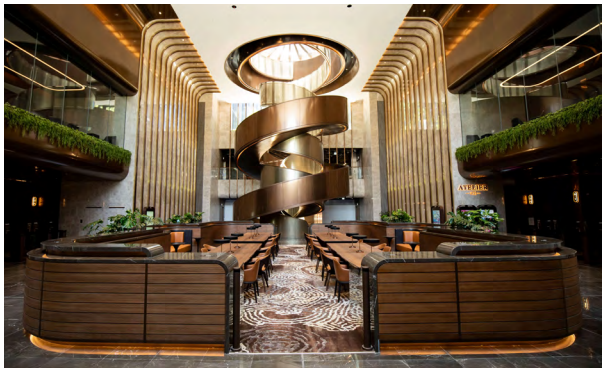
"11 SKIES is a regional hub project in the GBA. It comprises the largest retail complex and largest indoor entertainment facilities in the region, as well as a GBA commerce hub and major transport connectivities. Aimed at attracting annual traffic of over 70m, it also embraces sustainability in its development and operational life cycle, which is so important for our future."

Richard CHEUNG,
Senior Director, Commercial
New World Development Company Limited

of 11 SKIES also helps alleviate the risk of exposure to future extreme sea levels and intensifying tropical cyclones. As a result, 11 SKIES provides a resilient and climate-adaptive environment to safeguard its people and assets.

Given the development's airport location, an utmost priority is safeguarding the health and wellness of building occupants against outdoor air quality and aircraft noise. In the interior environment, the best quality in thermal comfort, acoustic environment, visual comfort, solar control and indoor air quality performance have been realised. By overcoming these difficulties, the project has not only become the first WELL Certified Core at Platinum Level on the Airport Island of Hong Kong, but is also going beyond certification by providing a responsive MVAC system to ensure indoor thermal comfort and air quality in future operations.

In collaboration with The Hong Kong Polytechnic University (PolyU), the first applications of Novel Demand Control Ventilation (nDCV) and Adaptive Comfort Temperature (ACT) Control system have been incorporated. Bespoke IAQ sensors can automatically self-calibrate with real-time data using big data analysis and AI machine learning, extending the sensors' lifespans. Together with a novel IAQ index, more accurate ventilation control can be achieved. Thermal comfort is also controlled by a calibrated ACT model, an integrated solution for saving energy and providing enhanced thermal comfort to building occupants.



Industry | Commercial

83 KING LAM STREET

Three Key Features Demonstrating the Sustainability Performance

A versatile place-making venue generating wellbeing and sustainable activities

Sustainable build form in addressing wind comfort, flooding, water stress and heat stress

Green and wellness-oriented operations and management

Project Team

Project Name	83 King Lam Street
Team or Organisation Name	New World Development Company Limited
Name of Owner / Developer	New World Development Company Limited
Project Manager	NW Project Management Limited
Main Contractor	Hip Seng Construction Company Limited
Architect	Rocco Design Architects Associates Limited
Civil & Structural Engineer	AECOM Asia Company Limited
Building Services Engineer	J. Roger Preston Limited
Landscape Architect	AXXA Group Limited
Project Designer	Collective Studio Limited
Sustainable Design Consultant	Arup
Management Company	New World Property Management Company Limited

https://www.83kls.com.hk/

The 83 King Lam Street development at Lai Chi Kok has been planned to create an upscale commercial complex that marries art, culture and modernity, seeking harmonious co-existence and co-development with the surrounding commercial area. By incorporating health and wellness elements into the design, New World Development has strived to reinvent spaces that enable people to appreciate the outdoor urban environment and foster social connectivity.

The development features approximately 2,300m² of greenery coverage as well as communal spaces including a podium garden of over 1,900m², a pixelated staircase, a rooftop wellness plaza, and a multipurpose hall, designed to promote the wellbeing of individuals and the community as a whole.

Its tropical soft landscape is intended to provide long-term green sustainability to the community with seasonal effects. The plan is to plant diverse tropical species in the podium landscape to enrich biodiversity.

Industry | Commercial

83 KING LAM STREET

"Connecting West Kowloon to the world, 83 King Lam Street is a hub of cultural innovation and collaboration. We are proud to present this visionary project that represents our core values of innovation, social responsibility and excellence."

Edwin CHAN,
Head of Projects,
New World Development Company Limited

The twin towers of the development create a "Green Canyon", vertically connecting the street to the mountain greenery behind. Its open transparent podium three-dimensionally expands the greenery to the podium garden which offers a variety of functions, encouraging people to use it as a green gathering place. A series of unique and generous spaces has been created, offering visitors, office workers and the public an exciting array of new gathering spaces within this former industrial neighbourhood.

The building separation design creates a wind corridor, which encourages wind penetration to the project site and neighbourhood to create a better microclimate. Round building corners enhance the surrounding wind movement. The open podium facilitates urban air ventilation, allowing air movement that reduces the urban heat island effect, so that less energy and fewer pollutants are needed to cool the fresh air intakes.

The retail podium of 83 King Lam Street will provide unique dining and leisure experiences for tenants and people in the vicinity. The office space adopts a healthy and comfortable design with low-emissivity glass.

In creating the best experience for the development's users, NWD has set high expectations for indoor environmental quality and hygiene. Smart facilities have been incorporated such as an indoor air quality monitoring system in the main lobby, handrail UV sanitisation, touchless buttons for lifts and a touchless entrance system. Energy usage is monitored by a Smart Building Management System, while the use of renewable energy is maximised through the installation of a photovoltaic (PV) system on the rooftop.

Further energy saving measures are being achieved by the use of high-performance chillers and pumps, energy efficient fans, energy efficient lighting and a high-performance façade.

Water conservation has also been considered through the use of low-flow-rate fixtures and the selection of native species for landscaping.

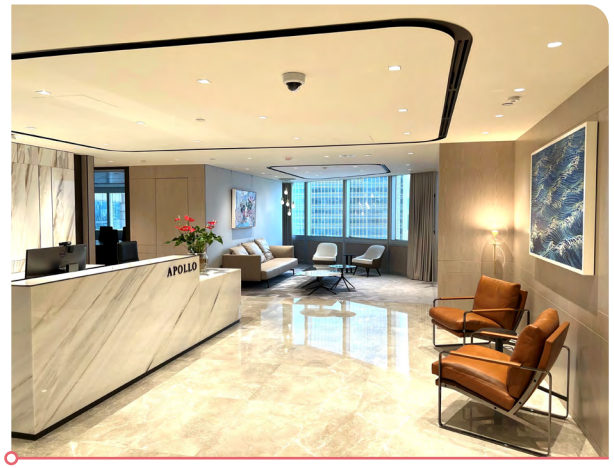
In consideration of any potential risks arising from climate change, MEP rooms are elevated and flood barriers provided at the car park entrance.

Industry | Commercial

APOLLO - ONE EXCHANGE SQUARE 36/F NEW OFFICE FIT-OUT, HK

Three Key Features Demonstrating the Sustainability Performance

- Integrated Sustainable Design
- Employee Wellbeing and Comfort
- Innovative Sustainability Features



Project Team

Project Name	Apollo - One Exchange Square 36/F New Office Fit-out, HK
Team or Organisation Name	Buro Happold International (Hong Kong) Limited
Name of Owner / Developer	Apollo Asset Management
Project Manager	Turner and Townsend Limited
Main Contractor	Wing Art Limited
Architect	Gensler Hong Kong Limited
Building Services Engineer	Buro Happold International (Hong Kong) Limited
Quantity Surveyor	Turner and Townsend Limited
Project Designer	Gensler Hong Kong Limited
Sustainable Design Consultant	Buro Happold International (Hong Kong) Limited
Others	AV / IT Specialist: PTS Managed Services Limited

https://www.burohappold.com/projects/one-exchange-square/

https://www.turnerandtownsend.com/en/news/hong-kong-team-wins-at-2023-hong-kong-green-building-awards/

The Apollo Office Fit-out project is a testament to consultant Buro Happold's vision of sustainability, contributing to the development of a sustainable city and community. It achieves some notable sustainability milestones, integrating a people-centred approach into its design and construction processes, and providing for continued progress to towards zero-carbon operations in the future.

The project has already achieved Platinum rating in BEAM Plus certification and Excellent Class in EPD's IAQ Certification Scheme, highlighting its contribution to building a sustainable city by creating a healthier and more energy-efficient workspace for employees.

The Fit-out project adopts a holistic approach that combines sustainable design strategies with innovative technologies. The office design prioritises natural daylight penetration, reducing the reliance on artificial lighting and minimising energy consumption. This approach not only improves energy efficiency but also contributes to climate resilience by reducing the building's carbon footprint.

Sustainable features that improve indoor air quality and combat the challenges of outdoor air pollution are also incorporated. A moss wall strategically located next to the print room acts as a natural air purifier, removing pollutants and increasing oxygen levels. This not only enhances occupant wellbeing but also creates a healthier indoor environment. In addition, a highly efficient lighting system has been installed, equipped with daylight and motion sensors. This optimises energy usage by adjusting lighting levels based on occupancy and natural light availability, helping to combat climate change by reducing energy consumption and associated greenhouse gas emissions.

The project is designed to maintain its environmental sustainability throughout future operations, aligning with the net zero carbon route maps of the client and consultant.

Industry | Commercial

APOLLO - ONE EXCHANGE SQUARE 36/F NEW OFFICE FIT-OUT, HK

"Through the Apollo Office Fit-out project, sustainability and employee well-being features have been seamlessly integrated, creating a high-performing workspace that positively impacts both people and the environment."

Jason TSE,
Associate Director,
Buro Happold International (Hong Kong) Ltd.

Various strategies will be implemented to ensure long-term sustainability and continued positive impact. Regular maintenance and monitoring of sustainable features will be conducted to ensure optimal functioning and energy efficiency.

Occupants will be encouraged to adopt sustainable practices and environmental responsibility. By fostering a culture of sustainability within the office, the project upholds energy conservation and waste reduction practices. The office operations team will remain at the forefront of innovation and technology, continuously exploring strategies to enhance environmental sustainability. Staying updated with emerging trends and best practices will ensure long-term environmental performance.

By focusing on maintaining environmental sustainability in future operations, the Apollo Office Fit-out project ensures a long-term positive impact. It is hoped that the project will serve as an inspiration, showcasing how sustainability can be embedded within the fabric of a modern office and contributing to a more sustainable future for people, places, and the planet.

Industry | Commercial

CCG + CLPe: ZERO CARBON CHILLER PLANT BUILD-OWN-OPERATE-TRANSFER AGREEMENT FOR NINA TOWER

Three Key Features Demonstrating the Sustainability Performance

Conversion from air-cooled to water-cooled chiller systems with drastically higher Coefficient of Performance (COP) figures and efficiency, trimming energy consumption by over 50%.

Implementation of AI and machine learning algorithms in chiller plant controls to improve new system's efficiency by selecting optimal combinations of chillers and cooling towers.

Establishment of off-site wind farm to generate renewable energy equivalent to that of the new chiller systems, contributing to the community and sustainability.

Project Team

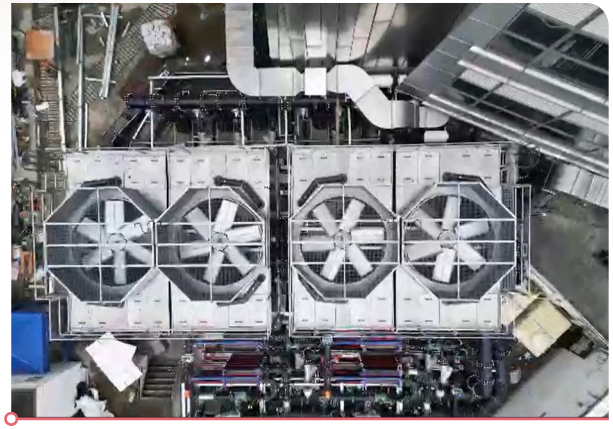
Project Name	CCG + CLPe: Zero Carbon Chiller Plant Build-Own-Operate-Transfer Agreement for Nina Tower
Team or Organisation Name	Chinachem Group and CLPe
Name of Owner / Developer	Chinachem Group and CLPe
Project Manager	CLPe Solutions
Main Contractor	Young's Engineering Co. Ltd.
Architect	Albert Liu and Associates Ltd.
Civil & Structural Engineer	Albert Liu and Associates Ltd.
Building Services Engineer	WSP Hong Kong Ltd.
Quantity Surveyor	WT Partnership Hong Kong Ltd.
Facility Manager	Chinachem Group

Chinachem Group is guided by its sustainability visions and values in every decision it makes, constantly seeking possible ways to reflect elements of its "3Ps" – People, Prosperity and Planet. This project, involving the replacement of all existing air-cooled chiller plants at its flagship building Nina Tower in Tsuen Wan, is one of the cornerstones of the Group's dedication to sustainability.

As the existing chiller plants are reaching beyond their typical service life periods, gradually requiring more O&M resources, the intention of the project is to upgrade these chiller plants in the greenest way possible. By working in partnership with CLPe, these goals can be achieved in several ways.

Industry | Commercial

CCG + CLPe: ZERO CARBON CHILLER PLANT BUILD-OWN-OPERATE-TRANSFER AGREEMENT FOR NINA TOWER



For starters, the upgrade from an air-cooled chiller system to water-cooled systems contributes to significantly lower energy consumption, as water-cooled chillers have notably higher COP figures. The bleed-off water from these chiller plants can also be recycled for flushing water use, minimising the water consumption of Nina Tower. Innovative chiller plant control technologies have also been adopted that utilise AI and machine learning algorithms to further optimise the performance of the new chiller systems. Combining these benefits, the new system is expected to reduce annual energy use by over 50%, equivalent to approximately 7,000 tonnes of CO_2 emissions a year or over 277,000 trees.

Conventional construction methods often incur significant amounts of wastage. To tackle this problem, MiMEP is being adopted throughout this project. With the help of BIM, major equipment and materials such as water pipes, pumps and even cooling towers can be prefabricated accurately into modules at an off-site location. These fabricated modules can be delivered to site, hoisted and anchored to their desired position right on the scheduled installation date.

Finally, to tackle future challenges posed by climate change, new generation refrigerant HFO R-514a has been carefully selected for the chillers. This is known for its ultra-low GWP value of 2 and no ozone depletion – among the lowest available for chiller systems – in comparison with traditional refrigerant HFC R-134a (GWP of 1,300). Chinachem Group is also partnering with CLPe whose expertise in chiller plant maintenance guarantees the performance of the new systems, maintaining the promised energy savings while minimising manpower and resources. As part of the CLPe partnership agreement, an off-site wind farm is being constructed in Mainland China, which will eventually offset all the new chiller system's remaining energy consumption, setting a new trend in sustainable building cooling systems.

Industry | Commercial

CREATIVE TRANSFORMATION OF A GLOBAL BUSINESS DISTRICT - TAIKOO PLACE

The Taikoo Place (TP) area has undergone a series of creative transformations to become one of HK's best-planned global business districts. With an HK$15 billion investment project now completed there, it has become a successful showcase of the sustainable placemaking strategy of Swire Properties (SPROPS), with a wide range of tenant participation centred on ESG and wellness.

Climate Resilience and Biodiversity

Asset-level climate risk assessment and modelling has been conducted by considering exposure to flooding, heat stress, water stress and extreme wind. Mitigation measures have been introduced including flood protection measures, chiller efficiency improvements and smart monitoring.

Two new green spaces (~69,000 ft^2) have been built, with water features, quiet pathways and native trees. A micro-climate study revealed a 26.7% increase in thermally comfortable areas attributed to the green space, mitigating the urban heat island effect.

Three Key Features Demonstrating the Sustainability Performance

- Climate Resilience and Biodiversity
- Lifecycle Carbon Management
- Tenant Involvement in ESG issues

A biodiversity study has also been conducted to examine the extent of urban biodiversity it would create. Green spaces are designed with feng shui woodland species that provide natural habitats and a green corridor facilitating the movement of fauna between public parks nearby.

Taikoo Place was recognised as a case study in the World Business Council on Sustainable Development's "Roadmaps to Nature Positive: Foundations for the Built Environment System", which highlighted how SPROPS integrates biodiversity considerations and assessments before and during the construction, and how it proactively seeks to incorporate nature-based solutions during planning.

Project Team

Project Name	Creative Transformation of a Global Business District - Taikoo Place
Team or Organisation Name	Swire Properties Limited
Name of Owner / Developer	Swire Properties Limited
Facility Manager	Swire Properties Management Limited

https://www.taikooplace.com/en

Industry | Commercial

CREATIVE TRANSFORMATION OF A GLOBAL BUSINESS DISTRICT - TAIKOO PLACE

"Swire Properties is a pioneer in incorporating sustainability considerations into property development and management. It has established a well-defined and impressive set of sustainability policy and goals which are translated into actual work programmes, as a result of its proactive communication and partnership with tenants and other stakeholders. It obviously stands out as an innovative industry leader."

Jury's Citation from Green Building Award 2021

Lifecycle Carbon Management

Two Taikoo Place (2TP), completed in 2022, is the last piece of the puzzle in the TP redevelopment. High energy efficiency measures have been applied to achieve Coefficient of Performance (COP) of over 7.6 for the chillers and Lighting Power Density (LPD) of 6W/m2. In addition to over 100 solar PV panels and a 3kW wind turbine, a "tri-generation system" has been installed, comprising a 200kW bio-diesel generator for which waste cooking oil collected from food and beverage tenants is used as a fuel source to generate heat, cooling and electricity while reducing pollutant emissions by 90%. Implementing these sustainable designs in the major building systems has allowed 2TP to achieve a 26.6% reduction in energy usage compared with the BEC 2015 baseline scenario. Furthermore, nearly 100% of the concrete used had CIC Green Product Certification (Platinum rating), while structural steel and rebar with a high recycled content and manufactured by the electric arc furnace process was also used. A comprehensive embodied carbon calculation has been conducted, demonstrating a reduction of ~20% in emissions compared with the "HKGBC Climate Change Framework For Built Environment" baseline.

At the portfolio level, a cross-TP cloud-based energy management platform has been implemented that uses IoT-connected data, big data analysis, AI and cloud computing to optimise building operation and generate energy-saving insights. This system was recognised with the Best Digital Innovation Award in the CIBSE Building Performance Awards 2023.

One Taikoo Place (1TP) and 2TP have both achieved Triple Platinum certification in the WELL, BEAM Plus and LEED, 1TP being the first building in Hong Kong to do so. 1TP has also received a Super Low energy performance certificate in both the Landlord and Whole Building categories of the HKGBC's Zero-Carbon-Ready Building Certification Scheme. Other buildings in TP have achieved Platinum ratings in various schemes, with TP being the first Hong Kong project to achieve Gold rating in LEED Communities certification.

Tenant Involvement in ESG issues

The Green Performance Pledge (GPP) is a performance-based collaboration between landlords and tenants, aimed at achieving shared sustainability goals. This programme spans the entire tenancy cycle, from fit-out to operations. Nearly 50% of TP office tenants have joined the GPP, giving them access to their environmental performance data through smart meters. Three-quarters of them utilise water flow restrictors, leading to a 22% reduction in water use intensity between 2022 and 2023. Additionally, 350,000 ft^2 of tenanted space has undergone free energy audits, uncovering over 70,000 kWh of energy-saving opportunities. The GPP also incorporates a smart waste reduction programme, which collectively achieved a 39% waste diversion rate among participating tenants in 2023.

Industry | Commercial

CYBERPORT EXPANSION PROJECT

Three Key Features Demonstrating the Sustainability Performance

Intertwining the building and the park to blend the built environment seamlessly with natural space

Synergising campus connectivity with new building linked to a new pet friendly waterfront park

A springboard to promote sustainable development of the innovation and technology industry

Project Team

Project Name	Cyberport Expansion Project
Team or Organisation Name	Hong Kong Cyberport Management Company Limited
Name of Owner / Developer	Hong Kong Cyberport Management Company Limited
Project Manager	Hong Kong Cyberport Management Company Limited
Main Contractor	Gammon Construction Limited
Architect	Rocco Design Architects Limited
Civil & Structural Engineer	WSP (Asia) Limited
Building Services Engineer	WSP (Asia) Limited
Quantity Surveyor	Rider Levett Bucknall Limited
Landscape Architect	AECOM Asia Company Limited
Project Designer	Rocco Design Architects Limited
Planning Consultant	Kenneth To & Associates
Sustainable Design Consultant	Ramboll Hong Kong Limited
Environmental / Ecology Consultant	Ramboll Hong Kong Limited
Wind / Air Ventilation Consultant	Ramboll Hong Kong Limited

The Cyberport Expansion Project aims at enhancing the environment and facilities of the existing Cyberport Campus to support Hong Kong's digital technology development. The project includes the development of a new commercial building, Cyberport 5, and an upgrade of the existing waterfront park by constructing a waterfront promenade, relaying turf, and adding pet-friendly and smart facilities for future operations for tenants and public use.

The green building design strengthens the connectivity of the campus with the waterfront park and adjoining promenade, while preserving visual permeability and wind corridors throughout the development. The incorporation of approximately 5,000m² of public open space allows for diverse activities under different weather conditions, providing an enjoyable experience for the public. The building's design blends seamlessly with the surrounding landscape for a harmonious and natural appearance. The allocation of over 30% of the building site to softscape further enhances its integration with the surroundings.

Sustainability and climate resilience are key aspects of the development, influencing the architectural language and design choices. The integration of photovoltaic panels into the skylight of the rooftop, spanning 287m², harnesses solar energy for a carbon offset of approximately 7,600kg of CO_2 per year. The building also features building-integrated photovoltaic (BIPV) panels, contributing to its zero-carbon possibilities. Additionally, a 169m³ recycling tank located in the basement collects rainwater from over 30% of the rooftop's catchment area, promoting efficient water management.

The project makes full use of Modular Integrated Construction (MiC) techniques, reducing construction waste. It will be the largest MiC installation yet commissioned in Hong Kong for commercial project in private sector. Moreover, 70% of the Mechanical, Electrical, and Plumbing (MEP)

Industry | Commercial

CYBERPORT EXPANSION PROJECT

"We are fully committed to offering a platform to foster sustainability. Our green building exemplifies the beautiful convergence of nature and technology as to support sustainable technology development in Hong Kong for years to come."

Will YU,
Project Director,
Hong Kong Cyberport Management Company Limited

installations utilise Modern Methods of Construction (MMC) and Design for Manufacture and Assembly (DfMA) practices. Building Information Modeling (BIM) technologies are being adopted throughout the project for extensive applications in design, statutory submissions and construction co-ordination. At the same time a Common Data Environment platform will consolidate construction data, promoting collaboration and governance and benefiting the future maintenance regime.

Cyberport is fully committed to long-term sustainable efforts and is developing a smart platform that leverages AI analytics, digital twins, and IoT technologies to manage energy and resources effectively in the building life cycle. The platform deploys smart sensors to collect real-time data in order to identify inefficiencies, simulate building performance, and monitor carbon emissions, ultimately promoting sustainable energy and resource management and reducing the building's carbon footprint.

Through these concerted efforts, the project exemplifies a commitment to sustainability with a new green design approach and smart technology deployment. This will play a crucial role in supporting the sustainable growth of technology development locally, aligning with Cyberport's mission to foster innovation in Hong Kong.

Industry | Commercial

HANG SENG BANK HEADQUARTERS – WORKPLACE TRANSFORMATION

Project Team

Project Name	Hang Seng Bank Headquarters – Workplace Transformation
Team or Organisation Name	Hang Seng Bank Limited
Name of Owner / Developer	Hang Seng Bank Limited
Project Manager	Arup
Main Contractor	Paul Y Builders Limited
Architect	Wong & Ouyang (HK) Ltd.
Civil & Structural Engineer	Wong & Ouyang (HK) Ltd.
Building Services Engineer	Wong & Ouyang (Building Services) Ltd.
Quantity Surveyor	Arcadis Hong Kong Limited
Project Designer	M Moser Associates One Space Ltd.
Sustainable Design Consultant	Allied Environmental Consultants Limited
Facility Manager	Jones Lang LaSalle Limited
Workplace Strategy Consultant	CBRE Limited

The transformation of Hang Seng Bank's Head Office draws inspiration from the concept of biophilia, recognising the innate emotional connection between humans and nature. By integrating the natural elements of forest, sky and ocean into the workplace design, the project creates a harmonious environment that promotes wellbeing and productivity. This approach reduces stress factors and contributes to staff resiliency, resulting in a positive and pleasurable work atmosphere. Furthermore, the adoption of activity-based working (ABW) optimises space utilisation and reduces waste. By creating a paperless office and enabling flexible work arrangements, Hang Seng's Head Office transformation enhances sustainability and work-life balance while fostering innovation and collaboration.

Three Key Features Demonstrating the Sustainability Performance

- Chilled Ceiling System
- Data Analysis System
- Automatic lighting control and shading system

Sustainable development was prioritised in the development phase through efficient resource management, energy conservation, waste reduction and recycling. Strict compliance with international energy management systems such as ISO 14001 and 50001 ensures responsible practices are followed. These strategies help the project minimise its environmental footprint, conserve resources, and reduce waste generation. Moreover, it has promoted a circular economy by recycling and repurposing more than 70% of materials, contributing to a more sustainable construction industry.

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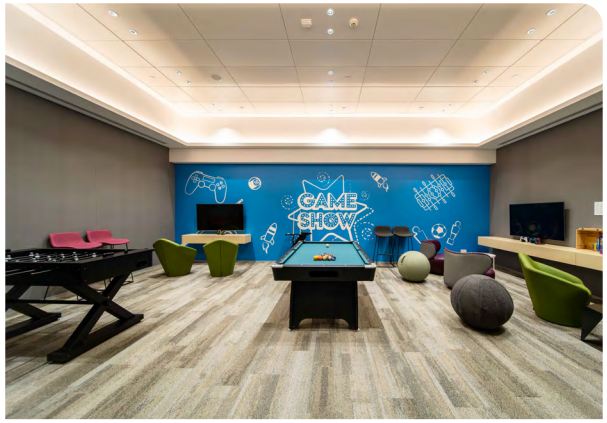
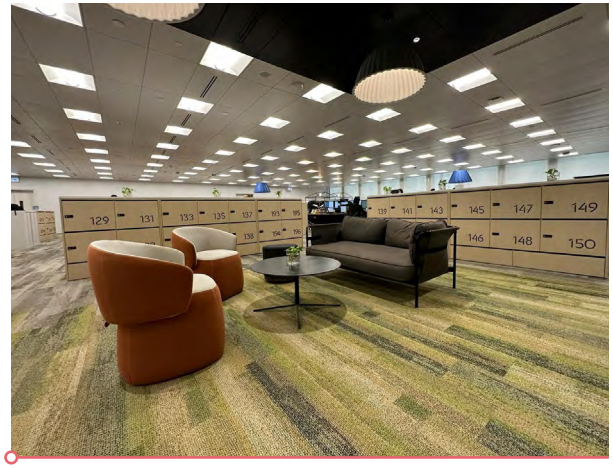
HANG SENG BANK HEADQUARTERS – WORKPLACE TRANSFORMATION

An innovative Data Analytics System (DAS) has been implemented, powered by Artificial Intelligence (AI) and Big Data. This cutting-edge software platform enables energy optimisation through AI while incorporating a risk control mechanism to enhance the efficiency of the chiller plant and AHU/PAU operations. The DAS provides 24x7 monitoring, minimising the potential for human error and ensuring optimal energy usage. The DAS has already demonstrated impressive results, reducing energy consumption by 321,631 kWh (11.88%) via the HVAC system from May to October 2023.

The transformation of Hang Seng's Head Office won the Grand Award in the Green Building Awards and was a finalist in the Quality Building Award. It has also achieved LEED Gold and WELL Gold certification – the first bank building to receive WELL (V2 pilot). These certifications validate the project's commitment to sustainable design, energy efficiency, and occupant wellbeing. By incorporating green building principles, optimising indoor air quality, and prioritising occupant comfort, the project creates an environmentally friendly and healthy workspace, aligning with the vision of a sustainable city and community.





These accomplishments demonstrate Hang Seng's aspiration to combat climate change, enhance staff wellbeing, and foster a positive work environment. The project serves as an inspiration for future developments, highlighting the importance of integrating sustainability into the fabric of our cities for a better and more sustainable future.

Industry | Commercial

NINA PARK AND WOOD FOSSIL EXPERIENCE CENTRE - REVITALISATION OF AN OLD PODIUM ROOF GARDEN

Three Key Features Demonstrating the Sustainability Performance

- Architectural Practice of Sponge Park Design
- Holistic Journey of Sustainable Design and System
- Integration of Educational and Sustainable Outdoor Furniture

Over 30% of the site area is dedicated to greenery, enhancing the overall sustainability and aesthetic appeal of Nina Park. Numerous passive building designs and strategies have been implemented to foster a sustainable community. These include a green roof, solar-reflective roof, cross natural ventilation and hybrid ventilation, which together achieve an estimated 21% energy reduction. The two-storey Wood Fossil Experience Centre features a windcatcher that harnesses the prevailing southwest summer wind and the annual east wind for natural ventilation.

Project Team

Project Name	Nina Park and Wood Fossil Experience Centre - Revitalisation of an old podium roof garden
Team or Organisation Name	Chinachem Group
Name of Owner / Developer	Ying Ho Company Limited
Project Manager	Chinachem Group
Main Contractor	Gammon Engineering & Construction Company Ltd
Architect	arQstudio Ltd
Civil & Structural Engineer	AECOM Asia Company Limited
Building Services Engineer	AECOM Asia Company Limited
Quantity Surveyor	Rider Levett Bucknall Ltd
Landscape Architect	Cohere Design Company Limited
Sustainable Design Consultant	AECOM Asia Company Limited
Management Company	Source Fame Management Limited

https://youtu.be/dqLDCds2pyM
https://www.ninapark.org/zh-hk

Nina Park, Hong Kong's first and only wood fossil park, is located in Tsuen Wan adjacent to Nina Tower, NINA MALL and Nina Hotel Tsuen Wan West. Nina Park and its facilities occupy an area close to 70,000 ft², showcasing the largest collection of wood fossils among urban parks in Asia, all gathered by the late Mrs. Nina Wang, former Chairwoman of Chinachem Group. This unique legacy will inspire local and international visitors through exciting "edutainment" programmes and innovative designs.

Industry | Commercial

NINA PARK AND WOOD FOSSIL EXPERIENCE CENTRE - REVITALISATION OF AN OLD PODIUM ROOF GARDEN

"Nina Park is designed with the community in mind, with attractions that appeal to a diverse audience of different ages, cultures, and nationalities, coming together in this shared social space to explore the mysteries of the natural world."

Donald CHOI,
Executive Director and CEO, Chinachem Group

A rainwater harvesting system has been installed to create a sponge park, effectively enhancing resilience to climate change and extreme weather. A large rainwater tank situated beneath the park regulates water supply between dry and rainy days. The harvested rainwater is used not only for irrigation but also for spot cooling, contributing to a more sustainable and comfortable environment. This system is expected to achieve approximately 51% of the park's annual water consumption for irrigation.

At the heart of the park, a steppable solar panel system, consisting of 36 panels, is projected to generate approximately 400 kWh of electricity per year to power a smart bench. Additional solar panels have been installed to generate approximately 100,000 kWh of electricity per year, equivalent to about 26% of Nina Park's overall annual electricity consumption.

Electric-powered construction equipment, including a cherry picker, spider crane and demolition robot, were utilised to reduce embodied carbon during construction. In addition, 1,700 tonnes of inert waste was recycled during the demolition phase. Prefabricated steel and Design for Manufacturing and Assembly (DfMA) were employed to expedite the process, ensuring minimal on-site waste generation. Moreover, 100% of concrete used was CIC-certified green concrete, resulting in a significant 260-tonne reduction in carbon emissions, equivalent to saving 10,230 trees.

To raise public awareness of climate change, a smart bench has been incorporated into the park's design. This features a compact bird-house design and a digital screen displaying weather updates, surrounding micro-climate data, and park news. It also includes a sensor that provides visitors with a reading light and wireless mobile phone charger, powered by its own nearby solar panel system. The bench also has a water-cooling feature with fans and motion sensors, using recycled rainwater to provide a refreshing experience for visitors.

An outdoor recharge bike merges the concepts of exercise and energy conservation, encouraging visitors to charge their electronic devices by pedalling. With eight resistance levels offered, users can customise their workout intensity. The bike also provides information on distance, speed and time for an immersive fitness experience.

Art and kinetic artworks are displayed to educate visitors about water conservation and earth history. An environmental dashboard and time capsule interface display live-streamed data on CO_2 emissions and promote health awareness. Creative IoT products are also featured, which serve as public facilities and enhance the sense of wellbeing for all.

Industry | Commercial

SITE 3, NEW CENTRAL HARBOURFRONT

Project Team

Project Name	Site 3, New Central Harbourfront
Team or Organisation Name	Henderson Land Development Company Limited
Name of Owner / Developer	Pacific Gate Development Limited
Project Manager	Henderson Land Development Company Limited
Main Contractor	China Overseas Building Construction Limited
Architect	Wong & Ouyang (HK) Ltd
Civil & Structural Engineer	Arup
Building Services Engineer	J. Roger Preston Limited
Quantity Surveyor	Arcadis Hong Kong Limited
Landscape Architect	PWP Landscape Architecture (Design) Urbis Limited (Adminstration)
Project Designer	Lead8 Hong Kong Limited UNStudio Hong Kong Limited
Planning Consultant	Arup
Sustainable Design Consultant	Arup
Environmental Consultant	Arup
Wind / Air Ventilation Consultant	Arup
Geotechnical Engineer	Arup
Traffic Engineer	Arup
Acoustic Consultant	Arup
BIM Consultant	isBIM Limited
Lighting Consultant	Speirs Major Light Architecture
Façade Consultant	Inhabit Asia Limited
Biodiversity Specialists	Outdoor Wildlife Learning Hong Kong

Central Harbourfront Site 3 is designed to serve a super "Bridge" connecting Urban areas with Nature, Commerce with the Community, Art with Culture, Heritage with the Future, and Visitors with Locals.

Its people-centric design calls for abundant green open spaces, accessible to people of all ages and backgrounds and with landscaping maximised at multiple levels for their enjoyment. Site 3's pioneering civic space with Grade A offices, retail and cultural facilities will create a new "work and play" lifestyle that can attract more talent to work in Hong Kong and contribute to economic vitality, as well as reinforce Hong Kong's status as Asia's World City.

Site 3 also represents a rare opportunity to revitalise biodiversity in Central. An urban biodiversity baseline study was conducted of the green open spaces around the area, as well as along the harbourfront promenade of Hong Kong Island. By introducing a rich interweaving tapestry of urban planting of diverse species, Site 3 will become a green hub to reconnect this urban site to nature.

Micro-climate and wind/ventilation studies have also been conducted to improve the neighbouring environment and minimise urban heat island effect, while maximising outdoor thermal comfort levels. A high performance building envelope and E&M systems, such as a site-wide sea-water cooling system and hydrogen-ready tri-fuel generator, will enable the project to attain exceptional levels of energy savings, at least 20% as compared with the HK-Building Energy Code 2021. In addition, a flood resilience study has been conducted to formulate planning strategies on how to handle future extreme weather events.

Three Key Features Demonstrating the Sustainability Performance

- People-Centric Design for the Community
- Sustainable Urban Oasis
- Smart, Digital and Future Ready

Industry | Commercial

SITE 3, NEW CENTRAL HARBOURFRONT

"The New Central Harbourfront development project is built around the design concept of a bridge, creating a world- class landmark that incorporates ample greenery and public space in support of a sustainable future."

Martin LEE,
Chairman, Henderson Land Group

The project is the first in Hong Kong to adopt a full BIM Tender documentation and full BIM Instruction model. The Smart Site Safety System (SSSS) and Digital Works Supervision System (DWSS) are being fully adopted as a means of advancing BIM and digitalisation. These concerted efforts are expected to result in higher construction efficiency, reduced wastage and minimised abortive works, as well as taking a significant step towards achieving zero accidents. Once the construction stage is completed, the as-built BIM model will be seamlessly transitioned to the Operations Team for integration into their building digital platform so as to enhance facility management.

In line with the Government waste charging policy, a comprehensive waste management approach will be implemented including the use of food waste decomposers, reducing dependence on Government waste treatment facilities.

With all necessary energy, water and waste meters or sub-meters provided, useful data will be collected and monitored in real time, as well as being analysed to generate insights and recommendations for enhancing building performance, including energy optimisation, fault detection and predictive maintenance. This advice and recommendations from the digital platform can help both the landlord and tenants reduce greenhouse gases and streamline ESG reporting through active tenant engagement, using bespoke ESG Mobile Apps.

The project has already achieved Provisional Platinum rating in BEAM Plus New Buildings NB, Pre-certified Platinum in LEED BD+C (Core & Shell) v4, and Pre-certification in WELL Building Standard v2. The target is to achieve BEAM Plus Neighbourhood ND Platinum rating and other accolades. It will set a new benchmark for sustainable development and the wellbeing of the community.

Industry | Commercial

SIX PACIFIC PLACE

Three Key Features Demonstrating the Sustainability Performance

- Low carbon materials
- AI enabled digital twin
- Wellness design

Project Team

Project Name	Six Pacific Place
Team or Organisation Name	Cherish Shine Limited
Name of Owner / Developer	Swire Properties Limited
Project Manager	Swire Properties Limited
Main Contractor	Gammon Engineering and Construction Company Limited
Architect	Wong & Ouyang (HK) Limited
Civil & Structural Engineer	Wong & Ouyang (Civil-Structural Engineering) Limited
Building Services Engineer	Wong & Ouyang (Building Services) Limited
Quantity Surveyor	Arcadis Hong Kong Limited
Landscape Architect	Ko Landscape Architects Limited
Sustainable Design Consultant	AECOM Asia Company Limited
Facility Manager	Swire Properties Limited

http://www.sixpacificplace.com

Six Pacific Place (6PP) is a newly developed Grade-A office building located opposite Three Pacific Place. As a new addition to the Pacific Place portfolio, it fully supports Swire Properties' sustainable development visions and strategy. A wellness design and innovative technologies have been widely adopted for the building which can benefit both its occupants and the community.

The design of 6PP is aimed at providing green features both inside and outside the building. The total greenery area in the development is over 30%, including a Podium Garden, a Sky Garden and a green roof, which can mitigate the urban heat island effect as well as creating a place for tenants to relax. Located at the junction of two busy streets in Hong Kong where the existing footpaths are narrow, the development includes a street widening scheme which can greatly improve walkability around the building. Green features including planters and a green wall are being newly created along the streets which will not only improve the existing streetscape but also bring fresh life to the street – benefits that can be enjoyed by both the public and tenants. Wellness of the occupants has been one of the major considerations. Key indoor environment aspects such as air, noise and visual quality have been addressed by features such as high efficiency air filters, excellent acoustic design and visually comfortable LED lighting.

Energy saving is one of Swire Properties' key strategies for addressing climate change. This concept is embedded in the building's system design. By using high-performance chillers, energy-efficient office lighting, EC-plug-fan AHU and optimised automatic control systems, energy savings

Industry | Commercial

SIX PACIFIC PLACE

"Six Pacific Place has achieved excellent performance in green building design. Amongst the salient features are extra-low energy intensity, a high-quality building environment, and sustainable construction and tenant involvement. We share Swire's vision and commitment to building a sustainable legacy. We are proud to take part in the journey towards carbon neutrality."

Wilson CHAN,
Sustainable Design Consultant,
AECOM Asia Company Limited

22% lower than Building Energy Code 2018 have been possible. The energy utilisation index of the landlord area is less than 75 kWh/m^2, which could achieve 'Super Low' rating in HKGBC's Zero-Carbon-Ready-Building Certification Scheme.

Sustainability was also a key issue in construction. An action plan to reduce embodied carbon was drawn up at the design stage and implemented in construction. All concrete used in superstructure work contains 25% recycled material (i.e. PFA) and is certified by the CIC Green Product Certification with Platinum rating. The rebars used contain more than 60% recycled content. Adoption of those low carbon materials will reduce carbon emissions by almost 6,400 tonnes. Power for the construction of 6PP was fully supplied from the electricity grid, avoiding use of an on-site diesel generator. This has helped minimise the air and noise impact on the public while further reducing carbon emissions. Savings of around 1,400 tonnes of CO_2 were made in comparison with traditional construction power supply arrangements.

The asset management of 6PP is supported by digital twin Neuron. This platform integrates BIM and various technologies including IoT, 5G and AI optimisation control to assist building operations. Neuron in 6PP is also expandable to support tenants' premises and help them achieve their ESG targets. The digital twin can consolidate data from disparate building systems and provide recommendations to suit customised operational conditions, while maintaining building comfort and energy efficiency. It will allow the building management team to focus fully on services to tenants.

Industry | Commercial

THE HENDERSON OFFICE DEVELOPMENT AT 2 MURRAY ROAD

Project Team

Project Name	The Henderson Office Development at 2 Murray Road
Team or Organisation Name	Henderson Land Development Company Limited
Name of Owner / Developer	Henderson Land Development Company Limited
Project Manager	Henderson Land Development Company Limited
Main Contractor	Hip Hing Construction Co. Ltd.
Architect & AP	Ronald Lu & Partners (Hong Kong) Ltd.
Design Architect	Zaha Hadid Architects
Civil & Structural Engineer	C M Wong & Associated Limited
Building Services Engineer	WSP
Quantity Surveyor	Rider Levett Bucknall
Landscape Architect	PWP Landscape Architecture Earthasia
Sustainable Design Consultant	Arup
Environmental / Ecology Consultant	Arup
Wind / Air Ventilation Consultant	Arup
Facility Manager	Goodwill Management Limited
Management Company	Goodwill Management Limited
Façade Consultant	Group 5F Meinhardt Façade Eckersley O' Callaghan
Lighting Consultant	Speirs Major Lichtvision
Cybersecurity Consultant	Pricewaterhouse Coopers
IT Consultant	Arup Microsoft Corporation
Façade Contractor	Seele GmbH

https://youtu.be/yYbE-W7E35o
https://youtu.be/Ia8yH73TohI
https://www.thehenderson.com.hk/

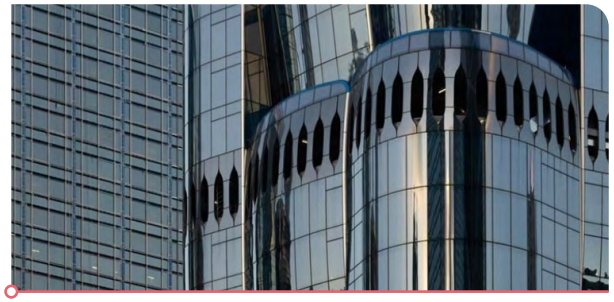
The Henderson is set to become a world-class architectural landmark of Hong Kong, "an icon amongst icons". Located at Murray Road, Central, this new super Grade-A office tower is a showcase project embracing four pillars of sustainability – Resilience, Health, Green, and Smart Technology – together with high-quality hospitality services for tenants and their staff and visitors. It will serve as flagship for implementing Henderson Land's sustainability strategies in other development projects going forward.

The Henderson echoes the organic beauty of the natural world, reinterpreting the structural form and layering of a Bauhinia bud about to blossom. This signature project has already achieved numerous awards and accolades, including BEAM Plus Platinum Provisional rating, and Platinum Pre-certification in both WELL Building Standard and LEED Standard. It is also one of the first in Hong Kong to attain WiredScore and SmartScore, a global digital connectivity certification system that helps landlords assess, improve, benchmark and promote their buildings.

Three Key Features Demonstrating the Sustainability Performance

- Sustainable
- Liveable
- Smart Workplace

Multiple strategies have been incorporated to reduce annual energy consumption by 26% and water consumption by 60% compared with the baseline equivalent. The building's Insulated glass façade is designed to reduce its cooling load significantly and eliminate harmful UV light penetration into the interiors. Hybrid ventilation is controlled by the



Industry | Commercial

THE HENDERSON OFFICE DEVELOPMENT AT 2 MURRAY ROAD

"Sustainability is fundamental to building a better and more liveable future for all. We hope to realise a smart, sustainable workplace of the future at The Henderson through this all-round ESG Partnership Programme, which reaffirms the Group's aspiration to reshape the current ESG landscape in the property sector and to champion industry-leading sustainable practices."

Martin LEE,
Chairman,
Henderson Land Group

building's smart system and enables all office levels to be naturally ventilated. The innovative patented Solar Responsive Ventilator (SRV) negates heat gain in the glazed building perimeter zone.

Climate risk assessments have been carried out to uphold the vision of a future-proof office and ensure its resilience to potential damage or disruption to business activities. A hi-tech four-ply, double-curved, double-insulated glass façade is employed to withstand the powerful typhoons that can impact buildings in Hong Kong. This façade design maximises outdoor views while blocking 100% of UV rays and insulating the building's interior against the city's summer heat. In this regard, The Henderson can serve as a refuge for the surrounding area, providing shelter and protection. The chiller design makes use of condensate water while maintaining full cooling even if two units should fail, ensuring thermal comfort in all conditions. The telecom system is built upon resilience characteristics such as dual telecom back-up and dual block wiring system, to ensure robust network connectivity in all situations.

The Henderson features an array of patented inventions and proprietary smart building technologies. Its innovative designs integrate novel applications of cutting-edge systems and solutions to optimise occupant experience, eco-performance and operations. Three patented innovation strategies are of particular note:

- Solar Responsive Ventilator (SRV): This automatically increases airflow to mitigate higher temperatures while reducing solar radiation penetration through the facade. The SRV is designed to maintain occupant comfort autonomously near window areas most susceptible to thermal fluctuations. The SRV has already received industry recognition, including Merit awards from both the HKIE for Innovation and from the HKGBC for iBuilding Product & Technologies design.
- Lift Sterilisation System: All lifts are equipped with a patented integrated lift sterilisation system. This innovation provides optimal air quality within the congested environment to safeguard people's health in any future pandemic, acting within one minute of a pollutant sensor's reading.
- Air Quality Enhancing And Conditioning System and Corresponding Method: This can improve human thermal comfort, prevent pathogen transmissions, improve air quality, and enhance the building's energy efficient design.

A variety of sustainability strategies have been adopted at The Henderson to reduce whole-life-cycle carbon emissions. As some of the operational carbon emissions will inevitably be related to user behaviour, fostering behavioural change by customising the workplace environment was seen as being critical. IT and sustainability consultants conceptualised the analytical modules using a Digital Twin method and the Smart Office App to enhance control over various workplace systems. The module generates and analyses building performance data which can provide insights to the tenants to assist them on their carbon neutrality journey. Tenants can control the indoor environmental conditions in the workplace through this bespoke App. This user-driven approach serves to involve tenants in reducing their own carbon emissions as part of The Henderson's wider carbon neutrality efforts.

Industry | Commercial

THE REVITALISATION OF CENTRAL MARKET

Project Team

Project Name	The Revitalisation of Central Market
Team or Organisation Name	Central Market
Name of Owner / Developer	Urban Renewal Authority / Chinachem Group
Project Manager	Urban Renewal Authority / Chinachem Group
Main Contractor	Shui On Construction Company Limited / Interior Contract International (HK) Limited
Architect	AGC Design Limited / Shadow Design Limited
Civil & Structural Engineer	Arup
Building Services Engineer	AECOM Asia Company Limited / Ferrier Chan & Partners Limited
Quantity Surveyor	Rider Levett Bucknall Limited / WT Partnership (HK) Limited
Landscape Architect	Earthasia Limited
Sustainable Design Consultant	BeeXergy Consulting Limited
Research Investigator	Architectural Preservation Studio, DPC
Facility Manager	Sources Fame Management Ltd.

https://youtu.be/oi_rOGYBK1E
https://www.centralmarket.hk

Central Market, a Grade III heritage building completed in 1939, has been preserved and adapted for affordable commercial, cultural and community use. It offers a curated heritage experience for the public to enjoy and recall their collective memories. The renovated Market is designed to provide a comfortable and enjoyable experience for tenants and visitors while minimising environmental impact and energy consumption. Sustainable building operating practices have been applied to achieve Chinachem Group's green goals and raise public awareness of environmental protection.

Three Key Features Demonstrating the Sustainability Performance

- Human Centric Lighting System
- Zero Irrigation System (ZIS)
- Centralised Management System with Advanced Technology Applications

Central Market is an excellent example of innovative market space design: open plan and high ceiling, with a three-to-four-level high open central atrium that improves natural lighting and ventilation. The atrium is easily accessible from Jubilee Street, Queen Victoria Street and Des Voeux Road Central, providing about 745m^2 of public open space, landscaped for passive recreation and leisure uses. This open-plan design with natural ventilation can be adopted to serve cultural and leisure activities, exhibitions and public events. A number of low-speed high-volume ceiling fans have been installed to enhance outdoor thermal comfort along the covered open areas.

Industry | Commercial

THE REVITALISATION OF CENTRAL MARKET

"Central Market has been conceptualised as a 'Playground for All', not only by preserving the unique historical value of the site, but also by creating new collective memories for people of all ages and backgrounds to enjoy. The revitalised Central Market is aimed at fostering social cohesion and inclusion, sustaining cultural legacy, and fuelling innovation for future generations."

Donald CHOI,
Executive Director and CEO, Chinachem Group

About 1,000m² of landscaped open space has been provided in the existing atrium and entrance plaza facing Queen's Road Central for recreation and leisure uses. Facades facing the atrium have been opened up and glazed to introduce natural light to the interior space and improve the physical and visual connection between the interior and atrium garden on the ground and upper floors. When the outdoor temperature is low enough to cool the perimeter zone of the internal space without the need to turn on the air conditioning system, energy can be saved. The building is equipped with passive free cooling, utilising openable partitions in the external wall and the wall facing the open plan atrium, such that they can be opened during intermediate seasons to allow the air-conditioning to be turned off.

To minimise the need for irrigation water, a zero irrigation system (ZIS) with a rainwater storage unit has been adopted for this urban oasis. This achieved by retention boxes underneath the greenery areas collecting excess rainwater, which operate almost year-round. Moisture transferred from the water storage units is generated by

thermal energy balance in the soil. It is estimated around 180L/m² of water can be saved per month, or around 1,400,000 L per year – half of an Olympic-sized swimming pool. An off-grid PV system with 48 solar panels has been installed on the upper roof to generate renewable energy of an estimated 16,000 kWh per annum.

A centralised building management system (BMS) controls a human-centric lighting (cognitive light) system, IEQ sensors, water leakage sensors, waste bin detection sensors, smart toilets, and a video analytics platform, which enhances wellbeing and facilitates operations through a series of advanced IoT platforms and technology. By deploying IoT sensors, facilities are protected through a real-time alert system that reacts to any potential disasters such as water flooding caused by a burst pipe, extreme weather or overheating of equipment. Immediate action can be taken upon detection of any fault, mitigating damage to the facility or injury to its users. and ensuring that preventive maintenance can be promptly arranged.

Industry | Commercial

TOPSIDE OF WEST KOWLOON STATION EXPRESS RAIL LINK, WEST KOWLOON, HONG KONG

Three Key Features Demonstrating the Sustainability Performance

SUSTAINABLE DEVELOPMENT GOALS

Call for change – Alignment with all 17 UNSDG targets

Last piece of the puzzle to complete the 1.5km West Kowloon Parkway

Super-low energy performance with AI-empowered Energy Management Platform

Project Team

Project Name	Topside of West Kowloon Station Express Rail Link, West Kowloon, Hong Kong
Team or Organisation Name	Century Opal Limited & Max Century (H.K) Limited
Name of Owner / Developer	Century Opal Limited & Max Century (H.K) Limited
Project Manager	Sun Hung Kai Real Estate Agency Limited
Main Contractor	Yee Fai Construction Company Limited
Architect	Zaha Hadid Architects Wong & Ouyang (HK) Ltd.
Civil & Structural Engineer	Structural: Arup Civil: AECOM Asia Company Limited
Building Services Engineer	Sun Hung Kai Architects and Engineers Limited/ AECOM Asia Company Limited
Quantity Surveyor	Rider Levett Bucknall Limited
Landscape Architect	URBIS Limited
Project Designer	Zaha Hadid Architects
Planning Consultant	Masterplan Limited
Sustainable Design Consultant	Arup
Environmental / Ecology Consultant	Environmental: Ramboll Hong Kong Ecology: Arup
Wind / Air Ventilation Consultant	Ramboll Hong Kong
Facility Manager	Kai Shing Management Services

Situated directly above the West Kowloon Station Express Rail Terminus, connecting seamlessly with the Greater Bay Area, this topside property development is positioned to become an iconic Grade A commercial and retail hub in the heart of the district. Seeking distinguished international recognition in sustainable building landscaping, it is Hong Kong's first BREEAM-certified office, earning an 'Excellent' rating (Interim Certificate).

Surrounded by the vibrant West Kowloon Cultural District and major transport hubs, the Express Rail Link (XRL) development completes the 1.5km West Kowloon Parkway, a vital north-south connection from the inland to the 2km waterfront along West Kowloon District.

The project's architectural design prioritises the local microclimate with its strategic tower placement, streamlined built-form with stepping profile and 50m-wide wind corridor that preserves natural ridgelines and promotes wind penetration. This has also created an additional 8,500m^2 of high-quality public open space at podium level to fulfil social needs and enhance the wellbeing of the neighbourhood. The development boasts over 40% greenery from podium to roof, featuring more than 120 plant species. Not only does this minimise the urban heat island effect, it also enhances biodiversity within the urban context.

The project is designed to respond to climate change challenges such as flooding, typhoons and extreme heat risks. Despite the site constraints, all pedestrian entrances are elevated to podium level, minimising any interruption due to flood risk. A rainwater collection system and lush softscape areas act as effective stormwater management measures. A high-performance curtain wall system with triple glazing enables the building to remain stable under strong winds and to block excessive future heat waves.

Industry | Commercial

TOPSIDE OF WEST KOWLOON STATION EXPRESS RAIL LINK, WEST KOWLOON, HONG KONG

To minimise the project's carbon footprint, a series of eco-friendly technologies with multifaceted benefits has been implemented. This includes an indirect seawater cooling system that enhances HVAC efficiency and conserves fresh-water resources. Additionally, the use of ultra-efficient lighting fixtures with ample headroom harmonises indoor spaces with the natural elements, fostering tenant wellbeing and reducing energy consumption. The project also incorporates bio-fuel generators and photovoltaic panels as alternative renewable energy sources to supplement grid electricity.

Efforts to reduce embodied carbon span from the design phase to construction. The design team is working closely with contractors to refine the structural scheme, making use of green concrete and responsibly sourced materials. The use of DfMA in the MEP system, along with reusable aluminum formwork, BIM Integration and a VR interaction platform, enhances co-ordination and minimises on-site waste. As a result, the project has achieved a 21% reduction in embodied carbon compared with the HK Baseline, positioning it as a pioneer in Hong Kong's sustainable development.

"With our belief in 'Building Homes with Heart', the developer is committed to incorporating green features at every stage of a building's life cycle. We strive to develop high-quality properties that are low-carbon, climate resilient, and beneficial to the wellness of users. The XRL project, with enormous strategic value and importance for the city to capture development opportunities in the Greater Bay Area, showcases plenty of smart and green elements, effectively incorporating sustainability into a new commercial icon. It is poised to attain world-class recognition as a sustainable and environmentally friendly project, with various well-recognised green building certifications."

Sustainability Steering Committee of Sun Hung Kai Properties

To carry forward the sustainable design intent during operation, an AI-empowered energy management platform has been implemented, adopting cutting-edge technologies, such as digital twin, building management systems (BMS), and a wide array of real time IoT sensors. Developed in collaboration with The Hong Kong Polytechnic University, this smart, efficient, and flexible energy management platform utilises real data collected across the SHKP portfolio, to assist automated demand responses.

Industry | Commercial

ZERO-CARBON-READY BUILDING CERTIFICATES FOR CENTRAL PORTFOLIO

Hongkong Land's Central Hong Kong portfolio, comprising approximately 450,000m² of premium real estate across six complexes and twelve buildings, is overseen by a single property management team. The Central Portfolio is the first to receive certification under the HKGBC's prestigious Zero-Carbon-Ready Building Certification Scheme (ZCRBC). As a pioneer in the Scheme, Hongkong Land aims to contribute actively to the transition of Hong Kong into a net zero metropolis.

The Hongkong Land Central Portfolio has been widely recognised for its wide-ranging sustainability efforts. It has received BEAM Plus Existing Buildings V2.0 Comprehensive Scheme Final Platinum rating, won the Pioneer Award under the Facilities Management category of the Green Building Award 2023, and was named the Sustainability Achievement of the Year in the RICS Awards 2020. ZCRBC certification further highlights the company's energy-saving achievements. Every one of its six development complexes has earned a low-energy rating, with over half surpassing this by obtaining super-low rating (the second highest rating below Net Zero Ready).

"This recognition has demonstrated our continuous effort in reducing our energy consumption with the goal of achieving net zero by 2050."

End-user of Hongkong Land (Property Management) Limited

Project Team

Project Name	Zero-Carbon-Ready Building Certificates for Central Portfolio
Team or Organisation Name	Hongkong Land (Property Management) Limited
Name of Owner / Developer	Hongkong Land Limited
Facility Manager	Hongkong Land (Property Management) Limited

Three Key Features Demonstrating the Sustainability Performance

- Energy-savings of over 30% achieved compared with 2008 baseline
- Successful multi-faceted retrofitting programme
- A1-enabled Central Monitoring Centre further enhancing energy performance

Continuous retrofitting of existing building systems have made a significant contribution to this goal. This includes the replacement of chiller plants with high-efficient zero-GWP refrigerant chillers, the installation of EC plug fans, upgrading to high-efficiency lifts, and the replacement of lighting with LED installations.

Complementing these initiatives is an upgraded Central Monitoring Centre with AI capability and 3D-digital twin, which can further enhance energy performance through machine learning optimisation and automation. By the end of 2023, the Central Portfolio had seen overall energy consumption reductions of 11% compared with 2019 and 32% compared with 2008, resulting in annual savings of up to 10 million kWh and 39 million kWh respectively.

As a driving force and pioneer of sustainable development in Hong Kong, Hongkong Land is steadfastly committed to achieving zero-carbon buildings across all its properties and to sharing the experience of its long sustainability journey with the industry.

Industry | Institution/Community

CONVERSION OF EX-SAI KUNG CENTRAL PRIMARY SCHOOL

Three Key Features Demonstrating the Sustainability Performance

- Green Oasis Integration
- Multi-Layered Design
- Eco-system and Carbon Footprint

Sai Kung Central Primary School was constructed in the 1980s to serve students from Sai Kung and its neighbouring rural communities. Adjacent to the estuary of the Ho Chung River, the site offers a magnificent view. The vacant school has deteriorated rapidly since 2007. Under the reutilisation programme for vacant school buildings, Haven of Hope Christian Services was commissioned by the Social Welfare Department to bring new life to the complex by transforming it into a combined social welfare facility consisting of a Day Activity Centre (DAC), a Hostel for Severely Mentally Handicapped Persons (HSMH), and a Residential Care Home for the Elderly (RCHE).

The project team implemented an innovative approach to rejuvenation by combining the natural beauty of scenic greenery with the functional requirements of the RCHE and HSMH. This was accomplished through the creation of 'Five Green Oasis', an initiative aimed at enhancing sustainability and promoting the health and wellbeing of residents. By utilising the expansive structure of an existing sewage treatment plant, the rooftop area was transformed into a therapeutic playground. Additionally, an abandoned basketball court was converted into therapeutic terraces and herbal gardens, while the rooftop podium was repurposed into a café that seamlessly integrates the surrounding scenic nature and greenery with services needed by the facility's users.

Project Team

Project Name	Conversion of ex-Sai Kung Central Primary School
Team or Organisation Name	Haven of Hope Christian Service
Name of Owner / Developer	Haven of Hope Christian Service
Project Manager	Haven of Hope Christian Service
Main Contractor	Wan Chung Construction Co. Ltd
Architect	Urbanage International Ltd.
Civil & Structural Engineer	Arthur Yung and Associates Co. Ltd.
Building Services Engineer	M&P Consulting Engineers (HK) Limited
Quantity Surveyor	Turner & Townsend Ltd.
Landscape Architect	ACLA Limited

https://youtu.be/zw-GZUOIzEs

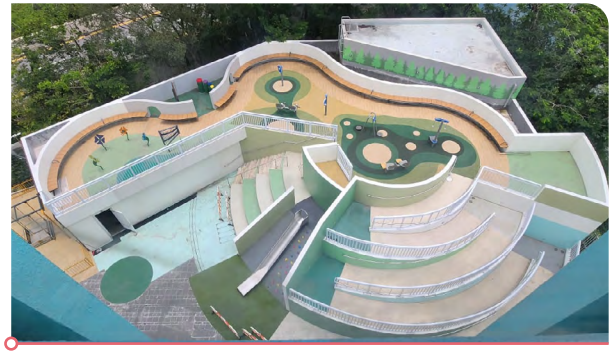
Industry | Institution/Community

CONVERSION OF EX-SAI KUNG CENTRAL PRIMARY SCHOOL

"We are committed to create a resilient, sustainable and innovative design. The site location has a splendid riverfront view, while the social services complex incorporates five oasis designs that seamlessly merge indoor and outdoor spaces. This integration infuses the complex with a vibrant and lively atmosphere, promoting a healthy and sustainable lifestyle."

TSENG Yen-wei William,
Director,
Urbanage International Ltd.

The entire complex has been redesigned using passive design strategies to address problems related to traffic noise from Hiram's Highway, river floods, and excessive exposure to westerly sun. Utilising a multi-layered approach, all the dormitories and living quarters have been oriented towards the picturesque sea view. Additionally, new lift shafts, corridors and AC platforms have been strategically placed to block the afternoon sun and traffic noise.



With a history of over 50 years of flooding, the riverbank along Ho Chung River is prone to erosion and flood risks. To address this issue, over 40 deteriorating trees were replaced by locally-adapted species which are better equipped to withstand extreme weather conditions. Anti-flood measures were also integrated into an existing unused back alley, resulting in the creation of a multi-sensory pathway for users. This pathway not only serves its intended purpose but also establishes a new habitat for flora, fauna and the local bird community.

The upgrade of the sewage treatment plant has ensured that the quality of effluent water meets the standards of the river coastal protection zone, while repurposed fence walls now function as noise barriers. Completing the mid-life rejuvenation of the old school, a simple yet iconic façade treatment has been adopted.

Industry | Institution/Community

CROP SCIENCE LABORATORY, HONG KONG BAPTIST UNIVERSITY

Three Key Features Demonstrating the Sustainability Performance

- Double Layer System combined with green roofs and a glass canopy
- Renewable Energy by incorporating integrated air-quality improvement Photovoltaic (AIPV) panels and a rooftop wind turbine
- Smart Automated Control System

Project Team

Project Name	Crop Science Laboratory, Hong Kong Baptist University
Team or Organisation Name	Hong Kong Baptist University
Name of Owner / Developer	Hong Kong Baptist University
Project Manager	Estates Office of Hong Kong Baptist University
Main Contractor	Yan Lee Construction Co., Ltd.
Architect	Urbanage International Ltd.
Civil & Structural Engineer	Arthur Yung and Associates Co. Ltd.
Building Services Engineer	Talent Mechanical & Electrical Engineers Ltd.
Quantity Surveyor	Beria Consultants Limited

https://youtu.be/5xXrlJDf574

The existing Science Tower and Botanical Laboratory have served the Department of Biology at Hong Kong Baptist University since 1989 and 1999 respectively, providing research and development facilities for thousands of students. The latest addition to the family is the Research and Development Crop Science Laboratory which supports advanced research and provides a precisely-controlled environment for experiments.

To overcome the different challenges of their eras, each generation of laboratories has adopted different innovative approaches to provide sustainable research and development facilities for students. The three resulting generations of R&D facilities have demonstrated how the understanding of sustainable building and technology design has progressed.

The Crop Science Laboratory, representing the newest generation of HKBU's green heritage, demonstrates an innovative and sustainable approach to the research and teaching facility. The project incorporates both active and passive designs, including double thermal layers with AIPV panels, green roofs and low-E glass which reduces excessive heat transfer to the indoors. The integration of a Smart Automated Control System is effective in reducing excessive radiation and minimising energy consumption by monitoring and controlling temperature, humidity and lighting for optimal plant growth and research. AIPV technology on the glass roof covers over 90% of the roof area, while wind turbines in the garden generate green energy for the garden area and support zero carbon emissions targets.

Industry | Institution/Community

CROP SCIENCE LABORATORY, HONG KONG BAPTIST UNIVERSITY

"By incorporating the latest technology and design elements, the Crop Science Laboratory promotes sustainability, reduces environmental impact and creates a comfortable and energy-efficient social hub for the University."

TSENG Yen-wei William,
Director,
Urbanage International Ltd.

The Crop Science Laboratory is also designed to be a new gathering space within the HKBU. The project team adopted a holistic approach that brings together research facilities, greenery, recreational areas and research farming areas to create a distinctive social interaction space that is both scientifically functional and socially inclusive.

The experimental farmland is aimed at developing innovative farming systems by utilising a diagonal layout that is both visually appealing and functional. The green features make best use of the limited rooftop space to create a unique aesthetic for social interaction spaces. The rooftop area transforms into a green oasis, providing a relaxing atmosphere for rooftop farming and a space for peace of mind within the dense urban-based university, benefiting the wellbeing of both students and the public.

Industry | Institution/Community

HONG KONG METROPOLITAN UNIVERSITY JOCKEY CLUB INSTITUTE OF HEALTHCARE

Three Key Features Demonstrating the Sustainability Performance

"Green MU Link" provides a visual and physical green connection.

This multi-purpose vertical learning hub provides spaces for lectures and social gatherings.

Design for active learning promotes learning that is not limited to classrooms.

In response to the increasing pressures on Hong Kong's healthcare system and the growing demand for professional healthcare services in an ageing society, Hong Kong Metropolitan University (MUHK) initiated a new development for its Nursing and Healthcare programme, aiming to cultivate the next generation of healthcare professionals while serving as a resource centre and talent hub for health-related activities. MUHK was keen for the building to be a focal point where academics could gather and collaborate on healthcare projects, promoting health education within the community.

The new Jockey Club Institute of Healthcare is located on Sheung Shing Street, directly opposite MUHK's Ho Man Tin Main Campus. Seeking to achieve its three key missions – creating a learning environment, incorporating greenery and connecting with the community – RLP Asia introduced an innovative and vibrant circulation concept into the design, naming it the "Green MU Link".

Project Team

Project Name	Hong Kong Metropolitan University Jockey Club Institute of Healthcare
Team or Organisation Name	Hong Kong Metropolitan University
Name of Owner / Developer	Hong Kong Metropolitan University
Project Manager	Hong Kong Metropolitan University
Architect	Ronald Lu & Partners (Hong Kong) Ltd.
Structural / Geotechnical Engineering Consultant	AECOM Asia Co. Ltd.
Building Services Consultant	AECOM Asia Co. Ltd.
Environment Consultant	WSP (Asia) Ltd.
Land Consultant	Larry H. C. Tam & Associates Ltd.
Landscape Consultant	ADI Limited
Quantity Surveyor	Rider Levett Bucknall Limited
Traffic Consultant	MVA Asia
Acoustic Consultant	WSP (Asia) Ltd.

https://www.hkmu.edu.hk/

Industry | Institution/Community

HONG KONG METROPOLITAN UNIVERSITY JOCKEY CLUB INSTITUTE OF HEALTHCARE

"This project demonstrates the integration of sustainable building design with end-user functionality requirements. The healthy stairs are a very popular sustainable design feature."

Project Team

With a gross floor area of 18,680m², the new 13-storey building is equipped with state-of-the-art facilities including lecture theatres, nursing and allied health laboratories, a psychology laboratory, a special educational needs centre, a learning commons, and student activity and active learning rooms. The academic concourse, featuring wide open stairs and walkways, promotes walking and provides more flexible and relaxed learning spaces. Over 30% of the institute is enveloped in greenery to harmonise with the adjacent public leisure park and unify the neighbourhood. Multi-level weather-proof link bridges and walkways enhance connectivity and contribute to neighbourhood climate resilience. The column-free covered plaza also caters to multi-purpose uses, with an extensive setback area that ensures it is located away from air-sensitive zones.

The green link connection extends via a healthy staircase to the terrace on the topmost floor, an integrated stepped amphitheatre that encourages active movement and fosters a culture of "learning everywhere". The building utilises solar and water resources to further facilitate low-impact operations – more than 10% of the building's footprint is equipped with solar panels, carefully positioned to avoid affecting surrounding sensitive receivers. Additionally, a rainwater collection tank is used for irrigation, while a dynamic façade design ensures a high-performance building envelope that responds to the building's context and the broader climate. Off-site rebar fabrication reduced waste during the construction phase and improved the overall quality of construction work.

The Jockey Club Institute of Healthcare will have a lasting impact on MUHK's students and the community, as it provides a rich training ground for Hong Kong's future healthcare providers. It is helping to foster an environment that is conducive to learning, while its integration of greenery and community connections promotes a holistic approach to healthcare education and collaboration.

Industry | Institution/Community

HONG KONG REPERTORY THEATRE EDUCATION HUB

Project Team

Project Name	Hong Kong Repertory Theatre Education Hub
Team or Organisation Name	Tony Ip Green Architects Ltd.
Name of Owner / Developer	Hong Kong Repertory Theatre
Project Manager	Tony Ip Green Architects Ltd.
Main Contractor	Po Shing Construction Ltd.
Architect	Tony Ip Green Architects Ltd.
Civil & Structural Engineer	Alex Yau & Associates Engineers and Planning Ltd.
Building Services Engineer	SC Consultants Ltd.
Quantity Surveyor	The QuantumS Ltd.
Project Designer	Tony Ip Green Architects Ltd.
Sustainable Design Consultant	Tony Ip Green Architects Ltd.
Heritage Consultant	B+G Design Co. Ltd.

https://www.hkrep.com/tc/Outreach-And-Education/Hkrepeducationhub.html

Going Beyond the Brief: Achieving Sustainable Design, Climate Resilience and Environmental Sustainability in a Heritage Building Revitalisation Project

The Hong Kong Repertory Theatre Education Hub embarked on a heritage building revitalisation project that eventually surpassed the initial project brief, delivering added value to both the client and the environment. This project not only restored a 120-year-old building but also integrated sustainable design practices, climate resilience and environmental sustainability into its design and construction processes.

To realise the Hub's vision of sustainable design in heritage revitalisation, historical restoration, cultural revitalisation, environmental strategies and ecological preservation were all prioritised. Low-carbon retrofitting strategies were implemented such as increasing green coverage, adopting energy-efficient glazing systems, installing skylights with solar glass, and facilitating natural ventilation. These measures not only enhanced the building's energy efficiency but also ensured the preservation of its historical significance. Climate resilience was integrated into the design by incorporating a skylight that enhanced natural daylight, reducing the need for artificial lighting and promoting energy efficiency. The skylight not only improved indoor environmental quality but also effectively managed water leakage issues, preventing further damage to the space.

Three Key Features Demonstrating the Sustainability Performance

- Sustainable Design Integration and Historic Fabric Conservation
- Climate Resilience, Environmental Strategies, and Vacant Institutional Space Revitalisation
- Material Circularity for Community Impact

A comprehensive materials audit was conducted to optimise sustainability, with multiple site inspections undertaken to document and evaluate items that could be reused or upcycled. Through meticulous assessment and selection, materials were identified that could be salvaged, refurbished, and incorporated into the project, thereby reducing the demand for new materials and minimising waste generation. In addition, innovative methods of upcycling existing materials were explored, bringing unique and inventive elements to the construction process. Of particular note, discarded glass panes were successfully repurposed into new glass blocks through collaboration with a local manufacturer. These glass

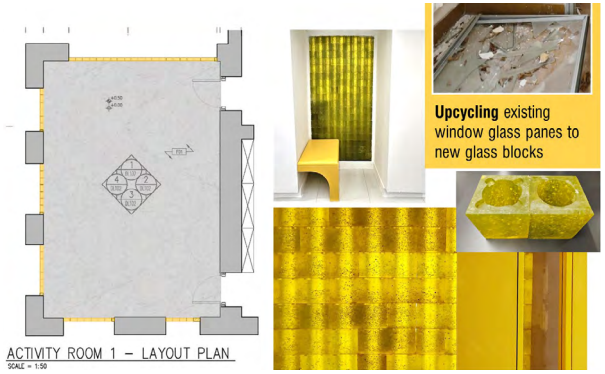
Industry | Institution/Community

HONG KONG REPERTORY THEATRE EDUCATION HUB

"As part of our commitment to sustainable design and material circularity, conducting an existing materials audit is essential. We have conducted thorough site inspections to document and assess reusable or upcyclable items present on-site."

Tony IP,
Founder,
Tony Ip Green Architects Ltd.

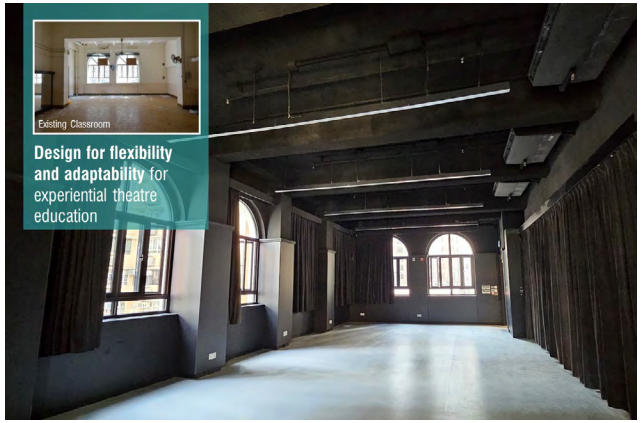
blocks were then integrated into the design as feature and partition walls, transforming the ground floor into a gallery space that showcases the building's evolution and development.



The ultimate aim of the project was to create an adaptable environment that respected the building's heritage while promoting community involvement. Heritage conservationists were enlisted to preserve the authenticity and uniqueness of the historical contexts, ensuring the building's integrity was maintained. Through the provision of inviting and accessible indoor and outdoor spaces, individuals from diverse backgrounds have been encouraged to come together, exchange ideas and participate in cultural activities, fostering a sense of belonging and strengthening social bonds within the community. Ecological restoration has been achieved through tree preservation and native planting, contributing to overall environmental wellbeing and providing a revitalising environment for the neighbourhood.

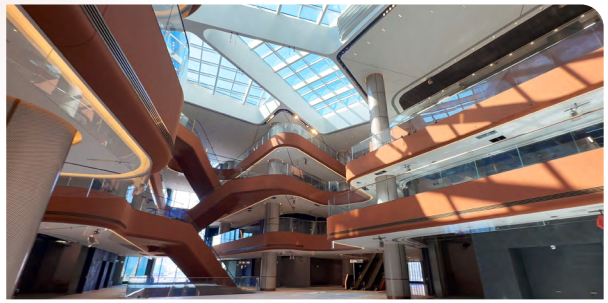
The success of this project was made possible by the collaboration and support of the Hong Kong Repertory Theatre, who played a pivotal role in extending the lifespan of the building and creating value for the community

and the environment. Their trust and commitment enabled sustainable design practices to be implemented, historic elements preserved, and innovative solutions incorporated that positively impacted the theatre and its surroundings. The project has become a model for sustainable heritage revitalisation, contributing to the cultural fabric of the neighbourhood and leaving a positive impact on the community.



Industry | Mixed Use

AIRSIDE



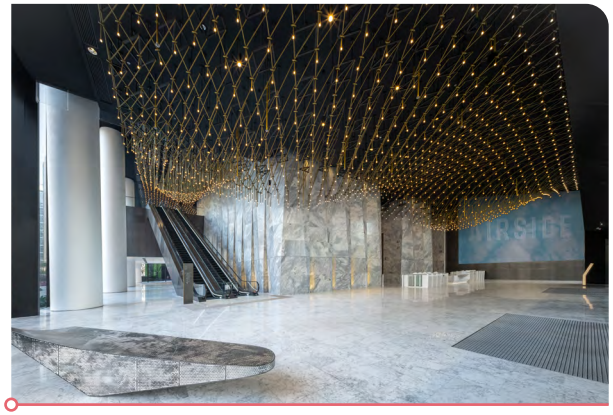
Project Team

Project Name	AIRSIDE
Team or Organisation Name	Rich Union Development Ltd. (Wholly owned by Nan Fung Group)/ Arup
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)
Main Contractor	Hip Hing Construction Co., Ltd.
Architect	Ronald Lu & Partners (Hong Kong) Ltd. (Project Architect) Snøhetta Overseas Architecture (Design Architect)
Civil & Structural Engineer	Arup
Building Services Engineer	Arup (Podium) J. Roger Preston Limited (Tower)
Quantity Surveyor	Arcadis Hong Kong Ltd.
Landscape Architect	Urbis Limited
Planning Consultant	Arup
Sustainable Design Consultant	Arup
Environmental / Ecology Consultant	Arup
Management Company	New Charm Management Ltd.
Others - Executive Interior Designer	Ronald Lu & Partners (Hong Kong) Ltd.

https://www.airside.com.hk/en

AIRSIDE, located on the former Kai Tak Airport site, is a 1.9 million ft² development designed to create a holistic neighbourhood. It integrates the UN SDGs into its sustainability development framework 'CO6 Metrics' to demonstrate a collaborative and holistic approach to the pursuit of building decarbonisation. Testifying to this commitment, AIRSIDE has become the first building in Hong Kong to receive seven of the highest green and smart building final certifications.

With its primary vision of carbon efficiency, AIRSIDE's extensive sustainable infrastructure excels in going beyond local codes with a 33% reduction in operational energy. Key energy-saving features include the largest renewable solar farm in a Hong Kong commercial building, spanning over 1,350m² and providing electricity generation of up to 270,000kWh annually. AIRSIDE Is also the first commercial development to use the District Cooling System to achieve high plant efficiency, while its solar-responsive façade produces thermal insulation 14% better than the statutory OTTV code.



Three Key Features Demonstrating the Sustainability Performance

- First Automatic Refuse Collection System with weighing system and collection of recyclable waste in Hong Kong
- First Automatic Underground Bicycle Parking System in Hong Kong
- Carbon-tracking smart platform to maximise synergies within the landlord-tenant network

Achieving decarbonisation throughout a building's life cycle requires more than just the commitment of the developer; carbon reduction measures are rendered futile without tenant awareness and momentum in the operational stage. As one means of leveraging the landlord-tenant network, AIRSIDE employs a pioneering Automatic Refuse Collection System with a smart weighing function that efficiently sorts, stores, weighs and logs waste quantities by categories.

Together with an extensive system of sub-metering to tenant level and a unique carbon-tracking integrated

Industry | Mixed Use

AIRSIDE

"AIRSIDE, at the centre of Hong Kong's CBD 2.0, represents the green fabric of Kai Tak. This holistic development fosters a people-centric, socially inclusive community, combining exemplary environmental performance with innovative sustainable features through the integration of a Sustainability Development Framework – CO6 Metrics."

Christy CHOW,
Sustainability Consultant, Arup

digital platform for the use of both landlord and tenants, carbon performance can be evaluated based on data collected from energy, waste and water sources. To ensure ongoing environmental sustainability in future operations and maximise social impact, AIRSIDE has adopted Net Positive Lease, an incentive programme to reward tenants based on their measurable carbon performance indicator tracking and benchmarking.

Serving as a nexus for connectivity in Kai Tak, AIRSIDE embodies the principles of sustainable mobility. In line with the Government's GreenWay network initiative, a pioneering underground bicycle parking system promotes eco-friendly commuting while liberating public open spaces and waterfront areas for pedestrian and cyclist usage. In addition, the integration of an all-weather public transport interchange, elevated walkways and underground streets enhances connectivity within the neighbourhood and encourages the use of public transport. An urban farm, located in a publicly accessible rooftop garden, encourages collaboration with the community while providing a unique farm-to-table experience for diners. Stepped terraces, water features and innovative Air-Induction Units encourage visitors to enjoy the outdoors.

Given the increasing importance of stormwater resilience in coastal cities, a comprehensive resilience strategy has been implemented for AIRSIDE, incorporating 400m^3 stormwater tanks, green plantations, and ample catchment areas to prevent flooding crises. The harvested water is recycled, alleviating the demand for fresh water. A constructed wetland concept makes innovative use of water filtration by wetland plant species.

To further enhance climate resilience, a comprehensive Whole Life Cycle approach has been adopted for AIRSIDE, minimising the building's carbon footprint. Since the start of construction, a remarkable 28% reduction in embodied carbon has been achieved compared with the 2030 RIBA BAU design target. This was accomplished by structural optimisation and a hybrid 'semi-top-down' construction method. By forging end-product partnerships, AIRSIDE creates decarbonisation win-win opportunities, such as developing upcycled fabric as fit-out material, utilising over 109,000 PET bottles.

AIRSIDE lives out its practical and influential approach to reduce the building's carbon footprint throughout its life cycle. Its unwavering commitment to environmental sustainability will stretch over boundaries and time.

Industry | Mixed Use

HONG KONG-SHENZHEN INNOVATION AND TECHNOLOGY PARK BATCH 1A DEVELOPMENT – BUILDINGS 8 & 9

Project Team

Project Name	Hong Kong-Shenzhen Innovation and Technology Park Batch 1A Development – Buildings 8 & 9
Team or Organisation Name	Hong Kong-Shenzhen Innovation and Technology Park Limited
Name of Owner / Developer	Hong Kong-Shenzhen Innovation and Technology Park Limited
Project Manager	Hong Kong-Shenzhen Innovation and Technology Park Limited
Architect	Ronald Lu & Partners (Hong Kong) Ltd.
Interior Design Consultant	Ronald Lu & Partners (Hong Kong) Ltd.
Structural / Civil / Geotechnical Engineer	C M Wong & Associates Ltd.
Building Services Engineer	J. Roger Preston Limited
Landscape Consultant	Urbis Limited
Green Certificate Consultant (Beam Plus / LEED / WELL)	WSP (Asia) Ltd.
Environmental Consultant	WSP (Asia) Ltd.
Quantity Surveyor	Beria Consultants Limited
Way-finding Consultant	One Bite Design Studio Ltd.
Traffic Consultant	MVA Hong Kong Ltd.
Lighting Consultant	Inhabit Asia Limited
Facade Consultant	Inhabit Asia Limited
Acoustic Consultant	Shen Milsom & Wilke Ltd.
ICT / Smart Technology Consultant	Shen Milsom & Wilke Ltd.
Laboratory Consultant	HERA Laboratory Planners
BIM Manager Consultant	B BIM Creation Ltd.

The Hong Kong-Shenzhen Innovation and Technology Park (HSITP) will support the innovation and technology industry in Hong Kong and the Greater Bay Area, while also becoming a resource-efficient, low-carbon, climate-resilient district in its own right. HSITP has already achieved a BEAM Plus Neighbourhood Platinum rating through its incorporation of net-zero strategies and innovative features at the earliest planning stages. Buildings 8 and 9, part of the development's first batch of buildings, are wet-lab enabled buildings that will contribute to scientific breakthroughs and new innovations. They are designed with specifications that will allow them to receive BEAM Plus Platinum, LEED Gold and WELL certifications.

Three Key Features Demonstrating the Sustainability Performance

- "Green living room" design connects users with the outdoors
- Efficient use of natural resources reduces carbon emissions
- Driver for a resource-efficient, low-carbon, climate-resilient district

Buildings 8 and 9 are planned to be an integral part of a wider sustainable and climate-resilient neighbourhood. Landscaped areas are strategically placed along wind corridors, seamlessly connected to the nearby ecological area. The wide separation between the buildings preserves daylight and minimises ventilation disturbances to nearby sensitive areas. These buildings also house the first district cooling system in HSITP, which can serves up to 72,000m^2 of building space, and a comprehensive park-wide automatic refuse collection system which encourages waste sorting while minimising inconvenience to residents. Meanwhile, the "Green-Point" communal area promotes materials recycling, while a mobile application allows

Industry | Mixed Use

HONG KONG-SHENZHEN INNOVATION AND TECHNOLOGY PARK BATCH 1A DEVELOPMENT – BUILDINGS 8 & 9

"Much more than basic laboratories, Buildings 8 & 9 are the heart of the Hong Kong-Shenzhen Innovation and Technology Park – fostering innovation and cultivating creativity for a sustainable future."

Project Team

personal carbon tracking and incentivises sustainable behavioural change. Waste during the construction phase was also reduced through the Design for Manufacture and Assembly (DfMA) and Multi-trade Integrated Mechanical, Electrical and Plumbing (MiMEP) processes.

Natural resources are efficiently utilised, creating further reductions in carbon emissions: on-site PV panels are placed on rooftops and potable water reduction measures are in place. Habitable spaces are well lit with energy-saving lighting, while high-performance building envelopes and HVAC systems reduce cooling loads by over 40%. Passive design strategies such as a low window-to-wall ratio, high-performance glazing and external shading devices further contribute to energy efficiency.

To enhance the wellbeing of building users, biophilic design elements were employed throughout, with over 20% of the site area covered by diverse tree species, reducing the urban heat island effect and providing shade in pedestrian zones. An additional 20% of the site is designated as a bioswale area, capturing rainwater to enhance climate adaptation.

The "green living room" design concept allows users to connect with the green outdoors during meetings, and when gaming, networking, exercising or relaxing. Buildings 8 and 9 are also equipped with bicycle racks and IAQ sensors to optimise air quality, while a "healthy staircase" facilitates seamless movement between floors. Intelligent automation and environmental dashboards augment user-friendliness and promote sustainable living.

Industry | Mixed Use

HONG KONG-SHENZHEN INNOVATION AND TECHNOLOGY PARK BATCH 1A DEVELOPMENT – BUILDING 11

Project Team

Project Name	Hong Kong-Shenzhen Innovation and Technology Park Batch 1A Development – Building 11
Team or Organisation Name	Hong Kong-Shenzhen Innovation and Technology Park Limited
Name of Owner / Developer	Hong Kong-Shenzhen Innovation and Technology Park Limited
Project Manager	Hong Kong-Shenzhen Innovation and Technology Park Limited
Architect	Ronald Lu & Partners (Hong Kong) Ltd.
Structural Engineering Consultant	C M Wong & Associates Ltd.
Building Services/MEP Consultant	J. Roger Preston Limited
Quantity Surveying Consultancy	Beria Consultants Limited
BIM Consultant	B BIM Creation Ltd.
Way-finding Consultant and Interior Designer	One Bite Design Studio Ltd.
Traffic Consultant	MVA Hong Kong Ltd.
Lighting Consultant	Inhabit Asia Limited
Acoustic Consultant	Shen Milsom & Wilke Ltd.
Facade Consultant	Inhabit Asia Limited
Landscape Consultant	Urbis Limited
Environmental Consultant (Non-green Certificate Consultant)	WSP (Asia) Ltd.
ICT / Smart Technology	Shen Milsom & Wilke Ltd.
Green Certificate Consultant (BeamPlus / LEED / WELL etc.)	WSP (Asia) Ltd.

Three Key Features Demonstrating the Sustainability Performance

- A "co-home • co-living"cconcept designed to inspire innovation
- A semi-outdoor living experience to promote climate resilience
- Intelligent automation used to drive sustainable behavioural changes

Located in the buffer zone between the southern edge of the Hong Kong-Shenzhen Innovation and Technology Park (HSITP) and the adjacent ecological area, Building 11 is a sustainable, high-performance dormitory building consisting of 100 accommodation units.

An important sustainable design consideration was the need to prevent the building from interfering with the flight paths of migratory birds, keeping these paths free from obstacles as much as possible. A key objective was therefore reducing the building's bulk. A continuous transition of greenery between indoors and outdoors also creates integration with the natural buffer zone, and includes a barrier of trees intended to minimise disturbance to ecology and biodiversity. The surrounding landscape design provides over 30% greenery, 35% tree coverage and a jogging trail, putting the users in close proximity to nature. The planting is diverse, with around 50% of trees and plants being native species – these were specifically selected to enhance biodiversity and support local habitats.

Designed to foster the exchange of innovative ideas, the "co-living core" at the heart of Building 11 connects all of its modular integrated construction (MiC) units and supporting facilities. This layout also encourages a semi-outdoor living experience, promoting climate resilience by reducing reliance on artificial cooling and lowering electricity consumption. It also incorporates low-RTTV and OTTV design elements, utilises photovoltaic panels to generate 3.5% of the building's energy, and incorporates

Industry | Mixed Use

HONG KONG-SHENZHEN INNOVATION AND TECHNOLOGY PARK BATCH 1A DEVELOPMENT – BUILDING 11

"Building 11 is more than a structure that accommodates talent, it is a sustainable shared living space where people can encounter new ideas and experience the spark of innovation."

Project Team

skylights with hybrid ventilation in communal spaces and individual units, creating further semi-outdoor circulation areas.

The adoption of MiC for Building 11, the first HSITP building to do so, also enabled construction waste to be reduced and the construction process streamlined. All of these innovative features have helped Building 11 achieve a BEAM Plus New Buildings V2.0 Provisional Platinum rating.

Its "co-home • co-living" design concept helps create a wellness-oriented and mindful living experience with the aim of gaining a three-star FitWel rating. The building offers rooftop urban farming, communal laundry and kitchen facilities, dry/wet pantries, music rooms, gaming corners, and a smart home system. A healthy staircase enables seamless movement between floors, while bicycle racks, yoga and exercise areas, and indoor air quality monitoring and environmental dashboards are provided to promote and enhance a healthy lifestyle. Waste reduction and recycling are encouraged through reverse vending machines, recycling corners and a food waste decomposer installed at ground level. Meanwhile, intelligent automation and environmental dashboards enhance user-friendliness and further support sustainable living. Through a linked mobile application, users can track their personal energy usage, waste production and carbon emissions data, driving sustainable behavioural change at the individual level and ensuring continuous improvements in all sustainability metrics in the future.

Industry | Mixed Use

ONE SOHO

Project Team

Project Name	ONE SOHO
Team or Organisation Name	P&T Architects Ltd.
Name of Owner / Developer	Sino Land Company Ltd. Chuang's Consortium International Ltd. Urban Renewal Authority
Main Contractor	Chevalier (Construction) Company Ltd.
Architect	P&T Architects Ltd.
Civil & Structural Engineer	Aurecon Hong Kong Ltd.
Building Services Engineer	Wong & Ouyang (Building Services) Ltd.
Quantity Surveyor	Rider Levett Bucknall (Hong Kong) Ltd.
Landscape Architect	Otherland Ltd.
Sustainable Design Consultant	Allied Environmental Consultants Ltd.
Facade consultant	Inhabit Hong Kong Ltd.

https://www.onesoho.hk/index.html

ONE SOHO is a unique mixed-use urban development in the dense neighbourhood of Mong Kok. It comprises a 23-storey residential tower, a single-storey clubhouse and a three-storey retail podium with one retail floor in the basement. At ONE SOHO, an integrated series of environmental missions, policies and strategies has been put in place to achieve sustainable green living, add overall value, and promote health and wellbeing for residents and the community. These driving visions and design core values led to the project attaining BEAM Plus Gold rating and the Grand Award in the New Building category of the Green Building Award 2023.

The development offers an expanse of space for the community, anchored by an urban plaza with connecting sunken plaza at the vibrant junction of Shantung Street and Reclamation Street. Another urban passage has been opened up across the site from Shantung Street to the rear lane facing a park of the opposing lot, creating a physical connection through the site. This greatly improves the streetscape and urban fabric of the neighbourhood.

The podium and tower massing are set back to enhance the openness of the plaza. The building façade takes the shape of 'vitrines' to draw attention to the urban plaza and street junctions. A layered garden and lush planting surrounding the urban space adds to the rich experience, creating a comfortable environment and a place for community interaction. Lush vegetation, which covers over 20% of the site area, is both visually pleasing and visible from different angles and distances in the dense and bustling city.

Three Key Features Demonstrating the Sustainability Performance

- Improving Urban Porosity and Spatial Identity
- A Green Enclave in a Dense Neighbourhood.
- Quality Living Space for Residents

Designed with a concept of retail streets, open passages are provided across the podium floors, linking the plaza with these passages and enabling cross-ventilation for the retail floors. The microclimate is further enhanced with an Air Induction Unit (AIU) installed at podium level to improve the air-flow rate. A water feature is set within the green walls of the sunken plaza as a passive cooling feature. In addition, a grey water recycling system is provided for irrigation and water conservation. Other low-carbon design and renewable energy features such as a kinetic floor to generate electricity from pedestrian movement, hybrid lamp poles and a smart bench with solar-powered energy are installed for community use.

Industry | Mixed Use

ONE SOHO

"ONE SOHO presents a golden opportunity for us to push forward a sustainable design vision to develop a quality building and crafting spaces that is engaging and promotes health and wellbeing, supporting and inspiring a sustainable lifestyle."

KONG Choong Kit,
Architect & Director,
P&T Architects Ltd.

The project design achieves estimated energy savings of 26.7% against the ASHRAE Standard by bringing together passive and active designs, as well as a 21.3% reduction in CO_2 emissions from the BEAM Plus baseline case.

Various sustainable and wellness features are incorporated into the building's design, including enhanced indoor air quality, thermal comfort and biophilic features. Highlighted features include high-performance air conditioning and home appliances, a spacious landscape garden and a clubhouse area providing avenues for wellness and a sustainable lifestyle.

Various management plans have been created to ensure sustainable operations, including real-time environmental monitoring, a smart building system and more. Residential units are equipped with a Smart Home system providing owners with near real-time data on energy and water consumption, waste generation and air quality levels. This integrates the building management system and smart home display system, assisting owners, tenants and building management alike with easy information exchange, and providing a sustainable foundation for future operations.

Industry | Residential

ARTISAN GARDEN

Project Team

Project Name	Artisan Garden
Team or Organisation Name	New World Development Company Limited
Name of Owner / Developer	New World Development Company Limited / Urban Renewal Authority
Project Manager	New World Development Company Limited
Main Contractor	New World Construction Company Limited
Architect	P & T Architects & Engineers Ltd.
Civil & Structural Engineer	C M Wong & Associated Ltd.
Building Services Engineer	P&T (M&E) Ltd.
Quantity Surveyor	WT Partnership (HK) Ltd.
Landscape Architect	AXXA Group Limited
Project Designer	P & T Architects & Engineers Ltd.
Sustainable Design Consultant	Arup (BEAM Plus submission)
Environmental / Ecology Consultant	Ramboll Environ Hong Kong Ltd.
Management Company	New World Property Management Company Limited

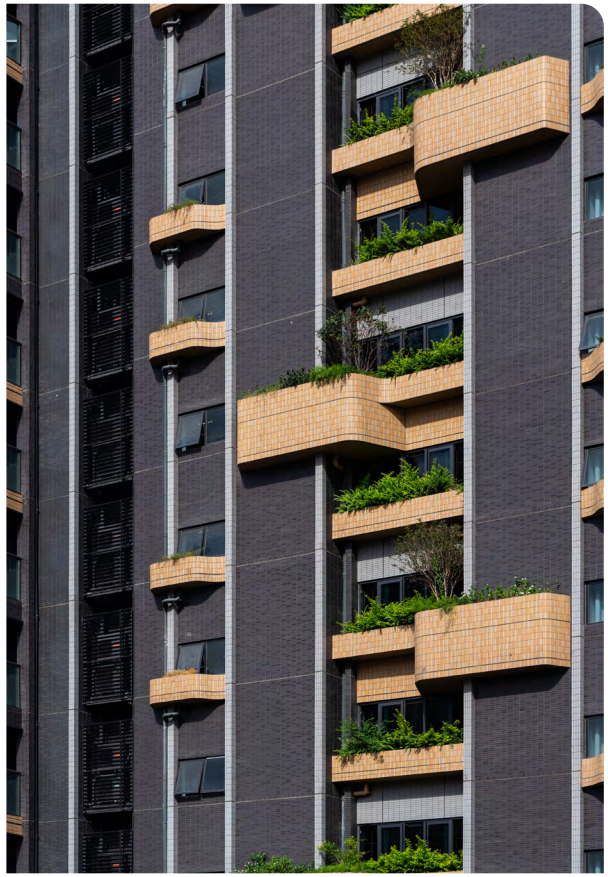
https://youtu.be/ik3Bm94YMYE
https://www.artisangarden.com.hk/

Three Key Features Demonstrating the Sustainability Performance

- A successful urban renewable project promoting a "Garden Living" lifestyle and total wellbeing
- Potential of passive design in the urban area maximised with AC free lift lobbies and mall
- A relaxed green journey for residents

Artisan Garden, nestled in To Kwa Wan – a historic district of Hong Kong – is a captivating mixed-use urban redevelopment. The local neighbourhood exudes character with its ageing low-rise residential buildings and vibrant street markets. In contrast, the 21-storey residential floors of this development rise elegantly above a seven-storey podium. This podium houses a three-storey shopping mall, a clubhouse, a serene podium garden, and two mechanical floors. This careful arrangement ensures that most units enjoy unobstructed views, abundant natural light, and minimal noise intrusion from nearby highways.

The central theme of "Garden Living" permeates every facet of Artisan Garden. Despite the site's constraints and the bustling surroundings, the landscape extends beyond traditional boundaries. From ground level to terraces and even the vertical façade, multiple layers of lush gardens thrive. These verdant spaces create a harmonious green journey, inviting residents to embrace



Industry | Residential

ARTISAN GARDEN

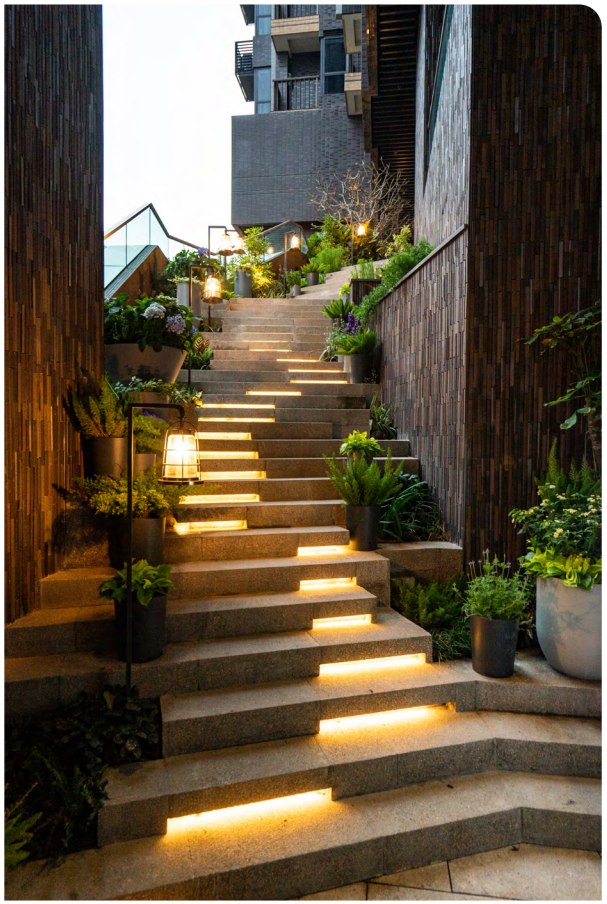
"Artisan Garden exemplifies New World Development's efforts in urban regeneration. Prioritising our residents' wellbeing, the urban oasis demonstrates our commitment to sustainability."

Edwin CHAN,
Head of Projects,
New World Development Company Limited

a lifestyle of wellbeing. Impressively, the greenery covers over 515m^2—more than 37% of the site area. Despite all the constraints, this landscaped oasis remains visually enchanting from various viewing points.

The project has earned Final Gold rating in the BEAM Plus certification. Noteworthy features include enhanced natural air ventilation, reduced reliance on mechanical systems (air-conditioning-free lift lobbies and the mall), thoughtful building setbacks, and strategically perforated building mass. The implementation of eco-friendly systems, such as rainwater and greywater recycling, further underscores Artisan Garden's commitment to sustainability.

The development not only enriches the lives of its residents but also serves as a beacon of urban renewal, inspiring the entire community.



Industry | Residential

LOHAS PARK PHASE 12 – SEASONS PLACE

Three Key Features Demonstrating the Sustainability Performance

Part of Wheelock's O'East portfolio which creates a connected sustainable community in Tseung Kwan O, offering a plethora of amenities and green ambience for a balanced lifestyle.

Well-connected to transport networks and close to the city's heartbeat, harmonising nature and sophisticated aesthetics to create a serene and elegant environment.

Digitalisation applied to support sustainable construction, and CIC Carbon Assessment Tool (CIC CAT) used to monitor carbon emissions from design stage to the end of the project.

Project Team

Project Name	LOHAS Park Phase 12 – Seasons Place
Name of Owner / Developer	Wheelock Properties Limited MTR Corporation Limited
Project Manager	LOHAS Twelve Project Management Ltd.
Main Contractor	Gammon Engineering & Construction Company Limited
Architect	Ronald Lu & Partners (Hong Kong) Ltd.
Civil & Structural Engineer	AECOM Asia Company Limited
Building Services Engineer	Meinhardt (M&E) Ltd.
Quantity Surveyor	Arcadis Hong Kong Limited
Landscape Architect	AECOM Asia Company Limited
Project Designer	CL3 Architects Ltd.
Sustainable Design Consultant	WSP (Asia) Ltd.
Environmental / Ecology Consultant	WSP (Asia) Ltd.

LOHAS Park Phase 12 has been jointly developed by Wheelock Properties Limited (WPL) and MTR Corporation Limited (MTRC), with Gammon Engineering & Construction engaged for its construction.

Phase 12 is part of WPL's O'EAST portfolio in Tseung Kwan O district, also encompassing Malibu, Monrata, Marini and Seasons Place, and has attained Provisional Gold rating under BEAM Plus New Buildings V1.2. Its concept of health and wellness reflects WPL's "The Spirit of Living" vision for the whole LOHAS Park development.

Digitalisation

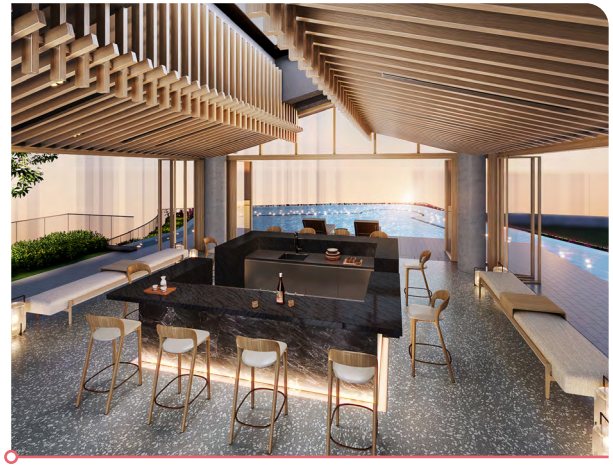
WPL is striving to streamline and optimise the entire project by leveraging digital technologies and tools, from construction to handover stage. Since the design phase, CIC CAT has been used to provide opportunities for better monitoring and optimised resources consumption. Additionally, the use of a digital platform at construction stage enables the tracking and traceability of sustainable materials and products, ensuring compliance with building standards. Digitalisation was also implemented to improve construction site safety. By using drones and IoT sensors, site inspections and monitoring could be conducted remotely to minimise risks and hazards for workers, as well as reduce the need for unnecessary travel. During the handover stage, WPL has created its own e-Residential Apps to streamline the process from handover to defect rectification. These apps serve as an online platform, allowing residents to book facilities and receive the latest updates.

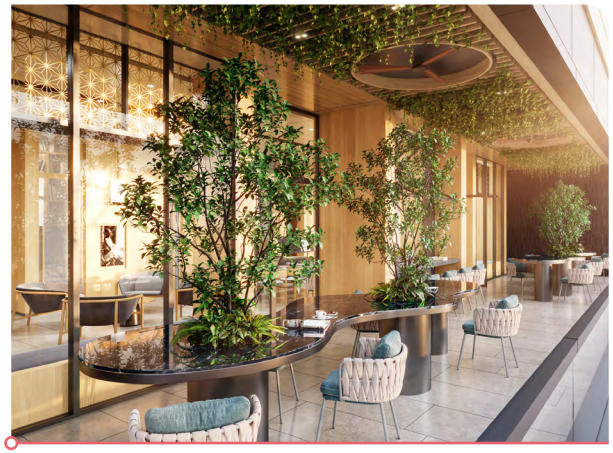
Industry | Residential

LOHAS PARK PHASE 12 – SEASONS PLACE

Energy-efficient equipment

During the construction phase, electrical equipment played a crucial role in promoting sustainable construction practices. The use of energy-efficient plant such as electric forklifts and EV contract cars enabled the project's energy consumption and carbon footprint to be significantly reduced. The AMPD Enertainer energy storage system allowed advanced building automation and control systems to be adopted, optimising resource usage and efficient operations. These electric alternatives offer cleaner, more environment-friendly and more sustainable construction practices.





BIM

To better estimate the quality of building materials and avoid construction clashes on site, BIM has been fully adopted since design stage. This has helped avoid abortive works as well as reducing paper usage by simplifying marking and amendment processes on the design and construction drawings.

Natural lighting

WPL understands the importance of air ventilation and adequate solar access for each dwelling and surroundings. The adoption of an ideal high window-to-wall ratio and usage of Low-E IGU Glass among all O'East projects offers substantial benefits for energy efficiency. These practices effectively channel sea breezes, optimise solar access and maximise the use of natural lighting.

With this commitment to sustainable practices, WPL strives to create a comfortable living environment that truly benefits its customers.

Industry | Residential

ONE INNOVALE

Project Team

Project Name	One Innovale
Team or Organisation Name	Henderson Land Development Company Limited
Name of Owner / Developer	Henderson Land Development Company Limited
Project Manager	Henderson Land Development Company Limited
Main Contractor	Build King
Architect	CYS Associated (HK) Ltd
Civil & Structural Engineer	Mr Stephen Cheng Consulting Engineers
Building Services Engineer	P&T (M&E) Limited
Quantity Surveyor	WT Partnership (HK)
Landscape Architect	QUAD Ltd.
Project Designer	Philip Liao & Partners Limited CREAM
Sustainable Design Consultant	Arup
Environmental / Ecology Consultant	Allied Environmental Consultants Ltd.
Wind / Air Ventilation Consultant	Arup
Others	Butterfly Ecologist: C&R Wildlife Firefly Ecologist: Keiryu Company Limited

https://youtu.be/irB2OMO5-Gk
https://youtu.be/N9I8vp37EvU

The impact of the global pandemic on every aspect of life has been undeniable. A lack of connection between buildings and health resilience has become evident. As "home" has become a last shelter, it's necessary to start reassessing how a more pandemic-proof environment can be created for the future.

With public and residential areas found to be of high public health concern, Henderson Land is trying to foresee the future demands for a "secure home".

This needs a rethinking of community connections, health and wellbeing, as well as the security level of one's home. Security should be able to cover both the physical and mental aspects of daily living The aim must be to strike a balance between the built environment and the needs of the human body and mind.

One Innovale is a new residential development in this newly-expanded area of Fanling, geared to the needs of occupants while providing a natural environment to combat the challenges of climate change through these strategies:

- GREEN building concepts fully incorporated in terms of passive design, energy and resources;
- HEALTH and WELLNESS elements Integrated into the building and facilities with people-centric designs;
- NATURAL ENVIRONMENT preserved to reattract biodiversity;
- EDUCATIONAL messages delivered through passive design strategies and activities.

Three Key Features Demonstrating the Sustainability Performance

- Conserving the local habitat by integrating the built environment with inspiring art features
- Balancing the needs of humans and the environment through science-based creations
- Bringing together the community by delivering sustainability value

This is the first residential project in Hong Kong to achieve WELL v2 Platinum Precertification for the whole development, including residential flats. This reflects Henderson Land's long-established commitment to sustainable and healthy developments and its holistic approach to providing a "human centric" touch.

The project team has incorporated numerous scientific design strategies to create a high-standard living environment with enjoyable outdoor spaces. A specially designed wind deflector enhances natural ventilation according to the local weather. The development features a Butterfly Garden and Firefly Habitat created using

Industry | Residential

ONE INNOVALE

"With human-centric innovations supported by science-based environmental analyses and biodiversity in place, One Innovale vividly exemplifies the beauty of integrating art, tech and nature for a new direction in green, healthy and liveable residential developments in Hong Kong."

Kevin NG,
Senior Deputy General Manager,
Henderson Land Development Co. Ltd.

computational science to restore native species and provide a sustainable outdoor design that takes full consideration of residents' and nature's needs. A renewable energy system and rainwater collection system have been integrated into the development's design to conserve natural resources and optimise the opportunities for offsetting its carbon footprint.

An Information, Communication and Technology (ICT) system has been adopted to enhance residents' experience and safety, and to facilitate operations and maintenance. A project-specific Home Automation system enables users to enjoy convenience, safety, security and improved peace of mind. A weather totem interlinks indoor thermal controls with the outdoor weather and air quality conditions to alert residents to changes in weather. Two patented designs, namely a Lift Sterilisation Pod and Depuration Porch, have been developed to enhance living quality by providing high levels of health protection and guaranteed high air quality. Using smart technology and transparent data collection, it allows system monitoring and optimisation to maintain sustainable operations.

To bring continuous positive impacts to the next generation, a community social platform includes clubhouse facilities and an automated farming system. Urban farming workshops and community education programmes will be organised to provide fulfilling individual and communal experiences.

In summary, One Innovale incorporates a comprehensive variety of wellness designs that address physical, mental, and social wellbeing.

Industry | Residential

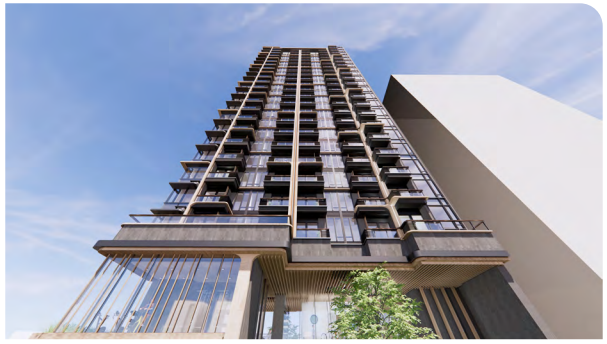
TONKIN STREET REDEVELOPMENT PROJECT

Three Key Features Demonstrating the Sustainability Performance

- First private residential development built with MiC by private developer
- Smart home display system
- Advanced IoT and digitalisation adopted

Project Team

Project Name	Tonkin Street Redevelopment Project
Team or Organisation Name	Chinachem Group and Urban Renewal Authority
Name of Owner / Developer	Chinachem Group and Urban Renewal Authority
Project Manager	Chinachem Group
Main Contractor	Gammon Engineering & Construction Company Limited
Architect	Ronald Lu & Partners (Hong Kong) Ltd.
Civil & Structural Engineer	Ben Tse & Associates Limited
Building Services Engineer	Aurecon Hong Kong Limited
Quantity Surveyor	AECOM Cost Consulting (Hong Kong) Limited
Landscape Architect	(Soft Landscape) Earthasia Limited (Hard Landscape) Ronald Lu & Partners (Hong Kong) Ltd.
Project Designer	Ronald Lu & Partners (Hong Kong) Ltd.
Sustainable Design Consultant	BeeXergy Consulting Limited
Environmental / Ecology Consultant	BeeXergy Consulting Limited
MiC Supplier	Guangzhou Municipal Construction Group Co.,Ltd.



This project is the first private residential development built with Modular integrated Construction (MiC) by a private developer in Hong Kong. Situated at the junction of Tonkin Street and Fuk Wing Street in Cheung Sha Wan, it is a composite development comprising one 22-storey private residential tower with 198 units, a retail podium, landscaped staircase, urban plaza, clubhouse and sky-garden. Given MiC's unprecedented advantage over conventional building methods, the construction process can achieve a higher level of quality control and assurance. Waste management and pollution can be optimised at the factory and construction waste from on-site formworks and plastering substantially reduced.

To counteract the urban heat island effect, the building is set back from the road and incorporates an urban plaza, which enhances the local wind environment and promotes thermal comfort. A light well on the roof and a sky garden at the base are designed to channel sunlight into bathrooms and open kitchens.

Industry | Residential

TONKIN STREET REDEVELOPMENT PROJECT

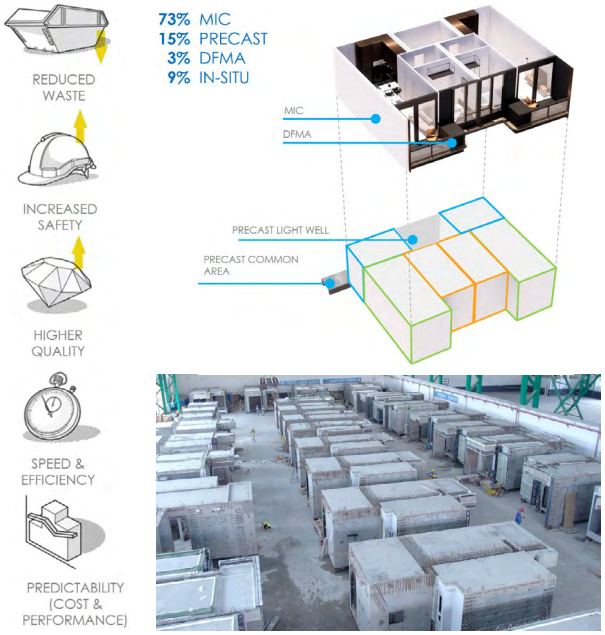
"With our commitment to sustainability and carbon reduction, we have set high green building standards. We build homes that accentuate quality and comfort to meet residential needs while creating positive value for society and the environment."

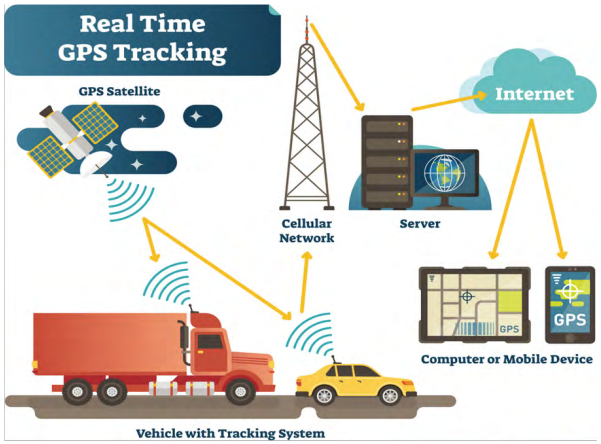
Donald CHOI,
Executive Director and CEO, Chinachem Group

The project will feature water-efficient appliances and a water leakage detection system, projected to save approximately 48% of fresh water annually, equivalent to about 6,872,000L or 2.7 Olympic-sized swimming pools. The inclusion of a high-performance façade with low-e coating insulated glass units (IGUs) and energy-efficient air-conditioning and lighting fixtures is expected to reduce energy consumption by 30%, equivalent to a reduction of approximately 360,000 kg of CO_2 emissions annually – equivalent to planting 15,700 trees.

To ensure excellent indoor air quality and energy efficiency, the basement car park will be equipped with an exhaust air fan controlled by CO and NO_2 sensors, and a timer for air pollution control. A smart home display system in each residential unit will enhance residents' environmental awareness and wellbeing by providing easy access to real-time data such as the fill level of the smart bin, water leakage in the kitchen, and home energy and water consumption. All kitchens and toilets are designed with openable windows to improve indoor air quality and wellness.

During the construction phase, 65% of CFA works will be carried out in a MiC factory, minimising air and noise disturbance on site. The project's CO_2e emissions are expected to be reduced by approximately 613 tonnes thanks to the use of recycled materials for excavation and lateral support (ELS), steel platforms and in-situ rebar. A number of strategies have been implemented to support decarbonisation, including the use of Enertainer electric storage generators, electric forklifts, green carbon concrete, and waste management. This is projected to save approximately 90,000 trees. Over 99% of CIC-certified ready-mixed green concrete is being used on site with a carbon footprint of products (CFP) of approximately 172 kg CO_2e/m3, saving an additional 47,000 trees. The embodied carbon for the superstructure is approximately 24% lower than the baseline.





A variety of digitalisation technologies such as BIM, Novade, Aconex, and G-Twin are being extensively applied from the design to the construction stage. G-Twin is being utilised to reduce carbon emissions and enhance resource allocation efficiency. For example, delivery trucks can be digitally tracked and their actual locations monitored in real-time, reducing truck waiting time and preventing traffic congestion near the site.

This is the first BEAM Plus certified project under the Compliance Assessment route in Hong Kong.

Industry | Other

KWU TUNG STATION ON THE EAST RAIL LINE

Three Key Features Demonstrating the Sustainability Performance

Sustainability embedded into each stage of the project, including its planning, design, construction and operations

Sustainable station features incorporated such as use of the District Cooling System, natural ventilation, natural lighting, a green roof and a neighbourhood-integrated design

Innovative technology adopted as Building Information Modelling and Design for Manufacture and Assembly to enhance construction quality

Project Team

Project Name	Kwu Tung Station on the East Rail Line
Team or Organisation Name	MTR Corporation Limited
Name of Owner / Developer	MTR Corporation Limited
Project Manager	Arup
Main Contractor	Dragages Hong Kong Limited
Architect	Arup
Civil & Structural Engineer	Arup
Building Services Engineer	Arup
Quantity Surveyor	Arcadis Hong Kong Limited
Sustainable Design Consultant	Arup
Facility Manager	MTR Corporation Limited

https://mtrnorthernlink.hk/en/kwu-tung-station

The Kwu Tung Station project stands as a notable example of fulfilling the vision of building a sustainable city and community. By incorporating various green elements and creating a harmonious environment, the project demonstrates a commitment to sustainable development. The station's overall design not only reflects the area's historical and cultural characteristics but also embraces the features of its natural landscape. This integration of urban and rural elements, as well as the blending of traditional and new cultures, will ensure the railway development makes a positive contribution to the community.

The integration of the station design with the surrounding open space is one of the key aspects of MTR's sustainability efforts. By incorporating sustainable features such as a green roof, the station will not only enhance passengers' experience, providing them with a recreational area to enjoy after their journey, but will also contribute to climate resilience. In addition, the station entrances and exits have been thoughtfully designed to align with the nearby natural ventilation and green corridor, ensuring efficient airflow and maintaining a harmonious connection with the environment.

As a further means of enhancing sustainability and energy-efficiency, the station will be connected to the proposed Kwu Tung North New Town District Cooling System (DCS) to provide a reliable and efficient supply of cooling water. The station will also be equipped with skylights and high canopies to strengthen air circulation and maximise natural lighting within the station, creating a pleasant and eco-friendly environment for passengers and the community.

Industry | Other

KWU TUNG STATION ON THE EAST RAIL LINE

"The majority of the population of the Kwu Tung North New Development Area will be distributed within walking distance of Kwu Tung Station. Residents can easily reach it on foot and benefit from the efficient, convenient, and low-carbon railway services."

Dominic LAW,
Project Manager – Northern Link,
MTR Corporation Limited

Building Information Modelling (BIM) technology has been applied at every stage of the Kwu Tung Station project to visualise the railway structure's internal and external design, facilitating integration and communication on construction works. In addition, the project team is actively exploring innovative approaches such as Design for Manufacture and Assembly (DfMA) and Modular Integrated Construction (MiC) to minimise on-site construction processes and reduce environmental impact. As a result, potential sound, waste, dust and sewage generated by the works will be reduced, better upholding the principles of sustainable development.

Once construction of the Northern Link is completed and services commence, passengers will experience these efforts to advance sustainable development. Energy-saving measures in the new stations, trains and railway facilities will include the use of energy-efficient lighting equipment and air-conditioning systems. An Energy Consumption Monitoring System will continuously monitor energy consumption, improve energy efficiency, and reduce environmental impact across different levels of the railway's operations.

The Kwu Tung Station project exemplifies the vision of building a sustainable city and community. Through its thoughtful design, integration with the natural surroundings and adoption of advanced construction practices, the project effectively addresses climate resilience and environmental sustainability. It will set an example for future operations, promising a greener and more resilient future for the community.

Research and Planning

EXPERT INSIGHTS ON HONG KONG'S CARBON NEUTRALITY ROADMAP

FROM RESEARCH TO ACTION: INSIGHTS ON GREEN ARCHITECTURE AND URBAN PLANNING TO TACKLE CLIMATE CRISIS

Prof. Edward NG

Prof. Edward NG, Yao Ling-sun Professor of Architecture at the Chinese University of Hong Kong (CUHK), has dedicated over three decades to research and teaching. His focus lies in ecologically sustainable architecture and urban planning based on urban climate. At the same time, he has also contributed to the development of urban climate blueprints for governments and organisations in Singapore, Macau and many Mainland China provinces and cities. Here Prof. NG elucidates how green architecture and other measures can address the imminent global climate crisis, especially in the face of extreme heat.

CONFRONTING EXTREME HEAT: COLLABORATING ACROSS SECTORS TO STRENGTHEN URBAN INFRASTRUCTURE ADAPTATION TO CLIMATE

United Nations Secretary-General António GUTERRES has declared that the era of global warming has ended, and we are now in the era of global boiling. In April 2024, Hong Kong experienced its highest recorded average temperature since 1884, reaching 26.4 degrees Celsius, according to the Hong Kong Observatory. The city has witnessed numerous extreme heat events in recent years, setting temperature records annually since 2019. Prof. NG is deeply concerned about the climate adaptation-related weaknesses in Hong Kong's urban infrastructure. One major issue is the lack of long-term weather forecast data. He points out emphatically, "There is a need for weather predictions, beyond the next 15 days, extending with data projected up to the year 2100." Based on his past research, Prof. NG predicts that by 2100, Hong Kong will no longer experience winter, with only November and December offering slightly cooler weather, while the remaining months will be summer. Summers can be further divided into Peak Summer, the hottest period and Shoulder Summer, with relatively milder temperatures.

Prof. NG's latest research data emphasises the emergence and increasing frequency of extreme weather events in Hong Kong, prompting the urgent need for all sectors, including the building sector, to proactively develop strategies for coping with adverse weather conditions. He recommends leveraging predictive data to enhance infrastructure and reviewing forecasting mechanisms, such as strengthening the heatwave warning system and providing weather forecasts for the next two weeks. He underscores the necessity of establishing a cross-departmental platform to coordinate disaster preparedness efforts across social welfare and healthcare sectors, ensuring continuity and providing relevant disaster response guidelines.

During scorching weather, the Government currently opens 19 Community Halls and Community Centres as temporary cooling shelters. Prof. NG highlights the insufficiency

> "In society, when environmental protection is discussed, it is often given great importance and prioritised. However, when it comes to implementation, it is consistently placed last whenever other priorities come up. In the face of extreme weather conditions, we must confront environmental issues head-on, and it is imperative that we do so without delay."

EXPERT INSIGHTS ON HONG KONG'S CARBON NEUTRALITY ROADMAP

of these centres and their remote locations, which discourage residents, particularly those in subdivided flats, from seeking refuge. He recommends improving operational efficiency, enhancing internal facilities and amenities, and expanding "third spaces" such as shopping malls, public lounges, and community centres to serve as cooling havens, especially for vulnerable elderly citizens. Implementing these measures, according to Prof. NG, will enhance the city's climate resilience, safeguarding the wellbeing of its citizens and promoting environmental sustainability.

ENHANCING URBAN CLIMATE RESILIENCE USING GREEN BUILDINGS TO ADDRESS EXTREME WEATHER

Prof. NG has for years been dedicated to researching how green buildings can mitigate extreme heat and extreme weather conditions. He emphasises the crucial role of green architecture in combating extreme heat. His recommendation involves designing buildings with two distinct spaces, akin to a bedroom and a living room. The first space serves as an activity area during summer, featuring high ceilings, large windows, and cross-ventilation. The second space, reserved for extremely hot weather, can be smaller and equipped with air conditioning to manage energy consumption.

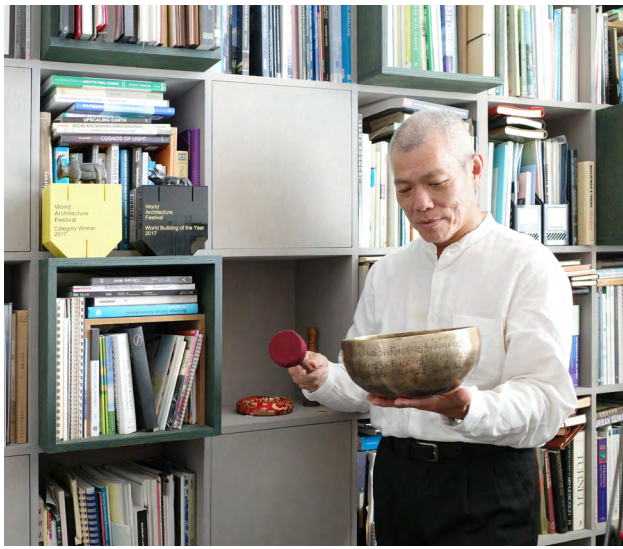
Furthermore, Prof. NG underscores the importance of balancing indoor and outdoor spaces in urban design. Outdoor areas, like extensions of indoor living rooms, can include temperature-cooling features such as parks with shade trees, pavilions, green vegetation, and artificial water features like fountains. Prof. NG explains with examples, "For parks or cooling shelters to be effective in hot weather conditions, they need to be equipped with community elements for seniors to use them. Data about seniors' psychological stress must be collected, for instance, to understand their level of awareness of physical symptoms or emotional fluctuations during extreme heat warnings."

COLLABORATION AMONG GOVERNMENT, EDUCATION, AND INDUSTRY TO PROMOTE SPECIALISED AND MAINSTREAM ENVIRONMENTAL EDUCATION

Prof. NG believes that Hong Kong's efforts in environmental education remain inadequate, especially considering that environmental education as a subject is not yet mainstream in the educational sector. In contrast, European countries like Germany and Denmark have achieved greater success in promoting environmental and green building education. Prof. NG reiterates, "Educating the next generations about the environment is a common mission between the academia, the industry and the Government. Environmental education should be professionalised, similar to practices in medical and dental schools, by establishing specialised faculties within schools." With over 30 years of experience in higher education, Prof. NG emphasises the need to improve the overall atmosphere for environmental education, a challenge faced globally. He believes that professional development and mainstreaming environmental education require multi-faceted collaboration. And every significant change begins with a single step.

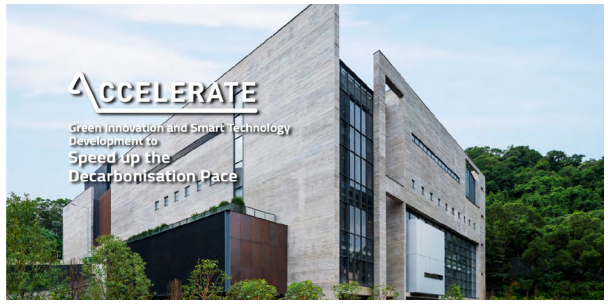
AVOIDANCE OF HIGH-DENSITY CONSTRUCTION AND CONSIDERATION OF EXTREME WEATHER RISKS RECOMMENDED FOR FUTURE DEVELOPMENT OF THE NORTHERN METROPOLIS

Urban planning always looks towards the future rather than the present. The upcoming Northern Metropolis in Hong Kong, which will take 10 to 20 years to construct, must consider the gradual normalisation of extreme weather conditions by the time it is completed. Prof. NG highlights that the Northern Metropolis falls within a geographical region known as the "airshed", characterised by intense heat and lack of sea breezes. To mitigate the urban heat island effect, the area should avoid high-density construction. The Government's planning process must carefully assess the environmental carrying capacity of the region. Concepts like "Sponge City" should be incorporated into long-term urban planning to prevent flooding, to store and manage excess rainwater, and to enhance climate resilience. Measures such as providing more green spaces, proper ventilation design and adequate shading facilities are also essential.



Government

3A STRATEGY: INNOVATIVE AND INTERACTIVE TOOLS FOR LOW CARBON DESIGN AND CONSTRUCTION



Project Team

Project Name	3A strategy: Innovative and Interactive Tools for Low Carbon Design and Construction
Name of Organisation	Architectural Services Department
Collaborating Party	Arup
Members of Research / Planning Team	ArchSD Carbon Neutrality Strategy Study Taskforce

https://youtu.be/c0e3dh7_YAE

Amplify, Accelerate and Act Together

ArchSD's '3A' Strategy has three core elements.

'Amplify' refers to adopting a performance-based approach that goes beyond statutory requirements and applies green, high-productivity construction technologies to the Department's projects to maximise decarbonisation performance.

'Accelerate' refers to exploring, developing and adopting smart and advanced technologies to accelerate low-carbon transformation in these projects.

'Act Together' describes how the Department works hand-in-hand with stakeholders to combat future climate challenges and build a carbon neutral future.

Under the above strategic framework, two innovative and interactive design tools have been developed which assist project teams to develop low carbon designs and assess, benchmark and review carbon performance.

The first tool is the Innovative and Handy Low Carbon Design Flow Map, created to match the six most common building types in ArchSD's projects. It is a concise guide that exhibits all the market information readily available, as well as emerging strategies in multi-disciplinary services. It assists project design teams to identify low carbon design strategies easily.

Objectives

This Carbon Neutrality Strategic Framework – '3A' Strategy – was set up to lay a solid foundation for Architectural Services Department (ArchSD) to advance to carbon neutrality.

The second tool is the Interactive and Easy-to-use Low Carbon Design Toolkit, which enables project design teams to assess carbon performance of their projects easily, instantly and accurately. This toolkit not only integrates with the carbon emission factor database, but also includes local and international baselines to offer project design teams a one-stop-shop experience with instant and automatic carbon emission calculations and benchmarking.

How the Project can enhance Climate Change Resilience

With Hong Kong having set a clear target to achieve carbon neutrality before 2050, there is a strong demand in the industry to understand how to achieve a low carbon built environment. These innovative tools can help project design teams overcome the difficulties encountered in developing low carbon designs as well as assessing, tracking and monitoring the projects' carbon emissions. They can be the beginning of the answer that the industry needs.

Government

APPLICATION OF HIGH VOLUME OF GROUND GRANULATED BLAST-FURNACE SLAG (GGBS) FOR CEMENT REPLACEMENT IN CONCRETE CONSTRUCTION

Minimising the embodied carbon of concrete pile foundations

For over a decade, the Housing Authority has been using Ground Granulated Blast-furnace Slag (GGBS) for concrete façade fabrications precast in Mainland China. GGBS is a by-product of iron production and offers a much lower level of embodied carbon than cement which is a major constituent and carbon contributor of concrete. The partial replacement of cement with a "high volume" of GGBS is considered a major carbon reduction solution for concrete construction.

By exploring with local concrete suppliers the mass introduction of GGBS for cement replacement, the Housing Authority hopes to adopt a high volume of GGBS in structural concrete components such as pile foundations and pile caps for public housing developments. A pilot study with field trials is being carried out on the application of more than 50% of GGBS for cement replacement in large diameter bored piles, so as to evaluate its impact on the operational process, pile strength and pile integrity, with a view to mass adoption in the near future.

Objectives

To explore with local concrete suppliers the mass introduction of GGBS for cement replacement, with a view to adopting a high volume of GGBS in structural concrete components such as pile foundations and pile caps for public housing developments.

How the Project can enhance Climate Change Resilience

Concrete is the second most widely used material on earth and contributes 7% of GHG emissions globally per year. The progressive application of low carbon concrete from concrete foundation piles to all other structural concrete components can progressively reduce carbon emissions and thereby reduce the harmful global warming effect.

Project Team

Project Name	Application of High Volume of Ground Granulated Blast-furnace Slag (GGBS) for Cement Replacement in Concrete Construction
Name of Organisation	Hong Kong Housing Authority
Members of Research / Planning Team	Structural Engineering Section / Development and Construction, Development & Construction Division, Housing Department

Government

APPLICATION OF INNOVATIVE ROBOTICS TECHNOLOGIES FOR DESILTING WORKS AT DRAINAGE FACILITIES FOR SUSTAINABILITY OF WATER QUALITY PRESERVATION AND FLOOD PREVENTION

Smart Drainage Maintenance: Robotics for a Sustainable Future

As one of the most densely populated cities in the world, Hong Kong faces formidable challenges in stormwater collection and flood prevention. At present, Drainage Services Department (DSD), manages over 2,800 km of stormwater drains and river channels in the city. Recognising the need to respond to global pressures such as climate change and ensure Hong Kong's sizeable and complex drainage network is properly maintained, DSD has been developing innovative approaches to sustainable water management, and taking proactive measures to enhance work safety and efficiency and bring benefits to the public. One notable initiative is developing and deploying smart remote-controlled desilting robots to facilitate drainage maintenance by leveraging state-of-the-art robotics technologies.

When stormwater is collected and discharged to the sea through box culverts and river channels, debris such as washed-away leaves, silt, sand and gravel accumulates gradually at these drainage facilities. To minimise flooding risks and preserve the water quality of river channels and sea, the drainage facilities need to be inspected regularly and desilting arranged to ensure their proper functioning.

Traditionally, loaders, excavators, backhoes, crane lorries or even divers are deployed for carrying out these desilting works. If workers use traditional desilting methods,

Objectives

- To assess challenges and limitations in the traditional desilting methods used for drainage facilities.
- To identifying and leverage state-of-the-art robotics technologies to develop different types of robots for desilting works at drainage facilities, so as to minimise the need for man-entry operations and enhance works safety, efficiency and productivity.
- To apply different types of desilting robots at drainage facilities to suit different conditions and working environments.

Project Team

Project Name	Application of Innovative Robotics Technologies for Desilting Works at Drainage Facilities for Sustainability of Water Quality Preservation and Flood Prevention
Name of Organisation	Drainage Services Department
Members of Research / Planning Team	Mainland North Division, Drainage Services Department

https://www.youtube.com/playlist?list=PL3Khq2hTaWZaoCVtMsrVrluavj1sa3A22

https://www.info.gov.hk/gia/general/202203/29/P2022032800227.htm

https://www.dsd.gov.hk/EN/What_s_New/What_s_New/news30900.html

Government

APPLICATION OF INNOVATIVE ROBOTICS TECHNOLOGIES FOR DESILTING WORKS AT DRAINAGE FACILITIES FOR SUSTAINABILITY OF WATER QUALITY PRESERVATION AND FLOOD PREVENTION

they are required to enter confined box culverts or river channels to operate plants, thus exposing themselves to certain safety risks. To minimise safety risks, these traditional desilting methods are mostly limited to the dry season and sometimes require the interception of water flow to allow workers to work in an water-free environment. This leads to the desilting works having low efficiency and high costs.

To take advantage of recent innovations in robotics technology, more than ten remote-controlled desilting robots of various types have been developed and introduced to assist in desilting. These robots can enhance work safety by avoiding the need for workers to enter the river channels and box culverts. In addition, they can be operated under water and are not affected by tides and weather restriction. As a result, desilting works can be carried out throughout the year, making such operations more flexible and efficient. This expedites the work process, lowering the cost and driving impactful change. One of these desilting robots won a Silver Medal at the 48th International Exhibition of Inventions of Geneva in 2023.

Sustainability Action(s) of the Project

Compared with traditional desilting methods, the desilting robots not only enhance works safety, but also increase productivity by at least two times and reduce the cost of desilting works by up to 17%. In addition, the robots can remove silt and other debris from water bodies more thoroughly, thereby preserving and improving the water quality, strengthening flood prevention and contributing to the city's sustainable development.

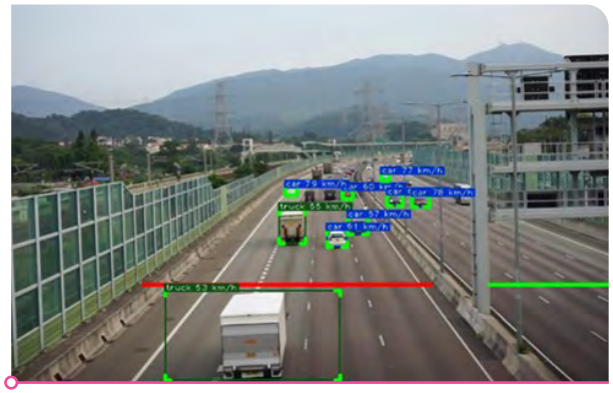
How the Project can enhance Climate Change Resilience

By leveraging innovative robotics technologies, desilting works can be carried out throughout the year, more effectively minimising the risk of flooding and enhancing Hong Kong's resilience to climate change.

Government

DEVELOPMENT AND APPLICATION OF MiC IN PUBLIC HOUSING DEVELOPMENTS

Development and application of MiC 2.0, logistics study on MiC application and measurement of MiC performance in public housing developments



This project involved collaboration with research institutions such as Nano and Advanced Materials Institute (NAMI), a subsidiary of Hong Kong University of Science and Technology, to develop a second generation MiC (MiC 2.0), with a focus on simplifying the connection and rebar fixing details.

Since transportation and logistics planning is one of the crucial factors affecting MiC construction, The Hong Kong Polytechnic University was also invited to conduct a generic logistics study on MiC application in public housing developments.

In addition to proposing improvements for the MiC construction process and logistics, there is a need to measure the Housing Authority's MiC performance. The Centre for Innovation in Construction and Infrastructure Development (CICID) of the University of Hong Kong was also invited to join this project to develop a systematic framework for measuring the performance of MiC projects to date, with respect to Environmental, Social and Economic at different stages of construction.

Project Team

Project Name	Development and Application of MiC in Public Housing Developments
Name of Organisation	Hong Kong Housing Authority
Collaborating Parties	Nano and Advanced Materials Institute (NAMI) The Hong Kong Polytechnic University The University of Hong Kong
Members of Research / Planning Team	Structural Engineering Section / Development and Construction, Development & Construction Division, Housing Department

Objectives

To develop a second generation of Modular Integrated Construction (MiC 2.0) to expedite production and construction processes, relieve labour shortages and improve the productivity and quality of MiC.

Sustainability Action(s) of the Project

- By developing MiC 2.0 to simplify the connection and rebar fixing details, the current MiC production and construction process can be expedited, the labour shortage relieved and the productivity and quality of MiC improved.
- By enhancing logistics planning, re-engineering the construction process and creating a framework to measure the performance of all these processes, the sustainable development MiC within the Housing Authority can be reshaped in the future.

Government

STUDY ON ACTIVE DESIGN FOR HEALTHIER LIFESTYLE - FEASIBILITY STUDY

A valuable reference for development practitioners to understand and incorporate active design considerations in development projects

Objectives

To take forward the advocacy of mainstreaming active design in the planning and development process, so as to foster a built environment conducive to an active and healthy lifestyle, in line with the recommendations of the "Hong Kong 2030+: Towards a Planning Vision and Strategy Transcending 2030".

Project Team

Project Name	Study on Active Design for Healthier Lifestyle - Feasibility Study
Name of Organisation	Arup
Collaborating Party	Planning Department
Members of Research / Planning Team	Theresa Yeung, Wai-Lam Lee, Matthew Gevers, Derrick Juda, Derek Tsang

https://youtu.be/BcLkDRFg6nA

https://www.arup.com/projects/active-design-guidelines-hong-kong

Designing for a Healthier Lifestyle

Modern technology offers unprecedented daily convenience; however, it has inadvertently reduced our physical activity. Besides public promotional initiatives, planners, architects, and designers can play an important role in encouraging healthier lifestyles by implementing 'active design' concepts in urban developments.

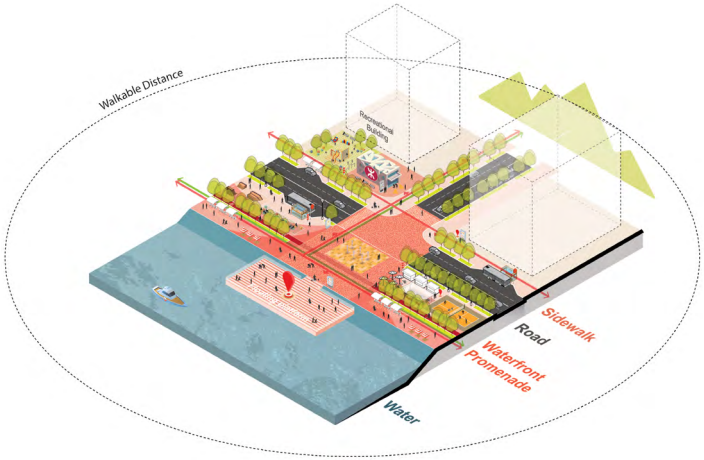
Drawing upon global expertise combined with participation by local stakeholders, academics and the industry, Arup and the HKSAR Government's Planning Department delivered a first-of-its-kind strategy and design guidelines for Hong Kong's urban transformation. This study identifies the barriers and opportunities for various user groups with a view to shaping an urban environment that makes it easier for all Hong Kong residents, regardless of age or fitness level, to choose more active daily lives.

Creating an active city with healthy people

Responding to the complexity of designing high-density urban environments in a challenging topography, a set of Active Design Guidelines was formulated with themes, objectives and design guidelines at the neighbourhood and building levels.

At the neighbourhood level, the Guidelines emphasise the creation of an active city through the provision of diverse and flexible active destinations that are accessible for all groups in society, complemented by interesting and convenient pedestrian routeings that offer people the opportunity to engage in more physical activities in their daily lives.

At the building level, in response to the inclusion of multiple uses, the Guidelines focus on the strategic positioning of building functions, the creation of active spaces and facilities and the design of active routes within and around the buildings, encouraging users' movement. Active building frontages support a vibrant and safe pedestrian realm, enhancing the walking experience.



Government

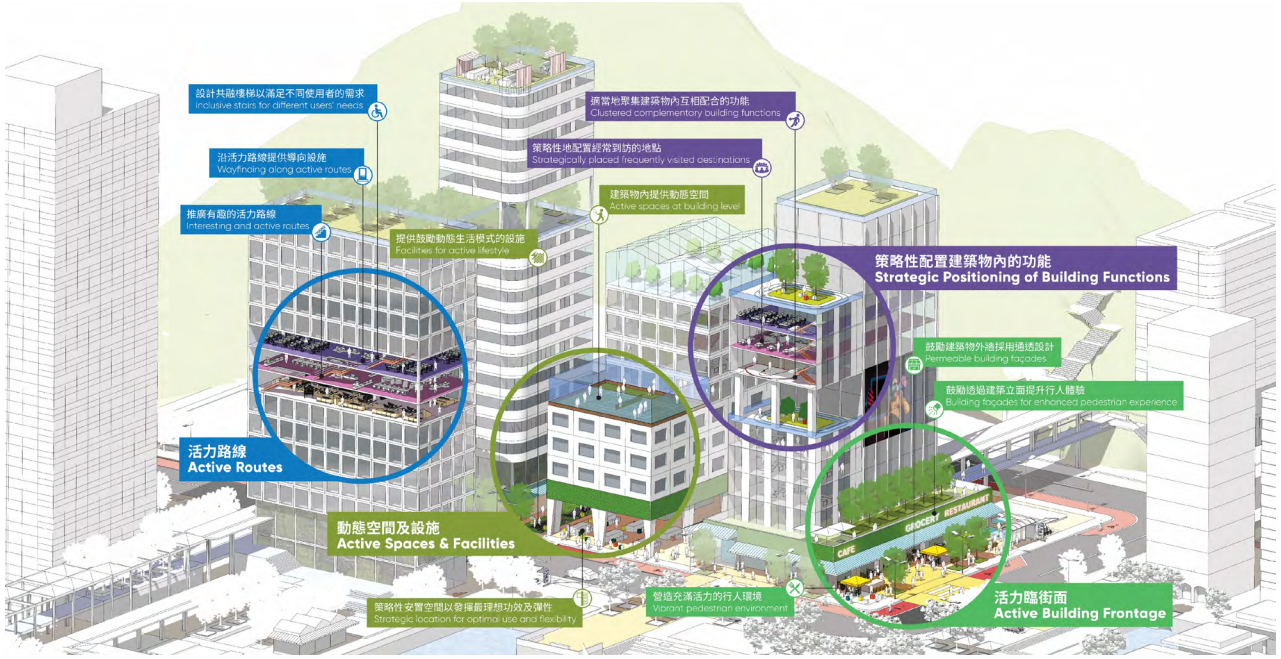
STUDY ON ACTIVE DESIGN FOR HEALTHIER LIFESTYLE - FEASIBILITY STUDY

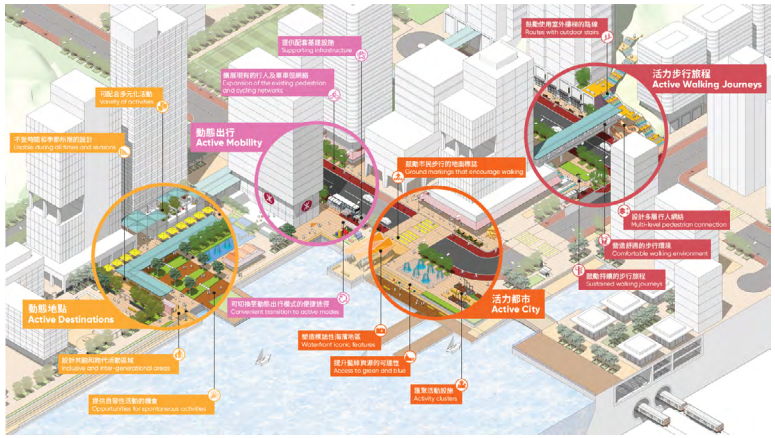
Contributing to a healthy urban environment

The progression from policy to implementation is challenging. The study proposes an incremental approach to mainstreaming the concept of active design in the planning and development process. As a start, the advisory Guidelines are being made publicly available to raise awareness among practitioners. Application of the Guidelines will then be promoted in multiple public development projects to capture public attention to the associated benefits of active design. Lastly, efforts will be scaled up to institutionalise the Guidelines into the planning and development regime when opportunity arises.

Sustainability Action(s) of the Project

The Active Design Guidelines not only serve as a valuable reference for development practitioners to understand and incorporate active design considerations in development projects, but also provide a forward-looking and people-oriented approach to nurturing active design, ensuring healthy lives, and promoting wellbeing for all.





Academia

3D MODEL FOR ENERGY SAVING IN HONG KONG BUILDINGS

An innovative use of technology to showcase the energy saving potential of buildings and stimulate discussion on scaling up solutions for building owners, financiers and Government between now and 2050

Objectives

To bring the buildings of Hong Kong to life through 3D digital visualisation, with initial focus on energy efficiency for self-evaluation and benchmarking by asset owners.

Some 90% of Hong Kong's electricity is consumed in buildings, and buildings alone account for about 60% of Hong Kong's greenhouse gas emissions.

This coloured 3D model is still at a stage where co-operation in its development is taking place, with collaboration with the Government and stakeholders being sought on how best to approach it. To create the model, the following information has so far been embedded:

- Number of buildings
- Types of buildings (commercial, residential, institutional etc.)
- Energy usage (actual where actual data is available and estimated where unavailable)
- Carbon emissions

While it is known in principle that retrofitting existing buildings in a city can reduce energy consumption, the potential for energy saving and therefore decarbonisation requires seeking and putting together many types of information, which makes it hard for the full potential of retrofitting to be easily grasped. This is why such a tool is so useful.

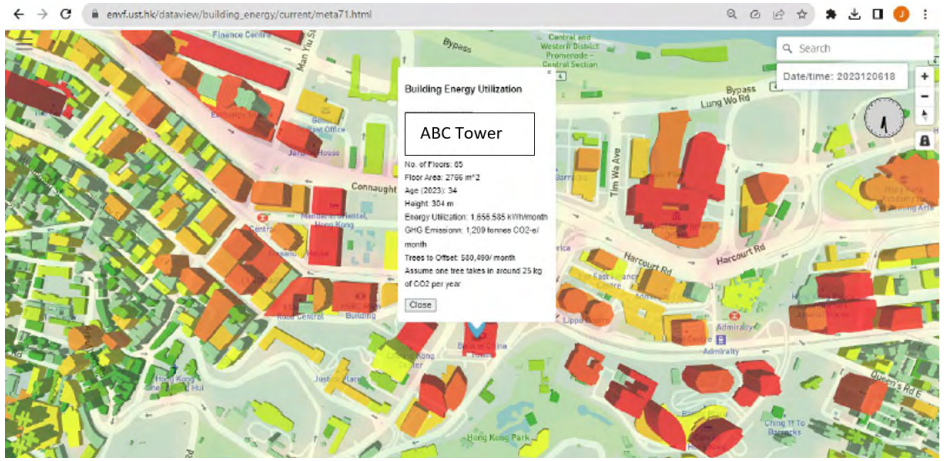
Project Team

Project Name	3D Model for Energy Saving in Hong Kong Buildings
Name of Organisation	Hong Kong University of Science and Technology (HKUST)
Members of Research / Planning Team	Prof. Christine LOH, Prof. Alexis LAU, Prof. Jimmy CHAN, Ms Shannon HO

https://youtu.be/Pyj-5WP_koo?si=VuhO2m5s88_Zy1OL

Sustainability Action(s) of the Project

This dynamic platform will offer far more than a mere snapshot of the present. It will lay the groundwork for an advanced visualisation core within what could be a Decision Support System. With such a system, the scope of energy saving can be estimated assuming various types of retrofits, depending on the extent of retrofit and costs involved. The Hong Kong University of Science and Technology (HKUST)'s belief is that once the energy saving potential becomes known, it should become easier for the Government, asset owners, financiers and other stakeholders to consider collaboration and take action to capture this potential.



Academia

BIG DATA-BASED "AI INSPECTOR" FOR GAUGING INERT CONTENT AT CONSTRUCTION WASTE OFF-SITE SORTING FACILITIES IN HONG KONG

Enhancing construction waste management with big data

Objectives

To develop a portable, handheld device that can quickly and accurately estimate the composition (e.g. inert and non-inert ratio) of a truckload of construction and demolition (C&D) waste. This will enable users such as construction managers and waste hauliers to make better C&D waste disposal plans without having to undertake complex processes.

Project Team

Project Name	Big data-based "AI Inspector" for Gauging Inert Content at Construction Waste Off-site sorting facilities in Hong Kong
Name of Organisation	iLab, Faculty of Architecture, The University of Hong Kong (https://ilab.hku.hk/about/)
Collaborating Party	Environmental Protection Department (EPD)
Members of Research / Planning Team	Chair Prof. Weisheng LU; Prof. Fan XUE; Mr Liang YUAN; Dr Junjie CHEN; Ms Mun Wai Wendy LEE

https://repository.hku.hk/cris/project/hkugrant126153

Construction waste management is one of the major environmental protection and sustainability concerns of governments. In Hong Kong, the prevailing '3Rs' waste management initiative necessitates waste sorting, with off-site sorting facilities (OSFs) playing a key role in the Government's strategic construction waste management initiative. By paying a HK$175/tonne levy, contractors can deliver their construction waste to OSFs for sorting if the waste contains more than 50% of inert (recyclable) compositions by weight. An accurate methodology for estimating composition is therefore required to ensure that the waste truly meets the >50% criterion. However, an Audit Department report in 2016 found that the inspection methodology currently used in OSFs is ineffective, even though the Government has strengthened it several times, as the inert waste sorted had always fallen significantly below the bar.

Focusing on this real-life problem faced by OSFs, this project was established to develop an "AI Inspector" based on big data analytics and mathematical modelling. It can automatically gauge whether or not incoming construction waste loaded by vehicles meets the 50% inert content requirement. Both lab experiments and field tests (at Tseung Kwan O Area 137 Sorting Facility) have demonstrated that the accuracy of the AI Inspector is far higher than that of the currently used methodology for gauging composition. More importantly, the AI Inspector does not require any new equipment to be installed.

Applying the AI Inspector at OSFs can fix loopholes in the existing methodology. It will significantly improve the efficiency and sustainability of the Government's OSFs, enhancing sustainable construction waste management in Hong Kong. The AI Inspector can also be applied to waste landfills as they operate to a similar system. This can significantly reduce the amount of inert construction debris sent to landfills, thereby salvaging recoverable materials (with their massive embodied carbon emissions) and saving precious landfill space.

Academia

BIG DATA-BASED "AI INSPECTOR" FOR GAUGING INERT CONTENT AT CONSTRUCTION WASTE OFF-SITE SORTING FACILITIES IN HONG KONG

Sustainability Action(s) of the Project

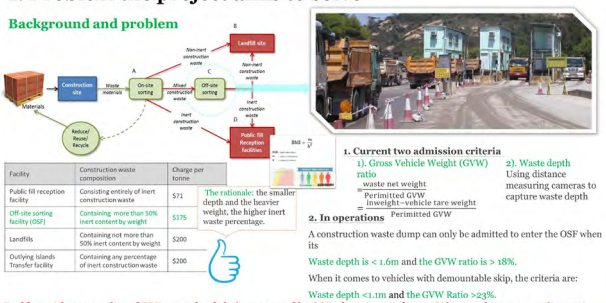
Up to now, the project team have held two meetings with Civil Engineering and Development Department (CEDD) and Environmental Protection Department (EPD) to discuss in detail the trial implementation of AI Inspector in OSFs and landfills. A preliminary scheme and agreement have been drawn up for further planning and decision. After successfully completing its trial implementation, the AI Inspector can be applied to the Government's construction waste management facilities. Some regulations and criteria in the "Construction Waste Disposal Charging Scheme" legislation might need to be corrected to maintain the environmental effects of the AI Inspector in future.

How the Project can enhance Climate Change Resilience

Given its contribution to construction waste management and the saving of materials resources, the AI Inspector can have a valuable impact on helping Hong Kong combat environmental and climate challenges.

1. Problem the project aims to solve

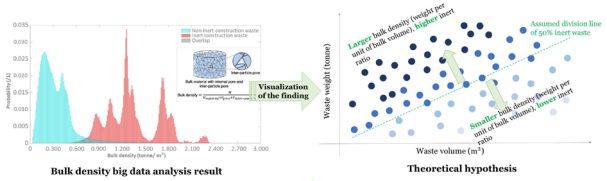
Background and problem



Problem: A large number of C&D waste loads being accepted by OSFs do not meet the >50% inert-substance requirement (Audit Commission, 2016).

2. Solution proposal

Big data analysis and hypothesis



Bulk density big data analysis result

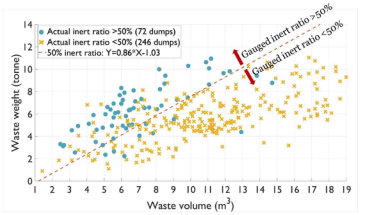
Theoretical hypothesis

Based on the big data analysis on the bulk density (weight per unit of bulk volume) of 4.27 million construction waste dumps, we found that the larger the bulk density, the higher the inert waste ratio.

We hypothesize that the inert content ratio strongly correlates with the bulk density (=weight/volume). In such a case, there may be an oblique line to roughly divide data points into "inert ratio > 50%" and "inert ratio < 50%".

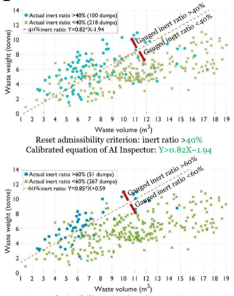
3. Lab experiment to test the AI Inspector

Testing AI Inspector based on the 318 ground-truth data



Admissibility criterion: inert ratio >50%

Equation of AI Inspector: Y>0.86X−1.03



Reset admissibility criterion: inert ratio >40%

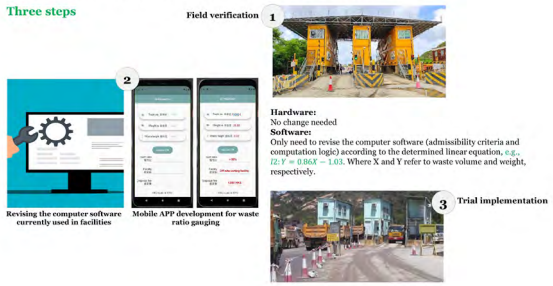
Calibrated equation of AI Inspector: Y>0.82X−1.94

Reset admissibility criterion: inert ratio >60%

Calibrated equation of AI Inspector: Y>0.85X+0.59

4. Next plan discussed with CEDD and EPD

Three steps



Revising the computer software currently used in facilities

Mobile APP development for waste ratio gauging

Hardware:
No change needed
Software:
Only need to revise the computer software (admissibility criteria and computation logic) according to the determined linear equation, e.g., $Y = 0.86X - 1.03$. Where X and Y refer to waste volume and weight, respectively.

5. Field test and other related research activities

Face-to-face meeting with the EPD, CEDD officers, and OSF staff (February 1, 2021)

The HKU-Tsinghua Workshop on Construction Scene Understanding and Applications (March 27, 2021)

Virtual project visit with EPD staff (March 1, 2022)

Field test (July 11, 2021)

Industrial interview with building demolition site workers (September 10, 2021)

Research award

Academia

CARBON CALCULATOR & ESTIMATOR TOOLS FOR SMEs

Easy-to-use tools representing an early step by Hong Kong to assist SMEs in periodically estimating their carbon footprints for disclosure to stakeholders

Objectives

This initiative addresses the need for businesses in Hong Kong, including its approximately 340,000 Small and Medium Enterprises (SMEs), to start calculating their greenhouse gas (GHG) emissions for sustainability reporting.

Project Team

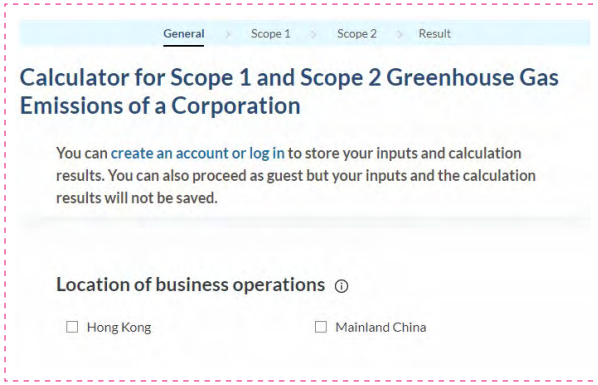
Project Name	Carbon Calculator & Estimator Tools for SMEs
Name of Organisation	Hong Kong University of Science and Technology (HKUST)
Collaborating Parties	Securities and Futures Commission (SFC), Hong Kong Monetary Authority (HKMA), The Government of the HKSAR
Members of Research / Planning Team	Prof. Christine LOH, Prof. Alexis LAU, Prof. Jimmy CHAN, Ms Shannon HO

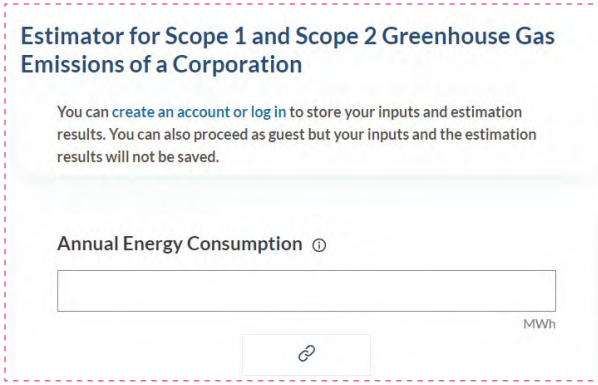
https://youtu.be/Pyj-5WP_koo?si=VuhO2m5s88_Zy1OL
(GHG Emissions Calculator) https://bit.ly/3wHPtmv
(GHG Emissions Estimator) https://bit.ly/3WJU4zl

Recognising that most SMEs cannot afford a lot of time and expenses to hire sustainability experts, the SFC/HKMA asked HKUST to create simple tools that were also locally or regionally specific (i.e. based on Hong Kong and Mainland China data) which could help SMEs easily estimate their carbon emissions.

The new tools include:

- A calculation tool that enables users to easily calculate their own GHG emissions based on actual activity levels (energy and electricity usage which make up the vast majority of their carbon emissions); and
- An estimation tool that enables users, including financial institutions, to estimate their own GHG emissions as well as those of their investees or borrowers where data of underlying companies is limited.





Sustainability Action(s) of the Project

These tools provide companies with an opportunity to understand their competitive standing in industry-wide emissions performance. Over time, as the system is utilised by more entities, the data set will become more robust, enhancing the estimator's accuracy, and making it a more reliable tool for estimating GHGs.

Academia

DEVELOPMENT OF ADVANCED SEISMIC DESIGN GUIDELINES FOR MIC BUILDINGS IN HONG KONG AND THE GREATER BAY AREA (GBA)

Development of Advanced Seismic Design Guidelines for MiC Buildings in Hong Kong and the GBA

Objectives

To investigate the seismic performance of Modular Integrated Construction (MiC) buildings through both linear and non-linear analysis, so as to develop a seismic design method with optimum design parameters for MiC buildings that can ensure satisfactory performance under earthquakes of different intensities.

Project Team

Project Name	Development of Advanced Seismic Design Guidelines for MiC Buildings in Hong Kong and the Greater Bay Area (GBA)
Name of Organisation	The Hong Kong Polytechnic University
Members of Research / Planning Team	Prof. CHAN Tak-Ming Dr WANG Chen Mr TIAN Peifeng

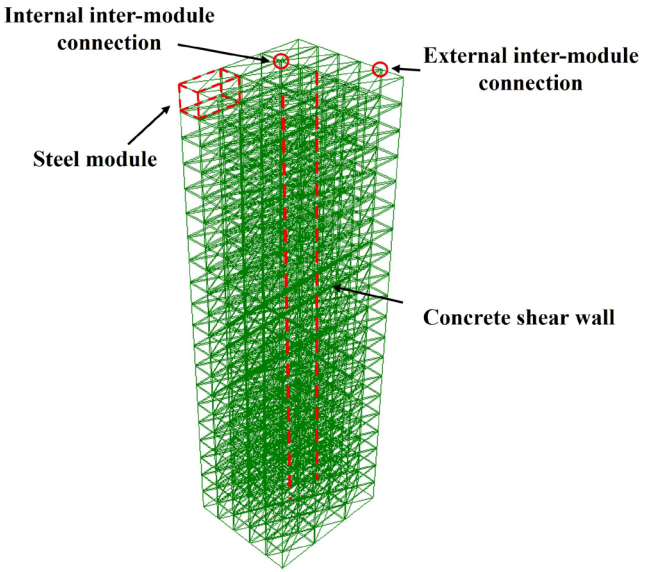
Given Hong Kong's continued population growth and high construction demand, MiC has drawn increasing attention. By assembling prefabricated modules to form complete structures, MiC offers accelerated construction timelines, safer manufacturing processes, better quality control, and lower environmental impacts. Unlike conventional buildings, MiC building structures are constructed through the assembly of individual modules, hence the floor diaphragms are generally discrete and the force transfer between modules is mainly through various inter-module joints. This may lead to different structural behaviour under earthquake loading compared with conventional building structures.

The objectives of this proposal are achieved through the following three stages:

- Prototype building design and numerical modelling
- Parametric study on design seismic force and properties of inter-module connections
- Compilation of the seismic design guidelines and worked examples

Through linear elastic analysis, non-linear static analysis (pushover), and non-linear incremental dynamic analysis (IDA), this study further investigates the structural properties and plastic mechanisms.

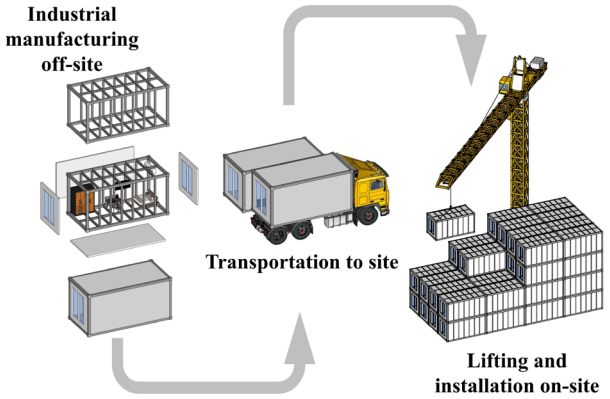
Inter-module connections are one of the most important components of MiC buildings since force and deformation will be transferred through horizontal and vertical connections between modules. The research of this project so far has shown that the properties of inter-module connections have a significant impact on the inelastic performance of MiC buildings. It has also found that the existing seismic design codes for traditional structures may not be suitable for MiC building structures because of their unique construction method. This calls for specific seismic design guidelines for MiC buildings to be proposed.



Academia

DEVELOPMENT OF ADVANCED SEISMIC DESIGN GUIDELINES FOR MIC BUILDINGS IN HONG KONG AND THE GREATER BAY AREA (GBA)

The findings of the project are pivotal for understanding the structural performance and seismic behaviour of MiC buildings and providing references for engineering design practice. The outcomes possess substantial theoretical and practical significance, promoting the application and development of MiC steel structures in Hong Kong. The aim is to integrate essential earthquake resilience into MiC buildings as they become a method of mass construction in Hong Kong, and strengthen and maintain Hong Kong's leading position in the research and application of MiC buildings.



Sustainability Action(s) of the Project

Through advanced industrial manufacturing and smart construction on-site, MiC buildings can achieve greater sustainability and environmental friendliness by reducing dust and noise nuisance to the surrounding environment, minimising construction waste, and improving construction waste management.

How the Project can enhance Climate Change Resilience

MiC buildings transform the conventional on-site construction method to modern off-site industrial production. Academic study results show that MiC can minimise on-site waste by at least 70%, reduce the number of site delivery trips by 60% and shorten construction time by 15%, which implies lower energy consumption, lower carbon emissions, and improved sustainability performance to help slow down climate change. Furthermore, the prefabricated nature of MiC buildings helps mitigate the impacts of extreme weather conditions on the construction period.

Since MiC buildings have a shorter construction time compared to conventional buildings, the prefabricated modules can be quickly delivered to the affected area even in the aftermath of severe weather events. This allows MiC buildings to be rapidly deployed and constructed for a variety of emergency functions, such as offices, storehouses, hospitals, or temporary living spaces for people in the affected area. Once the emergency rescue operations are complete, these MiC buildings can be easily detached and either recycled or integrated into existing hospital facilities.

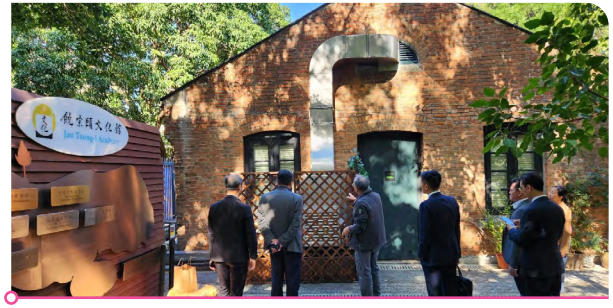
Academia

JAO TSING-I ACADEMY (JTIA) RETROFIT PROJECT

Substantial energy savings, improved indoor air quality and controlled humidity at an affordable cost, for a building with heritage conservation limitations

Hong Kong has a sub-tropical climate that is wet, warm and humid for much of the year. The typical solution is to install air conditioners and keep them running almost continuously. However, the cooled air exacerbates condensation on interior surfaces.

A four-month pilot project has been successfully conducted at JTIA to provide a relatively simple and affordable solution. JTIA is a century-old heritage compound spreading across 32,000 m^2 of hillside in Lai Chi Kok. It represents the most challenging type of retrofit because there are cracks and leaks in rooftop tiles, doors and windows – not untypical of old heritage sites – and retrofits and renovations must meet the high demands of conservation policies.



To tackle this challenge, Hong Kong University of Science and Technology (HKUST) installed a smart Fresh Air Unit (FAU) in the Heritage Hall of JTIA, designed and manufactured by a local engineering firm. The ambient moist air is cooled and pre-dried in the unit before it enters the hall. The unit maintains a slight positive pressure indoors that effectively prevents the external hot and humid air from getting inside.

The findings were remarkable. Prior to the installation, the old air conditioning unit kept indoor temperatures at around 25°C, but the relative humidity remained as high as 70-80%. With the smart FAU, the indoor humidity decreased to about 55%, while indoor temperature could be kept at 4-6 degrees below the outside temperatures without the need for additional cooling.

Project Team

Project Name	Jao Tsing-I Academy (JTIA) Retrofit Project
Name of Organisation	Hong Kong University of Science and Technology (HKUST)
Collaborating Party	Jao Tsung-I Academy (JTIA)
Members of Research / Planning Team	Prof. Christine LOH, Prof. Alexis LAU, Ir CF LAM

https://youtu.be/Pyj-5WP_koo?si=VuhO2m5s88_Zy1OL

Objectives

To enhance the energy efficiency, humidity and indoor air quality of a century-old heritage compound.

Moreover, by adding aluminium and HEPA filters to the unit, 75-90% of respirable particulate matter was removed. This meant the indoor air was cooler, drier and much cleaner than the outside air. This smart system reduced energy usage by around 70% in this project, resulting not only in cost savings and lower carbon emissions, but also better indoor air quality and lower humidity, which can translate into better public health.

Sustainability Action(s) of the Project

This retrofit methodology is now being explored for use in other parts of the JTIA site such as its restaurant and hostel. It can also serve as an exemplary model for other local heritage revitalisation projects.

How the Project can enhance Climate Change Resilience

The successful implementation of this retrofit project highlights its usefulness for some newer buildings, including offices, schools, institutional and even residential buildings. It also demonstrates vast potential for generating measurable decarbonisation benefits, better indoor air quality, improved health, and enhanced building conservation, when coupled with financing schemes to retrofit buildings in Hong Kong on a larger scale.

Academia

QUANTIFYING THE MITIGATION POTENTIAL OF USING WASTE MATERIALS FOR SUSTAINABLE LAND RECLAMATION IN HONG KONG

Building tomorrow's infrastructure responsibly today

This project is focused on addressing the environmental challenges associated with traditional cement binders, particularly in large-scale reclamation projects in Hong Kong using Deep Cement Mixing (DCM) (Fig.1). It investigates the feasibility of replacing cement with alternative binders derived from construction and industrial waste. Through a case study in Hong Kong, the potential was assessed of using ground granulated blast furnace slag (GGBS), steel slag (SS), and waste concrete powder (WCP) as partial replacements for cement in DCM construction.

Life Cycle Assessment (Fig.2) was first conducted to assess the emissions involved in processing GGBS, SS and WCP, to provide a detailed comparison of the carbon footprint associated with these alternative binders. This revealed that the grinding process would be a significant contributor to the Global Warming Potential (GWP) for GGBS and SS, while the GWP for WCP was distributed across the separation, sieving, and loading processes. The lowest GWP was observed with high levels of WCP substitution, which could be especially advantageous as WCP is locally available in Hong Kong. Interestingly, the land-based U-DCM process exhibited a lower carbon footprint than offshore DCM barge operations, largely resulting from the high electrical demands of the latter. By replacing 60% of cement with GGBS, SS, and WCP in DCM projects, respective decreases in GWP of 34.7%, 34.5%, and 35.8% were observed.

Objectives

The primary objective was to assess the climate impact reduction potential of using construction and industrial waste – primarily ground granulated blast furnace slag (GGBS), steel slag (SS), and waste concrete powder (WCP) – as alternative binders to partially replace cement in construction projects involving Deep Cement Mixing (DCM) in Hong Kong.

Project Team

Project Name	Quantifying the mitigation potential of using waste materials for sustainable land reclamation in Hong Kong
Name of Organisation	Hong Kong University of Science and Technology
Members of Research / Planning Team	Dr Kravchenko EKATERINA, Dr Wenjun LU, Dr Meike SAUERWEIN, Mr Anthony H.K. WONG

https://www.sciencedirect.com/science/article/abs/pii/S0195925523003645

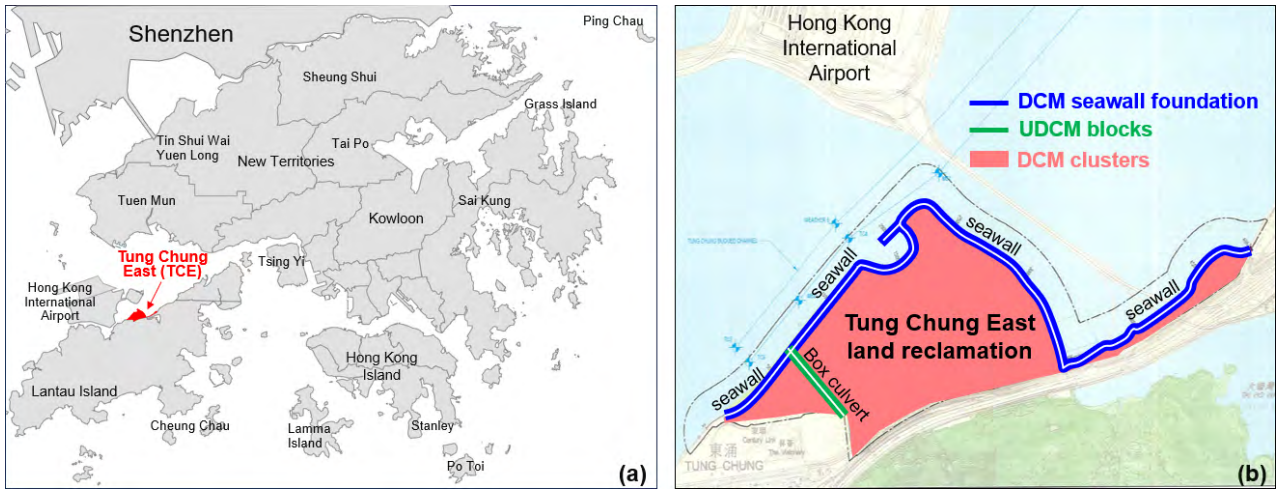
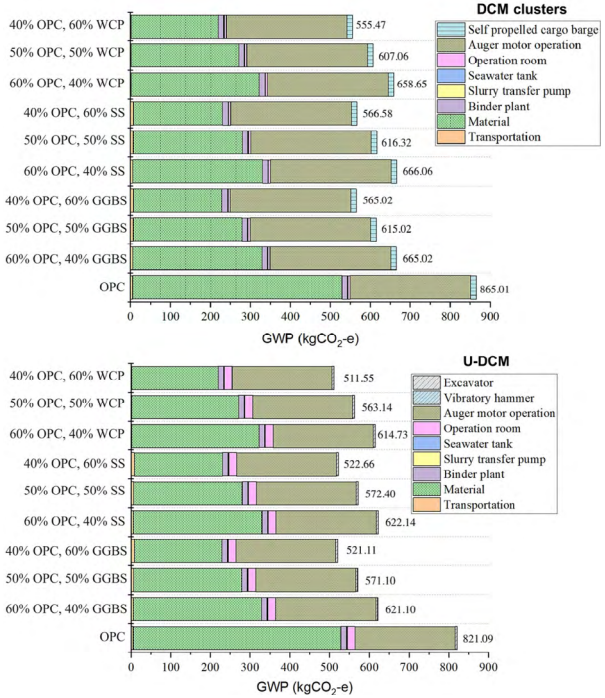


Fig. 1

Academia

QUANTIFYING THE MITIGATION POTENTIAL OF USING WASTE MATERIALS FOR SUSTAINABLE LAND RECLAMATION IN HONG KONG

The impact of transportation distance on emissions was then explored through sensitivity analysis. This demonstrated the strong potential of locally sourced, waste material-based alternative binders in reducing the carbon footprint of reclamation projects and highlighted the importance of integrating sustainable practices into construction. The findings have implications for researchers, engineers and stakeholders in the construction industry, underlining the feasibility and environmental benefits of using alternative binders derived from waste materials. By advancing sustainable practices and addressing the urgent need for climate-friendly solutions in infrastructure development, this project contributes to building a greener future.



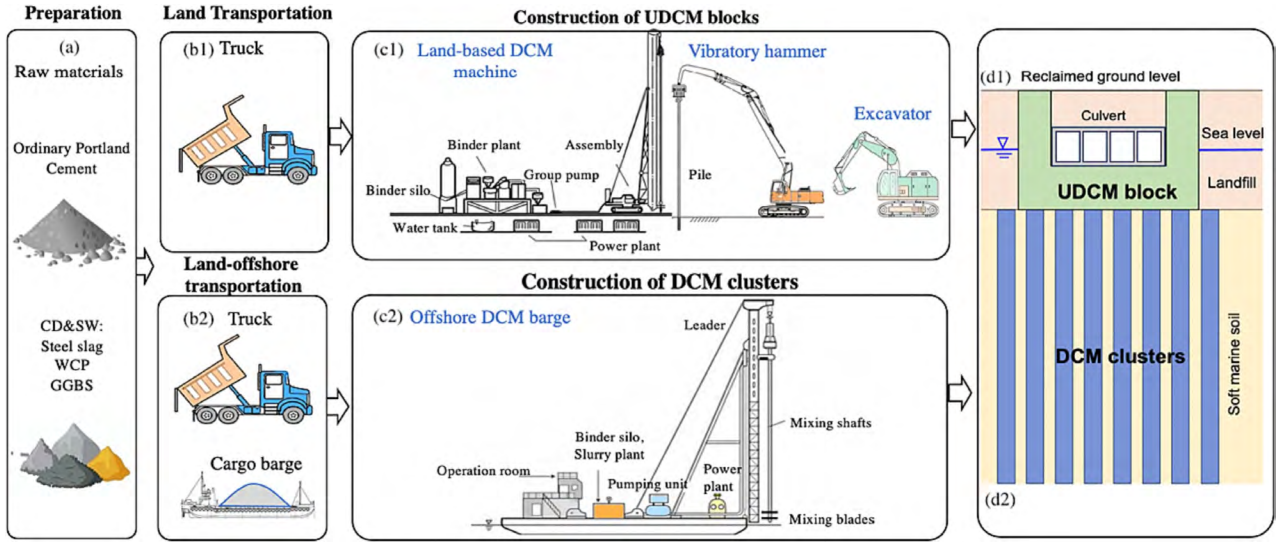


Fig. 2

Sustainability Action(s) of the Project

This project has used life cycle assessment and primary data from a land reclamation project in Hong Kong to evaluate and quantify the greenhouse gas mitigation potential of incorporating different construction and industrial waste materials into the binders for DCM as a partial substitution for traditional cement.

How the Project can enhance Climate Change Resilience

This research addresses the demand for measuring and reporting the embodied carbon of sustainable construction materials in Hong Kong.

It quantifies the mitigation potential of using construction and industrial waste for land reclamation. It further highlights the hotspots involved in waste materials processing and the importance of the use of locally available waste materials to minimise impacts from materials transportation processes.

Academia

STUDY ON EFFECTIVE TRANSITIONAL HOUSING DELIVERY IN HONG KONG

Project Team

Project Name	Study on Effective Transitional Housing Delivery in Hong Kong
Name of Organisation	Jockey Club Design Institute for Social Innovation (DISI), The Hong Kong Polytechnic University (PolyU) (Funded by Strategic Public Policy Research Funding Scheme of The Government of the HKSAR)
Members of Research Team	*Principal Investigator* Prof. LING Kar-kan, DISI PolyU *Project Manager & Co-Investigator* Dr Calvin W.H. LUK, DISI PolyU *Co-Investigators* Prof. Eddie C.M. HUI, Department of Public and International Affairs, City University of Hong Kong Prof. LI Heng, Department of Building & Real Estate PolyU Ir Prof. CHUNG Kwok-fai, Department of Civil and Environmental Engineering PolyU Prof. TANG Siu-keng, Department of Building Environment and Energy Engineering PolyU Prof. Daniel W.L. LAI, Department of Applied Social Sciences, The Hong Kong Baptist University Prof. Wallace P.H. CHANG, Faculty of Architecture, The University of Hong Kong Prof. Thomas W.L. CHUNG, School of Architecture, The Chinese University of Hong Kong Dr CHEUNG Tin-cheung, Hong Kong Green Building Council Prof. Stephen M.B. TANG, Countryside Conservation Office, Environment and Ecology Bureau Prof. Elvis W.K. AU, Faculty of Architecture, The University of Hong Kong Prof. Bernard V. Lim, Architectural Design & Research Group Mr James LAW, James Law Cybertecture Ir Thomas Y.N. TONG, Asia Infrastructure Solutions (Technology & Innovation) Ms Rosana W.M. WONG, Yau Lee Holdings Ltd Dr Raymond K.Y.TAM, Department of Applied Social Science PolyU *Project Associate* Ms Tina P.W. WONG, JCDISI PolyU

A solution to Hong Kong's acute short-term housing supply needs, and a contributor to future public policies on sustainable construction and placemaking

Objectives

To propose policy recommendations, development and technical references for the effective delivery of Transitional Housing (TH) projects in Hong Kong, encompassing the development, construction, operation and relocation processes, and aligning with UN Sustainable Development Goal 11 – "Sustainable cities and communities".

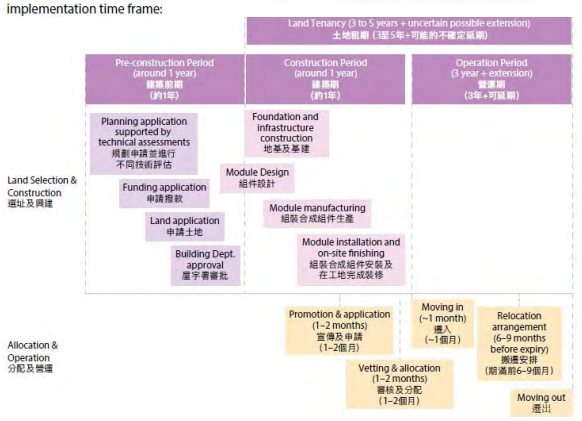
An international comparison study was first conducted to identify challenges and reference solutions in the development and operation of transitional housing globally, then an empirical study to identify solutions in Hong Kong through industry efforts, build consensus, and measure tenants' wellbeing and public acceptance of transitional housing.

A mixed-method research approach was adopted, including a literature review, in-depth interviews, case studies, site visits and a survey of the public and tenants (n=189). The findings emphasised the significance of implementing a long-term strategy for relocatable transitional housing and establishing an effective cross-sector collaborative network. They also highlighted the Government's crucial role in co-ordinating efforts to align stakeholders' interests, address challenges and mitigate project risks.

The following long-term strategies were proposed:

- Develop a comprehensive strategy encompassing available land, funding mechanisms, infrastructure requirements, community participation, recruitment criteria and effective relocation planning.
- Sustain a well-functioning mechanism with strong partnership and collaboration among stakeholders to address both housing and social needs in Hong Kong;
- Establish a centralised one-stop platform for promoting, recruiting and processing transitional housing applications to facilitate an equitable and transparent process.

A transitional housing project has the following broad implementation time frame: 過渡性房屋項目的實施時間表如下：



Academia

STUDY ON EFFECTIVE TRANSITIONAL HOUSING DELIVERY IN HONG KONG

Land development

- Shorten processing time and streamline approval procedures for planning and land applications;
- Actively involve both Government and private land owners in activating idle land;
- Establish a Geographic Information System (GIS) platform to consolidate information on potential sites and module details.

Finance and rental control

- Expand funding scope to cover operations, maintenance and relocation;
- Establish transparent evaluation mechanism to ensure effective fund allocation;
- Provide longer tenancy period and renewal options;
- Offer additional rental subsidies to tenants with low or unstable income.

Comparison of Transitional Housing Programme and the Light Public Housing Programme

過渡性房屋與簡約公屋的比較

Design and construction - Modular Integrated Construction (MiC)

- Streamline statutory frameworks and develop specific technical guidelines;
- Prioritise standardisation and modularisation through industry initiatives;
- Utilise advanced technology for real-time monitoring and data collection during the manufacturing, transportation and installation phases;
- Upscale funding support for R&D in relocatable MiC technology, advanced building materials, and a local MiC supply chain.

Health and wellbeing

- Create a supportive neighbourhood by incorporating communal spaces and facilities;
- Provide tenant support such as comprehensive social services and employment.

Environmental and social sustainability

- Prepare for relocation and reuse of MiC modules;
- Develop a whole-life-cycle tracking system for effective management of module reuse;
- Aggregate data from transitional housing projects to identify suitable units for tenants;
- Promote community participation in planning, site selection and design of housing units.

Sustainability Action(s) of the Project

- Promotes sustainable construction by adopting MiC as a key construction technology for future housing;
- Promotes a sustainable society through an innovative collaboration model for community participation or community-led planning and design of public housing, i.e. People + Public-Private partnership (P+PPP) model;

How the Project can enhance Climate Change Resilience

The main findings may be synthesised to construct a Transitional Housing Delivery (THD) framework, providing a useful reference for future local and global development of relocatable housing. The ultimate aim is to propose a holistic and sustainable model of housing as a social determinant of health (World Health Organisation Housing Goals 2015), as well as towards wider coverage of UN SDGs in addition to SDG11, notably SDG3 (Good health and wellbeing); SDG7 (Clean energy); SDG9 (Industry and Innovation); SDG10 (Reduced inequality); and SDG17 (Partnership for sustainable development goals).

Academia

TECHNICAL REPORT ON THE DECONSTRUCTION, RELOCATION AND REINSTALLATION OF MiC MODULES AT NAM CHEONG 220 TRANSITIONAL HOUSING PROJECT

A documentation of the first relocation and reuse of a complete four-storey modular housing block, and a substantiation of the high efficiency and reusability of such a process to enable multiple life cycle use

Project Team

Project Name	Technical report on the Deconstruction, Relocation and Reinstallation of MiC modules at Nam Cheong 220 Transitional Housing Project
Name of Organisation	Jockey Club Design Institute for Social Innovation (DISI), The Hong Kong Polytechnic University (PolyU)
Collaborating Parties	Department of Building & Real Estate (BRE), PolyU; Chinese National Engineering Research Centre in Steel Construction (Hong Kong Branch) (CNERC (HK)) (Funded by Construction Industry Council, Hong Kong)
Members of Research Team	*Principal Investigator:* Dr Calvin W. LUK, DISI PolyU *Co-Principal Investigator:* Dr YANG Yang, Oxford Brooks University, U.K. *Co-Investigators:* Ir Prof. CHUNG Kwok-Fai, CNERC (HK) PolyU Dr Andrea JIA Yun-yan, BRE PolyU Dr Jeff SHEN Jian-fu, BRE PolyU *Research Assistants:* ZHENG Bo-wen, BRE PolyU Eric YUEN, BRE PolyU *Industry Advisors:* Ir Wilson CHEUNG, Wilson Cheung & Associates Ir K. M. MA, CNQC Intelligent Construction (HK) Limited Ir Thomas TONG, Asia Infrastructure Solutions Ir Eric JIANG, Construction Industry Council

https://www.youtube.com/watch?v=l0woRFR6FP8

The research methodology included a literature review of relocatable modular building technology and projects overseas; data collection of project details and plans from contractors and consultants; on-site visual inspections with photographic and video recording; semi-structured interviews with the project team; a questionnaire survey on the allocation of manpower and equipment; and data analysis and estimation of the reusability of MiC building components.

Relocation or Disposal?

- Generation of **demolition waste**
- Greater adverse **environmental impact** relative to the short period of use
- Failure to seize the opportunity to foster the development of **circular economy**

In general, the MiC modules were found to be in good condition after two years of use, indicating a high overall reusability rate of 95%. More specifically, there were no visible deformations of the modules. Structural steel members and intermodule connections remained 100% reusable, while 95% of module foundation connections were reusable, with a 5% touch-up rate. The roof structure was 100% reusable with a 10% touch-up rate of protective coatings. Firestop systems exhibited 100% reusability, with an overall touch-up rate of less than 2% attributable to normal use. The external envelope, including windows and side walls, was 100% reusable after minor touch-ups. Over 90% of the internal finishes were found to be reusable. More than 95% of built-in fixtures and mechanical, electrical, plumbing (MEP) and fire services inside MiC modules were also reusable.

Objectives

- To investigate and document the technical details of MiC disassembly, relocation and reuse, using the relocation project located at 220 Nam Cheong Street (NC220) as a case study.
- To assess the degree of reusability of MiC building components;
- To develop good MiC relocation practices that can guide future project teams in planning (de) construction methods at the design stage and improve the efficiency of MiC relocation and reuse.

Academia

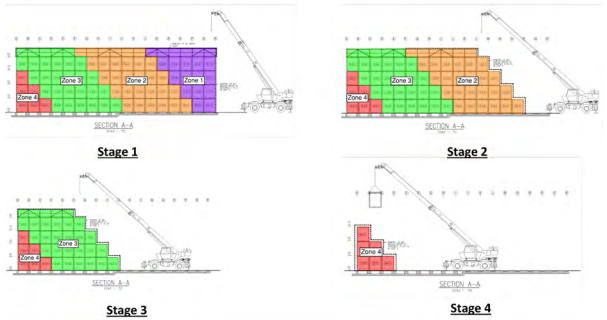
TECHNICAL REPORT ON THE DECONSTRUCTION, RELOCATION AND REINSTALLATION OF MiC MODULES AT NAM CHEONG 220 TRANSITIONAL HOUSING PROJECT

The findings are compiled in a video, along with five technical recommendations, with the aim of providing valuable references for future relocatable housing:

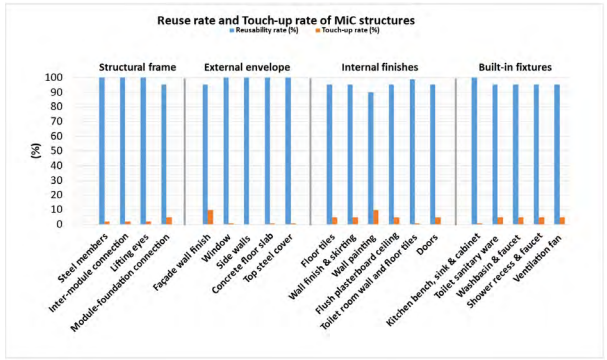
- Include Design-for-Disassembly (DfD) solutions in early design phase
- Provide MiC User Manual from original designers
- Pilot the innovative Design-Build-Deconstruction (DBD) contract
- Establish BIM-based disassembly models
- Provide MiC maintenance manual to housing operators

This report serves as a pioneering study documenting the technical aspects of MiC building disassembly, relocation, touch-up and reinstallation – a subject that has received limited prior attention. By offering comprehensive technical details of the good practices adopted in the NC220 project, along with useful insights and lessons, this study has contributed to enhancing the reusability potential of MiC buildings. The findings offer valuable references for construction practitioners, guiding them to adopt good practices and utilise design guides to enhance the reusability of MiC components and efficiency of MiC relocation. Although the Hong Kong SAR Government has recently announced that no more MiC transitional housing projects will be built in the future, these strategic recommendations may be applicable to existing MiC transitional housing and probably upcoming Light Public Housing projects.

Disassembly sequence (4 zones/stages)



Reusability of MiC units



- Structural frame were almost 100% reusable, Only 2% needed touch-ups.
- The external envelope was almost 100% reusable. Less than 1% of exterior elements required touch-ups due to normal use.
- More than 95% of internal finishes were reusable, while the remaining (5%) were made-up to clean and recondition the interiors.
- More than 95% of built-in fixtures and mechanical, electrical, plumbing (MEP) were reusable.

Sustainability Action(s) of the Project

All MiC modules of NC220 were found to be reusable after minor touch-up, establishing local and international practices for MiC reuse. Learning from this case, this report formulates viable recommendations for future relocatable MiC projects by streamlining the design, procurement, maintenance, disassembly and reinstallation process.

The project has also established the high reusability of a complete MiC building, as well as the flexibility of adapting individual MiC modules for other uses when the original housing project ceases to operate. This is significant as over 21,000 transitional housing modules could be released in the next five to ten years.

The relocation and reuse of NC220 provides a valuable reference and good practice for implementing sustainable development in the Hong Kong construction industry by reducing demolition waste, avoiding the consumption of virgin materials, maximising the effective use of public money, and ultimately achieving sustainability of MiC projects.

Academia

THE EFFECTS OF SMALL BUSINESS ORGANISING PATTERNS ON PRIVATE AND SOCIAL OPTIMALITY: A BIG DATA-AUGMENTED SOCIAL NETWORK ANALYSIS OF THE CONSTRUCTION WASTE COLLECTION SECTOR IN HONG KONG

Objectives

- To understand small business organising patterns in Hong Kong's construction waste collection sector by constructing and analysing social networks generated from big data;
- To hypothesise and test the effects of different small business organising patterns on (i) waste hauliers' private optimality, (ii) waste hauling services' social optimality, and (iii) the alignment of private and social optimality (Pareto optimality) by using big data analytics;
- To understand the causes and effects of different small business organising patterns by adopting qualitative methods such as case studies, interviews, and focus group meetings.

Project Team

Project Name	The effects of small business organising patterns on private and social optimality: a big data-augmented social network analysis of the construction waste collection sector in Hong Kong
Name of Organisation	iLab, Faculty of Architecture, The University of Hong Kong
Members of Research / Planning Team	Prof. Weisheng LU, Mr Ziyu PENG, Mr Liang YUAN, Ms Bing YANG

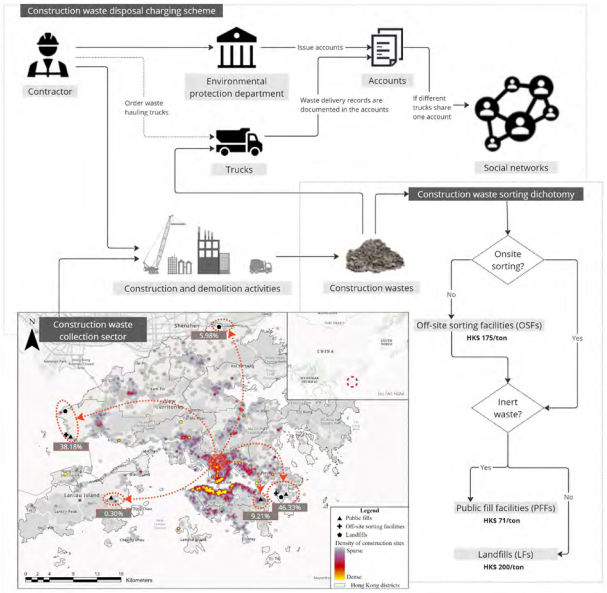
The small business in 'cowboy construction'

It is known that small businesses often organise themselves as sole proprietors or sister companies, consciously tapping into formal and informal (social) networks to survive and thrive. However, it is not clear to what extent such organising helps achieve the designated goals (e.g. private optimality or societal optimality).

This research is aimed at understanding the effects of small business organising on private and social optimality, contextualised on construction waste collection services in Hong Kong. Thousands of trucks navigate Hong Kong's narrow streets, collecting and transporting construction waste. Most of them are operated by sole proprietors competing freely in the market. They also organise themselves under different social networks to boost business. We have noticed that some waste hauliers ultimately leave the business. Others enjoy abundant orders, achieving a state of private optimality. However, they do not achieve social optimality, as evidenced by their chaotic trip patterns to chase business everywhere. These give rise to an urgent need in Hong Kong for better organising of the construction waste haulage business.

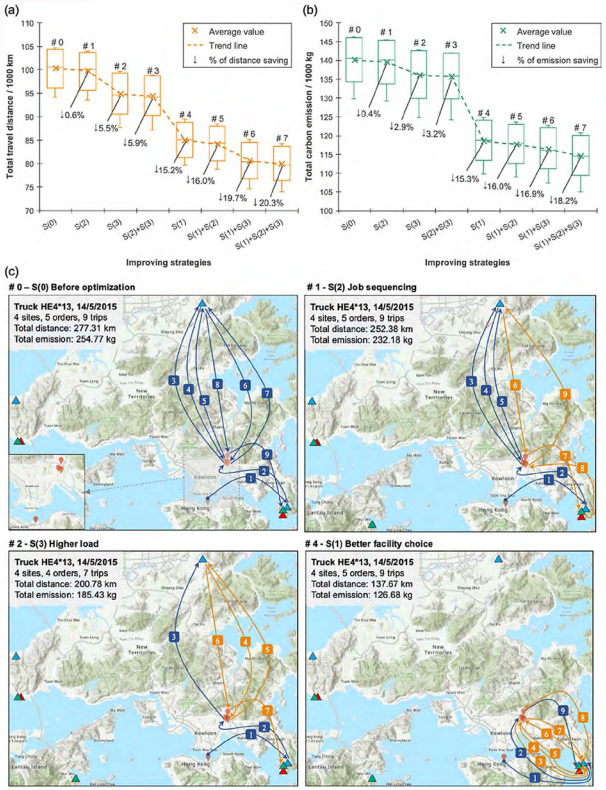
The social network showed that the stronger the ties between two hauliers, the higher the quantity of job opportunities they share. The greater the proportion of strong ties that a haulier has, the higher will be the quantity and quality of job opportunities shared, in terms of shorter distance and less underloading. However, these positive effects will be diminished when the strength or proportion of ties exceeds a certain point.

Our further statistical analyses show that (a) small and well-organised groups (which could be termed syndicates) spontaneously emerge as the whole social network expands by merging with each other; (b) occupying a



Academia

THE EFFECTS OF SMALL BUSINESS ORGANISING PATTERNS ON PRIVATE AND SOCIAL OPTIMALITY: A BIG DATA-AUGMENTED SOCIAL NETWORK ANALYSIS OF THE CONSTRUCTION WASTE COLLECTION SECTOR IN HONG KONG



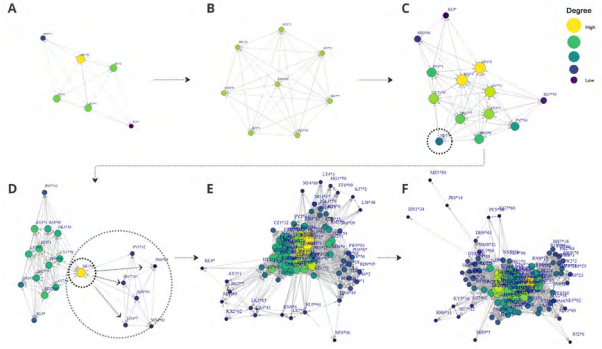
Results: (a) total travel distance of strategies; (b) total CO_{2eq} emission of strategie; and (c) an example of routes before and after optimization of truck HE4*13.

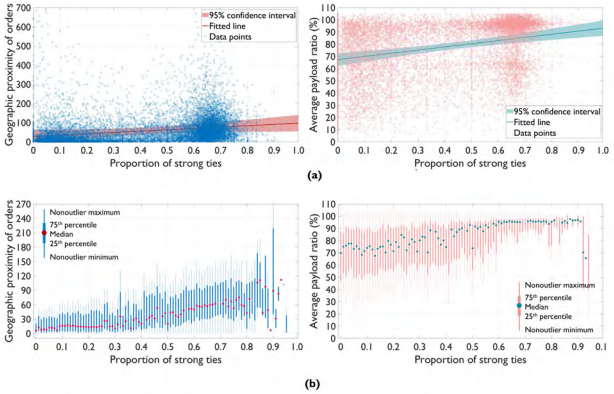
higher status within the syndicate is more significant than joining a larger syndicate in helping hauliers receive more orders with larger values; and (c) larger and denser syndicates help alleviate adverse environmental impacts by improving the overall business efficiency.

To help solve these inefficiency problems in Hong Kong's construction waste hauling networks, a combinatorial algorithm was developed to optimise construction waste collection and transportation through (1) optimal facility choice, (2) proper order sequencing, and (3) increased loading ratio. Simulation results indicate that optimal facility choice is most effective of these three strategies, reducing travel distance by 15.2% (15,256 km) and saving 15.3% (21,467 kg) in CO_2-equivalent emissions. Combining the three strategies creates the best optimisation effects, saving 20.3% of travel distance (20,346 km) and 18.2% of CO_2-equivalent emissions (25,544 kg).

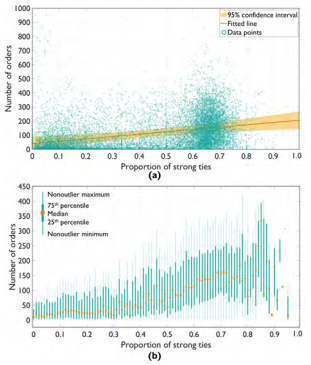
How the Project can enhance Climate Change Resilience

The research team have proposed a novel optimisation algorithm for Hong Kong's construction waste hauling sector, combining three improvement strategies: optimal facility choice, order sequencing, and raising load ratio. By combining these strategies the best optimization results can be achieved, achieving significant savings in carbon emissions.





The correlation between the proportion of strong ties and the quality of construction waste hauling orders by (a) scatter plot and (b) box plot.



The correlation between the proportion of strong ties and the number of construction waste hauling orders by (a) scatter plot, and (b) boxplot

Industry

BIG DATA ANALYTICS FOR ENERGY MANAGEMENT – PREDICTIVE CONTROL OF AIR CONDITIONING SYSTEM AT HONG KONG INTERNATIONAL AIRPORT (HKIA)

A demonstration of collaborative synergy across different disciplines to drive innovation for effective building energy savings

Objectives

The research was aimed at predicting variations in the cooling load of the HKIA air-conditioning system and applying the findings to proactively control the chiller plant and reduce energy wastage.

Project Team

Project Name	Big Data Analytics for Energy Management – Predictive control of air conditioning system at Hong Kong International Airport (HKIA)
Name of Organisation	Hong Kong Green Building Council
Collaborating Parties	Airport Authority Hong Kong, CLP, Hong Kong Observatory
Members of Research / Planning Team	Hong Kong Green Building Council

Research Concept

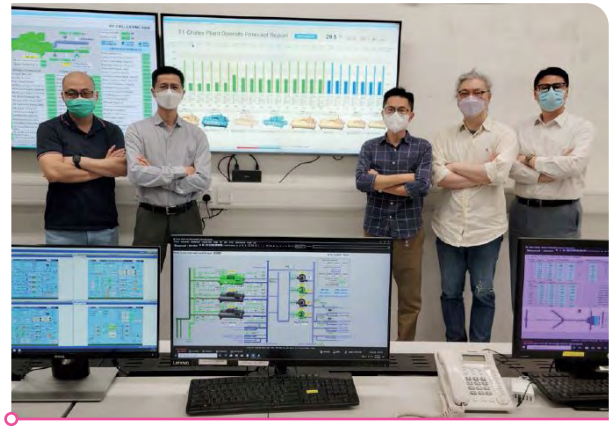
Traditional chiller plant control mechanisms are complicated. They take time to react when cooling load variations occur. To avoid customer complaints, operators may overcool their buildings, especially in summer, causing energy wastage. Cooling load prediction can be an effective way of optimising the chiller sequencing control by using proactive control strategies to match the cooling supply to predicted demand. It can minimise the energy consumption of the air-conditioning system by reducing the number of action and reaction responses by the chiller plant. The resultant energy savings can be substantial.

Methodology

The project team comprised experts from diverse professional disciplines including building services and retro-commissioning, operation engineering and meteorology science. The predictive model developed for Terminal 1 of HKIA is a combination of multiple regressive and autoregressive analysis to enhance the accuracy of cooling load prediction. There were five major development stages, namely identification of necessary air-conditioning plant and meteorology data; collection of relevant big data; development and testing of the cooling load predictive model; development of air-conditioning control rules; and estimation of energy savings.

Challenges and Findings

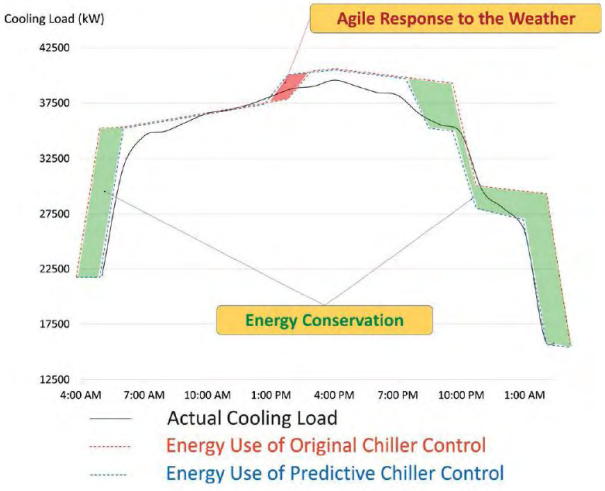
The accuracy and stability of the prediction model are of utmost importance because they will affect the reliability of the control strategies adopted and the amount of energy saving. To raise prediction accuracy, the project team critically reviewed the physical characteristics and operational modes of HKIA in relation to its electricity consumption profile at different period of times and in various weather conditions. Different hypotheses were initiated, tested, modified and retested.



Industry

BIG DATA ANALYTICS FOR ENERGY MANAGEMENT – PREDICTIVE CONTROL OF AIR CONDITIONING SYSTEM AT HONG KONG INTERNATIONAL AIRPORT (HKIA)

The passenger terminal building is a huge thermal body, sensitive to the variation of multiple weather parameters including temperature, humidity, cloud coverage and solar rays, especially when weather conditions change from sunny to cloudy or rainy. The thermal inertia of the building is large which can mean delays of up to several hours in responding fully to weather impacts. The prediction model has now established and assessing a number of significant energy-saving opportunities.



Sustainability Action(s) of the Project

This project showcases the benefits of collaboration between governments, public utilities and professional bodies in utilising big data across their respective disciplines for effective building energy saving. Complementing an advanced chiller system, the predictive air-conditioning control system has achieved annual energy savings of 5.1 million kWh, or approximately 12% of the chiller system's total energy consumption. Moreover, the cooling load predictive model can serve as an exemplary case for wide adoption by other airports and commercial buildings with central air-conditioning systems.

Newly replaced Variable-speed Chiller at Terminal 1 Chiller Plant

Industry

CIC SUSTAINABLE FINANCE CERTIFICATION SCHEME

Hong Kong's first sustainable finance certification scheme developed for the construction industry

Objectives

To provide a common framework and user-friendly assessment system to encourage more sustainable construction practices across Hong Kong's construction industry, which will also allow sustainable finance to be more accessible for industry stakeholders and accelerate Hong Kong's progress towards achieving carbon neutrality before 2050.

The Construction Industry Council (CIC) has developed a Sustainable Finance Certification Scheme (SFCS) to accelerate the Government's decarbonisation progress as well as position the city as a leading sustainable finance hub in Asia.

Project Team

Project Name	CIC Sustainable Finance Certification Scheme
Name of Organisation	Cundall Hong Kong Limited
Collaborating Party	Construction Industry Council
Members of Research / Planning Team	Cundall Hong Kong Limited, Construction Industry Council, CECEP Environmental Consulting Group Limited, Gammon Construction, SGS

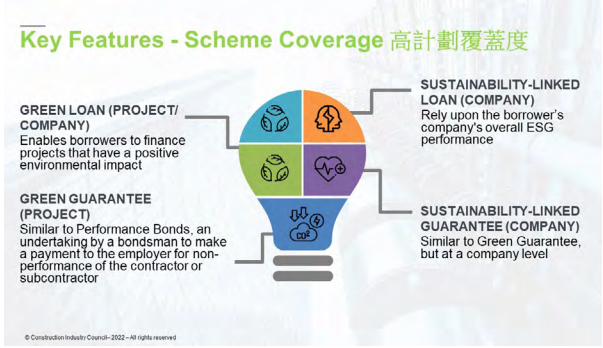
https://sfcs.cic.hk/en/Home

The purpose of this scheme is to provide a common framework and user-friendly assessment system than can encourage more sustainable construction practices across Hong Kong's construction industry. The development of SFCS also bridges the gap between the financial and construction industries in Hong Kong, enabling the industry to decarbonise its supply chain from public and private project owners to contractors and suppliers. This is a major step for the industry, as it has always been a struggle to find ways of decarbonising the supply chain.

Some key benefits of SFCS include:

- Increasing green capital for companies by acquiring financial incentives (e.g. low-interest rates)
- Enhancing stakeholders' trust through third-party conformity assessments.
- Expanding market exposure and business opportunities for sustainable finance investors in Hong Kong and the Greater Bay Area (GBA)
- Building capability and credibility of the company, business partners and value chain

The SFCS was developed and implemented in two phases. The first stage involved an extensive number of stakeholder engagement workshops and activities. Through close collaboration between CIC and the



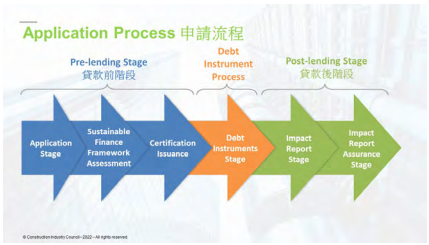
Industry

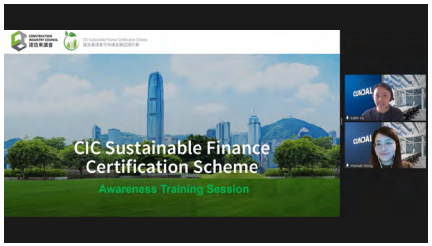
CIC SUSTAINABLE FINANCE CERTIFICATION SCHEME

financial and construction advisors of the project, a wide range of key stakeholders were selected to contribute their expert opinions and ideas to the scheme, including financial institutes, construction industry practitioners and regulators who all hold a key role in sustainable finance or construction. Their input has been essential to the project as it will ensure the scheme is inclusive to all users, as well as secure buy-in from the financial and construction industries and deliver meaningful results for Hong Kong and the GBA.

Apart from stakeholder collaboration, 19 pilot projects were carried out during the development phase to gain an understanding of challenges likely to be encountered by users and ensure that the SFCS was suitably designed to address them. These issues were then reviewed and analysed before developing any scheme documents, e-platforms and other guidance materials to ensure a smooth user experience. Through the pilot projects, CIC was recognised by the HKSAR Government as an external reviewer under the Hong Kong Monetary Authority (HKMA) Green and Sustainable Finance Grant Scheme (GSF Grant Scheme).

The second phase of the project involved hosting a series of webinars and discussions to promote the SFCS and gain recognition from professional institutes, associations, industry practitioners, FIS and regulators. Awareness and assessor training sessions have also been held to enhance the public's understanding of sustainable finance and the SFCS while maintaining a sufficient pool of qualified assessors.





For the SFCS to reach a wider industry audience, a collaboration between the SFCS and the BEAM Plus assessment tool has been proposed to BEAM Society Limited and the Hong Kong Green Building Council, so that ideally it can become a cross-platform experience and benefit the industry by promoting both tools at the same time.

The SFCS was launched in November 2021 with the support of over 80 organisations. It is hoped that the Scheme will continuously drive the industry forward on its decarbonisation journey and grant the construction industry greater access to green or sustainable finance.

How the Project can enhance Climate Change Resilience:

- It will encourage sustainable finance activities in the construction industry and any climate-related disclosures.
- It will ensure projects under the SFCS incorporate sustainable elements or strategies into the construction process.
- It will expand market exposure and business opportunities to sustainable finance investors in Hong Kong and the GBA, providing an incentive for the industry to opt for climate resilient buildings.

Industry

CONSULTANCY SERVICES FOR PRODUCTION OF A GUIDEBOOK FOR DEVELOPMENT OF THE SUSTAINABLE BUILT ENVIRONMENT

Building a Sustainable Future Where Urban Precincts Think Green, Go Green, Build Green and Live Green

Objectives

To provide recommendations that can facilitate the development of sustainable built environments at urban precinct level.

Project Team

Project Name	Consultancy Services for Production of a Guidebook for Development of the Sustainable Built Environment
Name of Organisation	URBIS Limited - Arcadis Hong Kong Limited
Collaborating Party	Ecosystems Limited
Members of Research / Planning Team	Alan MACDONALD, David MORKEL, Achareeya PARKMARUK, Tanya UPPAL, Margaret KAM, Hadley LIU

https://www.hkgbc.org.hk/eng/resources/publications/HKGBC-Publication/Guidebook/HKGBC-Guidebook-for-Sustainable-Built-Environment.pdf

The Guidebook for the Sustainable Built Environment sets out proposed design strategies to support the development of sustainable built environments in Hong Kong, specifically at a precinct level. The research began with an assessment of the main development challenges involved in realising sustainable urban precincts, which then enabled important concepts to be defined and practices proposed that could be utilised to realise sustainable built environments.

Building upon these initial concepts, nine regional and international case studies were undertaken to gather empirical information to demonstrate real-life applications of such strategies in different contexts. The consultants also sought to assess the relevance of those case studies to Hong Kong and to demonstrate how the identified design strategies, along with examples of synergies achieved, could help address prevailing key urban challenges.

Further research was then undertaken on a range of identified guidelines, policies, design strategies and international best practices that could be applied in combination to promote the generation of sustainable development precincts or urban quarters within Hong Kong. The core objectives that formed the basis of these strategies were carbon neutrality before 2050, the UN SDGs, and smart green city development.

Detailed design strategies that could be utilised to realise the development of sustainable built urban precincts in Hong Kong were then elaborated, defining the means through which they could be practicably applied. These were categorised across eight themes comprising (a) Planning Liveable Precincts; (b) Integrative Planning and Governance; (c) Climate Resilient and Carbon Neutral Precincts; (d) Connected and Circular Precincts; (e) Urban Biodiversity; (f) Inclusive and Accessible Communities; (g) Innovative Sustainable Design and Technology; and (h) Mitigation of Health Risks.

To promote understanding and application, the assessments and analysis were reported in both written and graphic form. Numerous reference images were sourced to illustrate findings and the initial draft guidelines. The aim was to subsequently use these, where appropriate, in the Guidebook for Sustainable Development that formed the ultimate deliverable of the assignment. It was considered important that the guidelines should be accessible to a wide range of practitioners involved in creating sustainable urban precincts and not just professional planners, architects, and engineers. Illustrative material was considered key to meeting this objective.

Industry

CONSULTANCY SERVICES FOR PRODUCTION OF A GUIDEBOOK FOR DEVELOPMENT OF THE SUSTAINABLE BUILT ENVIRONMENT

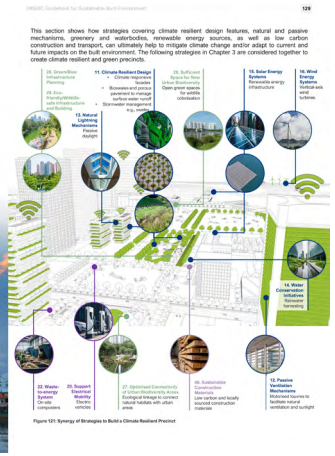
The research stage prior to the drafting of the Guidebook assessed the potential challenges and opportunities that could arise from the guidelines and how public awareness and education could be facilitated.

Sustainability Action(s) of the Project

The fundamental action of the project was to produce multidimensional and multidisciplinary guidelines that could advance and promote the application of sustainable building practice within urban precincts. Specific actions to be included in the Guidebook were categorised across the eight themes listed earlier.

How the Project can enhance Climate Change Resilience

A significant proportion of the research addressed Climate Resilience and how, alongside Carbon Neutrality, this could be built into the design of communities and initiatives to minimise energy consumption and carbon emissions. At the same time the research examined how urban biodiversity should be employed in urban precincts to minimise the adverse effects of urban development on existing natural habitats, promote the growth of urban biodiversity, and reduce the damage caused by urbanisation to ecological resources. In combination these initiatives could, in parallel with wider regional initiatives in the Greater Bay Area, help to mitigate the adverse impacts of extreme weather events and climate change. All findings, strategies and actions developed under the research stage of the project were represented in the final edition of the Guidebook under a suite of multi-dimensional initiatives.



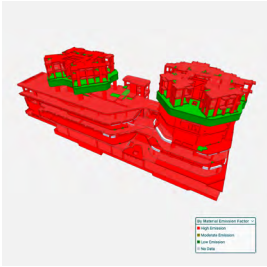
Industry

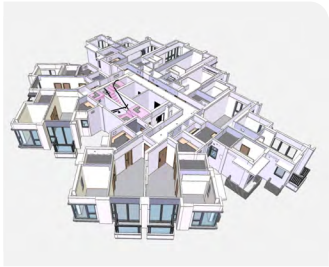
iBEAM UNISON – OPTIMISING THE APPLICATION OF A BUILDING INFORMATION MODEL FOR GREEN BUILDING ASSESSMENTS

Proving the Concept of BIM-based Green Building Assessment

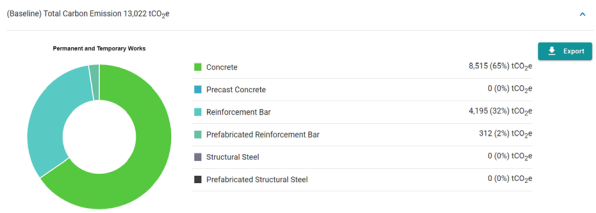
Building Information Modelling (BIM) and green building assessments are equally important for promoting efficiency, sustainability and versatility in the design of new buildings. While both concepts are aimed at improving the management of environmental and sustainability data during building design, they are distinct and overseen by separate disciplines within a design team. Integrating the two concepts and maximising their potential in building design requires aligning data preparation processes and standardising the business workflow.

In this regard, the research outlines the concept of Green BIM, which seeks to enhance the data management of BIM for green building assessments. The Green BIM concept comprises several components: (i) standardisation of guidelines for preparing data in BIM models for green building assessments, (ii) a data conversion engine that translates BIM model data for green building assessments, (iii) an assistive plug-in that creates a downsized BIM model with just the appropriate amount of green building information in a common file format; and (iv) capacity building activities to align practitioners' understanding of BIM for green building assessments.





The application of Green BIM was implemented in the iBEAM Unison platform and has yielded promising results. This indicates that by establishing effective co-ordination, the concept of Green BIM can be expanded to enhance the effectiveness of BIM in green building assessments.



Project Team

Project Name	iBEAM Unison – Optimising the Application of a Building Information Model For Green Building Assessments
Name of Organisation	BEAM Society Limited (with funding support from CIC Research and Technology Development Fund)
Members of Research / Planning Team	iBEAM Unison Project Working Group

https://www.beamsociety.org.hk/en/BEAM-Plus/iBEAM-New (Project Introduction Website)

Objectives

- To conduct research on unifying data for various environmental and sustainability attributes generated during the design and construction processes;
- To demonstrate the feasibility of establishing a Common Data Environment between sustainability design, green building analysis and green building assessments; and
- To design an innovative platform to enable the direct importing of building modelling data into iBEAM for the submission of BEAM Plus assessment, Carbon Assessment Tool analysis and other green building assessments available in the market.

Sustainability Action(s) of the Project

- It enables analysis of sustainability metrics for building designs during the initial design phase.
- It integrates environmental and sustainability information into BIM for green building assessment.
- It improves the accuracy and efficiency of life cycle analysis needed for complying with green building assessments.

Industry

INTEGRATED FACILITY MANAGEMENT CONTROL TOWER (IFMCT)

IFMCT Revolutionises Operations with Data-Driven Insights, Enhanced Efficiency, Tenant Satisfaction, and Pioneering Sustainable Building Solutions

The IFMCT initiative has been a game-changer, elevating building operations to unprecedented heights and demonstrating its potential as a tool to transform the facility management industry. By integrating over 20 data sources – including HVAC systems, an array of IoT devices, asset information, work order management, security systems, and other BMS data – IFMCT addresses important aspects such as Volume, Variety and Veracity.

Leveraging the power of Hongkong Land's iBMS, IoT networks and big data, IFMCT enables proactive asset maintenance, energy efficiency and operational sustainability, achieving outcomes aligned with the company's ESG commitments. This strategic initiative has given rise to a centralised platform capable of storing and utilising over 15TB of data, paving the way for refined monitoring and analytical precision.

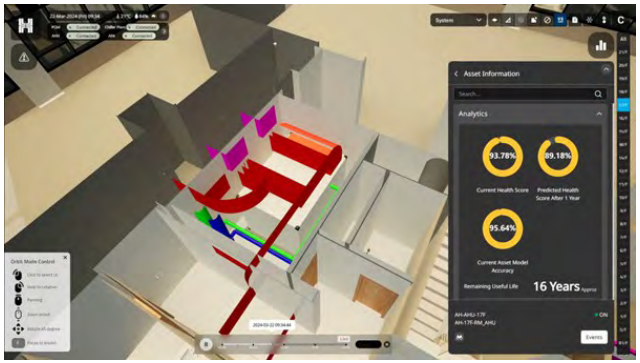
With practical features such as an Event Panel and 3D visualisation, as well as the integration of external factors, the pilot project at Alexandra House has not only met but exceeded initial expectations, transforming:

- Reactive Maintenance to Predictive Maintenance
- Excel Analysis to 3D Visualization
- Experience-Based Operations to Data-Driven Operations
- Scheduled Inspections to Continuous Monitoring
- Siloed Systems to Integrated Analytics
- Energy Consumption to Strategic Energy Management
- Passive Comfort to AI-Enhanced Personalisation

Objectives

The objective of Hongkong Land Property Management's Integrated Facility Management Control Tower (IFMCT) is to transition the company from the traditional mode of reactive maintenance and human intervention to a proactive, data-centric approach.

The Alexandra House pilot serves as a showcase of the IFMCT's capabilities, far exceeding what was originally envisioned. The energy optimisation of AHUs, guided by predictive algorithms, has demonstrated substantial conservation achievements. Transitioning to machine-learning-driven maintenance schedules has not just refined operations but reshaped them.



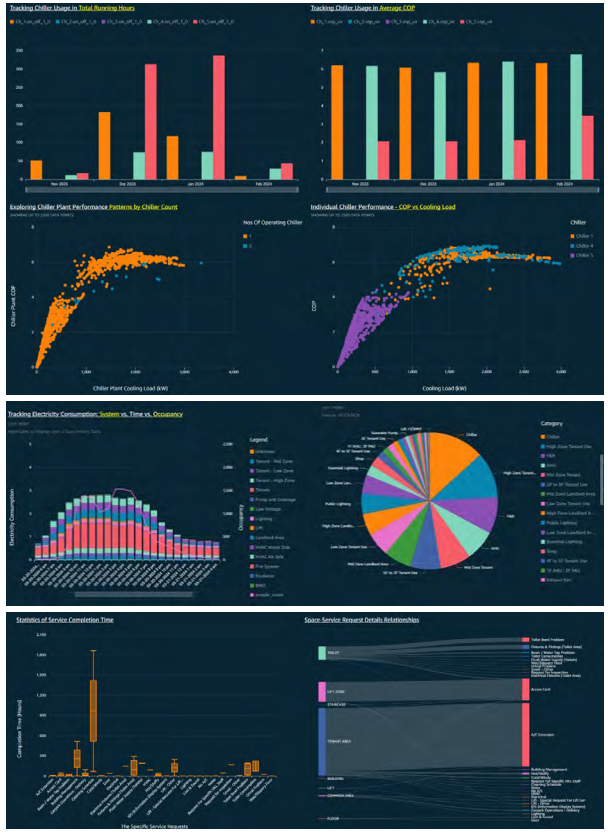
Project Team

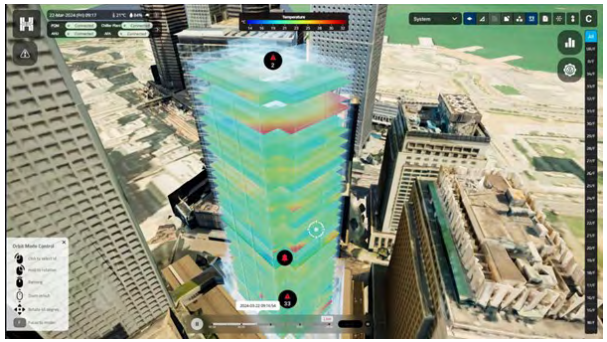
Project Name	Integrated Facility Management Control Tower (IFMCT)
Name of Organisation	Hongkong Land (Property Management) Limited
Members of Research / Planning Team	Sherry WONG Ryan TANG Daniel TSANG Derek CHAN

Industry

INTEGRATED FACILITY MANAGEMENT CONTROL TOWER (IFMCT)

Building on the solid foundation of this pilot phase, Hongkong Land has outlined plans for integrating the IFMCT into the whole Central Portfolio by 2025. By expanding its data lake capabilities and putting new dashboards and a digital twin into operation, transparency can be





redefined and efficiency enhanced across all buildings. This elevated level of information will empower staff to focus on high-value tasks such as strategic vendor management, fostering an environment where decision-making is data-driven and focused on continuous improvement and service excellence.

Sustainability Action(s) of the Project

With its robust algorithmic core, the IFMCT has transitioned facility management from passive consumption tracking to active energy optimisation. Through accurate occupancy prediction, IFMCT is able to determine the minute AHU start-up time and optimise the system operations to enhance energy efficiency of system operation.

In addition, the AI-enabled predictive maintenance can optimise the system replacement period and extend the lifespan of equipment to reduce the embodied carbon of product or equipment purchase.

How the Project can enhance Climate Change Resilience

By combining AI capabilities with weather data, work order data, and system operation parameters, AI algorithms can be used to predict and extreme weather events and operational weak points to enhance building resilience and prevent catastrophic events.

Industry

OUTCOME-BASED TRANS-DISCIPLINARY BUILDING DESIGN FRAMEWORK FOR ADVANCING NET-ZERO

A study of transdisciplinary and integrated design applicable to carbon-neutral, high-rise commercial buildings in sub-tropical cities

Project Team

Project Name	Outcome-based Trans-disciplinary Building Design Framework for Advancing Net-Zero
Name of Organisation	Behave Limited / Ronald Lu & Partners (Hong Kong) Ltd.
Collaborating Parties	*MEP & Structural System Designer:* Cundall Hong Kong Limited *Climate Engineering Designer:* Transsolar KlimaEngineering *Micro-climatic Design Experts:* The University of Hong Kong The Chinese University of Hong Kong *Quantity Surveyor:* Rider Levett Bucknall Limited *Smart System Specialist:* Siemens Limited
Members of Research / Planning Team	M.K. LEUNG (Principal Behaviourist, Behave Limited; Director / Director of Sustainable Design, Ronald Lu & Partners (Hong Kong) Ltd.) Dicken POON (Behaviourist, Behave Limited; Senior Sustainable Design Officer, Ronald Lu & Partners (Hong Kong) Ltd.) Joe TANG (Director, Building Services, Cundall Hong Kong Limited) Dong CHEN (Partner, Cundall Hong Kong Limited) Desmond LEE (Principal Engineer, Cundall Hong Kong Limited) Thomas AUER (Managing Director, Transsolar KlimaEngineering) Chao REN (Associate Professor, Faculty of Architecture, The Chinese University of Hong Kong) Anderson CHAN (Managing Director, Rider Levett Bucknall Limited) Nelson CHOW (Head of Sales, Siemens Limited)

https://youtu.be/pv8nrUmHdtM
https://rlp.asia/en/project/treehouse/

The research paper "Outcome-based Trans-disciplinary Building Design Framework for Advancing Net-Zero" set out a transdisciplinary design framework for Treehouse, a carbon-neutral office building located in a high-density, high-rise sub-tropical context. Its premise was that carbon-neutral buildings respond to complex, interlinked, socio-environmental sub-systems: the urban vertical microclimate, frequent extreme climate events, digital disruption, new hybrid working and living modes, and diverse occupant behaviours and expectations of carbon-neutral liveability.

Through iterative and integrated design explorations, innovative solutions and strategies were proposed that resulted in an adaptable and eco-effective solution that addresses challenges regarding future work, user expectations, cost, supply chain readiness, and regulatory barriers. The outcome-based transdisciplinary design framework, developed by a consortium led by Behave and Ronald Lu & Partners, provided innovative guiding principles for urban sustainability, including vertical microclimate-responsive planning, smart and adaptive comfort strategies and an outcome-based biophilic approach for future-ready buildings.

As the industry seeks to make Hong Kong's building sector carbon-neutral before 2050, Treehouse's transdisciplinary process provides a foundational framework that can be applied to other building types in a variety of urban contexts. To ensure that this process remains relevant and impactful in an ever-changing and uncertain environment, stakeholder gatherings must be regularly conducted; this will build professional capacity, ensure supply chain readiness and allow technological and regulatory advancements towards carbon neutrality.

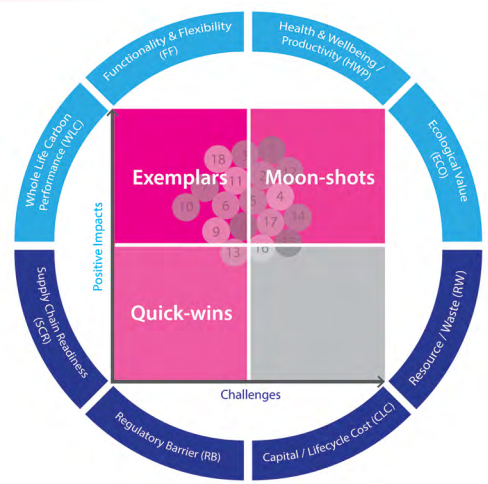
Treehouse's pioneering design is a model for future carbon-neutral projects, providing a new type of

Objectives

To develop an outcome-based transdisciplinary building design framework, pioneered by the Treehouse project and applicable in sub-tropical urban contexts, to support the carbon neutrality of Hong Kong's building sector by 2050.

Industry

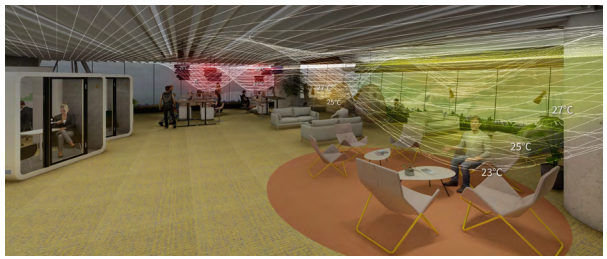
OUTCOME-BASED TRANS-DISCIPLINARY BUILDING DESIGN FRAMEWORK FOR ADVANCING NET-ZERO



workplace for the next generations – one that promotes carbon positivity and wellness through cutting-edge technology, design and management, and one that will help address the growing climate challenges faced by our cities.

Sustainability Action(s) of the Project

The study explored ways to build a deeper, common understanding of a complex system from the various perspectives of different disciplines so as to develop holistic solutions. The deep decarbonisation of office buildings requires a thorough investigation of opportunities and challenges across many disciplines. For instance, to be effective, passive and low-energy architectural design must be integrated with urban planning and based on an in-depth understanding of the urban climate. Transdisciplinary design views one discipline from the perspective of another and synthesises links between disciplines in a co-ordinated and coherent manner. Within a humanities context, it integrates natural, social and building sciences, transcending their boundaries in the process to discover new outcomes.



How the Project can enhance Climate Change Resilience

Treehouse features high building permeability in the low zone near pedestrian spaces and street level areas, as well as being open to prevailing summer winds, with the aim of alleviating the urban heat island effect.

The plans are for a 220m-tall, Grade A office building on a 4,238 m^2 site with a total GFA of 94,144m^2. Its operational energy use intensity and upfront carbon intensity are estimated to be 51 kWh/m^2/year and 342 kg CO_2-e/m^2 of construction floor area respectively, resulting in a reduced carbon footprint of 9.3 million tonnes of CO_2-e, 74% smaller than the business-as-usual base scenario.

The canopy integrates ETFE shading, covering 40% of the site's open areas to provide outdoor thermal comfort and all-weather protection around the building. Microclimatic simulations evaluated confirm the effectiveness of this urban canopy on typical summer days. The building's self-shading inclined façade, horizontal light reflectors and rooftop PV system contribute to energy efficiency. Passive cooling is achieved by capturing breezes 200m above ground through a heat exchange chamber. A solar chimney enables natural ventilation. The design incorporates elements of biophilia such as an urban native woodland, artificial wetland, sky gardens, green walls and roofs, as well as nature-themed materials. The space is designed to be airy and welcoming, with ample natural light and sea breezes. These interactions with the natural world are further enhanced by sensing, IoT and robotic technologies.

The post-pandemic world has created new options, choices and modes of working, and the Treehouse architects envisage a hybrid mode of remote work and office work distributed across homes, workplaces and satellite co-working spaces. Additional design elements include adaptable landlord-managed shared amenities, virtual desktop infrastructure, dynamic space-matching thermal zones that prioritise individual choice, and flexible interior spaces catering to diverse preferences and varying occupancy rates. The building systems will learn individual preferences and behaviours, further optimising resource use and reducing carbon emissions.

Industry

THE GREEN DECK

Objectives

The Green Deck is an innovative social project to be constructed over the Hung Hom Cross Harbour Tunnel Toll Plaza. It aims to create a public green space to improve the connectivity with adjacent areas, and provide a variety of social facilities and a 28,000m² landscape garden for the community. Aside from landscape architecture, Arup provided multidisciplinary services for the project, including structure, electrical and mechanical, environmental, sustainability, fire, transportation and urban planning.

The landscape design focuses on creating a vibrant and sustainable environment with multi-functional spaces for public use. These include a multi-generational playground, thematic gardens, water pavilion and footpaths. The project will transform the Toll Plaza into a thriving community hub that fosters connectivity and engagement.

Project Team

Project Name	The Green Deck
Name of Organisation	Arup
Collaborating Party	Rocco Design Architects Associates Ltd
Members of Research / Planning Team	Theresa YEUNG, Peter CHAN, Raymond HO, Gina CHEUNG, Yihan WU, Constance HUNG, Claudia YU

An innovative social project turning grey to green

Evolution of the Green Deck (GD) project at The Hong Kong Polytechnic has faced numerous challenges, with issues such as land constraints, structural and building services design, fire engineering and traffic and transport considerations all needing to be addressed to ensure the project's success. Throughout the design and development process, sustainability has been a fundamental consideration, with a wide range of features implemented to enhance overall energy efficiency.

The design of GD incorporates various technologies aimed at maximising the use of natural resources and energy generation. High-performance glazing is being utilised to maximise daylighting while minimising heat gain. Natural ventilation systems are being prioritised with hybrid ventilation modes considered for semi-outdoor spaces, which will further contribute to energy efficiency. The integration of photovoltaic (PV) panels and building-integrated photovoltaic (BiPV) panels will enable the generation of renewable energy, while small wind turbine generators will showcase on-site carbon-free energy generation. Additionally, kinetic tiles on footpaths are planned to convert the kinetic energy of pedestrians into energy for exterior lighting, promoting sustainable energy usage.

Industry

THE GREEN DECK

Environmental monitoring systems play a crucial role in the GD design. A network of wireless environmental sensors is planned to monitor air pollutants and weather conditions. This data can be leveraged to implement smart notification systems that provide users with helpful information. Photocatalytic coatings and roadside air purifiers are being considered as potential solutions to reduce the negative effects of air pollutants from tunnel traffic, thereby decreasing the energy required for ventilation. GD will also incorporate smart metering provisions for real-time monitoring and data collection on energy consumption. This will allow for energy optimisation and auditing across the development.

Waste management will be another key aspect of GD's sustainability, as organic waste from food and beverage stores, as well as smart waste bins, can be collected and recycled through composters for landscape fertilisation. Reverse vending machines will promote the recycling of empty beverage containers, educate the public, and help differentiate recyclable materials from non-recyclable plastics and metals.

The integration of these sustainable systems and the efficient design of GD will contribute to carbon reductions, forming a roadmap towards achieving carbon neutrality for the development. It is hoped that GD can achieve multiple objectives beyond sustainability, including improving air quality, enhancing community connectivity, meeting social needs, and revitalising the urban area. GD is also expected to have a positive impact on the local economy by attracting tourists and potentially increasing property values.

Sustainability Action(s) of the Project

The Green Deck project incorporates various water management systems for sustainability and efficient use of resources. Harvested water features are designed to collect rainwater, reducing the need for fresh water in irrigation. Rain gardens and bio-retention systems will collect and cleanse rainwater for landscape irrigation, providing ecological benefits. The Zero Irrigation System (ZIS) will optimise irrigation by absorbing rainwater into the soil, collecting excess water, and using capillary action to irrigate vegetation.

How the Project can enhance Climate Change Resilience

The landscaping will help control the microclimate by providing tree shade, controlling breezes and managing surface water through a sustainable and water-sensitive drainage design. Reflective pavements will lower the outside air temperature and save energy by reducing the need for electric street lighting at night. The dense vegetation can reduce urban heat island effects by shading the building surfaces, deflecting solar radiation, consuming CO_2 and increasing air humidity. Exposed water areas can help to lower air temperature in the microclimate through evaporation.

Green Building Materials & Technologies

EXPERT INSIGHTS ON HONG KONG'S CARBON NEUTRALITY ROADMAP

PIONEERING INNOVATION IN CONSTRUCTION: ADVANCING THE GREEN BUILDING SECTOR'S SUSTAINABLE FUTURE

Mr Arthur LAM

Green technology is a crucial theme among young climate advocates. The rising concern of young people about climate change and environmental issues has led them to recognise the potential of innovative technology in addressing these challenges.

Arthur LAM, a dynamic and enterprising young leader in the real estate technology sector, has been steadfast in his commitment to advancing sustainable development through his innovative green technology company. With a diverse portfolio encompassing engineering and energy management, Arthur has consistently emphasised the need for the construction industry to adapt and liberate itself from traditional paradigms. Firmly convinced of technology's critical role, he envisions its power to actualise green buildings and pave the way for a low-carbon future.

GREEN TECHNOLOGY-DRIVEN SMART BUILDINGS FOR A GREEN TRANSFORMATION

Over a decade ago, Arthur entered the environmental technology industry with the goal of contributing to global climate mitigation. In the past 15 years, he has managed sustainable development projects for various enterprises, including energy efficiency and emissions reduction efforts, across Southeast Asia and Africa. Having recognised the broader significance of Environmental, Social, and Governance (ESG), he founded a real estate technology startup. Leveraging Artificial Intelligence of Things (AIoT), his company provides smart-city solutions for buildings, including energy monitoring and saving, big data and AI-based optimisation services.

DISCOVERING NEW HORIZONS THROUGH TECHNOLOGY AMIDST THE PANDEMIC

During the COVID-19 pandemic, the shift to remote work for most employees compelled businesses to adopt technology for monitoring property operations from a distance. Arthur and his company came in to address this need by developing a Building Operation System (BOS) that leverages IoT and AI intelligent modules. This system manages various aspects, including central air conditioning and frontline operations, optimising energy efficiency in commercial buildings. They also provide disinfection services by installing a system that detects airborne coronavirus risks and activates harmless ultraviolet lights when concentrations exceed normal levels. He emphasises, "Our goal is to transform Hong Kong into a world-class smart city, driving innovation and sustainability through technology."

DRIVING SUSTAINABLE SOLUTIONS: A TECHNOLOGICAL APPROACH TO ENVIRONMENTAL CHALLENGES

Green construction has long grappled with the divergent interests of property owners, management companies, and tenants. In response, some real estate developers have introduced Green Leases as binding agreements to establish

> "Our goal in researching and developing technology is to empower humans and add more value. As technology can empower every individual in practising Environmental, Social and Governance (ESG) goals more effectively, it can also promote both our physical and mental health."

EXPERT INSIGHTS ON HONG KONG'S CARBON NEUTRALITY ROADMAP

environmental goals. However, even with Green Leases in place, the interests of stakeholders still diverge. Arthur therefore proposes aligning their interests to achieve sustainability and suggests leveraging technology as a solution. While Green Leases offer a framework for promoting energy efficiency, environmental protection, and ESG practices, their effectiveness requires ongoing monitoring and evaluation.

Arthur believes that technology can also help businesses and citizens embrace environmentally-friendly, low-carbon living. He enthusiastically shared a successful collaboration with the Hong Kong Housing Society (HKHS), implementing a community programme across 150 buildings under their management. Leveraging a mobile application developed by his company, HKHS digitised participants' green lifestyle behaviours while encouraging them to complete various carbon-reduction tasks through gamified interactions. Participants can earn points and redeem rewards and gifts for their efforts. Arthur explains that this incentive platform fosters carbon reduction habits in participants' daily lives, enabling everyone to make significant contributions.

To encourage widespread adoption of ESG practices, Arthur believes that providing incentives is essential for transforming people's behaviour and mindset. The gamified app motivates participants to record their efforts in various ESG areas, earning points for activities like walking instead of using transportation, recycling, and bringing their own utensils when ordering takeout, earning redeemable points.

Among the participants in this platform, 40% are seniors. Through their engagement with this mobile platform, they gain a sense of purpose and recognise their contribution to environmental protection. Arthur enthuses, "This platform cultivates a sense of social responsibility in them, transforming them into social citizens. Joining forces with people from different backgrounds, social strata or ethnicities, this action embodies social inclusivity. They have a stronger sense that they are part of the city." By participating in mobile games, senior citizens find common ground with their families and become more cohesive within society.

Arthur highlights that this successful case demonstrates how innovative technology and community collaboration can drive green living and sustainability. By offering incentives and rewards, people's behaviour undergoes a positive change, integrating environmental awareness into their daily lives. Arthur firmly believes that through sustained effort and collaboration, we can advance energy-efficient, environmentally-friendly practices and work towards a more sustainable future.

LEVERAGING HONG KONG'S GREEN TECHNOLOGY ADVANTAGE ON THE INTERNATIONAL STAGE

In March of last year, Chief Executive Mr John LEE led a trade delegation to the Middle East with the aim of exploring business opportunities and promoting Hong Kong. Arthur, the founder of a green technology startup, was also part of the delegation. He successfully signed a Memorandum of Co-operation with Abu Dhabi's large-scale smart city, Masdar City. Occupying 600 hectares, Masdar City, once fully developed, will accommodate 50,000 residents. Notably, three of its buildings will adopt the energy-efficient system designed by Arthur's company—an innovative Energy Efficient System. Arthur asserts with high confidence, "Dedicated green technology entrepreneurs like us have nurtured a pool of exceptional IT talent, providing environmentally-friendly energy-saving solutions. Our extensive experience in managing smart cities positions us well, for us now to seize the opportunity and leverage this advantage on the international stage!"

EXPERT INSIGHTS ON HONG KONG'S CARBON NEUTRALITY ROADMAP

A NEW FORCE OF CLIMATE ADVOCACY

Ms Natalie CHUNG

Natalie CHUNG, a climate advocate born in 1997, decided to champion climate causes during her primary school years. In 2023, she completed a climate change expedition to Antarctica, as the sole participant from Hong Kong alongside climate experts from around the world. Natalie believes that everyone must make efforts to safeguard the environment and hopes that the public will reevaluate the natural resources bestowed upon us by the Earth.

HONG KONG'S OUTSTANDING ENVIRONMENTAL POLICIES WORTHY OF INTERNATIONAL PROMOTION

Natalie, a passionate nature conservationist, has attended numerous international climate change conferences in recent years. From her perspective, Hong Kong possesses several advantages in sustainable development, albeit underestimated on the global stage. As the world's focus on climate change and sustainability intensifies, urban sustainability becomes a critical issue. In this regard, Hong Kong's unique geographical environment and urban development model provide essential prerequisites for creating a sustainable city. Despite its compact size of about 2,755 square kilometres and its dense population, Hong Kong has implemented numerous environmental measures in recent years to reduce carbon footprint and to provide green spaces for its citizens.

Firstly, Natalie emphasises the pivotal role of Hong Kong's public transportation system in reducing carbon emissions. Within such a compact city, residents rely extensively on the comprehensive network of public transportation, including mass transit railways, buses, and trams. This highly efficient public transportation system not only alleviates traffic congestion but also reduces individual reliance on private cars, benefiting both the urban environment and citizens' health as well as contributing to lower carbon emissions within the transportation sector.

In contrast, many countries and cities face different environmental challenges. For example, residents in suburban areas of the United States or Australia often spend significant time commuting by private cars to city centres, causing traffic congestion and increased carbon dioxide emissions. Moreover, some households own two or more vehicles for convenience, further exacerbating carbon emissions—a major greenhouse gas increasing global warming.

Secondly, Hong Kong boasts abundant natural resources, with beautiful country parks and coastlines. These natural environments represent opportunities for citizens to connect with nature, often located close to residential areas.

Natalie emphasises that the Government has implemented a series of environmental policies to mitigate pollution, such as supporting eco-friendly technologies, promoting green building, energy conservation, and enhancing environmental education. Through these initiatives and low-carbon emissions measures, Hong Kong aims to become one of Asia's greenest cities. As a young climate advocate, Natalie is willing to collaborate with the Government to promote the city's robust environmental policies on the international stage with Hong Kong's image as a high-quality green city.

PROMOTING ENVIRONMENTAL EDUCATION THROUGH NATURE

As an avid hiker, Natalie places great importance on environmental education. In recent years, she has organised local ecological tours and assisted other organisations in content creation. She also collaborates with various schools, aiming to influence students' attitudes towards environmental conservation from a young age. She shares her experience by conducting a sustainable training week with students, including visits to Tung Chung to understand how urban planning incorporates sustainable development elements. At the end of the training week, students presented proposals to improve Hong Kong's sustainable tourism plans. She also enthusiastically recalls, "With some primary school students, I shared my Antarctic expedition experiences, bringing to their attention that we saw a lot of microplastic waste even in the Southern Ocean! This surprising revelation raised their awareness of the urgent need to protect nature."

> "Our guiding principle has been to use nature-based experiential learning to inspire behavioural change towards sustainability, going beyond just learning technical concepts in a classroom. We cannot protect what we do not love, and we cannot love what we do not know. Therefore, we focus on rebuilding the innate connection between nature and humanity."

Green Building Materials | Government

EXPLORATION OF THE USE OF GREEN BUILDING MATERIALS AND TECHNOLOGIES IN BUILDING PROJECTS

Objectives

To explore and widen potential use of green building materials such as S690 high strength steel, passive radiative cooling paint, use of combustible and low embodied-carbon material and BIPV.

Architectural Services Department (ArchSD) is committed to delivering its facilities development/upkeep services in an environmentally responsible manner by incorporating the latest sustainable development and trends of green innovations.

Project Team

Project Name	Exploration of the use of Green Building Materials and Technologies in Building Projects
Name of Organisation	Architectural Services Department
Collaborating Parties	City University of Hong Kong Arup (fire engineering consultant)

https://youtu.be/JqVvlkf7IZ8

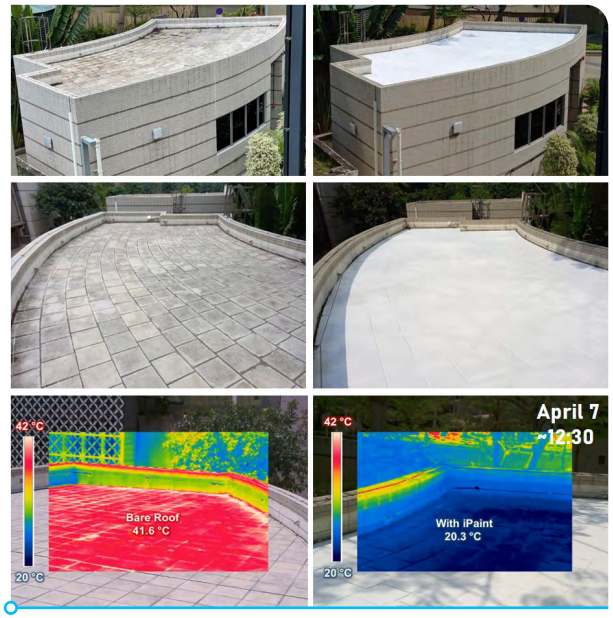
Pilot use of S690 in Redevelopment of Kowloon Tsai Swimming Pool Complex

Following successful experience from the Cross Bay Link project under CEDD, this project was selected for pilot application of Grade S690 high-strength steel for major roof truss members above the indoor pool. Steel sections of

those members were built-up from S690 steel plates. With the high strength steel properties, the use of S690 high-strength steel resulted in about 30% saving on materials compared with the use of Grade S355 normal strength steel.

Pilot application of Innovative Material – Passive Radiative Cooling Paint

Radiative Cooling Paint is a nano-material that can resist incoming solar irradiance while simultaneously emitting long-wave infrared radiation to the cold universe through atmospheric transmission window and eventually creating a cooling effect. In recent years, in order to optimise and promote the development of green materials, ArchSD has collaborated with City University of Hong Kong to explore the usage of this "iPaint" in Government premises. A few trials have been carried out on roofs of premises maintained by ArchSD, including Harcourt Garden Management Office, Ngau Pei Sha Street Playground Management Office and Tong Fuk Correctional Institution. Preliminary results have shown that ambient indoor temperatures can be reduced by 1-2°C on average.



Green Building Materials | Government

EXPLORATION OF THE USE OF GREEN BUILDING MATERIALS AND TECHNOLOGIES IN BUILDING PROJECTS

Fire Study on the Use of Combustible Materials as Façade Cladding for Small-scale Buildings

Due to current restrictions of the Building Regulations on non-combustibility, low embodied-carbon materials such as timber, bamboo and some bio-based materials cannot be used as façade materials in ArchSD projects. It is envisaged that certain types of smaller scale buildings, which are of small footprint, single or two stories, low fire risks, short travel distance and are detached from other buildings, may fulfill basic fire safety principles without going through complicated fire engineering studies. This study by the consultant will provide a valuable reference on alternative/modified prescriptive requirements for the use of combustible materials as façade cladding for small-scale buildings. When the building parameters identified in the study are met (e.g., fire spread between buildings, protection of external evacuation routes, etc.), projects may apply to the approving authority for exemptions under the Buildings Ordinance on a case-by-case basis.

Application of PV/BIPV Renewable Energy in Government Buildings

To combat climate change, ArchSD is endeavouring to deliver renewable energy projects in collaboration with various Bureaus or Departments. In the past five years, ArchSD has already installed over 175 photovoltaic (PV) systems covering different PV technologies including air improvement PV, walkable PV, flexible PV and solar lamp poles, generating around 1.78 million kWh of electricity each year – sufficient for monthly use by nearly 6,500 households.

INNOVATIVE APPLICATION OF PHOTOVOLTAIC MODULES IN DSD FACILITIES

Harvesting renewable energy in untapped spaces through unconventional technologies

Objectives

To make use of available spaces in the facilities of Drainage Services Department (DSD) to harvest renewable energy with innovative application of photovoltaic modules.

As part of the Government's commitment to combat climate change and achieve carbon neutrality before 2050, DSD has intensified its renewable energy (RE) endeavours. By leveraging a range of cutting-edge RE technologies, DSD is harnessing the untapped potential within its facilities to contribute to a sustainable future. Remarkably, the implementation of floating photovoltaic (PV) systems, flexible PV systems, and steppable PV systems has revolutionised the utilisation of open spaces in the DSD facilities, maximising energy generation while minimising land requirements.

DSD installed the first pilot floating PV system in March 2022 at San Tin Polder, a flood storage pond, with an installed generation capacity of 37kW. This groundbreaking system now supplies RE to the nearby San Tin stormwater pumping station. As the polder is designed to protect nearby villages from flooding under extreme rainstorms and tropical cyclones, the floating PV system has utilised the water surface and taken into account of severe water levels of the polder, and the ecological and environmental impacts, to co-exist with the natural environment. An ecological floating island has also been installed adjacent to the floating PV system in the San Tin Polder to enhance its ecological diversity.

To further utilise the open space at the San Tin stormwater pumping station to develop renewable energy, low reflective flexible monocrystalline PV modules and steppable PV modules have been installed on the covers of the screw pump troughs and maintenance platforms respectively. As a symbol of DSD's dedication to solar energy harnessing, two solar trees now grace the pumping station. These trees not only showcase the aesthetic appeal of solar power but also serve as functional energy generators.

Another ambitious project is being implemented to harness solar power at Stonecutters Island Sewage Treatment Works (SCISTW). To maximise the space available, DSD has installed cutting-edge Copper Indium Gallium Diselenide (CIGS) flexible thin film PV modules on the sedimentation tank covers, which were originally designed for odour management, revolutionising the utilisation of previously untapped surfaces. The low temperature coefficient of CIGS solar cells minimise the impact of the module's power generation efficiency when the temperature rises. The flexible and lightweight CIGS thin film PV modules can contour to the curved sedimentation tank covers without load-bearing implications, thereby ensuring a reliable, safe, and stable operation of the PV system. Upon completion, it will be the largest PV installation of its kind in Hong Kong, with total installed generation capacity of over 1 MW.

Project Team

Project Name	Innovative Application of Photovoltaic Modules in DSD Facilities
Name of Organisation	Drainage Services Department

Sustainability Action(s) of the Project

The project's sustainability actions are multifaceted, focusing on the adoption and integration of renewable energy technologies to align with the Government's climate change and carbon neutrality targets.

Green Building Materials | Government

INNOVATIVE APPLICATION OF PHOTOVOLTAIC MODULES IN DSD FACILITIES

Key actions include:

1) Innovative Renewable Energy Technologies:

- Implementation of floating, flexible, and steppable photovoltaic (PV) systems to unleash renewable energy on unused open space.

2) Utilisation of Existing Infrastructure:

- Low reflective flexible monocrystalline PV modules and steppable PV modules are installed on the covers of screw pump troughs and maintenance platforms.
- Solar trees have been erected within the San Tin stormwater pumping station to showcase the aesthetic appeal of solar power.

3) Largest Installation of its Kind:

- Upon completion, the Stonecutters Island installation will be the largest of its kind in Hong Kong, with over 1 MW of generation capacity.

4) Ongoing Commitment to Expansion:

- DSD is committed to continuously expanding PV module installations to increase solar energy harnessing capabilities.

These initiatives not only bolster Hong Kong's renewable energy capacity but also demonstrate an innovative use of space and resources, while steering the city towards a greener, more sustainable future.

How the Product / Technology takes Climate Resilience into account

The project showcased by DSD takes climate resilience into account by implementing solutions designed to combat and adapt to climate change challenges effectively. The floating photovoltaic systems are not only a source of renewable energy but designed to withstand extreme weather conditions, which are becoming more frequent and intense due to climate change. Their placement on water surfaces, such as the San Tin Polder, utilises space that is naturally resilient to fluctuations in water levels, ensuring continued operation during adverse weather events.

Additionally, the choice of flexible and steppable PV modules for the stormwater pumping stations meet the necessity for durable, non-intrusive systems that can adapt to varying environmental conditions without compromising functionality.

The adoption of CIGS flexible thin-film PV modules at Stonecutters Island Sewage Treatment Works is particularly significant for climate resilience. Their low temperature coefficient is crucial for maintaining efficiency in high-temperature scenarios, which are expected to occur more frequently due to global warming. The lightweight and adaptable nature of these modules allows them to fit on existing structures without the need for additional, potentially climate-vulnerable, infrastructure.

In essence, DSD's product/ technology is a testament to resilience-focused innovation, ensuring that Hong Kong's renewable energy infrastructure not only contributes to reducing carbon emissions but is also robust enough to withstand the evolving challenges presented by climate change.

SITE FORMATION AND INFRASTRUCTURE WORKS FOR POLICE FACILITIES IN KONG NGA PO

Piloting the use of High-Performance, Low Carbon GGBS Concrete for Sustainable Development




Objectives

To prepare for the co-location of various police facilities in New Territories North to Kong Nga Po.

The addition of Supplementary Cementitious Material (SCM) to replace part of Ordinary Portland Cement (OPC) can improve concrete performance, reduce cement consumption to lower the carbon footprint, and reduce waste disposal.

Among the various SCMs, Pulverized Fuel Ash (PFA) is the most commonly used in Hong Kong, but its production is diminishing owing to reduced use of coal for power generation. Facing the anticipated PFA shortage, Ground Granulated Blast-furnace Slag (GGBS) obtained by drying and grounding of quenching molten-slag from steel mill blast furnaces offers one useful alternative. Apart from the aforementioned advantages of substituting OPC with SCM, not only could GGBS replace a larger portion of OPC than PFA, the use of GGBS could also improve durability, dimensional stability and aesthetic appearance. However, most construction professionals in Hong Kong lack experience in the real-life use of GGBS.

It is noted that GGBS concrete does not have the same properties as most commonly used PFA concrete. It is known that when GGBS to be used as SCM is grounded to the same fineness as OPC, it exhibits lower early strength and requires a longer period of curing and temporary support. Fineness and chemical composition, which will affect the properties of the GGBS concrete, are also dependent on its source. For this reason, each source of GGBS should be evaluated before use.

Civil Engineering and Development Department, the consultant and the contractor of this project, worked closely with the concrete supplier to develop a high performance low carbon GGBS concrete. The supplier chose a new source of GGBS with relatively high fineness. A concrete mix based on the chosen GGBS and contract requirement was developed for use in this project. The GGBS concrete showed considerable higher 28-day compressive strength, as well as better dimensional stability and durability than OPC and PFA concrete. It was assessed that the replacement of 50% OPC with GGBS could reduce the carbon footprint of the concrete by half.

Project Team

Project Name	Site Formation and Infrastructure Works for Police Facilities in Kong Nga Po
Name of Organisation	Civil Engineering and Development Department

Sustainability Action(s) of the Project

Part replacement of OPC and PFA with GGBS can reduce the carbon footprint of concrete production and ensure sustainable supply of concrete constituents.

How the Product takes Climate Resilience into account

The replacement of OPC with SCM such as PFA or GGBS could significantly reduce the carbon footprint of concrete production in Hong Kong. Furthermore, with PFA supplies set to diminish as coal-fired power plants are phased out, the use of GGBS can ensure a sustainable supply of concrete.

Green Building Materials | Government

TUNG CHUNG NEW TOWN EXTENSION – RECLAMATION AND ADVANCE WORKS

Sustainable reclamation with Deep Cement Mixing method and low-carbon cement

Deep Cement Mixing barge

Project Team

Project Name	Tung Chung New Town Extension – Reclamation and Advance Works
Name of Organisation	Civil Engineering and Development Department
Collaborating Parties	AECOM Asia Co. Ltd. Build King – SCT Joint Venture

https://publications.aecom.com/social-infrastructure/projects/tung-chung-new-town-extension-east-eco-shoreline

Sustainability Action(s) of the Project

This project comprises non-dredged reclamation works for about 130 hectares of land with a novel technique, Deep Cement Mixing (DCM). This involves injecting cement slurry from works vessels into marine mud and "mixing" them together, which strengthens the marine mud in its original position and forms a hard cement mixing column. The columns integrate into a layer of DCM treated soil which supports the seawalls and fill materials that are later constructed on top.

The choice of a suitable binder for DCM augments its sustainability. Ordinary Portland Cement (OPC) is commonly adopted as the binder for DCM works but its intrinsic drawback is high carbon emissions involved in its production. Hence Portland Blast-furnace Cement (PBFC), a mixture of Ground Granulated Blast-furnace Slag (GGBS) and OPC at a ratio of 60:40, was adopted as the binder for this project.

Objectives

Reclamation of the seabed at Tung Chung East by a non-dredged method to form about 130 hectares of land, and construction of seawalls with eco-shorelines.

How the Product takes Climate Resilience into account

Compared with conventional dredging, the DCM method does not require the removal of marine mud. This reduces the generation of suspended particles in seawater, minimising the impact on water quality and marine ecology. In addition, since no transport is required for shipping the marine mud, it reduces the carbon emissions arising from dumping 4.4 million m^3 of marine mud and 17,600 vessel trips.

GGBS is a by-product of the steel industry and its embodied carbon is much lower than OPC. It is not only environmentally friendly but also improves the overall durability of the end product resistance to alkali-silica, sulphate and chloride reactions. Moreover, a higher DCM strength can be achieved with PBFC, reducing cement consumption by 20% in this project. As such, it has brought about reductions of around 600,000 tonnes of CO_2 emissions.

Green Building Materials | Industry

ADVANCED AUGMENTED BAMBOO MATERIALS

Elevating two of the most promising bio-based green building materials through novel microstructure

Objectives

To create novel, low-embodied-carbon high-performance materials from bamboo.

Hong Kong is striving towards a circular economy and embracing bio-based materials to reduce carbon emissions. This project takes two of the best biomass materials and re-engineers them to create new sustainable materials for the built environment.

Bamboo is widely regarded as a key material for achieving carbon neutrality. However, all current bamboo panels in the market contain toxic adhesives, which increase embodied carbon, hinder circularity, and pose a threat to living things. To address these challenges, a novel Super Bamboo material has been developed, using no toxic adhesives yet delivering superior mechanical performance. Notably, it exhibits a bending strength two times higher than laminated bamboo panels (~90 MPa), reaching 204 MPa.

A second newly-developed material is Porous Biochar. Biochar is one of the most carbon-negative materials that exists, but currently its use is limited to lower-value applications such as fertilisers. However, the carbon-sequestration capabilities of biochar can be immensely valuable for the built environment. Porous Biochar thermal insulation panels can increase fire resistance from 10 minutes to 40 minutes, making it an ideal carbon-negative fireproofing material.

The aim is to launch these two materials into the market within the next two years, introducing building products that are not only sustainable but also high-performing.

Project Team

Project Name	Advanced Augmented Bamboo Materials
Name of Organisation	Super Bamboo Limited
Collaborating Party	Bamboo International (Group) Co., Ltd.

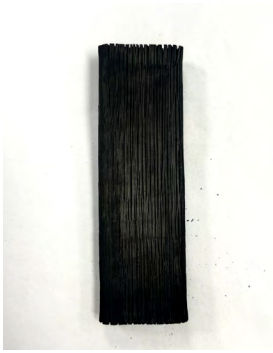
https://www.thesuperbamboo.com
https://youtu.be/Ic8mgn8hDrs?si=yg0XlED571P1-lOn
https://youtu.be/ndfkgav92E4?si=_iwfHfm9rptJQVt7
https://youtu.be/oxA6Z7oHh8A?si=4J_MLn1fzDlt6Zd6

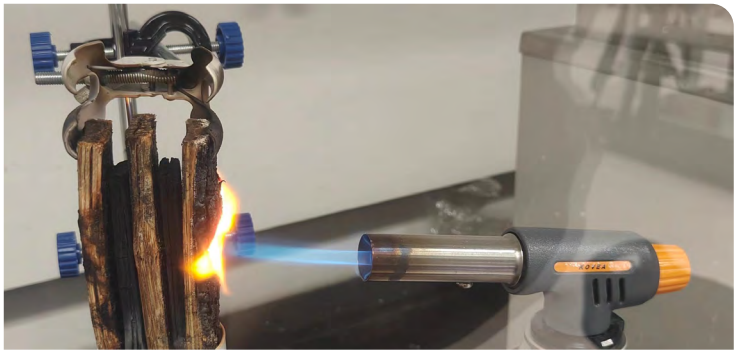
Sustainability Action(s) of the Project

Base materials have only been obtained from FSC certified sources, and only clean and bio-based methods used in the engineering process. Ultimately, this can be a further step towards upcycling waste materials, especially the construction industry's ubiquitous bamboo scaffolding waste which can be turned into Super Bamboo and Porous Biochar.

How the Product takes Climate Resilience into account

Bamboo is an extremely renewable plant that requires few resources and easy maintenance. It can grow in poor and degraded soil, making it more resilient than other biomass materials. Moreover, upcycled bamboo scaffolding wastes could be used as raw materials for production. Being 100% bio-based, the materials will eventually bio-degrade and close the life-cycle loop.





Green Building Materials | Industry

BIO-BASED CARBON-NEGATIVE CONCRETE

Bio-based Structural Carbon-Negative Concrete

Objectives

To developing concrete material with both structural performance and negative carbon emissions.

Carbon reduction in the building and construction sector can play an important role in efforts to achieve carbon neutrality. Using carbon-negative biochar (-2.0 ~ -2.6 tCO_2e/t) is a promising solution. However, directly incorporating biochar into concrete will negatively influence its mechanical properties, particularly when the volume used exceeds a certain threshold, owing to biochar's high water absorption and low strength.

A novel core-shell aggregate (CSA) made possible by encapsulating compacted biochar (the core) with cement-type materials (the shell) is therefore proposed for artificial aggregate production. This not only overcomes biochar's drawbacks, but also attains good strength for use as aggregate in high-volume concrete production, resulting in bio-based carbon negative concrete (BCNC) with sound structural performance.

The loose biochar is first compacted into pellets, with this process achieving a carbon sequestration density improvement of more than double. The compacted biochar is then encapsulated with cement-type materials with a core-shell structure design. The biochar-CSA produced attains a loose bulk density of less than 880 kg/m^3, a crushing strength higher than 7.0 MPa, and water absorption of no more than 20%, When utilised to replace natural aggregate for producing concrete, a density of less than 2000 kg/m^3 is attained and a compressive strength higher than 40 MPa. The carbon emissions related to 1t of biochar-CSA and $1m^3$ of BCNC production are -174 kg CO_2e/t and -10.68 kg CO_2e/m^3 respectively.

Considering its merits of both good performance and negative carbon emissions, the innovative biochar-CSA and structural BCNC can satisfy a wide range of applications and contribute to the carbon neutrality of the construction industry.

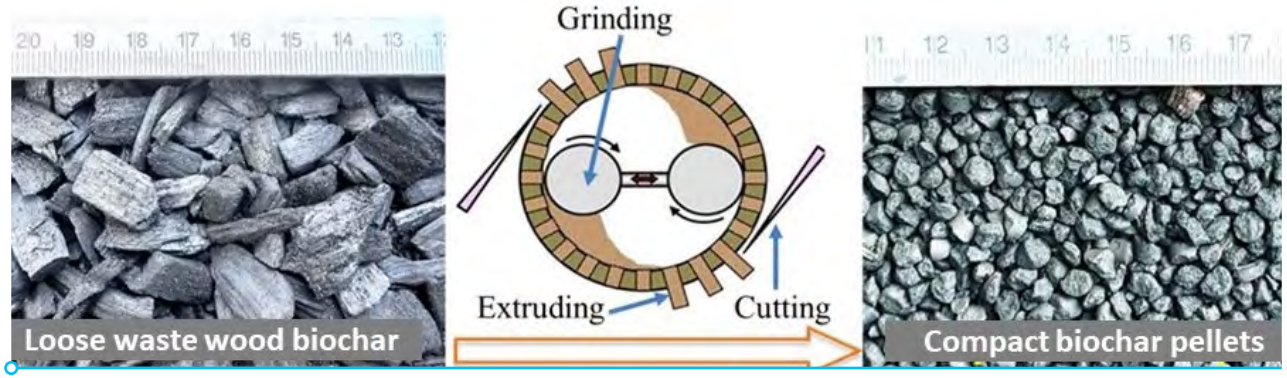


Fig. 1 Biochar compaction

Project Team

Project Name	Bio-based Carbon-negative Concrete
Name of Organisation	Nano and Advanced Materials Institute
Members of Research / Planning Team	Mr Frank ZOU Shuai, Dr Ivan SHAM Man Lung, Dr Gordon LEUNG Lai Ming

Green Building Materials | Industry

BIO-BASED CARBON-NEGATIVE CONCRETE

Fig. 2 Developing process of biochar-CSA and BCNC

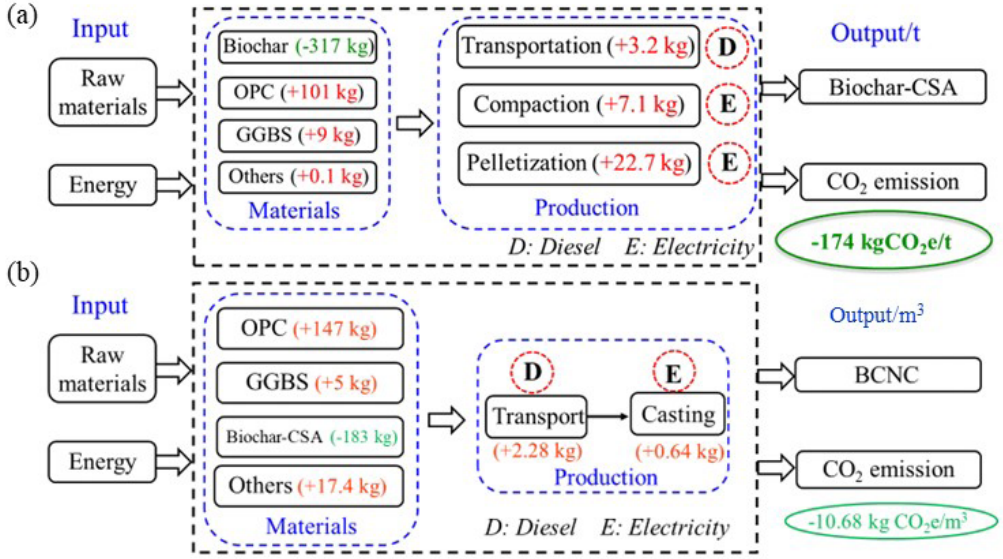


Fig. 3 Carbon footprint assessment of biochar-CSA and BCNC

How the Product takes Climate Resilience into account

The 'Bio-based Carbon Negative Concrete towards Carbon Neutrality' project is driven by the Government's long-term target of achieving carbon neutrality. With negative embodied carbon, the BCNC incorporating compacted bio-based super aggregate possesses satisfactory structural performance and is much more environment-friendly than traditional concrete. It is believed that BCNC will have promising market potential in the China region as well as worldwide.

Green Building Materials | Industry

ELECTRICITY-FREE COOLING TECHNOLOGY

Pioneering electricity-free cooling technology

Objectives

To promote a novel energy-free and environmentally friendly passive radiative cooling paint to save energy and assist in decarbonisation.

i2Cool is a technology company incubated by the HK Tech 300 programme at City University of Hong Kong, which has successfully commercialised the outcomes of seven years' research. Its electricity-free cooling technology products utilise outer space as their cooling source, operating without energy consumption or refrigerants. They leverage efficient solar reflection and mid-infrared thermal radiation to achieve refrigeration effects below ambient temperatures.

The two main i2Cool products are electricity-free cooling paint (iPaint) and electricity-free cooling film (iFilm). Unlike traditional paint that absorbs sunlight and heat, iPaint deflects and dissipates solar heat to the surrounding space through the mid-infrared wavelength range. It is applicable to various types of surfaces such as buildings, automobiles and outdoor electronic equipment.

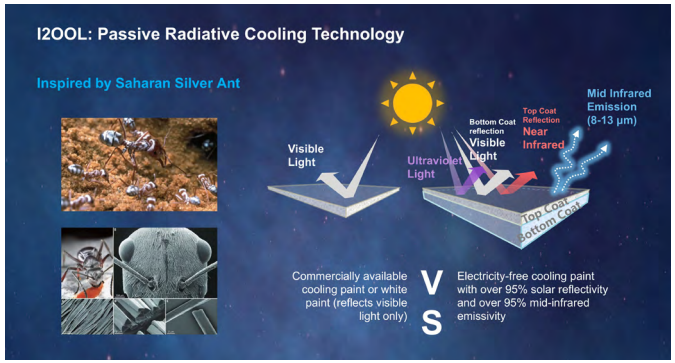
This combination of reflection and radiation achieves a significant drop in the building's indoor temperature, without any energy input. Produced from a mixture of polymers and nanoparticles, the paint is capable of lowering surface temperature by up to 42°C and saving energy for AC systems by up to 40%.

The product is also resilient and durable, showing resistance to corrosion, salinity, alkalis and weather conditions. It is a water-based paint, so does not emit any harmful solvent odours. It also has low Volatile Organic Compound (VOC) emissions, aligning with the growing demand for green, sustainable solutions in industrial applications.

Project Team

Project Name	Electricity-free Cooling Technology
Name of Organisation	I2COOL LIMITED

https://youtu.be/WsqbEI7dUyw
http://www.i2cool.com



Sustainability Action(s) of the Project

Since commercialisation of i2Cool in 2022, it has made significant strides in both environmental sustainability and social impact. Its solutions have been implemented in places such as the Wing Ming Building in Sham Shui Po, which houses many underprivileged families. The company also contributes to the community by utilising its expertise in green technology and sustainable practices, including hosting educational seminars on green technology.

How the Product takes Climate Resilience into account

The development and commercialisation of this innovative technology can integrate electricity-free cooling technology into various aspects of the community. It will help mitigate the urban heat island effect, making comfort and high energy efficiency achievable for all citizens.

Green Building Materials | Industry

FEASIBILITY STUDY ON THE DEVELOPMENT OF LOW CARBON EMISSION CONCRETE BLOCKS

Development of carbon-neutral or carbon-negative concrete products through the integration of Carbon Capture, Utilization, Sequestration (CCUS) and Life Cycle Assessment (LCA) technologies

Objectives

To investigate the possibility of carbon dioxide (CO_2) capture during carbonation curing of concrete paving blocks, in terms of the curing gas source, curing pressure and low-carbon raw materials.

A parametric experimental study was conducted of the effects of different low-carbon raw materials on the strength of concrete paving blocks and their CO_2 uptake properties. A systematic investigation was also undertaken on the effect of different curing parameters including pressure, curing temperature and CO_2 concentration.

Through judicious design formulation, the paving block developed as a result has a very low carbon footprint and over 30 MPa of compressive strength, which is sufficient for use as block paving for pedestrians. Furthermore, by using carbon capture technology, a certain amount of atmospheric CO_2 can be permanently locked within the paving block during production. The embodied carbon of each paving block is around -0.102kg of CO_2e, which indicates that this carbon-negative paving block can sequester more CO_2 than it emits. This makes it extremely promising for helping Hong Kong achieve its Zero-Carbon Emission City target by 2050.

Project Team

Project Name	Feasibility Study on the Development of Low Carbon Emission Concrete Blocks
Name of Organisation	Nano and Advanced Materials Institute
Collaborating Party	Formwork IO Limited
Members of Research / Planning Team	Dr Gordon Leung Mr Xianrui Chen Dr Ben Cheng

Sustainability Action(s) of the Project

- Use of low-carbon raw materials such as recycled aggregates, GGBS and biochar
- Use of carbon capture technology
- Negative embodied carbon

How the Product takes Climate Resilience into account

This technology involves the Carbon Capture, Utilisation and Sequestration (CCUS) technique which can capture CO_2 permanently. It makes use of low-carbon raw materials and the overall embodied carbon of each paving block, which has been evaluated through Life Cycle Assessment (LCA).

Green Building Materials | Industry

HIGH-STRENGTH LIGHTWEIGHT CONCRETE FOR HYBRID MiC

Effective and Sustainable Building of Durable Housing

Objectives

To use high-strength lightweight concrete to produce hybrid MiC.

Modular Integrated Construction (MiC) has become a rapidly emerging technology in recent years. However, conventional steel-based MiC may not be suitable for humid weather conditions, while concrete-based MiC is relatively heavier, requiring modules to be smaller in size.

The hybrid steel-concrete MiC developed by NAMI combines the advantages of both concrete and steel MiC systems. It uses high-strength lightweight foamed concrete with C-25 structural strength but weighs only 60% of normal concrete, with a density of 1500kg/m^3. The manufacturing process is also low-carbon emitting.

Project Team

Project Name	High-strength Lightweight Concrete for Hybrid MiC
Name of Organisation	Nano and Advanced Materials Institute
Collaborating Party	Chevalier (Construction) Company Limited

https://www.nami.org.hk/en/technologies/mic-innovations-35

Owing to its low density and cellular structure, foamed concrete has three times the insulation qualities of normal concrete, enabling the finished modules to produce electricity savings of more than 50%. It has passed fire resistance tests for wall and slab panels and has a durability performance comparable to normal concrete.

The foamed concrete wall panels are lightweight yet able to provide sufficient anchorage strength of 4000N for direct high-level wall cupboard installation. The hybrid steel-concrete MiC technology can provide the same user experience for occupants as traditional concrete buildings.

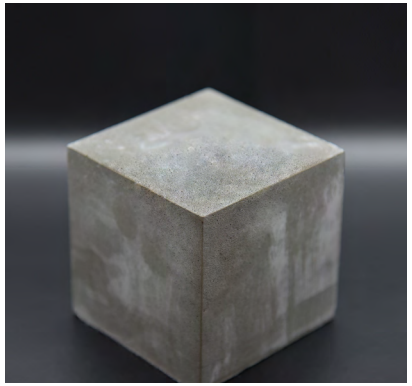
Chevalier Construction has applied NAMI's high-strength lightweight concrete to its hybrid MiC system for construction of a 10-storey elderly rental block at Jat Min Chuen. Buildings Department has also accepted the use of NAMI's hybrid MiC in principle for private building projects in Hong Kong.

Sustainability Action(s) of the Project

- Prefabricated components with flexibility for future reconfiguration
- Long design life of 50 years
- C25 concrete wall panels for maximum space efficiency
- 3-time thermal insulation for energy saving
- Reduction of overall building weight by 40%

How the Product takes Climate Resilience into account

Owing to its low density and cellular structure, foamed concrete has three times the insulation qualities of normal concrete, enabling buildings using hybrid MiC modules to achieve electricity savings of more than 50%.



Green Building Materials | Industry

INNOMASTER SPC WALL PANEL SYSTEM

Transforming Construction, Building a Sustainable Future

Objectives

To refurbish wall panelling at the Clubhouse of Dynasty Court, Mid-levels.

Derived from limestone, a readily available and environmentally-friendly resource, the Innomaster SPC Wall Panel System presents a versatile alternative to traditional decorative wall linings such as natural stone, ceramic tiles and wood veneer. Offering wide functionality including resistance to water, fire, UV rays, impact loads and scratches, the panels provide high durability without compromising aesthetic appeal. Available in a range of textures and patterns from natural stone to wood and cement finishes, they provide designers and architects with many creative options while promoting sustainable practices. The product has been recognised as a Gold rated Green Product by the Construction Industry Council.

Project Team

Project Name	Innomaster SPC Wall Panel System
Name of Organisation	Kwan Tai Engineering Co., Ltd

https://kte-innomaster.com/

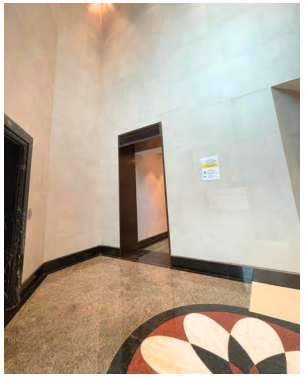
Unlike conventional installation methods that entail extensive processes such as wet trades and woodworking, the SPC Wall Panels can be directly installed on to various wall substrates including concrete, gypsum block and tiled walls. By eliminating the need for additional wall furring and demolition, this minimises materials usage and waste generation. Moreover, the use of innovative electron beam technology in printing production eliminates the use of solvent-based inks, significantly reducing energy consumption and carbon emissions.

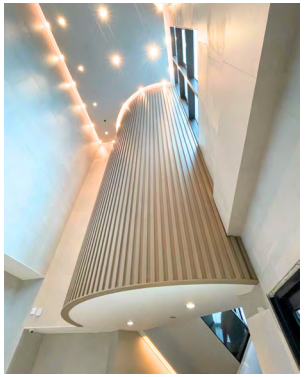
Sustainability Action(s) of the Project

The Dynasty Court Clubhouse renovation project was completed in just two months, as the SPC Wall Panels could be directly installed on to the existing wall substrate. This innovative approach not only reduced the consumption of new materials but also significantly decreased waste, reducing the project's overall carbon footprint.

How the Product takes Climate Resilience into account

The SPC Wall Panel System has been specifically engineered to address the climate resilience needs of Hong Kong. Firstly, the panels are designed to withstand the rigours of rainstorms and flooding-hazards. Secondly, the panels incorporate anti-bacterial properties, essential for maintaining IAQ and ensuring the health and safety of occupants. Additionally, the system's low maintenance requirements alleviate the need for frequent interventions, reducing demand for resources and labour.





Green Building Materials | Industry

PALMECO ULTRA-LIGHTWEIGHT WALL PANELS

Ultra-low weight, fireproof panels with high thermal and sound insulation performance and low carbon footprint

Objectives

To reduce on-site labour time and waste, while enhancing building safety by eliminating fire hazards generated from insulation materials.

The development of Palmeco Ultra-lightweight Wall Panels answers market needs for safer and greener insulated panel walls. The fireproof insulation core of the panels helps reduce fire hazards. The product also achieves significant energy savings, helping to reduce carbon footprint.

The panels are largely made of industrial by-products, such as ground granulated blast furnace slag (GGBS) and fly ash. Deploying a unique geopolymerisation and foaming technology, they provide a novel fireproof thermal insulation panel strengthened by palm-fibre.

Project Team

Project Name	Palmeco Ultra-lightweight Wall Panels
Name of Organisation	Palmeco Tech Limited
Collaborating Party	NAMI

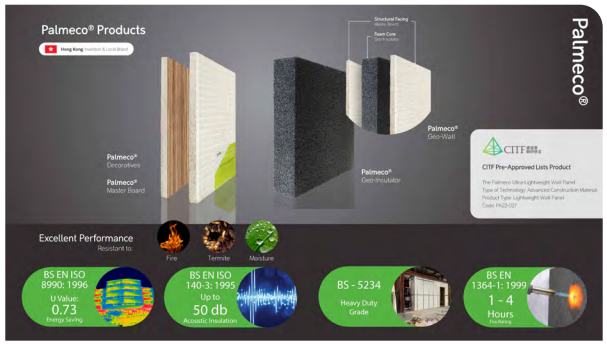
https://youtu.be/rSPQVLa9nsU
https://palmecotech.com/en/products/geopanel

The product has demonstrated superior performance and been used in a wide range of applications. All materials are pre-fabricated, and once on site the panels just need to be fastened together, reducing construction time and labour costs.

The panels are ideal for modular integrated construction (MiC) as they are ultra-lightweight, which means less loading on the steel structure. The weight of a 75mm panel is about 22 kg/m² compared with 60kg/m² for an Autoclaved Aerated Concrete (AAC) panel. The lighter weight also makes them easier to transport and lift on site.

Sustainability Action(s) of the Project

At present, thermal insulation materials that meet Class A standards are generally inorganic. Materials with good quality and higher performance tend to exhibit low strength, brittle texture, high water absorption and high density. Also, the production processes of inorganic materials such as cement, ceramics, foam glass and perlite are not eco-friendly and require very high levels of energy.



In contrast these panels are made using industrial by-products such as fly ash from power plants and steel mill slag. The manufacturing process requires very little energy with no pollution. The panels can also be recycled to make the product more sustainable.

How the Product / Technology takes Climate Resilience into account

- Recycled Raw materials
- Low carbon manufacturing process
- Low carbon footprint work process
- Reduced burden on landfills as material can be reused

Green Building Materials | Industry

RENOVATION OF INTERIOR WALLS AT TWGHS LIONS CLUB OF SOUTH KOWLOON NURSERY SCHOOL USING SUSTAINABLE COATING MATERIALS

Sustainable coatings for a quieter, more stable and healthier school environment

Objectives

To achieve high durability, save energy, retain heat and cold, deaden sound and improve air quality through unlimited negative ion emission.

It is now over 30 years since Ishiko Tatsujiro, president of Nissin Sangyo in Japan, started to develop GAINA – an innovative product that can save energy by coating – with JAXA (Japan Aerospace eXploration Agency). Unlike normal insulation paint products, GAINA is not just based on solar reflectance technology but on several thermal insulation properties.

GAINA has been shown to reduce heat movement, unify temperatures and create a comfortable living environment while minimising energy losses. Its electrostatic propensity of 0.0 prevents dirt adhesion, while ionised moisture combines with airborne particles and VOCs to enhance air quality and reduce impurities. The dense ceramic bead coating on GAINA-treated surfaces significantly reflects heat and reduces sound. It is also a certified fire-retardant material.

The many ceramic layers of GAINA provide strong resistance to ultraviolet rays, creating a coating that lasts two to three times longer than regular paint. The coating's features do not diminish over time, resulting in sustainable buildings with long-lasting benefits.

Project Team

Project Name	Renovation of interior walls at TWGHs Lions Club of South Kowloon Nursery School using sustainable coating materials
Name of Organisation	Tung Wah Group of Hospitals

https://www.azabu.com.hk/gaina/

Sustainability Action(s) of the Project

GAINA is registered on the UNIDO ITPO Tokyo's Sustainable Technology Platform for its low-carbon and energy conservation properties (UN-SDG 9) and prevention and destruction of pollution (UN-SDG 11).

How the Product takes Climate Resilience into account

Demand for energy-efficient solutions to reduce greenhouse gas emissions in cooling and heating processes is rapidly growing. GAINA, a versatile ceramic coating based on rocket insulation technology, provides an effective solution. absorbing 93% of ultraviolet light when applied to external walls and reflecting 87% of near-infrared light, which prevents heat absorption and maintains cooler interiors. Applied to interior walls, it retains approximately 60% of heat energy and cold air from air conditioning, enhancing its effectiveness.

Green Building Technologies | Government

APPLICATION OF CONSTRUCTION ROBOTICS IN PUBLIC HOUSING DEVELOPMENTS

Construction Robotics for painting and wall rendering to enhance efficiency and environment friendliness

Objectives

To address the problems of shortage and ageing of skilled labour, improve site safety and achieve more environmentally friendly construction.

Facing the problem of a shortage of skilled labour and ageing of the workforce, the Housing Authority (HA) has recognised the importance of using construction robotics. By incentivising tenderers with bonus marks to adopt such technologies, over 40 HA building projects have included the use of construction robots for both indoor and outdoor painting works.

Tasks that were once physically demanding and potentially hazardous to human labourers are now carried out with precision and efficiency. By programming the robots to perform repetitive tasks accurately, not only is uniform coverage ensured but also human error eliminated, the risk of work at height reduced and materials waste lowered, resulting in more environmentally friendly construction sites. Moreover, as the robots work tirelessly without breaks, project completion is expedited and construction efficiency enhanced, contributing to low-carbon targets.

Two examples of construction robotics application are:

1. Indoor paint spraying making use of Building Information Modelling (BIM) technology to automate tasks such as painting walls and ceilings. For a typical domestic unit, a single operator can remotely control multiple robots simultaneously to cover over 90% of indoor painting works,

2. A "3 in 1" multifunctional wall rendering robot combining wall plastering, grinding and painting works. The robot employs laser scanning together with AI vision and algorithms to map the surrounding layouts, including obstacles like ceiling and pipe ducts, to achieve optimum operational efficiency.

Project Team

Project Name	Application of Construction Robotics in Public Housing Developments
Name of Organisation	Hong Kong Housing Authority

Sustainability Action(s) of the Project

The adoption of construction robotics not only enhances construction quality but also improves the safety culture of the industry. By removing the 3Ds (Dirty, Dangerous, Dull) label associated with construction work, HA can attract a new generation of talented individuals and elevate the professional image of the industry. In essence, the integration of construction robotics is a testament to HA's commitment to excellence, innovation, and sustainability in public housing projects.

Green Building Technologies | Government

DEVELOPMENT OF HOUSING AUTHORITY PROJECT INFORMATION MANAGEMENT AND ANALYTICS PLATFORM (HA-PIMAP)

Integrated Digital Management Platform with Digital Twin, BIM and GIS to uplift managerial efficiency and project sustainability

With housing production set to increase in the coming years, and plentiful amounts of data generated in construction, HA has developed its own centralised cloud-based digital management platform, the Housing Authority Project Information Management and Analytics Platform (HA-PIMAP). The platform was piloted at HA's Yip Wong Road Project in 2022 and unveiled in July 2023. HA is the first government department to develop such a comprehensive source for project data, ensuring that all involved parties have access to the latest and most pertinent information.

HA-PIMAP is characterised by its cloud-based infrastructure and innovative use of 3D digital maps and Digital Twin technology, seamlessly integrating data from diverse Internet of Things (IoT) applications in the sphere of public housing projects. By harmonising with recognised models such as Building Information Modelling (BIM) and the Geospatial Information System (GIS), the platform renders 3D visualisations throughout the project life cycle and enables real-time monitoring of construction activities. Stakeholders can proactively track progress, pinpoint bottlenecks and institute corrective measures expediently. Moreover, the robust analytical tools within HA-PIMAP shed light on valuable insights derived from collected data, empowering decision-makers to optimise project performance with spontaneous command, analysis, and decision and uplift the overall sustainability.

In the planning phase, HA-PIMAP provides a comprehensive 3D model of surrounding developments and a panoramic view of geographical constraints to expedite decision-making processes in site selection. Meticulous analysis of environmental impacts, such as microclimate studies and solar and wind analysis, facilitates refinement of building designs and layouts to align with sustainability imperatives. During the construction stage, integration of data from prefabrication factories, such as the status of Modular Integrated Construction (MiC) units allows real-time monitoring for achieving just-in-time delivery and operational efficiency as well as reducing carbon emissions.

To enhance construction safety, HA-PIMAP integrates with smart site safety systems and IoT devices to heighten vigilance and pre-empt hazard identification. Noteworthy applications include the integration of data from smart helmets with IoT installations to trigger alerts in hazardous zones, exemplifying the platform's commitment to bolstering safety protocols.

Project Team

Project Name	Development of Housing Authority Project Information Management and Analytics Platform (HA-PIMAP)
Name of Organisation	Hong Kong Housing Authority

Objectives

To provide an integrated management platform for data visualisation and analytics at various stages of public housing development project to enhance works productivity, improve site safety, and uplift managerial efficiency and project sustainability.

Sustainability Action(s) of the Project

The multidimensional capabilities of HA-PIMAP not only provide analytics to streamline project operations and fortify safety protocols, but also harness the benefits of data to generate synergies, foster a culture of excellence and innovation in the construction industry and reduce carbon emissions.

Green Building Technologies | Government

USE OF HOLOLENS 2 FOR RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS

Greatly improving the existing STSTW environment and releasing about 28 hectare of land for other uses

Objectives

To upgrade the ageing Sha Tin Sewage Treatment Works and improve the surrounding environment.

The Trimble XR10 equipment with HoloLens 2 has revolutionised fieldwork for the relocation project by using mixed reality (MR) technology. The site supervision team can now verify the location of rock bolts or drill holes in real-time, eliminating the need to wait for survey results.

During site inspection of blast holes, comprehensive information is available including total blast hole count, blast hole positions, delay sectors, in-hole delay times and blast hole types.

Project Team

Project Name	Use of HoloLens 2 for relocation of Sha Tin Sewage Treatment Works to Caverns
Name of Organisation	AECOM
Collaborating Party	Drainage Services Department

https://www.ststwincaverns.hk/index.php

Using traditional inspection methods, engineers manually count blast holes using 2D drawings, resulting in time-consuming and error-prone inspections. With the HoloLens inspection method, engineers and work supervisors can project a virtual blast design onto the actual blasting surface, saving resources and reducing environmental impact. They can instantly check the alignment of each blast hole and delay sector with the design, reducing resource consumption and ensuring accurate inspections at a glance.

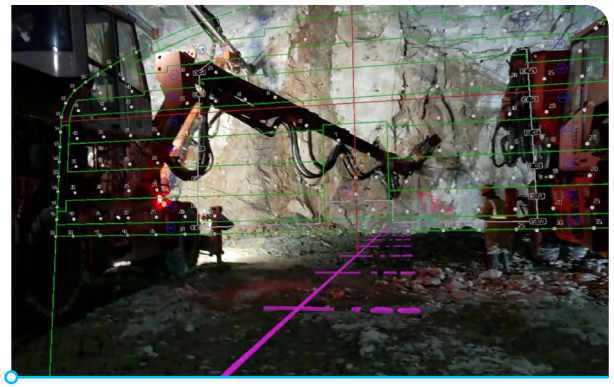
The benefits of using HoloLens for blast hole inspection are significant. Firstly, it improves construction quality by enabling more accurate inspections. The virtual projection verifies blast hole positions, reducing errors and discrepancies. Secondly, it increases work efficiency by speeding up the inspection process. Engineers can quickly assess the total number of blast holes needed by viewing the virtual projection. This can avoid unnecessary drilling and optimise the placement of drill holes, ensuring efficient use of materials. Thirdly, it enhances construction safety by reducing human errors during inspections. The clear visual representation of blast holes eliminates misunderstandings and ensures the blasting process adheres to the intended design. The equipment's hands-free operation also improves safety levels as engineers can focus on the inspections while having necessary information projected on to their field of view, enhancing situational awareness and response capabilities.

Sustainability Action(s) of the Project

The safety and efficiency benefits of using HoloLens are complemented by a Digital Works Supervision System (DWSS) which allows information to be digitally checked and updated anytime and anywhere, which not only greatly reduces paper consumption, but also makes record management faster and easier.

Waste is also reduced by maximising the reuse of materials such as trees, rocks, and fill materials produced during slope and tunnelling works. Furthermore, collaboration with other construction sites to find alternative disposal sites allows for better waste management.

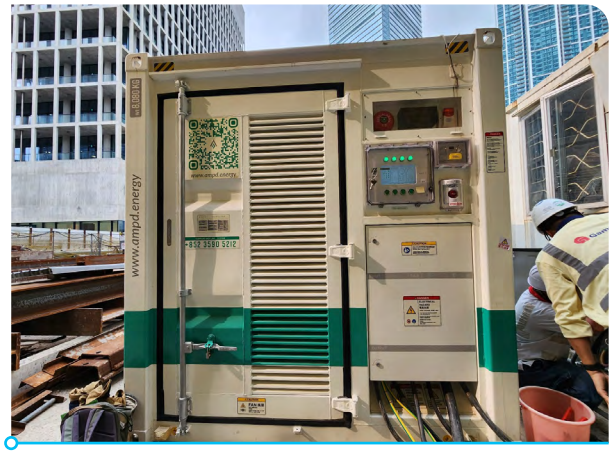
Additionally, solar energy facilities and solar street lights have been installed at the community liaison centre (CLC), footpaths and cycle track. The use of innovative technologies like Design for Manufacture and Assembly (DfMA) and Modular Integrated Construction (MiC) in the construction of CLC and Temporary Vehicle Bridge has reduced the overall impacts and carbon emissions.



Green Building Technologies | Industry

ADOPTION OF AMPD ENERTAINER AT LYRIC THEATRE COMPLEX

Powering the development of West Kowloon Cultural District sustainably



The construction industry has long been reliant on diesel generators for on-site power, grappling with environmental concerns and efficiency constraints. In this respect, the innovative Ampd Enertainer Battery Energy Storage System (BESS) takes a groundbreaking step towards sustainability by offering a cleaner, quieter and more reliable power supply.

Enertainer stores electrical energy for on-demand use at construction sites, reducing diesel dependency and benefiting sites near sensitive environments by lowering pollution and noise. For construction of the Lyric Theatre Complex at West Kowloon Cultural District, deploying it to power tower cranes significantly cut the project's diesel usage by 184,000L per year, reducing CO_2 emissions by 429T per year and exemplifying green construction. It also eliminates the manual efforts and risks of diesel refuelling.

An essential component of the product is Enernet, an intuitive online platform that allows contractors to monitor and manage the energy storage system remotely. This helps optimise energy use and provides valuable data analytics.

Project Team

Project Name	Adoption of Ampd Enertainer at Lyric Theatre Complex
Name of Organisation	Ampd Energy
Collaborating Party	Gammon Construction Limited

Sustainability Action(s) of the Project

The Enertainer represents a pioneering step in construction site power management and an important milestone for electrification of the construction industry, which will curtail greenhouse gas emissions, enhance air quality and reduce noise pollution, creating a safer and more enjoyable environment for all.

How the Technology takes Climate Resilience into account

Enertainer is a strategic innovation designed to bolster climate resilience in the construction industry by addressing and adapting to the multifaceted challenges posed by climate change. By replacing diesel generators, it significantly cuts greenhouse gas emissions. Construction sites become less vulnerable to the volatility of fossil fuel markets, which are expected to become more unstable with the advancing impacts of climate change.

Objectives

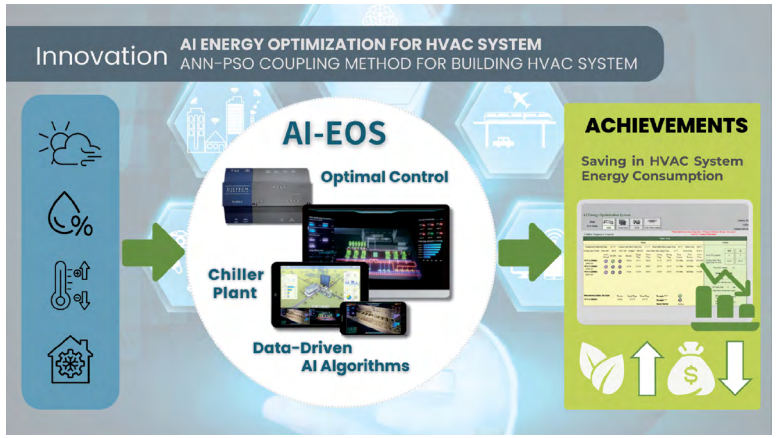
To reduce diesel fuel usage on construction sites.

The robust design of Enertainer ensures that it can withstand an anticipated increase in extreme weather events, providing reliable power that supports construction continuity in the face of climate uncertainty.

Green Building Technologies | Industry

AI ENERGY OPTIMISATION SOLUTION (AI EOS)

Optimising HVAC energy consumption by continually monitoring and controlling different system components



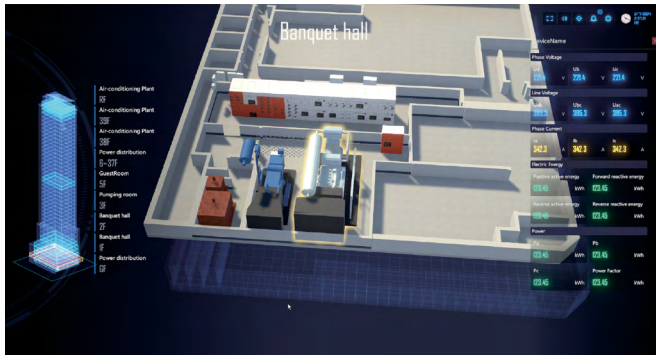
The AI Energy Optimisation Solution (AI-EOS) is designed to optimise the energy consumption of central air-conditioning systems by using big data analysis, while maintaining the thermal comfort of the occupants. It responds to real-time system load and changes in external weather conditions to continuously monitor and control different system components. The software solution also takes into consideration the effects of equipment degradation, and provides support for tower cranes, passenger or material hoists, welding, non-stop power supply and other construction needs.

Objectives

To reduce the energy consumption of central HVAC systems by responding to real-time system load and changes in external weather conditions.

Through big data analysis, the optimal set points can be calculated to reach the lowest energy consumption of the system while maintaining the occupants' thermal comfort. The first application project of AI-EOS, Holiday Inn Express Hong Kong SoHo, has helped achieved energy savings of 30%.

AI-EOS has also shown significant results in several public projects. In due course, it is planned to apply its big data analysis functions to other applications, such as the control of sewage plant pumping stations.



Project Team

Project Name	AI Energy Optimisation Solution (AI EOS)
Name of Organisation	REC Green Technologies Co. Ltd.

https://www.youtube.com/watch?v=eITGSf0Wz8M
https://www.youtube.com/watch?v=-58IKJdJ6No&list=TLGGqyaxYo8WeYkyMDAzMjAyNA&t=7s
https://www.rec-gt.com/solutions/ai-eos/

Green Building Technologies | Industry

AI-DRIVEN DIGITAL TWIN FOR ESG EXCELLENCE

Leveraging AI for Sustainable Success

Objectives

- To improve environmental performance by analysing and optimising resource consumption, waste management and emissions.
- To support regulatory compliance, reducing the administrative burden of ESG reporting.
- To support smart facilities management by integrating ESG considerations into the operation and maintenance of buildings and infrastructure.

ESG reporting has become a duty rather than an option, bringing permanent changes to how companies operate and are held accountable. To navigate the evolving ESG landscape, organisations must rethink their reliance on manual-based work practices and embrace advanced technologies. ATAL's ESG-centric Digital Twin utilises AI algorithms to optimise ESG performance. By continuously gathering and analysing data from various sources, such as Building Management Systems and environmental sensors, its machine learning algorithms uncover trends, patterns and actionable insights, facilitating the development of sustainability plans that align with organisational goals. Additionally, the platform generates customisable ESG reports, offering stakeholders up-to-date views of ESG performance.

The AI-powered Digital Twin is a versatile tool that seamlessly integrates into building management. It can monitor and analyse real-time energy usage, optimising building systems to save energy while maintaining occupant comfort. Its predictive maintenance capabilities prevent breakdowns and automate maintenance scheduling. Indoor environmental quality is enhanced by monitoring and adjustments based on factors such as air quality, temperature and humidity, creating a healthier and more comfortable environment. Safety and security are prioritised with video data analysis for issue detection and crowd monitoring. When managing multiple buildings, the Digital Twin provides a comprehensive view of the property portfolio, facilitating informed decision-making and efficient resource allocation.

Project Team

Project Name	AI-driven Digital Twin for ESG Excellence
Name of Organisation	ATAL Engineering Group

Sustainability Action(s) of the Project

- Carbon Footprint Reduction
- Resource Conservation
- Sustainable Operations and Maintenance
- Stakeholder Engagement and Education

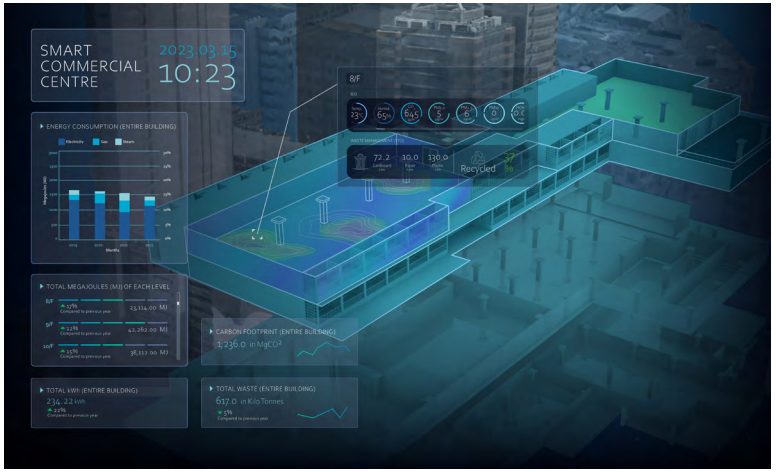
Green Building Technologies | Industry

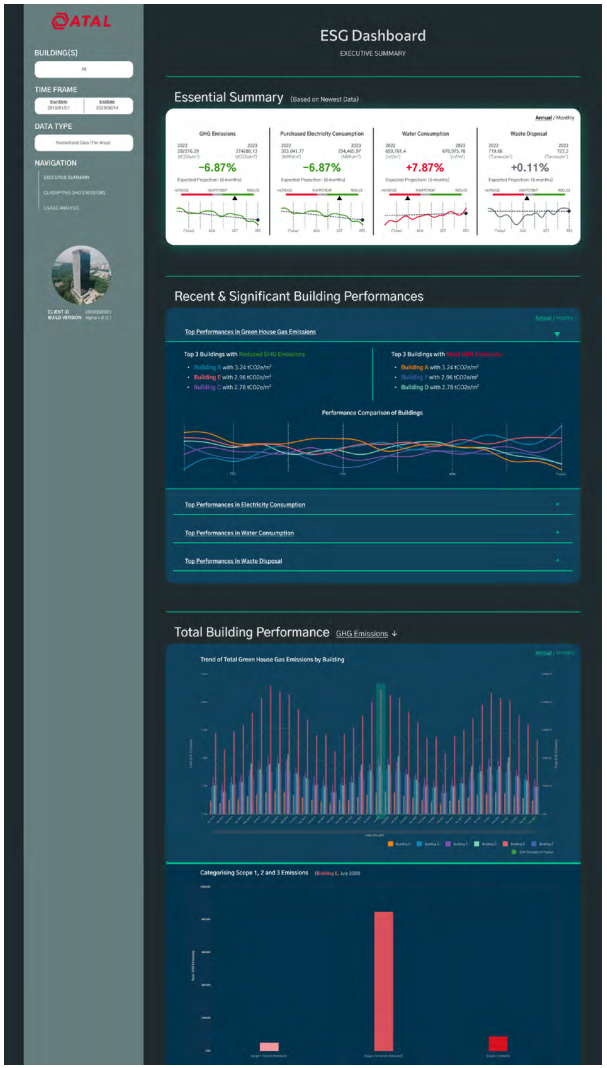
AI-DRIVEN DIGITAL TWIN FOR ESG EXCELLENCE

How the Technology takes Climate Resilience into account

By integrating climate resilience considerations into its functions, the AI-driven Digital Twin assists in combating and adapting to the challenges posed by climate change. It enables proactive planning, risk assessment, simulation and optimisation, contributing to more resilient and sustainable built environments.

- **Data Analysis:** The AI-driven Digital Twin utilises AI algorithms to analyse vast amounts of data, including historical climate data, weather forecasts, and other relevant environmental information. By understanding these patterns and trends, the AI-driven Digital Twin can adapt to various changes.
- **Adaptive Operations and Maintenance:** The AI-driven Digital Twin helps optimise building operations and maintenance practices in response to changing climate conditions. It can dynamically adjust energy management systems, HVAC controls, and other building systems to maximise energy efficiency and occupant comfort levels while considering climate resilience.
- **Real-time Monitoring and Alerts:** The AI-driven Digital Twin continuously monitors environmental conditions, including temperature, humidity, wind patterns, and precipitation. It provides real-time alerts and warnings, enabling timely responses to climate-related risks, such as extreme heat or floods.
- **Emergency Response and Recovery:** The AI-driven Digital Twin facilitates emergency response and recovery efforts, and supports decision-making by providing real-time data and situational awareness to users.





Green Building Technologies | Industry

BAMAKO BURNER

All-in-one Joss Paper Burning System for Smoke and Fly Ash Removal and Heat Absorption

Objectives

To minimise health and environmental hazards of black smoke, providing a brand new experience of a smoke-free, healthy, and green environment.

The Bamako Burner provides an effective solution for filtering black smoke and total suspended particulates in funeral or remembrance settings, with over 90% removal efficiency and zero emissions of black smoke. It not only safeguards the health of neighbouring residences, worshippers and facility staff, but also meets the expectations of the Government, environmental groups and society at large. Hence neighbourhood relationships can be harmonised.

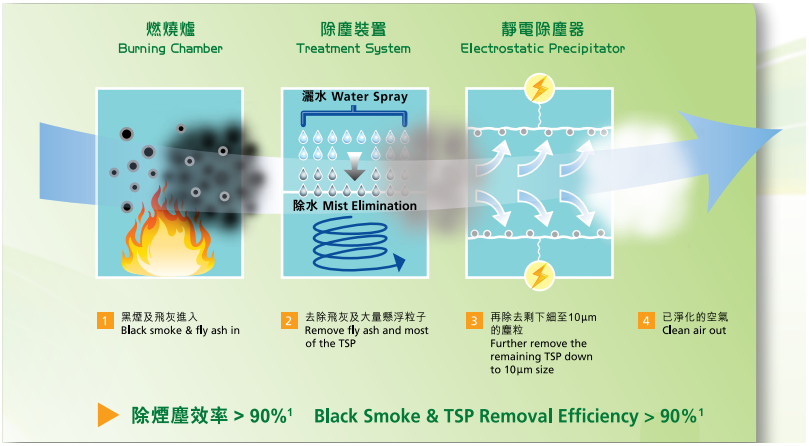
The Bamako Burner is included by Environmental Protection Department in its List of Local Suppliers of Cremation Equipment and Air Pollution Control Equipment (APCE) for the burning of paper offerings.

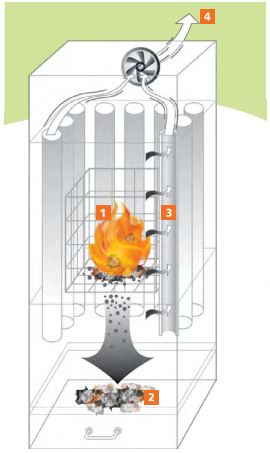
Project Team

Project Name	Bamako Burner
Name of Organisation	REC Green Technologies Co. Ltd.

https://www.youtube.com/watch?v=fUfnmNsxhk0
https://www.youtube.com/watch?v=4iqRoRaBD-Q
https://www.rec-gt.com/solutions/bamako-burner/

Wet-type Joss Paper Burning System





Dry-type Joss Paper Burning System

Green Building Technologies | Industry

BETTER GREEN BUILDING WITH INTELLIGENT TECHNOLOGY

By using the advanced construction robot technology, concrete work can change from low-precision to high-precision, save the worthless structure and process, reduce construction costs and environmental pollution

Constructing the flooring of a building using traditional techniques requires a three-stage process: a structural concrete layer, a fine aggregate concrete levelling layer of varying thickness according to building purpose, and a floor material layer. Using high-precision concrete technology can eliminate the need for a levelling layer, with the deployment of fabric robots, levelling robots and polishing robots achieving the high levels of flatness required. Three robots can replace eight workers, reducing the construction costs of a typical living room by more than HK$260/m^2.

By eliminating the levelling layer, a project covering 100,000m^3 can save 2,432m^3 of sand and gravel mining, save transportation of 4,864t and save carbon emissions of 705t, as well as shortening the construction period and reducing steel reinforcement usage. Cost savings on labour and machinery are also substantial.

How the Technology takes Climate Resilience into account

For the above-ground portion of a swinging platform, according to the Guangdong Province Housing Construction and Decoration Quota Specification, a 20mm thick levelling layer is required, which translates to mortar consumption of 2.02m^3 per 100m^2, or 0.06t. By using composite cement instead of Ordinary Portland Cement (OPC), a high-precision concrete floor slab can be achieved with savings in carbon emissions of 488t for a 100,000m^2 project, as every tonne of cement produced creates one tonne of carbon dioxide.

For the below-ground portion of the swinging platform which requires a 50mm thick levelling layer, traditional construction would require 4.08m^3 of pre-mixed concrete per 100m^2 and 0.06t of OPC. Using C20 fine aggregate concrete can save 217t of carbon emissions for a 100,000m^2 project.

It is anticipated that if applied to a residential building of 6-18 floors with a basement, savings in carbon emissions of around 9.53 million tonnes could be achieved, as well as substantially reduced labour and materials costs.

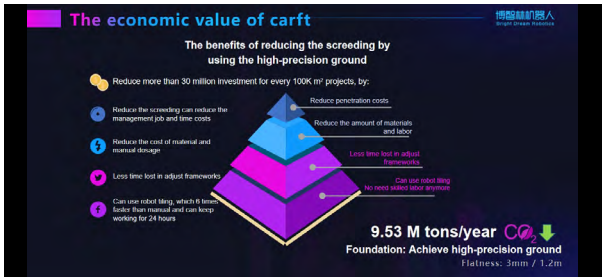
Project Team

Project Name	Better Green Building with intelligent technology
Name of Organisation	Bright Dream Robotics Co., Ltd.
Collaborating Party	Bright Intelligent Construction (HK) Company limited

https://youtu.be/oTkc8Isgx3E

Objectives

To combine the advantages of high-precision concrete with robotic technology to significantly lower construction costs and reduce carbon emissions.



Green Building Technologies | Industry

BUBBLEDECK BD 340

Building with Sustainability

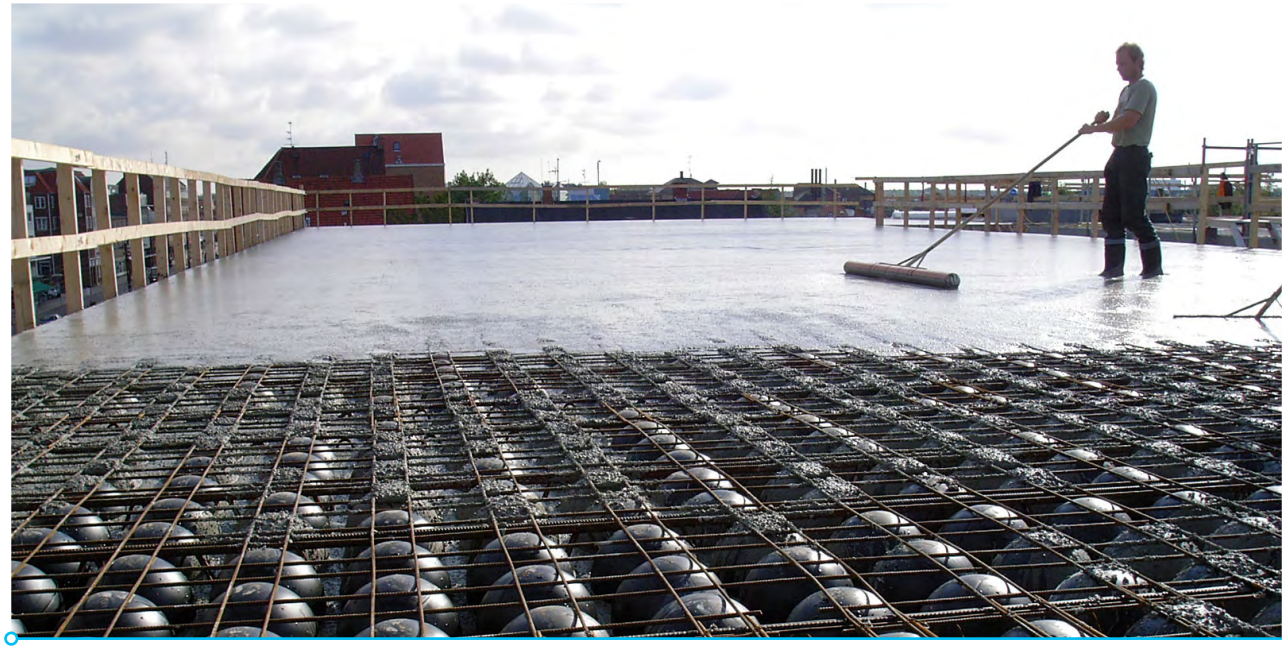
BubbleDeck helps to reduce embodied carbon in reinforced concrete structures by adopting a flat slab design and displacing the concrete in such a way that the reinforcing bars can be made lighter without sacrificing any of the required structural performances. The product can be made as precast elements or on-site modules; in either case the building process produces less waste and can be completed faster. The bubbles are made of recycled high-density polyethylene (HDPE) which enhances the product's sustainability.

Objectives

To reduce embodied carbon in building structures.

How the Technology takes Climate Resilience into account

BubbleDeck is an environmentally-friendly technology offering substantial sustainability value in the construction of buildings. By reducing embodied carbon in concrete structures, it lowers carbon emissions.



Project Team

Project Name	BubbleDeck BD 340
Name of Organisation	Advanced & Sustainable Technologies Limited
Collaborating Party	BubbleDeck (International) Limited

https://www.youtube.com/watch?v=YNscXlvrZ9c

Green Building Technologies | Industry

CLOUD-BASED SMART ENERGY MANAGEMENT PLATFORM (CBSEMP)

Digitalising energy management, driving energy efficiency

Objectives

To collect, analyse and visualise real-time energy and operational data from buildings across Swire Properties' portfolios with the goal of optimising energy performance.

The CBSEMP is a centralised cloud platform that collects, analyses and visualises real-time energy and operational data of Swire Properties' portfolios in Hong Kong and Mainland China. Implementing the platform required connection to local BMS and power metering systems, allowing full coverage of operational data and energy consumption for major equipment and systems.

The platform digitalises the process of monitoring-based commissioning (MBCx), automating energy analysis, operation analysis, control optimisation, and performance monitoring. It is now connected to 24 buildings with a total GFA of 1,860,000m^2, and is continually expanding to include the remaining buildings in Swire Properties' portfolio. Currently, over 41,000 energy and operational data points are collected across the portfolios every 15 minutes, which are then processed by the platform in real-time, converting raw data into useful KPIs for performance tracking and conducting analysis.

Through this collected data, the platform can utilise its AI Rule-Based Expert System to identify energy saving opportunities, automatically analysing the incoming data and providing real-time suggestions. Its multi-layer logic allows more precise diagnosis, eliminating false alarms.

Using machine learning, the platform can now predict the coming 24-hour cooling load of a chiller plant in 15-minute time steps, with accuracy of approximately 95%.

Project Team

Project Name	Cloud-Based Smart Energy Management Platform (CBSEMP)
Name of Organisation	Swire Properties Limited

Sustainability Action(s) of the Project

- Continuously monitors energy performance and energy reduction in line with the company's Science Based Targets
- Dashboards for visualising energy performance
- Automatic Reporting
- Data Analysis enabling flexible chart building
- Smart AI Diagnosis for identifying system inefficiencies
- Machine learning module for cooling load prediction and chiller plant optimisation
- Expected to help reduce HVAC energy consumption by over 10%

How the Technology takes Climate Resilience into account

CBSEMP continuously monitors the energy performance of the connected buildings and analyses the efficiency of their building systems. Through its analysis, energy performance is enhanced, reducing carbon emissions.

Green Building Technologies | Industry

CONDUCTOR CONSTRUCTION MANAGEMENT PLATFORM

Revolutionising Construction through Integration and Collaboration

Objectives

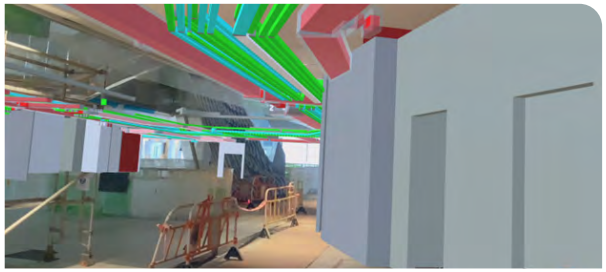
To improve building life cycle by integrating a digital management platform with Building Information Modelling (BIM).

The construction industry has growing demand for safer, smarter and more sustainable practices. However, a lack of co-ordination among some smart construction tools has limited their full potential. The Conductor digital platform is designed to address this challenge by integrating with Building Information Modelling (BIM) to enable seamless collaboration and improved decision-making. During the design stage, it leverages BIM data for aligned design and materials information. In the operational stage, it accesses BIM's repository for effective facilities management.

Similar to the role of a conductor in an orchestra, Conductor guides the collaboration of various smart tool providers, providing a well-defined framework to maximise the benefits of these tools working together. One of its key features is its ability to access and manage data from multiple tools and construction sites through a single log-in.

Users can select and customise their suite of smart tools based on specific project needs. The platform also offers a dedicated mobile app which streamlines site safety management, allowing users to capture and upload photos of safety issues and trigger task requests for resolution.

In addition the platform collects extensive data from various construction sites to give users a spatial perspective through a 3D BIM model. This innovative feature enhances situational awareness for operators by displaying alerts and notifications within the spatial context of the site.



Project Team

Project Name	Conductor Construction Management Platform
Name of Organisation	Arup

https://youtu.be/HK0L5Tmnvy0?si=JqLDIyFlvDcLCEgX
https://www.arup.com/projects/conductor

Sustainability Action(s) of the Project

- Dedicated Climate & Sustainability Modules.
- Integration with BIM.
- Worker Safety and Heat Stroke Prevention, by integrating real-time data from smartwatches worn by construction site workers.
- Climate Resilience through tools that allow users to assess and mitigate risks associated with extreme weather events and changing climate conditions.

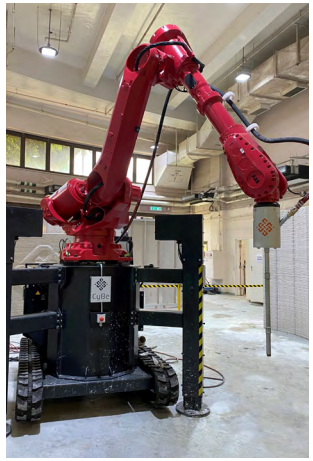
How the Technology takes Climate Resilience into account

Conductor takes climate resilience into account by integrating various features, tools and collaborative efforts to effectively combat and adapt to the challenges posed by climate change. It recognises the need to address climate-related risks and ensures that construction projects are designed and executed with long-term resilience in mind.

Green Building Technologies | Industry

ECO-MATERIALS FOR DIGITAL CONSTRUCTION BY 3D PRINTING

Developing Eco-materials for 3D Printing to Create a Sustainable City



Project Team

Project Name	Eco-materials for Digital Construction by 3D Printing
Name of Organisation	Nano and Advanced Materials Institute
Collaborating Parties	Architectural Services Department Chinachem Agencies Limited China State Construction Engineering (Hong Kong) Limited Chevalier (Construction) Company Limited Pacific Asia Limited Construction Industry Council HKALPS Limited The Hong Kong Polytechnic University
Members of Research / Planning Team	Dr Ivan SHAM, Dr Gordon LEUNG, Dr Dan HE, Mr Xianrui CHEN, Mr Xuan LIU, Mr Adye KWOK, Mr Alan LAM, Prof. Chi Sun POON, Dr Kin-hung CHUNG

With its advantages of cost reduction, time saving and lowered labour requirements, 3D concrete printing is an emerging technology in global construction applications. The aim of this project is to develop printable 3D concrete formulations using recycled and low carbon materials, specifically focusing on concrete extrusion. This will meet the requirements of load deflection and durability for various applications, such as outdoor furniture and wall planters.

The design considerations for 3D concrete printing construction were first identified, including load deflection requirements, durability under service load, and the construction and fixing sequence. Incorporating environmentally friendly materials such as recycled aggregates, GGBS and PFA will help reduce carbon emissions. Over 30% of low carbon materials and recycled materials have been utilised in the formulation developed. Admixtures such as viscosity modified agents and thixotropic agents can be added to the formulation at an optimised dosage to enhance its printing properties.

By utilising 3D concrete technology, accurate and customised production of designs and shapes can be realised rapidly and cost-effectively. Large-scale prototypes have been successfully printed to verify the feasibility of the process. Four furniture designs were selected from a competition organised in collaboration with Architectural Services Department and HK PolyU, printed and installed in Kwu Tung North Multi-welfare Service Complex in 2023. 16 wall planters have also been printed and installed along a slope feature at Hung Hom under a CEDD project in 2024.

Objectives

To develop printable 3D concrete materials incorporating low carbon raw materials and recycled construction waste.

The use of other local eco-friendly materials, including biochar and recycled plastic aggregate, is now being explored to minimise waste and reduce carbon emissions for the construction industry.

Sustainability Action(s) of the Project

- Use of low-carbon raw materials
- Reuse of construction wastes
- Formwork eliminated by 3D printing
- Materials waste reduced and working efficiency enhanced

How the Technology takes Climate Resilience into account

The formulation incorporates low-carbon raw materials to minimise carbon emissions, and utilises construction by-products or recycled aggregate to reduce the burden on landfills, helping Hong Kong achieve a greener and more sustainable environment.

Green Building Technologies | Industry

ENERGY SAVING WITH LOW ENERGY AIR FILTERS

Plug-and-play Low Energy Air Filter that saves energy, improves IAQ, and reduces carbon emissions and filter waste

Objectives

To contribute to substantial energy savings in HVAC systems and improve indoor air quality (IAQ).

The market demands antiviral and antibacterial HVAC filters with good filtration efficiency and low pressure drop that can achieve energy savings. The technical challenge is to produce low-pressure-drop HVAC filters without sacrificing filtration efficiency. To achieve this, cutting edge nano-technology and pleating technology have been adopted for manufacturing the filter media of Nanofil's Low Energy Air Filter (LEAF). The air resistance of LEAF is exceptionally low compared with commonly available bag filters made of micro-glass or synthetic fibres.

Project Team

Project Name	Energy Saving with Low Energy Air Filters
Name of Organisation	Nanofil Filtration Technology Limited
Collaborating Party	Television Broadcasts Limited

https://www.nanofil.com.hk/2023/11/04/green-building-award-2023-grand-award-building-products-technologies-category/

https://www.hkgbc.org.hk/eng/membership/members-corner/2023/20230308_NanoFIL.jsp

LEAF can also achieve improved IAQ and a lower Total Cost of Ownership (TCO) in terms of energy and filter maintenance costs. In addition, it can exterminate bacteria and viruses, including the COVID-19 Omicron variant. It is a plug-and-play solution that requires no modification of the HVAC system. Even buildings with limited space can take advantage of this innovative filtration technology without sacrificing performance.

A recent trial at TVB City in which existing pre-filters and bag filters were replaced with Nanofil LEAF in 70 AHUs and PAUs revealed it could save around 40% of electricity (fan), reduce carbon emissions by 240 tonnes and eliminate 75% of filter waste per year, also improving IAQ and contributing to ESG performance.

Sustainability Action(s) of the Project

- Saves energy and reduces carbon emissions
- Improves IAQ, particularly by reducing ultra-fine particles
- Saves labour costs from frequent replacement of pre-filters and bag filters
- Reduces waste, especially filter waste, reducing pressure on landfills
- Eliminates water consumption for regular cleaning of aluminium mesh filters
- Reduces risk of pandemic spread, eliminates mildew, bacteria and viruses
- Higher cooling coil heat transfer coefficient, increased cooling capacity of AHUs and PAUs

Green Building Technologies | Industry

INSTALLATION OF ECOSONIC FILTERS FOR SUN HUNG KAI CENTRE

Joint industry initiative to protect health and save energy, achieving annual savings of 500,000 kWh

Objectives

- To replace filters of lower MERV grading with those using sonic technology, thereby maintaining or improving filtration efficiency while enhancing indoor air quality (IAQ).
- To achieve energy savings by reducing pressure drop, lowering fan power requirements.

The core innovation behind Aurabeat's EcoSonic Technology is its sonic emitters, which introduce a new dimension to the filtration process. By infusing the air with vigorous vibrations as it passes through the filter core, this technology significantly enhances the capture rate of the filter, achieving at least two MERV ratings higher than conventional filters. The AHU fan can operate at reduced speeds while still maintaining the same volume of clean air in the building, resulting in energy savings of 15-35% in the HVAC systems.

In addition, compared with conventional filters that rely on higher fibre density, the EcoSonic filter cores are more porous. This achieves equivalent clean air output without extra filter resistance.

These air purification improvements and energy savings assist building owners to attain better scores in certifications such as WELL, making the properties more desirable to tenants. The filters' compatibility with existing systems and customisation potential add further to their appeal, ensuring they meet the diverse needs of various facilities.

Project Team

Project Name	Installation of EcoSonic Filters for Sun Hung Kai Centre
Name of Organisation	Aurabeat Technology Limited
Collaborating Party	Sun Hung Kai Properties Limited

https://aurabeattech.com/success-stories/
https://youtu.be/NI5BFVpAubk

Before installing EcoSonic

After installing EcoSonic

Sustainability Action(s) of the Project

After the air filters at Sun Hung Kai Centre were replaced with higher MERV grading filters using EcoSonic technology, savings were measured of 507,384 kWh in annual electricity consumption, over 14% in fan power, and over 57% in pressure drop.

How the Technology takes Climate Resilience into account

This technology strengthens climate resilience by enhancing energy efficiency, filtration capabilities, durability and adaptability to varying environmental conditions. It can contribute to more sustainable operations and healthier indoor environments, which are crucial in the context of a changing climate.

Green Building Technologies | Industry

INTELLIGENT FAN COIL UNIT (iFCU)

Patented technology using a permanent magnet rotor to generate magnetic flux

Objectives

To eliminate the source of power loss and achieve a high energy efficient operation, the iFCU has adopted the patented technology with a rotor of a permanent magnet to generate magnetic flux.

The Intelligent Fan Coil Unit (iFCU) adopts the rotor of a permanent magnet to generate magnetic flux, eliminating a source of power loss and achieving high energy efficiency in operation. By replacing mechanical brushes, the permanent magnet motor can also minimise noise levels and waste heat generation, thus improving motor lifespan.

With its variable speed drive, the motor further enhances the efficiency of the system compared with traditional fixed speed AC motor designs.

This patented technology has attained Platinum recognition in the CIC Green Product Certification.

Project Team

Project Name	Intelligent Fan Coil Unit (iFCU)
Name of Organisation	REC Green Technologies Co. Ltd.

https://www.youtube.com/watch?v=P7E7jF2IhzU
https://www.youtube.com/watch?v=8x39G1GSWaY&t=9s
https://www.rec-gt.com/solutions/ifcu/

Major Features

- **Variable speed FCU fully controllable**

  "AUTO" mode is available in iFCU, stepless variable fan speed is controlled based on room temperature set point. Reduce energy use while maintaining comfortable condition, e.g. unoccupied mode to maintain the minimal RPM and energy usage.

- **Programme Customisation to fit client's application/ configuration**

  Tailor-made programme to work with different system and fit the occasions requirements. Modbus Thermostat, Room control unit (0-10V), Group Control, RPM adjustment & wireless group control etc.

- **Duct type sensor**

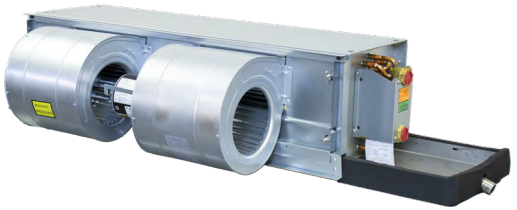
  Installed in return-air box to control temperature accuracy up to ± 0.5°C to increase human comfort.

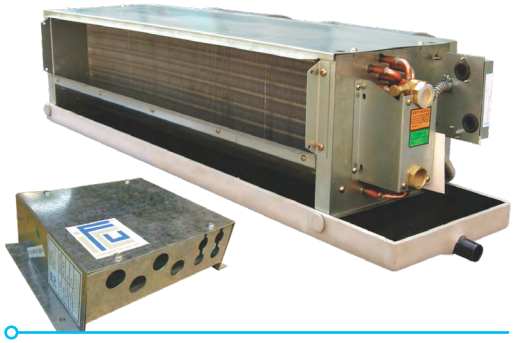
- **Both high & low static**

  Applicable to both high & low static pressure setting.

- **Wi-Fi Control**

  Can be controlled through any mobile device.





Green Building Technologies | Industry

KOWLOON HOSPITAL STREET LIGHTING UPGRADE PROJECT

Solar LED Lighting with Revolutionised Management System

Objectives

To assist Kowloon Hospital in upgrading its traditional street lights with new-generation LED solar street lighting.

The traditional street lights at Kowloon Hospital are ageing, leading to escalating electricity consumption and maintenance costs. To address these issues, the hospital has decided to transition to solar-powered lighting. However, existing solar options face challenges such as delayed fault monitoring, excessive daytime use and a lack of comprehensive lighting reports.

The Solgenix lighting management system deploys new-generation LED solar streetlights to overcome these challenges, using wireless signal transmission to minimise the need for wiring materials. Individual solar LED lights collect and transmit data wirelessly to a central receiver,

which processes and stores the data in the cloud for easy access and interpretation by operators.

These centralised control and monitoring capabilities provide real-time updates and manual control for each solar light. Illumination levels are automatically adjusted according to actual needs, thus enhancing safety, visibility and energy efficiency. By reducing unnecessary consumption during low-traffic periods, the system extends the lifespan of LEDs and batteries.

Additionally, the system integrates with GIS technology for precise location tracking of each street light. Its compatibility with various devices enables remote monitoring and control from any location, offering greater flexibility and convenience.

Project Team

Project Name	Kowloon Hospital Street Lighting Upgrade Project
Name of Organisation	SPL Lighting (Hong Kong) Company Limited
Collaborating Party	Electrical and Mechanical Services Department

https://www.youtube.com/playlist?list=PL3Khq2hTaWZYaTeOFXWUWaPTd-Exyb9kb

Sustainability Action(s) of the Project

- Energy Efficiency: By transitioning from traditional street lights to solar-powered LED lighting, this project significantly reduces electricity consumption, lowering carbon emissions.
- Reduced Maintenance: Maintenance processes are streamlined through real-time monitoring and proactive fault alerts, minimising the need for frequent site visits.
- Extended Lifespan: The optimisation of illumination levels based on actual needs helps prolong the lifespan of LEDs and batteries, reducing waste and promoting resource efficiency.
- Enhanced Safety and Visibility: The project's focus on optimising lighting levels ensures improved safety and visibility in the hospital surroundings, contributing to a safer environment for patients, staff and visitors.
- Data-Driven Decision Making: Comprehensive data analytics and reporting features allow informed decision-making based on real-time insights.

Green Building Technologies | Industry

MAGNETIC TUNED MASS DAMPER

Magnetic Tuned Mass Damper for Sheet Piling Noise Reduction

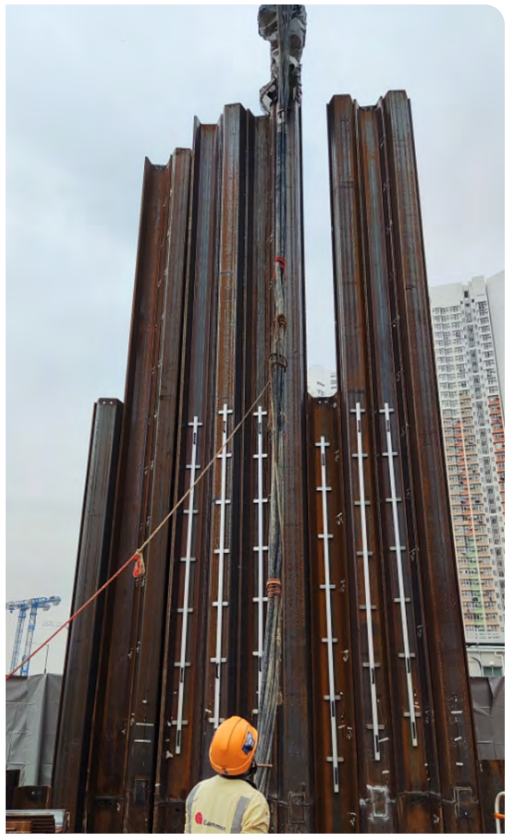
Objectives

To reduce noise radiated back from steel plates, such as when using hydraulic breakers and sheet pile walls.

The Magnetic Tuned Mass Damper (MTMD) uses amplified oscillations to counteract and absorb resonance vibrations. Each damper comprises multiple oscillation masses, made of stainless steel blocks sandwiched between resilient layers and magnets. During operation, most of the energy of the vibrating surface is transferred to the oscillating masses and dissipated by hysteresis in the resilient layers. The natural frequencies of the oscillating masses can be tuned independently by adjusting the stiffness of the resilient layers and the mass of the oscillators to provide effective damping.

The MTMD has three notable performance-enhancing features. Firstly, the masses oscillate along the directions of shear of the resilient layers, providing clear oscillation modes for absorbing vibration at target frequencies. Secondly, the damper's tunable natural frequency allows excellent noise reduction performance in a wide range of applications. The natural frequency of an object is affected by its shape and mass. MTMD comes with different sizes of oscillation masses, resilient layers and magnets, thus providing a wide range of natural frequencies to match the noise source. Thirdly, MTMD is convenient and easy to use, weighing around 2kg for each module and less than 20kg for an entire column that fills one sheet pile. Experienced workers can install MTMD in less than two minutes by themselves. A magnetic attachment on the surface allows easy installation and dismounting without machinery.

The MTMD can be custom manufactured with different column lengths and natural damper frequencies to match the vibration frequency of the noise source.



Project Team

Project Name	Magnetic Tuned Mass Damper
Name of Organisation	Acoustics Innovation Limited

https://youtu.be/Qcfq9DsFUdU
https://www.aihk.hk/

Sustainability Action(s) of the Project

MTMD is flexible and convenient for use on construction sites. Its light weight makes installation is fast and simple, allowing repeated usage at different sites. It minimises materials usage compared with conventional noise mitigation measures that require large obstacles to isolate or block the noise source.

Green Building Technologies | Industry

MATERIALS MANAGEMENT APP (MMA)

A digital platform to reduce costs, carbon emissions and landfill use

Objectives

To provide an effective and transparent communication channel for materials information exchange.

The Government's Climate Action Plan 2050 outlines four major decarbonisation strategies. It recognises that achieving carbon neutrality will require a variety of measures, of which improving waste management is a key element. It is essential for the construction industry to consider its strategy for the management and reduction of construction waste.

In Hong Kong, construction waste is sent to public landfills. Over 90% of it is inert waste (rock, demolition waste, concrete, etc). A major concern is that the limited space in public landfills is fast diminishing. As current forecasts indicate that the volume of waste generated will increase significantly in the next 10 to 15 years, it is clear that a solution is required now to minimise waste generated by the construction industry.

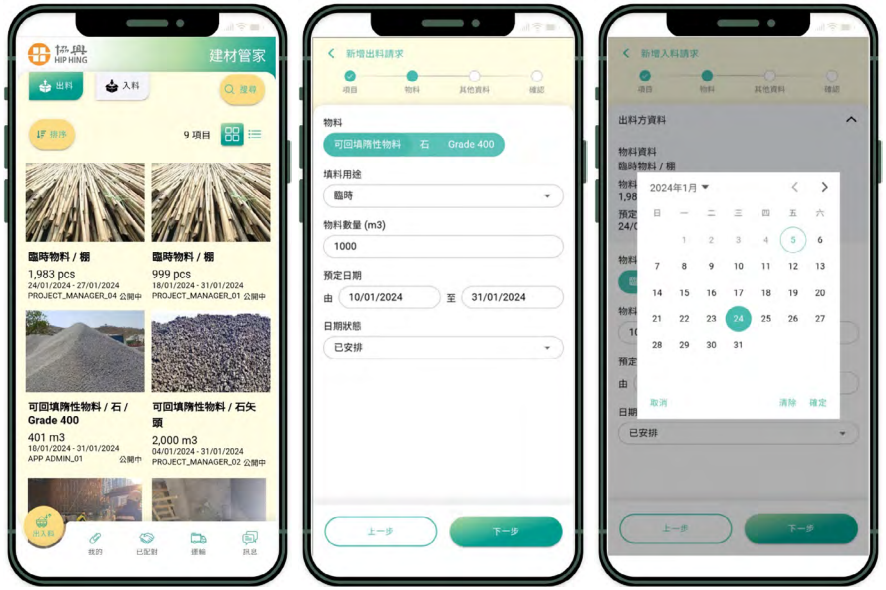
Project Team

Project Name	Materials Management App (MMA)
Name of Organisation	Hip Hing Construction Company Limited

In order to crack one of the pain points and help the industry become more environmentally-friendly and sustainable, Hip Hing has developed a digital materials exchange platform, MMA. which provides an effective and transparent communication channel for materials exchange among users.

The platform is divided into four parts: Data input, Order Matching, Document Collection, and Daily Operations. Users of the App first input details of their import requirements and disposal plans, including types and amounts of materials, key dates or time periods, and site locations. Based on the above information the MMA's pre-set algorithms will determine the most suitable match of import and disposal.

Necessary documents such as letters of authorisation for importing or exporting materials and test reports can be uploaded to the system for review and verification before proceeding with the exchange. The Daily Operations stage records every exchange trip, including date and time, vehicle types, loading conditions and photos. Frequently used construction materials including aggregate, soil, broken concrete and structural steel have been selected for trial in the pilot version of MMA.



Sustainability Action(s) of the Project

- Reduces construction waste
- Reduces CO_2 emissions from transportation
- Reduces the use of landfill / public fill space

Green Building Technologies | Industry

MULTIH MERV 14 COST EFFICIENT 2-IN-1 AIR FILTER

A revolutionary step towards making clean air more easily accessible

Objectives

To reduce the energy consumption and urban waste disposal costs associated with air-conditioning systems by 20% and 75% respectively.

It is estimated that reducing pressure drop by 1 Pascal can cut energy consumption by 11kWh. Nanofibre air filters are unmatched in this area, as their resistance to air circulation is much lower than that of ordinary filter media. The MERV14 energy efficient 2-in-1 air filter builds on the ultra-low air resistance of nanofibres by combining the prefilter and main filter into one, achieving a pressure drop almost no different from installations using a MERV2 prefilter. These combined advantages means that overall pressure loss is just one-third that of ordinary filters at the same MERV rating. The electric fan loading needed to drive the same air volume becomes much lower.

The high porosity of nanofibres also enhances dust loading capacity and therefore lengthens filter operation life to around 12 months, compared with 3-6 months for ordinary filters. This in turn cuts workload by up to 50%.

Sustainability Action(s) of the Project

The MERV142-IN-1 air filter offers a total IAQ solution, resolving many of today's sustainability pain points, especially targeting energy consumption.

Project Team

Project Name	MultiH MERV 14 Cost Efficient 2-in-1 Air Filter
Name of Organisation	Focus & Co (Far East) Limited

https://youtu.be/aEvQ8BrhWtk

Green Building Technologies | Industry

NEGAWATT BOS + ZERO2

Smart city solution with IOT enabled technology

Objectives

To foster a net-zero economy and sustainable community.

Negawatt Building Operation System (BOS) is a cloud-based IoT-enabled smart building platform that collects, visualises, analyses and automates building sustainability performance controls. These include MVAC optimisation, utility usage, waste management and tenant participation.

Negawatt Zero2 is an app designed to address industry pain points by gamifying the tracking of Scope 3 and Scope 4 emissions. It encourages users to adopt behavioural changes such as recycling and eco-friendly dining, focusing on physical health and education and digitising these actions to generate positive energy and carbon reduction impact.

Users are rewarded with coins and online shopping coupons, which they can redeem at offline shopping malls and retail stores. This incentivises foot traffic and boosts business for these establishments, thereby creating a circular economy. Additionally, Zero2 provides ESG reports to participating merchants, allowing them to align their practices with sustainability goals.

Project Team

Project Name	Negawatt BOS + Zero2
Name of Organisation	Negawatt Utility Limited
Collaborating Party	Hong Kong Housing Society

https://www.youtube.com/@negawatt1526/videos
https://www.negawatt.co/#/
https://www.zero2.app/

Sustainability Action(s) of the Project

A partnership between Negawatt and Hong Kong Housing Society has seen Zero2 implemented across 150 buildings covering 35,000 households and 1,000 staff, the largest such community programme in Hong Kong to date. Its impact spans 30t of recyclables collected and 900t of CO_2 saved – equivalent to planting around 37,000 trees.

How the Technology takes Climate Resilience into account

Sustainability has gained significant attention in recent years, with a particular focus on workplace health and safety. The WELL Health-Safety Rating (HSR) has become a crucial aspect of ensuring a safe working environment. Tenants are increasingly demanding that landlords take additional sustainability measures, or they may choose to leave.

In 2020, greenhouse gas emissions fell by 4.6% globally in the wake of the COVID-19 pandemic, due to economic downturn and factory shutdowns. Corporate carbon footprints were also reduced as employees worked from home. In 2022, however, global emissions rose by 6.2%, indicating a setback in sustainability efforts. This led to an examination of why individuals are not more sustainable, mainly through lack of knowledge, inconvenience and indifference. The lack of incentives emerged as the most significant obstacle. Zero2 is an innovative business model designed to address these issues by aligning the interests of different stakeholders to drive scalable social impact.

Green Building Technologies | Industry

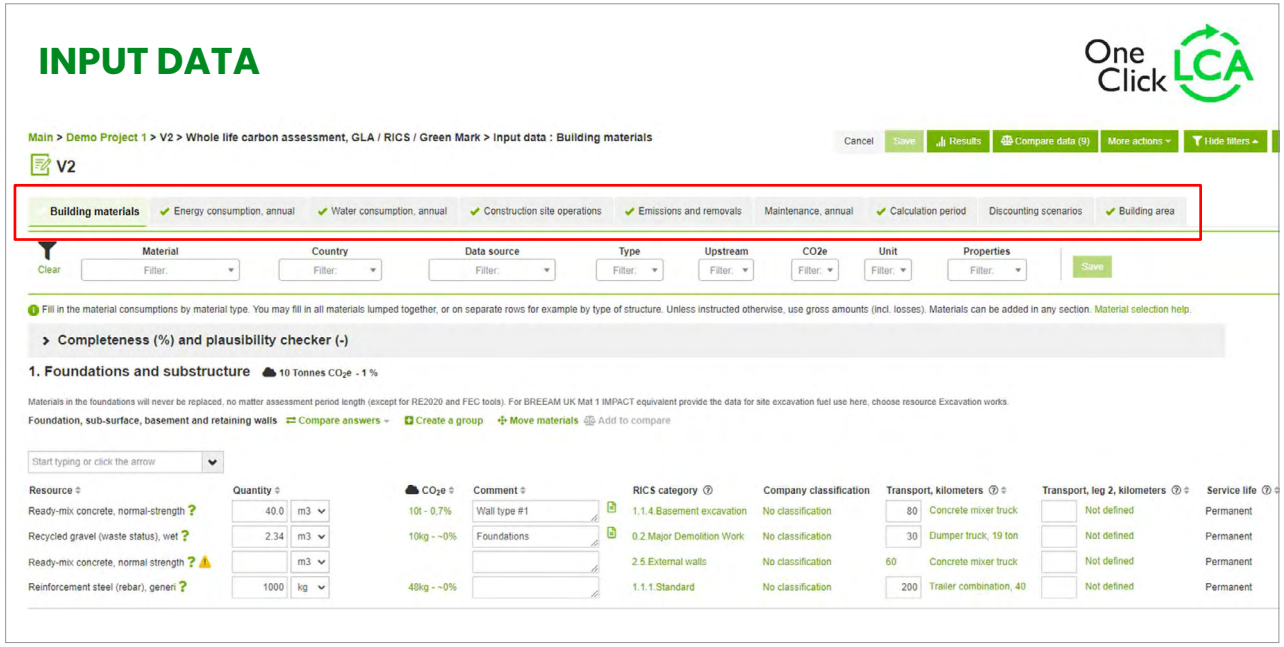
ONE CLICK LCA

A world-leading decarbonisation platform for construction projects and materials

Objectives

To conduct life cycle assessment and calculate embodied carbon for building, infrastructure and construction products.

One Click LCA, a member of the HKGBC, is an industry-leading tech company decarbonising construction and manufacturing. It provides global automated life cycle assessment (LCA) tools that let users calculate and reduce the environmental impacts of building, infrastructure, and renovation projects. These tools enable construction sector manufacturers to conduct LCAs and publish third-party verified environmental production declarations (EPDs), as well as streamlined circularity assessments, life cycle costs, and biodiversity.



Sustainability Action(s) of the Project

With over 200,000 construction LCA datasets, One Click LCA supports some 80 international standards and certifications, including LEED, BREEAM and BEAM Plus. It is used by blue-chip enterprises in more than 170 countries and seamlessly integrates with the most widely used BIM software tools.

How the Technology takes Climate Resilience into account

The company's mission is to drive a zero-carbon future with global LCA, EPD and sustainability solutions. These tools connect the whole construction value chain from property portfolio owners to manufacturers, applying a scientific approach to measuring, reporting, and reducing carbon, along with calculating other sustainability metrics for projects and products in the built environment.

Project Team

Project Name	One Click LCA
Name of Organisation	One Click LCA

www.oneclicklca.com
https://youtu.be/Wy6JgxcIiQc?si=2ITga1RmarkV4TOH

Green Building Technologies | Industry

SEWAGE TREATMENT PLANT FOR TRANSITIONAL HOUSING PROJECT IN KAM TIN, YUEN LONG

Advancing Sustainable Solutions – A Showcase Project for Kam Tin Transitional Housing

Objectives

To treat an estimated sewage flow of 533 m^3/day generated from the Kam Tin Transitional Housing project.

As cities urbanise rapidly, waste water management poses mounting issues. Traditional centralised infrastructure becomes strained under population growth, while rural communities lack adequate long-term solutions. New decentralised approaches are needed.

One such innovative project is the Kam Tin Transitional Housing development where the WetSep waste water treatment system has been implemented. Its containerised modular and integrated design streamlines construction off site, reducing waste.

At the forefront is chemically enhanced primary treatment (CEPT) using the impinging stream reactor (ISR) to achieve removal efficiencies of 85% for solids and 75% for Biochemical Oxygen Demand (BOD).

Advanced secondary technologies such as sequential batch reactors (SBR) and submerged ceramic membrane bioreactors (MBR) further polish the effluent to tertiary treatment standards. The ceramic membranes are fabricated from aluminium oxide or titanium oxide, giving them more strength and durability than polymeric membranes. Automated controls increase the lifespan of the membranes, while UV disinfection provides a finishing touch prior to discharge.

Project Team

Project Name	Sewage treatment plant for transitional housing project in Kam Tin, Yuen Long
Name of Organisation	Waste and Environmental Technologies Limited

https://wetsep.com/projects

Sustainability Action(s) of the Project

This project exemplifies sustainability through its innovative waste water management practices. Its modular and containerised system promotes decentralised approaches while reducing reliance on traditional infrastructure. Advanced technologies provide flexible treatment that adapts to changing occupancy levels, optimising energy consumption and maximising treatment efficiency. The project also incorporates cutting-edge ceramic membranes for thorough purification, ensuring that the treated water meets stringent tertiary treatment standards and supports sustainable water resource management. An advanced odour control system using activated carbon filters and scrubbers creates a more pleasant environment for residents and minimises the project's impact on the ecosystem.

How the Technology takes Climate Resilience into account

The WetSep technology incorporated in the Kam Tin Transitional Housing STP project demonstrates climate resilience through reduced energy usage, improved treatment effectiveness and a compact modular design which enhances protection against natural hazards like earthquakes, strengthening the plant's ability to withstand and recover quickly.

Green Building Technologies | Industry

SMART BUILDING MANAGEMENT PLATFORM FOR AIRSIDE

Accelerating Green Innovation, Empowering AIRSIDE's Carbon Reduction Roadmap

The Neuron Smart Building Solution deployed in the new AIRSIDE development at Kai Tak is specifically designed to address two of the most significant challenges that modern built environments face: adhering to the carbon reduction roadmap and dealing with the limitations of current, outdated building management systems.

The NSBS platform, along with its accompanying applications such as asset visualisation, IoT management, carbon tracking and energy optimisation, overcomes these limitations. It acts as the central intelligence core of the building, seamlessly interfacing with diverse building installations through advanced technologies such as AI data analytics and digital twins.

Centralising all data and supplementing it with additional IoT sensors makes carbon emissions tracking, benchmarking and portfolio management not only more feasible but also more efficient. It eliminates the need for manual data input and provides a transparent, comprehensive picture of the company's carbon emissions across various spaces and buildings, which assists with ESG decision-making. At AIRSIDE, the carbon emissions portal is also shared with individual tenants, encouraging them to implement net positive pledges.

Customised AI analytics allow operators to quickly detect abnormal data. This supports predictive maintenance and prevents unnecessary energy waste. Data is also collected on the number of people using IoT controls and AI analysis for proactive energy-saving measures. This should ultimately bring a significant reduction in carbon emissions.

Project Team

Project Name	Smart Building Management Platform for AIRSIDE
Name of Organisation	Neuron Operations Limited
Collaborating Party	Rich Union Development Ltd.

https://www.airside.com.hk/en

Sustainability Action(s) of the Project

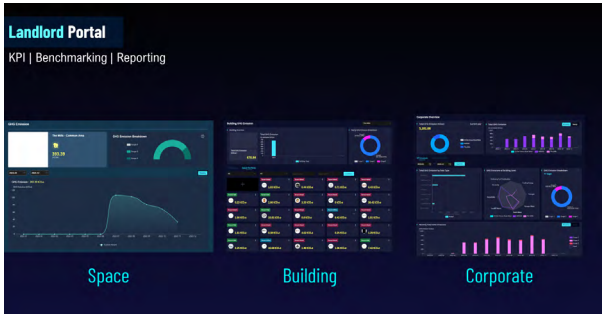
The central platform acts as a central intelligence core for the building, leveraging advanced technologies such as AI data analytics and digital twins.

Objectives

To deploy advanced AI-based strategies for building planning and energy optimisation through carbon tracking, green tenant collaboration, and corporate sustainability portfolio management.

How the Technology takes Climate Resilience into account

The platform allows transparency and effective carbon tracking, which facilitates decision-making for aligning with corporate ESG roadmaps.



Green Building Technologies | Industry

SOLAR RESPONSIVE VENTILATOR (SRV)

New levels of comfort in multiple senses (Invisible, Carefree, Silent, Thermally Stable)

Objectives

To provide a thermally stable workplace environment, saving energy and increasing occupants' productivity.

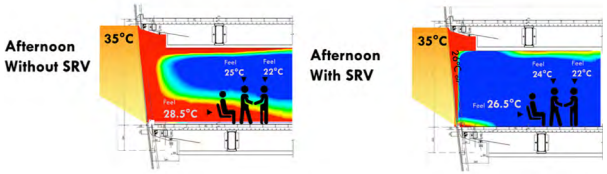
The Solar Responsive Ventilator (SRV) is an indoor ventilation device that works with air conditioning systems and is suitable for commercial buildings with glass curtain walls. The research team measured curtain wall temperatures and analysed office microclimates through fluid mechanics to predict air temperature, air flow and Thermoception. The results showed that users at perimeter zone especially west side would experience a hotter condition than people in interior zone on summer afternoons. For the comfort of all office workers, the team designed an environmentally friendly and quiet SRV which was patented in May 2020.

Project Team

Project Name	Solar Responsive Ventilator (SRV)
Name of Organisation	Arup
Collaborating Parties	Henderson Land Development Company Limited REC Green Technologies Company Limited

https://www.youtube.com/watch?v=rJCFNiUNhfQ

SRV innovatively combines the window sill with the shape of an aircraft wing and operates on the principle of aerodynamics. The goal is to maintain thermal comfort for users near the curtain wall by inducing indoor air flow. It draws indoor air into an inflatable booster chamber, then jets it to the curtain wall through a long and narrow outlet. This technology not only reduces the temperature of the glass, but also helps drive cold air to the curtain wall, so that the entire indoor environment can meet the ASHRAE 55 thermal comfort standard.

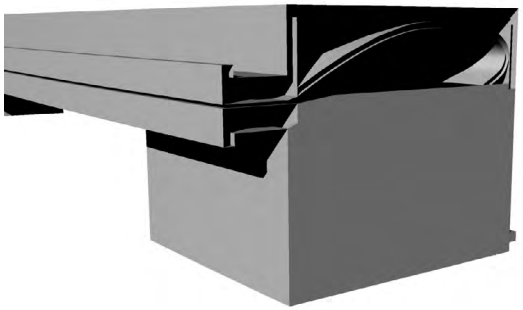


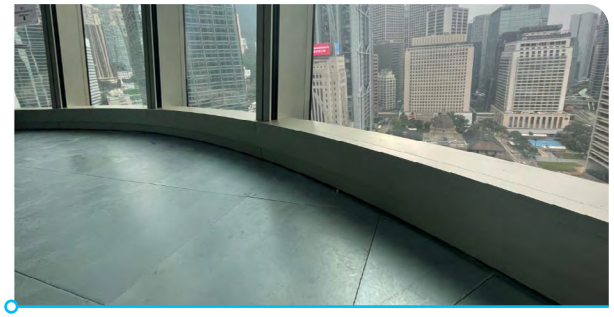
The SRV can only be turned on in hot weather. It is controlled by real-time solar sensors and powered by solar panels to achieve zero-carbon operation. Its main raw material is aluminium plate, which can be easily recycled and reused after the end of its life cycle. The SRV is connected to the building management system (BMS) for system management and maintenance.

SRV has been applied to a Grade A office building in Murray Road, Hong Kong. It has undergone various tests including on-site measurements, and obtained HOKLAS Lab accreditation.

Sustainability Action(s) of the Project:

- 100% supported by renewable energy (PVs)
- Over 100% effectiveness - consumes approximately 0.06% of annual building energy in return for approximately 1% potential energy reductions
- Controllable by sensors and operates only as needed





Green Building Technologies | Industry

SUSTAINABLE BIM FM PLATFORM FOR OPERATIONS AND MAINTENANCE

Maximising the use of data to drive sustainability and enhance overall environmental performance

Objectives

To streamline the daily FM workflow for URA projects, maintain a safe and comfortable environment, and achieve energy efficiency through active tracking.

The Urban Renewal Authority (URA) is on a transformative journey to upgrade the ageing infrastructure and urban fabric of Yau Ma Tei and Mong Kok districts. This presents a unique opportunity to revitalise businesses and communities, creating tangible social value. Central to this vision is the implementation of a Digital Twin platform, which will be instrumental in achieving a sustainable community.

Project Team

Project Name	Sustainable BIM FM Platform for Operations and Maintenance
Name of Organisation	Urban Renewal Authority / AECOM

https://www.ura.org.hk/en/project/heritage-preservation-and-revitalisation/shanghai-street-argyle-street

https://www.ura.org.hk/en/project/redevelopment/ma-tau-wai-road-chun-tin-street-project

https://www.ura.org.hk/en/project/heritage-preservation-and-revitalisation/central-market

A pivotal aspect of the Digital Twin platform is its operational efficiency, achieved through real-time collaboration between Building Information Modelling, the Facility Management System, and the Building Management System. By consolidating these into a centralised platform, the project can deliver substantial benefits to stakeholders at all levels.

Making use of advanced technologies like Internet of Things (IoT) and AI, the URA can collect and analyse vast amounts of data, enabling informed decision-making, proactive maintenance, and optimised energy consumption.

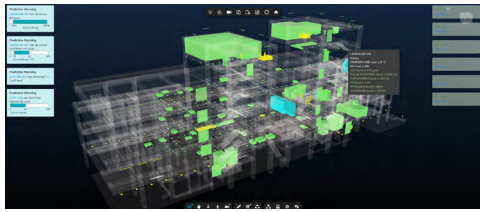
Sustainability Action(s) of the Project

The key to maintaining environmental sustainability is data availability. The quality of data available determines the level of sustainability the URA projects can achieve in the years to come. In this respect, the BMS gathers data from IoT sensors installed on site, such as long-range wireless door contact sensors, CCTV controllers, lift level sensors, plumbing and drainage services sensors, and fan speed controllers. With all data stored on a single cloud BIM-FM system, the use of paper and the time for completing forms is greatly reduced.

How the Technology takes Climate Resilience into account

Ageing infrastructure, characterised by low energy efficiency, significantly contributes to carbon emissions. The URA's commitment to preserving war-era buildings reflects its dedication to climate resilience, while the development of its Digital Twin platform serves as a prime example of achieving operational efficiency.

In the operational stage, this project is aimed at achieving two key objectives: firstly, reducing operational costs and enhancing energy efficiency through innovative technologies; and secondly, raising public awareness about the importance of heritage conservation in combating climate change.



Green Building Technologies | Industry

USE OF POROUS DRAIN COVERS (PDCs) AT AVENUE PARK, KAI TAK AND CUHK

Eliminates the need for insecticide spraying to curb mosquito breeding and restrict rodent activities

Objectives

To use PDCs for all 3.8km of the drain channels in Avenue Park, the first public park in Kai Tak, and for improvement works to existing drainage at Chinese University of Hong Kong.

Four decades ago, the PDC inventor witnessed his grandmother get cut by broken glass when clearing a drain blockage, and wished that someday he could find a way to prevent this from happening to others. In 1976, he learned to produce permeable paving materials with epoxy and pebbles. After many years of private practice he returned to Hong Kong from Canada and joined the Housing Department, where he devised a permeable slab to resolve the problematic clogging of channels in a public park. Ten years later, having returned to private practice as a Registered Landscape Architect, he was encouraged by the Sustainable Lantau Office to build on this success by creating the Porous Drain Cover (PDC), which received PRC and Hong Kong patents in 2014 and was shortlisted in the Hong Kong 2015 Green Innovation Awards. PDCs have since been deployed by many public and private sector organisations in Hong Kong.

In 2021, a patent was approved for the refined PDC-(K) system, which alleviates maintenance work. BEAM Plus awarded a Bonus Credit to Henderson Land's One Innovale development, recognising its contribution to safeguarding public health by reducing the use of insecticides.

A new invention, PDC-Water Recycling, now makes it possible to retain rainwater with a tank attached beneath a PDC block. Interconnection of the tanks can provide a reservoir of water for recycling applications, a unique benefit that could be valuable in regions of the world where rainwater conservation is a necessity.

Project Team

Project Name	Use of Porous Drain Covers (PDCs) at Avenue Park, Kai Tak and CUHK
Name of Organisation	Leisure Cultural Services Department Estate Management Office, CUHK
Collaborating Parties	*Project Management:* Architectural Services Department *Architect:* ALKF *Contractor:* Wanson Construction Co., Ltd. EMO, CUHK

www.greenplanshk.com (of PDC general information)
https://www.youtube.com/watch?v=dyhjT3dHqfQ

Sustainability Action(s) of the Project

- Prevents debris from clogging drain channels to avoid flooding.
- Reduces mosquito infestation by restricting their breeding access.
- Restricts rodent activities by denying access through drain covers.
- Screens away debris to reduce odours for better hygiene.
- Reduces the need for insecticide sprays, safeguarding public health.

How the Technology takes Climate Resilience into account

PDC is a low-tech product yet stood the test of a once-in-500-years rainstorm in 2023.

Conclusion

CONCLUSION

Charting Hong Kong's Sustainable Future

As we bring this Report to a close, it is evident that Hong Kong has made significant strides in its journey towards a more sustainable and resilient urban environment. Through insightful interviews with key industry leaders and advocates, we have gained valuable perspectives on the city's multi-faceted progress and the challenges it is encountering along this transformative journey. These insights serve as a reminder of the ongoing efforts and the collective commitment required to shape a brighter and greener future for Hong Kong.

In the pursuit of a sustainable and resilient city, Hong Kong has demonstrated its commitment through innovative projects and forward-thinking policies. For example, the Government-led "Well·Being" initiative for public housing exemplifies the city's focus on making the best use of existing buildings, avoiding unnecessary embodied carbon additions and delivering both economic and socio-cultural values. This approach complements the active development of green technologies such as BIM, MiC, MiMEP, smart construction and smart estate management, showcasing Hong Kong's environmental efforts and leadership.

Parallel to its physical transformation, Hong Kong has also emerged as a Green Finance and Green Technology Hub. Initiatives like Core Climate by the Hong Kong Stock Exchange, and the Hong Kong Taxonomy for Sustainable Finance by the Hong Kong Monetary Authority, underscore the city's ambitions to drive green finance businesses. Meanwhile, the vibrant ecosystem of local universities and startups continues to generate award-winning innovations that hold the potential to reshape the construction, real estate and energy sectors.

As Hong Kong forges ahead on its journey towards net-zero carbon emissions, the insights from the five industry-leading interviewees provide a strategic roadmap. Key focus areas for the next 5-10 years include: accelerating the development of specific timetables and policies to support the green building industry, fostering cross-sector collaborations to address climate challenges, and empowering the younger generation as climate advocates and catalysts for change.

The city's achievements in decarbonisation, such as the success of its Feed-in-Tariff (FiT) Scheme, EV-charging at Home Subsidy Scheme, and the pioneering applications of carbon capture, utilisation and storage (CCUS) technology, demonstrate Hong Kong's commitment to a low-carbon future. Looking ahead, with the Government's leadership, the Construction Industry Council's efforts to revolutionise the industry, and the Hong Kong Green Building Council's work to enhance the global status of BEAM Plus and play an active role in the WorldGBC Asia Pacific Network, Hong Kong will strengthen its position as an outstanding environmental steward, sharing its expertise and championing sustainable development on the international stage.

As the city navigates the complex landscape of climate change, Hong Kong's unwavering drive to create a sustainable, resilient, and low-carbon future serves as a beacon of inspiration. Through collaborative efforts, innovative solutions, and a steadfast commitment to environmental leadership, Hong Kong is charting a path towards a more prosperous and liveable tomorrow.

ACKNOWLEDGEMENTS

Funding Support

CONSTRUCTION INDUSTRY COUNCIL 建造業議會

Task Force of Hong Kong Report on the State of Sustainable Built Environment 2024

Task Force Convenor

Ms Grace KWOK	Hong Kong Green Building Council

Panel Convenor

Mr Franklin YU	Hong Kong Green Building Council

Members

Ms Corrin CHAN	Hong Kong Green Building Council
Ms Denise CHAN	Hong Kong Green Building Council
Ir Dr Bruce CHONG	Hong Kong Green Building Council
Ms Margaret HO	Construction Industry Council
Mr Son HO	Development Bureau, The Government of the Hong Kong Special Administrative Region
Mr Samuel KO	Development Bureau, The Government of the Hong Kong Special Administrative Region
Sr Dr Stephen LAI	Hong Kong Green Building Council
Mr Don TSE	Hong Kong Green Building Council
Ms Miranda WONG	Hong Kong Green Building Council

Content Contributors

Overall Content

- Construction Industry Council
- Hong Kong Green Building Council
- Development Bureau, The Government of the Hong Kong Special Administrative Region
- Environment and Ecology Bureau, The Government of the Hong Kong Special Administrative Region
- Housing Bureau, The Government of the Hong Kong Special Administrative Region

Public and Industry Projects

Government

- Agriculture, Fisheries and Conservation Department
- Architectural Services Department
- Civil Engineering and Development Department
- Drainage Services Department
- East Development Office, Civil Engineering and Development Department
- Electrical and Mechanical Services Department
- Environmental Protection Department
- Fire Services Department
- Health Bureau
- Highways Department
- Hong Kong Housing Authority
- Hospital Authority
- Inland Revenue Department
- Social Welfare Department
- Sustainable Lantau Office, Civil Engineering and Development Department
- Transport Department
- Water Supplies Department

Industry

- Arup
- AECOM Asia Company Limited
- Apollo Asset Management
- Build King-SCT Joint Venture
- Buro Happold International (Hong Kong) Limited
- Century Opal Limited and Max Century (H.K) Limited
- Cherish Shine Limited
- Chinachem Group
- Chuang's Consortium International Ltd.
- CLPe Solutions Limited
- Cyberport Expansion Project
- Daewoo - Chun Wo - Kwan Lee Joint Venture
- Gammon Construction Limited
- Hang Seng Bank Limited
- Haven of Hope Christian Service
- Henderson Land Development Company Limited
- Hong Kong Baptist University
- Hong Kong Cyberport Management Company Limited
- Hong Kong Metropolitan University
- Hong Kong Repertory Theatre
- Hong Kong-Shenzhen Innovation and Technology Park Limited
- Hongkong Land (Property Management) Limited
- Hongkong Land Limited
- Kwan Lee – Chun Wo Joint Venture
- MTR Corporation Limited
- New World Development Company Limited

ACKNOWLEDGEMENTS

- P&T Architects Ltd.
- Pacific Gate Development Limited
- Rich Union Development Ltd. (wholly owned by Nan Fung Group)
- Richwell Civil Engineering Limited
- Ronald Lu & Partners (Hong Kong) Ltd.
- Sino Land Company Ltd.
- Swire Properties Limited
- Taikoo Place Holdings Limited
- TFP Farrells Ltd.
- Tony Ip Green Architects Ltd.
- Trane Hong Kong o/b TYS Limited
- Urban Renewal Authority
- Urbanage International Ltd.
- Wheelock Properties Limited
- Ying Ho Company Limited

Research and Planning

Government

- Architectural Services Department
- Drainage Services Department
- Hong Kong Housing Authority
- Planning Department

Academia

- Hong Kong University of Science and Technology
- iLab, Faculty of Architecture, The University of Hong Kong
- Jockey Club Design Institute for Social Innovation, The Hong Kong Polytechnic University
- The Hong Kong Polytechnic University

Industry

- Arup
- BEAM Society Limited
- Cundall Hong Kong Limited
- Hong Kong Green Building Council
- Hongkong Land (Property Management) Limited
- Ronald Lu & Partners (Hong Kong) Ltd.
- URBIS Limited - Arcadis Hong Kong Limited

Green Building Materials & Technologies

Government

- Architectural Services Department
- Civil Engineering and Development Department
- Drainage Services Department

Industry

- Arup
- Acoustics Innovation Limited
- Advanced & Sustainable Technologies Limited
- AECOM Asia Co., Ltd.
- Ampd Energy
- ATAL Engineering Group
- Aurabeat Technology Limited
- Azabu International Co. Ltd.
- Focus & Co (Far East) Limited
- Green Plans Limited
- Guangdong Bright Dream Robotics Co., Ltd.
- Hip Hing Construction Company Limited
- I2COOL LIMITED
- Kwan Tai Engineering Co., Ltd
- Nano and Advanced Materials Institute
- Nanofil Filtration Technology Limited
- Negawatt Utility Limited
- Neuron Operations Limited
- One Click LCA
- Palmeco Tech Limited
- REC Green Technologies Company Limited
- SPL Lighting (Hong Kong) Company Limited
- Super Bamboo Limited
- Swire Properties Limited
- Tung Wah Group of Hospitals
- Urban Renewal Authority
- Waste and Environmental Technologies Limited

• Special Thanks •

Ms Natalie CHUNG
Mr Arthur LAM
Prof. Christine LOH, SBS, JP
Prof. Edward NG
Ir Dr Conrad WONG, BBS, JP

Editorial Team

- HKGBC Secretariat

Information and data of the projects and researches submitted by contributors are believed to be reliable and have not been further verified. The Construction Industry Council and the Hong Kong Green Building Council do not guarantee the accuracy and completeness of the submissions.

OUR JOURNEY TO SUSTAINABLE BUILT ENVIRONMENT

Hong Kong's Milestone

1995

Enactment of Building (Energy Efficiency) Regulation that governs the thermal performance of building envelopes on commercial buildings and hotels

1996

Establishment of HK-BEAM Society (currently BEAM Society Limited) and launch of HK-BEAM New & Existing Office Buildings (Version 1/96 & 2/96)

HK-BEAM Society 香港環保建築協會 HONG KONG BUILDING ENVIRONMENTAL ASSESSMENT METHOD 香港建築環境評估法

1998

機電工程署 EMSD

Launch of Hong Kong Energy Efficiency Registration Scheme for Buildings by Electrical and Mechanical Services Department (EMSD), which promotes the use of Voluntary Energy Codes for various kinds of building services installations

1999

Launch of HK-BEAM Version 3/99 – the pioneer high-rise residential rating scheme

2000

Launch of IAQ Certification Scheme

2004

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

2007

CONSTRUCTION INDUSTRY COUNCIL 建造業議會

Establishment of Construction Industry Council (CIC)

2009

HKGBC 香港綠色建築議會

Establishment of the Hong Kong Green Building Council (HKGBC)

Release of "Green Government Building" circular by the HKSAR Government

Launch of "Buildings Energy Efficiency Funding (BEEF) Scheme" by EMSD to subsidise building owners to carry out energy-cum-carbon audits and energy efficiency improvement projects

2010

Launch of BEAM Plus scheme after a comprehensive revision of the HK-BEAM rating tool

Launch of "BEAM Professionals" green building professionals accreditation scheme

2011

Promulgation of Practice Notes on:

- Building Design to Foster a Quality and Sustainable Built Environment (PNAP APP-151) – BEAM Plus becomes one of the prerequisites for applying for GFA concessions
- Sustainable Building Design Guidelines (PNAP APP-152), which sets out new requirements on greening, building separation and setback

屋宇署 BUILDINGS DEPARTMENT

2012

Enactment of Buildings Energy Efficiency Ordinance (Cap. 610) and mandatory implementation of Building Energy Code and Energy Audit Code

Opening of CIC - Zero Carbon Park, the first zero carbon building in Hong Kong

CIC ZCP 建造業零碳天地

OUR JOURNEY TO SUSTAINABLE BUILT ENVIRONMENT

Hong Kong's Milestone

2012

Launch of HK3030 Campaign by the HKGBC (Target: To reduce the absolute electricity consumption of buildings in Hong Kong by 30% by 2030, from 2005 level)

HKGBC's admission to Established Membership of the World Green Building Council (WorldGBC)

2013

Launch of BEAM Plus Interiors V1.0

Release of the first Clean Air Plan for Hong Kong

Release of Hong Kong Blueprint for Sustainable Use of Resources 2013-2022 (Target: To reduce the per capita disposal rate of municipal solid waste by 40% by 2022)

Sustainable Building 2013 Hong Kong Regional Conference

Hosting of the first edition of Hong Kong Green Building Week (A citywide public campaign promoting green building and green living)

Release of Hong Kong Green School Guide

Release of Hong Kong Green Shop Guide

Launch of Green Building Product Listing Service

Inclusion of mandatory BEAM Plus Gold requirement in land sales conditions for new private developments in Kowloon East

Commencement of operation of the first multi-user District Cooling System (DCS) in Hong Kong

2014

Release of Green Tenancy Driver for Office Buildings

Release of Health, Wellbeing and Productivity in Offices: The Next Chapter for Green Building Research Report with WorldGBC

Release of Market Drivers for Transformation of Green Buildings in Hong Kong at the HK3030 – Market Drivers towards Sustainable Built Environment Policy Forum

Launch of "BEAM Affiliate" green building supporting personnel accreditation scheme

Launch of Practice Note PNAP APP-156 that governs the thermal performance of building envelope on residential buildings and encourages good natural ventilation in flats

Launch of Eco Building Fund and Smart Power Fund by the two power companies to subsidise building owners to carry out energy efficiency improvement projects

2015

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)

Release of Hong Kong Climate Change Report 2015

Launch of Green Product Accreditation and Standards (HK G-PASS) (To assess the environmental performance of construction materials or products)

2016

Launch of BEAM Plus Neighbourhood V1.0

Launch of Hong Kong 2030+: Towards a Planning Vision and Strategy Transcending 2030

OUR JOURNEY TO SUSTAINABLE BUILT ENVIRONMENT

Hong Kong's Milestone

2016

Release of Hong Kong Biodiversity Strategy and Action Plan

香港綠建商舖聯盟 Hong Kong Green Shop Alliance

Launch of Hong Kong Green Shop Alliance (A platform fostering a green shopping environment)

ACT Shop

Launch of ACT-Shop (To enhance the energy efficiency of existing buildings via retro-commissioning)

HKGBC Benchmarking and Energy Saving Tool (HK BEST)

Launch of HKGBC Benchmarking and Energy Saving Tool (HK BEST) (To provide recognition and promote energy efficiency in buildings)

Release of Hong Kong Green Office Guide

Commencement of green finance initiatives (such as green bonds and green loans) in large local corporations, which helps to further promote green building

2017

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)

Launch of HKGBC Guidebook on Urban Microclimate Study

2018

Commencement of HKGBC Jockey Club Green and Smart Community Buildings Project, in which HKGBC assists a number of NGOs to transform their buildings

Signing of Memorandum of Co-operation (MoC) on Retro-commissioning of Buildings in Guangdong-Hong Kong-Macao Greater Bay Area among EMSD, HKGBC and several important institutions

Establishment of Construction Innovation and Technology Fund

CITF 建造業創科基金

The first edition of CIC Sustainable Construction Award

CIC Sustainable Construction Award 建造業議會可持續建築大獎

Release of Green Design Guide for Material Resources Optimisation in Building Life Cycle

Launch of HKQAA Green Finance Certification Scheme

Launch of Feed-in-Tariff (FiT) scheme by the two power companies to encourage building owners to retrofit renewable energy installations on their buildings; EMSD also launched the "Solar Harvest Scheme" for schools and NGOs accordingly

Launch of accelerated tax deduction for expenditure on energy efficient building installations under EMSD's Energy Efficiency Registration Scheme for Buildings

2019

ADVANCING NET ZERO

The HKGBC committed to participate in the WorldGBC's "Advancing Net Zero" project (Aims to promote and support the acceleration of net zero carbon buildings to 100% by 2050)

CIC GREEN PRODUCT CERTIFICATION

Launch of CIC Green Product Certification (Merge of the Carbon Labelling Scheme by the CIC and HK G-PASS by the HKGBC)

CIC Carbon Assessment Tool 建造業議會碳評估工具

Launch of CIC Carbon Assessment Tool

Retro-Commissioning
Significant Savings at Minimal Cost

Launch of Retro-commissioning Training and Registration Scheme

OUR JOURNEY TO SUSTAINABLE BUILT ENVIRONMENT

Hong Kong's Milestone

2019

Launch of BEAM Plus Existing Buildings Volume Certification

Release of Tips for NGOs to Transform their Existing Buildings

Launch of Renewable Energy Certificates by the two power companies to promote voluntary offset of carbon emissions

2020

WSBE2020

Launch of Jockey Club BEAM Plus in Schools Project (Engaged 125 schools)

Launch of EV-charging at Home Subsidy Scheme by the Government to subsidise building owners to retrofit EV charging facilities in residential carparks

Signing of Memorandum of Co-operation (MoC) with City University of Hong Kong (Industry Ready Programme)

2021

Announcement of Hong Kong's Climate Action Plan 2050

Launch of BEAM Plus New Data Centres and Existing Data Centres V1.0

Launch of iBEAM, the first ever locally developed green building cloud data platform

Launch of green mortgage plans (linked to BEAM Plus Gold rating) by various local banks

Establishment of CIC Sustainable Finance Certification Scheme

Launch of Hong Kong's first-ever Advancing Net Zero (ANZ) Ideas Competition

Launch of International Conference on Advancing Net Zero

Launch of Hong Kong Smart Green Building Design Best Practice Guidebook

Launch of Eco-Product Directory (Online directory of certified green building products)

2022

Launch of iBEAM Unison platform that enables data exchange with BIM

Launch of BEAM Plus Existing Schools V1.0

Release of Advancing Net Zero (ANZ) Ideas Competition 2021 E-book

Signing of Memorandum of Co-operation (MoC) on Building Energy Saving Retrofit in Guangdong-Hong Kong-Macao Greater Bay Area among EMSD, HKGBC and several important institutions

Launch of "Green Schools 2.0 – Energy Smart" programme by EMSD to assist schools to upgrade building services installations

2023

Launch of HKGBC Climate Change Framework For Built Environment

Launch of Zero-Carbon-Ready Building Certification Scheme

OUR JOURNEY TO SUSTAINABLE BUILT ENVIRONMENT

Hong Kong's Milestone

2024

WSBE24

Completion of development of BEAM Plus Existing Buildings (Global Version) V1.0

Signing of Memoranda of Understanding (MoUs) with 13 developers, property management companies, institutions, and state-owned enterprises from Hong Kong and the Greater Bay Area to explore applying BEAM Plus to properties outside Hong Kong

Launch of Net Zero Energy Building Certification

Commencement of BEAM Plus Energy Saver in Schools Project

Publication of leaflet on Decarbonisation Directions for Hong Kong Construction Industry

2025

Anticipated completion of development of BEAM Plus New Buildings (Global Version)

2030

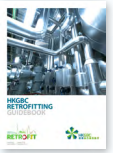
China's commitment to achieve the peak of carbon emissions in 2030

2050

Hong Kong's goal to achieve carbon neutrality by 2050

2023

Launch of HKGBC Retrofitting Guidebook



Launch of HKGBC Guidebook for Sustainable Built Environment

Launch of the first BEAM Plus rating tool for interior fit-out works in residential flats

Launch of Sustainable Construction Charter

Development of CIC Smart Waste Management Tool

Smart Waste Management Tool 建築廢料智慧管理工具

Buildings Department announced a new performance-based GFA concession mechanism that is linked to BEAM Plus ratings (revised PNAP APP-151), which will come into operation on 30 June 2024

Expansion of the Memorandum of Co-operation (MoC) on Retro-commissioning of Buildings and Energy-saving Retrofitting of Existing Buildings in the Greater Bay Area has included the China Association of Building Energy Efficiency (CABAA) as a signatory party

2035

Hong Kong's interim decarbonisation targets to achieve a 50% reduction in carbon emissions by 2035

2060

China's pledge to achieve carbon neutrality by 2060

CONSTRUCTION INDUSTRY COUNCIL
建造業議會

www.cic.hk

HKGBC
香港綠色建築議會

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