



## **Compact Sustainability and Liveability in Hong Kong**

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### **Sustainability and Liveability in Hong Kong**

Located at the southeastern tip of Mainland China at the mouth of the Pearl River Delta, Hong Kong is a small city with a total land area of 1,104 square kilometres. Over the years, Hong Kong has developed into a thriving international financial centre with impressive economic development. With 7 million inhabitants, Hong Kong is one of the most densely developed cities with an average population density of 6,540 persons per square kilometre (HKSARG<sup>a</sup>, 2013). Adding to this is a surging number of visitors, which reached over 54 million in 2013 (Tourism Commission, HKSAR Government, 2014). The territory will experience rising summer temperatures, increased rainfall and a rising sea level (Hong Kong Observatory, 2014). How does Hong Kong attain sustainability and liveability in such a high-density and compact urban environment at times of climate change?

Liveability and sustainability are essential for cities to flourish. Sustainability agenda and liveability initiative often share the same environmental, social and economic goals. Their definitions also overlap substantially. Dr Serge Salat (2014) examined urban morphology of world cities and identified the characteristics of low-carbon, liveable urban environment and the importance of compact urbanism. He cited the work of Schulz (2010) as in the Global Energy Assessment 2013, Hong Kong is in a more sustainable economic growth model with low energy per capita and a high GDP (International Institute for Applied System Analysis, 2013). Examining international studies on the liveability of cities also shed light on Hong Kong's performance in comparison to other cities. The Centre for Liveable Cities and the Urban Land Institute (2013) in Singapore examined the principles of achieving high liveability. Figure 1 shows the distribution of world cities in terms of density and liveability. The latter was measured by Mercer's Quality of Living Survey (Centre for Liveable Cities and Urban Land Institute, 2013). Both Singapore and London achieve high liveability in a high-density setting, while Hong Kong is behind in liveability. Likewise, the world liveability survey conducted by the Economist Intelligence Unit (EIU) measured five parameters of major cities, namely stability, healthcare, culture and environment, education and infrastructure. Hong Kong did not perform outstandingly in this survey (Economist Intelligence Unit<sup>a</sup>, 2012).

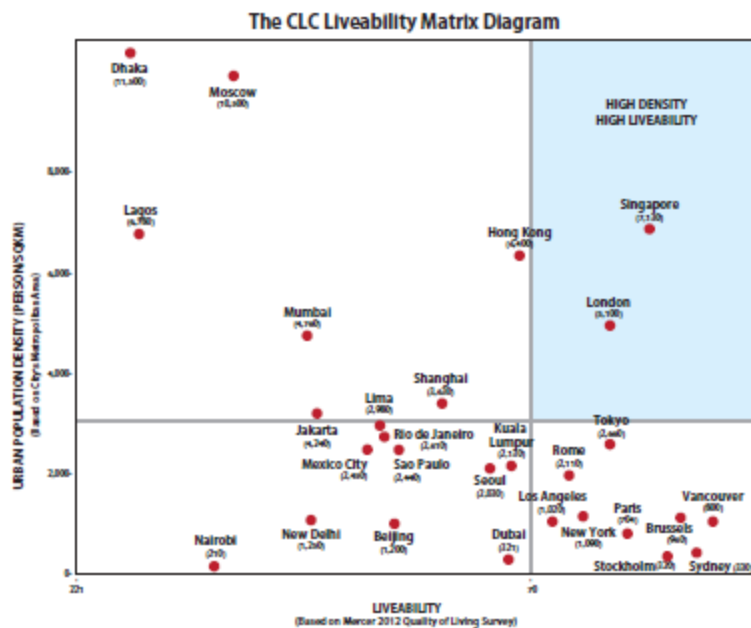


Figure 1: The Liveability Matrix Diagram

In a subsequent survey by the EIU in 2012, Hong Kong was ranked first of the Best Cities, based upon a new index, the spatially adjusted liveability index (Economist Intelligence Unit<sup>b</sup>, 2012). The new index added the category of spatial characteristics to the EIU’s existing liveability index. As Hong Kong scored particularly well in spatial characteristics, which concerned sprawl and natural assets, it jumped substantially in the ranking to top of the list, despite relatively low scores for pollution and cultural assets. The adjusted index sheds light on two important components of liveability – the provision of effective public transport and access to the natural environment. Indeed, the importance of green space and access to public transport was affirmed by various studies, not only in its role in creating liveable communities but also in promoting community health.

The provision of efficient public transport can be partly attributed to the compact urban development in Hong Kong: the tightly-knit urban structure favours public transport over private cars, and local residents can do daily errands on foot, in stark contrast to many cities. Hong Kong’s metro system carries over 4 million passengers a day (MTRC, 2012), while the three major bus operators carry over 3.5 million (HKSARG<sup>c</sup>, 2013). In a recent report entitled ‘Future of Urban Mobility 2.0’ by Arthur D Little, Future Lab (Van Audenhove and Kornichuk et al., 2014), Hong Kong was ranked first among 84 world cities on its high modal split, low number of vehicles per capita, high smart card penetration, low transport-related emissions, low rate of traffic-related deaths and respectable mean travel time to work, even though it scored low in areas concerning biking infrastructure and bike sharing (see Figure 2). In particular, the report gave credit to Hong Kong for turning the high population density into an opportunity to run one of the most efficient public transport systems in the world.

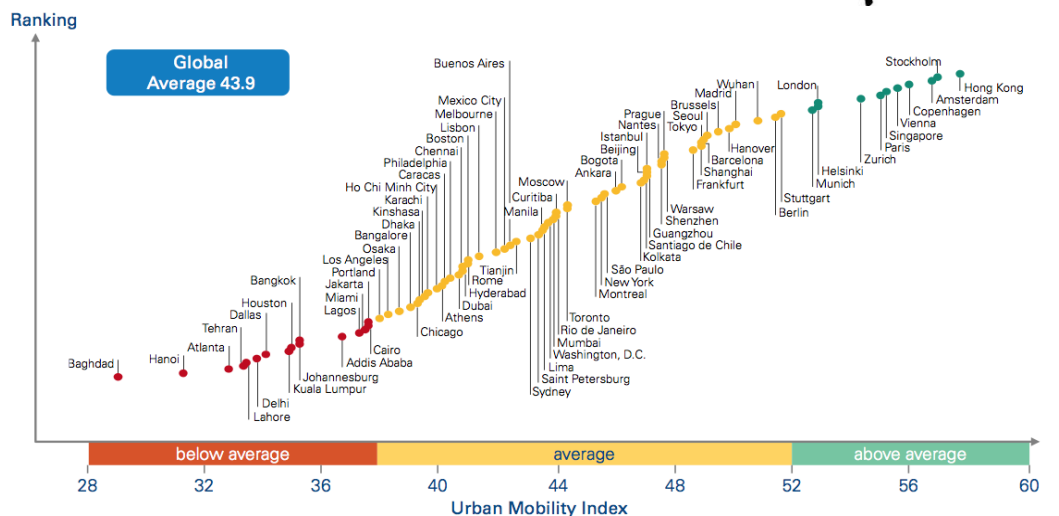


Figure 2: Urban Mobility Index 2.0

Efficient public transport within a compact urban environment also encourages walking and discourages driving. According to Walk Scores, Hong Kong can be characterised as a “walkers’ paradise” with an average score of 98 out of 100, suggesting that daily errands can be completed without cars<sup>1</sup>. Indeed, Hong Kong has one of the lowest car ownership rates in the developed world, with just 59 passenger cars per 1,000 people, substantially below the world average of 124.3 (World Bank, 2013). The well-developed transport system and infrastructure position the city favourably for collective mobility solutions. The environmental benefits are further affirmed by the analysis of The Economist (2012), with Hong Kong in the lower quadrant of high population and low urban transport emissions, in stark comparison to its American counterparts (see Figure 3).

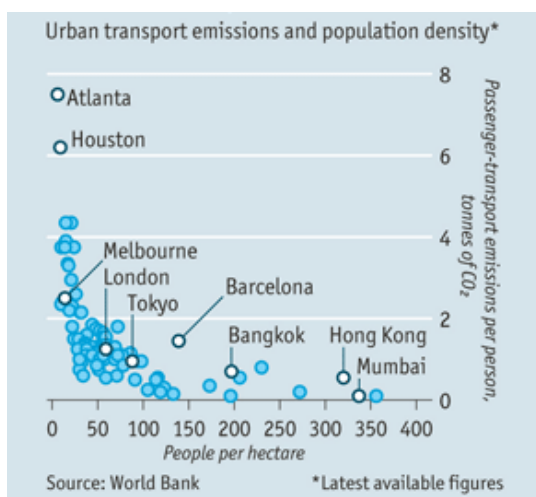


Figure 3: The relationship between urban transport emissions and population density

The advantages of public transportation are not limited to low energy use and environmental sustainability, there are positive implications for social sustainability. In the report ‘Intersections: Health and the Built Environment’ published by Urban Land Institute in 2013,

<sup>1</sup> <http://www.walkscore.com/score/26-leighton-rd-hong-kong-hong-kong-island-hong-kong>

transit users are found to be healthier according to studies in the US (Urban Land Institute, 2013). In addition, the costs of public transportation in Hong Kong are comparable to or even lower than those in developing countries<sup>2</sup>. It assumes a vital social role in enhancing physical mobility and social development in the lower income class.

Compact urban development also enables preservation of the city’s natural capital. Despite the dense urban inner city, which accounts for only about 24% of the total built-up area, around 40% of the land mass is designated as country parks. At present there are 24 country parks and 22 special areas established for nature preservation, covering a wide land area of 44,239 hectares (HKSARG<sup>d</sup>, 2013). Figure 4 shows that a big proportion of the land in Hong Kong is designated as country parks, providing a much needed natural sanctuary for the locals. The Hong Kong Biodiversity Database contains information on more than 1,000 species that can be found in Hong Kong, including those that are unique to the territory. In a further step to protect its natural assets, Hong Kong became one of 193 contracting parties to the UN Convention on Biological Diversity in 2011, and is now developing the Biodiversity Strategy and Action Plan before 2015 (AFCD, 2013). Above all, most of its country parks and nature reserves are easily accessible by public transport. They make a perfect escape and place of exercise for city dwellers, and form a solid basis for long-term sustainability in ecology and biodiversity.

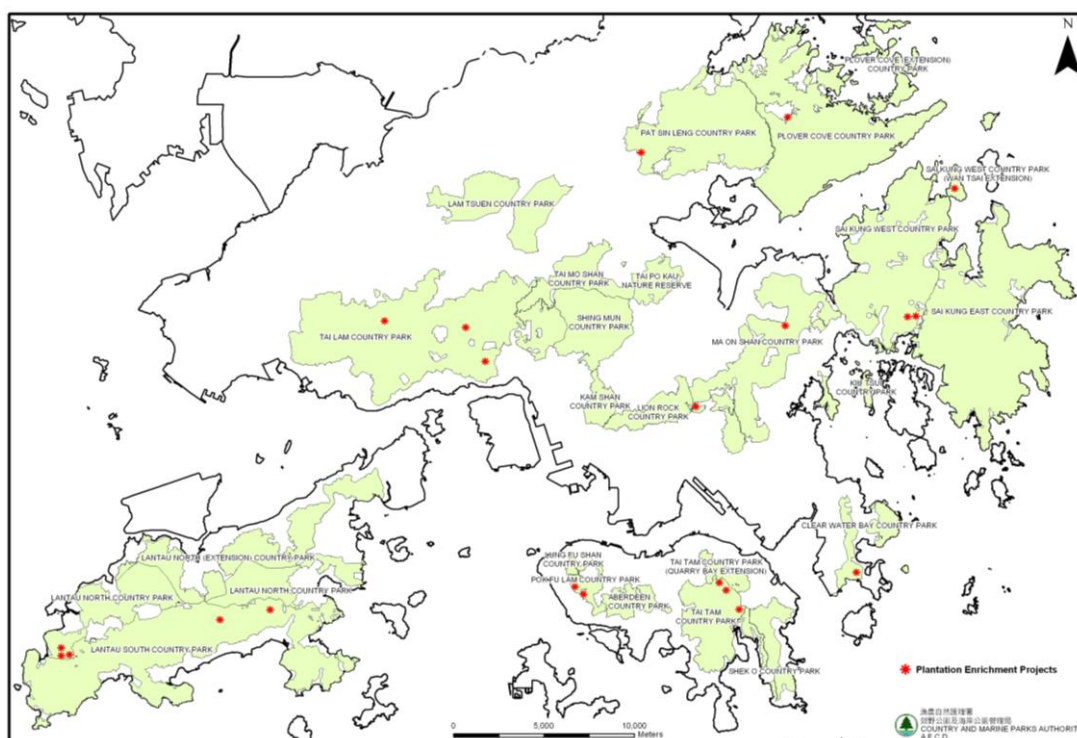


Figure 4: Distribution of the 24 country parks in Hong Kong

### Some pressing challenges

Like many other cities, Hong Kong is facing mounting challenges on the road to sustainability and liveability. It is likely that the challenges will be exacerbated by the demand for development and the worsening effects of climate change. Although its compact development allows efficient use of resources and infrastructure, the city is set to grapple with issues brought

<sup>2</sup> <http://www.priceoftravel.com/595/public-transportation-prices-in-80-worldwide-cities/>



by the increasing population and habitability needs and the associated negative effects on the environment and resources.

### *Air pollution*

First, the urban health of Hong Kong is constantly challenged by the worsening air pollution, most of which has to do with roadside pollution from outdated commercial vehicles and the often overlooked cross-boundary marine pollution. According to Clean Air Network (Hong Kong), the mid-year Air Quality review in 2014 showed that despite a slight drop in nitrogen dioxide, sulphur dioxide and particulate matter in the first six months of the year, the ozone pollution is the worst in almost a decade. The review pointed to cleaner fuels at berth and coordination with the Mainland on an emission control area as possible interventions<sup>3</sup>. The Environment Bureau (2013) along with the Bureaus of Transport and Housing, Food and Health, and Development, issued the 'Clean Air Plan for Hong Kong' in early 2013. The intention is to develop a comprehensive plan entailing solutions to roadside air quality, marine emissions, power generation and non-road mobile machinery. A new diesel commercial vehicle (DCV) replacement programme is being implemented that aims to replace the pre-Euro 4 DCV with the Euro 5 model, along with other initiatives like urban greening, a pilot green transport fund and a regional fuel switch at berth to tackle marine emissions (HKSARG<sup>c</sup>, 2013).

### *Waste*

Second, in recent years the issue of waste has constantly hit the city headlines. Despite years of promoting recycling and waste reduction, the waste production is still staggering. According to the Hong Kong Ecological Footprint Report 2013, around 80% of Hong Kong's ecological footprint is caused directly by household consumption (WWF, 2013). Landfills receive 13,458 tonnes every day representing 52% of total waste (Environmental Protection Department, 2012). Hong Kong's daily domestic waste generation per capita is the highest among Asian cities, at 1.36 kg compared to 0.77 kg in Metro Tokyo. With limited land resources and the associated negative environmental and health effects, landfill is not an effective long-term solution for waste management.

The Hong Kong Blueprint for Sustainable Use of Resources 2013–2022 (Environment Bureau, 2013) gives an overview of key actions the government will spearhead. These include driving behavioural change through policies and legislative measures, mobilising communities for waste recycling and reduction, and setting specific targets such as reducing 40% of municipal solid waste (MSW) per capita by 2022. The proposal to build a new incinerator and extend three landfills has been heavily criticised by some green groups and local citizens<sup>4</sup> and faces much controversy over funding approval at government meetings<sup>5</sup>. An effective long-term solution to the waste problem demands community consensus. Notwithstanding the prevalent consumerist and materialistic society, Hong Kong as a whole has more fundamental social and cultural issues to reflect upon.

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<sup>3</sup> <http://www.scmp.com/news/hong-kong/article/1555622/ozone-pollution-hong-kong-worst-level-decade-environmental-report>

<sup>4</sup> <http://www.scmp.com/news/hong-kong/article/1280402/chief-secretary-takes-case-landfill-expansion-tuen-mun-councillors>

<sup>5</sup> <http://www.scmp.com/news/hong-kong/article/1519852/lawmakers-work-through-filibuster-hk18b-waste-incinerator-plan>



### *Shortage of land*

Last but not least is the shortage of land to meet the need for affordable housing, offices, public spaces and related amenities. For years, the housing market has been criticised for its speculative activities. Rising numbers of people are living in substandard homes and subdivided flats, often lacking basic amenities and in conditions of poor hygiene and safety. According to the public engagement report of the Hong Kong Long Term Housing Strategy published in February 2014, there is overall support for a long-term housing supply target of 470,000 units over the next 10 years, with a higher proportion of public housing. Priority will be given to the elderly and people living in substandard housing (Long Term Housing Strategy Steering Committee, 2014).

The housing demand in Hong Kong underlines the rise of inequality. Hong Kong's latest GINI coefficient is 0.537 (Census and Statistics Department, HKSAR Government, 2012), the highest ever recorded, and considerably higher than that of Singapore (0.482) or the United States (0.469). Some local scholars have pointed out that GINI values above 0.4 are a warning sign for policymakers<sup>6</sup>. In addition, about 1.3 million people, or 19.6% of the population, subsist below the poverty line<sup>7</sup>. Unaffordable housing is the most prevalent concern among the poorer population. Housing issues are not only about market demand and supply, but also concern social development, equality and harmony for the whole society.

In considering the long-term housing supply, demographic change should be taken into account. Regarding the longevity of the local population, male and female life expectancies are 80 and 87 respectively (HKSARG<sup>a</sup>, 2013) with the proportion of the elderly aged 65 and over expected to comprise 30% of the population by 2041 (HKSARG<sup>b</sup>, 2013). The report by the Stanford Center on Longevity (2013) states that the concept of liveable communities calls attention to the ways in which the physical, social, and economic infrastructure of cities and towns promote or hinder the ability of older residents to age in place. This requires a proper housing mix within new and existing neighbourhoods to create sustainable communities for all.

Another issue is the shortage of office space. The shortage is increasing as traditional central business district (CBD) areas approach full capacity, potentially hampering the city's vibrant business activity. The Financial Secretary announced a steady and adequate supply of Grade A Office space in early 2011 (HKSARG<sup>1</sup>, 2013). The Government is consolidating the existing central CBD and developing new office nodes outside of the CBD, such as in Kowloon East, Quarry Bay and Wong Chuk Hang. The revitalisation plan for the Kowloon East district provides a rare opportunity to address this issue. With its old industrial buildings no longer in use, many are being revamped for commercial or hotel use through wholesale conversion and major retrofitting. The Government has established the 'Energising Kowloon East Office' to oversee various visionary initiatives to turn the district into a second CBD and a sustainable low-carbon community. The revitalisation of the district is expected to deliver not only an increase in much needed office space but also a vibrant and sustainable community with high quality public spaces (Development Bureau, 2013).

Practically all new developments provoke heavily politicised views, conflict and opposition. While it is unrealistic to halt new development, considerable challenges and social

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<sup>6</sup> [http://cpro.hkbu.edu.hk/online\\_pub/nh\\_1213\\_2/nh1213\\_2\\_p12-17.pdf](http://cpro.hkbu.edu.hk/online_pub/nh_1213_2/nh1213_2_p12-17.pdf)

<sup>7</sup> <http://www.bloomberg.com/news/2013-09-29/hong-kong-poverty-line-shows-wealth-gap-with-one-in-five-poor.html>



controversies must be dealt with, including compensation, encroachment on green belts and rural farmland, community amenities, and other public aspirations. On the threat to green belt and rural areas, a lot of land in northern Hong Kong is rural with scattered villages; such rural spaces are the ultimate backyard of the urban area with their rural lifestyle and natural ecosystems intact. The North East New Territories New Development Areas (NDAs)<sup>8</sup> have aroused fierce debate in the community about the destruction of homelands<sup>9</sup>, natural scenery and the traditional lifestyle. Such conflicts call not just for community engagement but also for new political wisdom before any major development can proceed smoothly.

### **Role of the building sector**

For a compact city like Hong Kong with no major heavy industry, the building sector accounts for about 91% of electricity consumption and over 60% of GHG emissions (HKGBC, 2012). The city simply cannot achieve low-carbon living without transforming this sector. The building sector must be prepared to tackle major environmental challenges, climate change, biodiversity loss and the energy crisis.

The built environment also serves as topsoil for nurturing the much-needed liveable environment for the wellbeing of its people. Therefore, green building remains at the top of the agenda and has a pivotal role in reducing energy consumption and responding to climate change. Apart from developing Kowloon East and other NDAs into low-carbon communities, an inter-departmental steering committee under the Secretary for the Environment was formed to promote green building. The committee will strengthen coordination among government departments to formulate implementation strategies and action plans, while maintaining close dialogue and cooperation with relevant sectors and stakeholders (HKSARG<sup>f</sup>, 2013).

Before delving into sustainability issues on buildings, it is crucial to recognise the intricate relationship between a building and its surroundings. This is particularly valid for Hong Kong, as the development of a high-rise built environment coupled with narrow street structures largely upsets air circulation in the city and creates an unpleasant walking environment. A study by the Planning Department in 2011 showed that the urban heat island (UHI) effect in Hong Kong was intensifying, indicating that the temperature in urban areas was substantially higher than in rural areas, as a result of the compact built environment and urban activities including vehicular emissions (Planning Department, 2011). Such a UHI effect reduces thermal comfort and increases energy consumption in urban areas. It also discourages social activities at street level and limits the option of natural ventilation of nearby buildings.

More importantly, as activities take place and humans interact in buildings and in the areas between, the social effects of the built environment must be factored into the urban liveability equation. As Jan Gehl noted in his famous work, 'Life between Buildings' (2011), 'life between buildings offers an opportunity to be with others in a relaxed and undemanding way, in public spaces the individual himself is present, participating in a modest way, but most definitely participating'. Research worldwide indicates the importance of streets for the community and also public health. The report by Civic Exchange titled Walkable City, Living Streets (Ng, Lau et al., 2012) noted that the Hong Kong streetscape is often characterised as a layered city, where pedestrians travel along the elevated street and at underground level, a development that is in

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<sup>8</sup> For information, please refer to <http://www.nentnda.gov.hk/eng/index.html>

<sup>9</sup> <http://www.scmp.com/news/hong-kong/article/1526945/protesters-storm-legco-over-northeastern-new-territories-plan>



opposition to good walkability and a sense of community. The report emphasised that improved walkability is crucial for a richer social life and social justice.

### **Green building as a solution**

Buildings, as an infill to the urban fabric, affect not only the behaviour of their occupants, but also the physical attributes of the urban landscape and the sense of community. In their 91% of total electricity consumption, commercial buildings take the lead (65%) followed by residential buildings (26%) (EMSD, 2012). Buildings and their users are therefore a source of carbon emissions, and yet also a solution to reducing carbon emission. Well thought out and designed buildings can offer residents a high quality of life while reducing energy consumption and even generating renewable energy.

Hong Kong Green Building Council (HKGBC) was established in 2009 to promote green building practices in Hong Kong. The Hong Kong-based green building assessment system, BEAM Plus, offers a comprehensive assessment of buildings and embraces a wide range of sustainability standards. Since its major overhaul from mid-2010 to the end of 2013, about 440 new buildings have been registered for assessment.

An analysis was conducted of the scoring patterns of the first 110 assessed projects including the 23 highest-scoring Platinum projects. The scoring patterns of these 23 Platinum projects are also analysed separately to review the attributes of the best performers. These 110 projects came from a fair spectrum consisting of commercial, residential, governmental, institutional and community projects. For ease of analysis, the 99 different credit scores were divided into four categories: (A) resources/environment; (B) liveability and health; (C) urban compaction; and (D) social sustainability. Depending on the percentage of projects achieving the particular credit scores, they are identified as upper quartile (75% or above) or lower quartile (25% or below) for analysis. Details of the analysis of these four aspects are detailed in the following paragraphs.

The credits/sub-credits per category numbered 46 for resource/environment; 35 for liveability and health; 13 for urban compaction and 5 for social sustainability. Clearly, the BEAM Plus rating system focuses primarily on resources, environment, liveability and health issues. This is understandable as it derives from early versions of the UK BREEAM system, which, as its name implies, is an 'environmental' assessment methodology focusing on global, local and indoor environments. However, as the BEAM scheme developed, it has gradually embraced more social elements in response to the concept of sustainability.

#### *Resources and environment*

In terms of achievement rate, of the 46 credit scores, 9 and 20 credits were identified in the upper and lower quartiles, respectively, for all projects. Buildings generally perform well in testing and commissioning, O&M documentation, metering provisions, use of non-CFC refrigerants and reduction of sewage discharge, with over 75% of projects achieving these credits. However, there is room for improvement in water recycling, material recycling, building reuse, energy conservation through passive building design, use of renewable energy and elimination of private car parking spaces, as less than 25% of all projects attained credits for these. Passive building design is particularly challenging in a high-density compact city as buildings are generally massive and there is often limited separation between buildings. This





makes natural ventilation and daylight utilisation difficult to achieve. Another interesting point is the elimination of private car parks, which was practised by less than 17.4% of all projects, although Hong Kong has an efficient public transport system. This phenomenon is believed to relate to property values, which are affected by the presence of car parks. However, to reduce air pollution and traffic jams, greater effort to discourage private car use is required.

Another observation is the reduction of energy usage. Analysis shows that the annual energy consumption of BEAM Plus certified projects was lower than the baseline (i.e. Building Energy Code) by 30%, 19%, 17% and 13%, respectively, for the Platinum, Gold, Silver and Bronze grades (see Table 1). In the reduction of peak electricity demand, 81% of Platinum projects achieved full scores compared with 46% of all projects. Green building designers appear well aware of the need to follow the low-energy development path. The findings corresponded well with an earlier report by Greenpeace on the role of BEAM Plus in reducing the average peak demand for electricity (Chung, 2012). The study echoes the policy paper prepared by Hong Kong’s Green Building Council in 2012, ‘HK3030: A vision for a low-carbon sustainable built environment in Hong Kong by 2030’, which proposes a 30% absolute reduction of electricity use in buildings by 2030 as compared to 2005 levels, equivalent to a 58% reduction in electricity consumption compared to the Business-As-Usual (BAU) scenario. An estimated 48% of the reduction target can be achieved by technology advancement and uptake, while the rest of the 12% must be accomplished through behavioural change.

Rating	Percentage of projects obtained the rating	Average percentage of annual energy reduction
Platinum	21	30
Gold	22	19
Silver	14	17
Bronze	19	13
Unclassified	24	N/A

Table 1: Energy use reduction among different classes of BEAM Plus buildings

### *Liveability and health*

Of the 35 credit scores, 5 and 10 credits are identified in the upper and lower quartiles, respectively, for all projects. Platinum buildings obviously outperformed the others overall on a larger number of scores, reflecting a strong focus on creating a good indoor environment. The general analysis results show that new building developments in Hong Kong are particularly strong in security design, IAQ assurance and drainage design to prevent the transmission of diseases. This is understandable, as Hong Kong learned painful lessons from the SARS outbreak in 2003. In terms of liveability, the availability of public transport and amenities near buildings is particularly good in Hong Kong, attributable to its compact urban design. However, more effort is required to adopt natural lighting/ventilation in buildings, increase site greenery and mitigate the UHI effect. The latter issues are particularly challenging in a compact, high-density city.

### *Urban compaction*

Compact urban development can be a double-edged sword. On one hand, it enables the efficient use of infrastructure and public transportation, the preservation of natural greenery, and enhanced liveability through convenience; on the other, any form of pollution or nuisance in or



around buildings easily affects neighbours. Densely placed buildings may also cause an unfavourable pedestrian environment through wind amplification or blockage of airflow. In the analysis, 3 out of the 13 credit scores were identified in the upper quartile and 2 in the lower quartile for all projects. In general, pollution management during construction and the control of noise from building equipment were well managed – these are essential given the compact living environment. However, achieving excellent noise isolation between living spaces is very challenging as the mass production of housing is not conducive to the adoption of delicate noise isolation designs. There is also a need to enhance air ventilation assessment for neighbourhood, as fewer than 20% of all projects achieved this score.

### *Social sustainability*

It is encouraging to note that new buildings commonly perform well in providing universal access for persons with a disability. This is probably due to comprehensive local legislation such as the Disability Discrimination Ordinance and Building (Planning) Regulations. However, in making on-site facilities available for public use, only Platinum buildings performed relatively well. These on-site facilities usually include basic services (e.g. banks, clinics, retail shops) that enhance convenience for the nearby community. There is also much room for improvement in the protection of cultural heritage and conducting community engagement exercises during the design stage. As development is heavily driven by economic returns, the above performance is understandable. However, as planning democratisation continues to grow alongside civic aspirations, BEAM Plus will evolve and embrace a more balanced sustainability agenda with more attention on social aspects. These future requirements may include social impact assessments for building developments, maintenance of communication channels with surrounding residents during construction, pay-for-safety schemes for contractors, protection of construction workers' wages, and management of health and safety design.

### **Green community and neighbourhood development**

The analysis of the assessed projects shows that performance on some aspects depends not only on the design of the building, but also the neighbourhood. For instance, the effective use of recycled water requires performance synergy from a multitude of buildings, as some may have surplus wastewater while others need water for irrigation. To achieve good passive design, daylight and ventilation blockages must be avoided through proper orientation, building separation and setback from the street. To reduce the number of private car parking spaces, the surrounding district needs good and accessible public transport. These issues lie beyond the control of a single building. Other issues include the quality of the public realm and the wider socio-economic factors of the whole community. In fact, within the current building rating scheme, nearly 30% of credits already relate to the neighbourhood around the buildings.

As such, a stand-alone 'green building' may not necessarily be green from a holistic point of view, and a mere collection of 'green buildings' may not result in a truly sustainable community either. The HKGBC is now in the process of developing a new rating tool that embraces the high-density urban community and the neighbourhood elements. One of the features of this tool is to place more emphasis on the planning of open/public spaces in multi-block developments. The new tool will place emphasis on the sense of place and community attributes. It will create both a label and a tool to quantify the quality of open space and urban design, and incentivise



the creation of low-carbon sustainable communities environmentally, socially and economically.

### **The existing building stock**

So far, much of the discussion in this paper has focused on driving sustainability in new building developments. However, the majority of building stock in Hong Kong comprises existing buildings. In the estimation of HKGBC, the existing building stock is likely to account for over 80% of electricity consumption (HKGBC, 2012). Improving the energy efficiency and environmental performance of these buildings is a crucial step in addressing energy reduction. From December 2012 to May 2013, HKGBC conducted a preliminary study on the major issues of its green assessment tool BEAM Plus EB (existing buildings). The study identified credit items that required modification. The issues identified include an overwhelming emphasis on inherent building characteristics, demand on performance that was out of the applicant's control, over-reliance on scientific analysis, disturbance to building operations during re-commissioning, inadequate scope of coverage in the sustainability assessment, and standards that are unrealistic for aged buildings.

Building on the results of this study, HKGBC has commissioned a further consultancy to revamp the BEAM Plus EB. The new tool is expected to embrace alternative paths through which stepwise improvement or partial upgrades of aged buildings can be recognised. This would help the regeneration and gradual transformation of the existing compact urban fabric to create a greener and more liveable city. There are also benefits from retrofitting existing buildings as opposed to pulling them down. It can avoid the tremendous demolition waste and conserve the embodied energy within them. This can be viewed as a great improvement over the current weaker performance in building reuse as reflected in our analysis of BEAM Plus assessment results for new buildings.

### **Conclusion**

Like many other world cities, high-density development and compact living are inevitable for Hong Kong. Compact urbanism has its downsides for urban liveability, but also offers inherent opportunities for sustainability. If it is well thought out, planned and designed, the city can use its urban compaction to advantage. Compact urbanism helps to preserve Hong Kong's natural capital and biodiversity. High-density mixed-use development provides its residents with convenience through the proximity of amenities, facilities and efficient public transport. These in turn lead to lower energy use per capita and provide an effective way to meet the global vision of reducing carbon emissions and meeting the challenges of climate change.

The city needs to strengthen efforts to meet the pressing challenges of air pollution, waste management, shortage of land for affordable housing and a steady supply of office space. The building sector, which accounts for 91% of electricity consumption and 60% of GHG emissions, has a major role to play in meeting habitability needs and reducing energy consumption and environmental effects. Green building is a solution. The BEAM Plus assessment scheme has achieved improvements in energy efficiency and led to the creation of greener, healthier and more liveable buildings. More focus is needed on passive building design, the urban microclimate, social engagement and the regeneration of our aging buildings.



There is a calling to go beyond green building to embrace the public realm, the wider community and neighbourhood development. Indeed, the roles and boundaries of green building must be readdressed to facilitate a more holistic and integrated approach towards both sustainability and liveability in a compact urban context. We need to extend our scope from buildings to their immediate neighbourhoods; from the environment to social sustainability and community issues; and from new buildings to existing buildings. The case of Hong Kong provides a vital lesson for any rapidly developing city facing similar challenges in economic and social development.

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