

URBAN ENVIRONMENTAL SUSTAINABILITY FOR SUSTAINABLE URBAN ENVIRONS

Learnings from and for China

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series focused on sustainability

CONTENTS

- 04** Executive summary
- 06** Introduction
- 07** A change for the good
- 08** The 15-minute city
- 12** What's happening in China?
- 13** Policy
- 14** General urban planning



15	Urban public space
18	Transit-oriented development (TOD)
20	Ecological solutions
25	Net-zero buildings
31	Key takeaways
32	Appendix
40	Business contacts
42	Research contacts

URBAN ENVIRONMENTAL SUSTAINABILITY FOR SUSTAINABLE URBAN ENVIRONS

EXECUTIVE SUMMARY

The COVID-19 pandemic has prompted a questioning of our traditional ways of living, with many employees globally now working remotely and spending a greater period of their time living within a few kilometres of their homes. At the same time, with our climate today transforming and changing at a rapid pace, sustainability is at the top of the agenda in terms of decisions made, how we act and what we do on a daily basis.

The quest for economic stability, liveability, and greenhouse gas (GHG) emissions reduction will be a testing endeavour, but because more than 60% of global greenhouse gases originate from cities, by doing more and bringing more change for the good, urban communities themselves will benefit.

To bring about beneficial urban environmental sustainability change that results in sustainable urban environs, one concept cities in China can look to adopt and implement is the '15-minute city' concept. The 15-minute city is a fresh concept that promotes both urban environmental sustainability and urban liveability. In a nutshell, the concept requires cities to be planned in such a way whereby citizens of all ages, backgrounds, and abilities in all parts of the urban area are able to gain access to their daily needs, such as lodging, employment, sustenance, health, education, culture and leisure and all be accessible within the distance of a 15-minute walk or bicycle ride.

When considering general urban planning and development in China, one always has to begin with policy. One overriding policy that is trying to transition China's development to be more people-centred especially when urbanisation is considered is China's 14th Five-Year Plan and Long-Term Targets for 2035, which was published in April 2021.

When it comes to planning sustainable urban environs in China, the 15-minute city concept has been already adopted by some cities in China, such as Shanghai and Beijing. In these cities, within particular designated areas, all the core amenities and services are now within walkable access to all citizens living in the area. Today, in these cities, walkability and access to all basic amenities and services for all citizens in an area is fast becoming the basis for general city planning when looking to build new urban areas or renovate/regenerate existing urban areas.

When specifically considering urban public space in China in relation to sustainable 15-minute city urban environs, the aim for local governments is to generate all-inclusive citizen-friendly settings that are also economically workable. It's not just a matter of simply planning, designing and incorporating a public space which is accessible by a short walk; ideally it must be a placemaking approach that produces community ownership of public spaces from space planning to space operation and management. Ultimately, the approach adopted should produce a public space which a 15-minute walkable community and visitors alike wish to be active in and wish to spend time in again and again.

To interconnect sustainable 15-minute urban environs, it is essential for cities in general, including those in China, to have a well-planned and efficient overall public transport system that is easily accessible, is convenient and cuts both journey times and air pollution levels for all their citizens. One resolution

that a number of cities in China have implemented or are looking to implement is transit-oriented development (TOD). Alongside this, national level encouragement and backing in China for TOD is growing, including TOD planning and development, TOD financing, and land set aside for TOD use.

The 15-minute city concept also places much emphasis on the need for more green areas, a lessening of the urban heat-island effect, a reduction of the occurrence of flooding, and greater biodiversity. One urban planning model which can certainly assist in this, and which is being adopted and implemented in China is ecological-oriented development (EOD).

Finally, in order to reduce the amount of energy used by, and carbon emissions from, buildings in China, including buildings in walkable 15-minute city precincts, it will additionally be important to take the next step and go carbon neutral, which requires a 'carbon balance' to be established. When considering optimal carbon neutrality solutions for buildings in China, there needs to be collective and early involvement of all professionals within a design team. In addition, the 15-minute city concept is not just about how we move around but also about how we live on a daily basis, such as how we utilise buildings. Multiple-use buildings which can also accommodate a mix of living and commercial space are ideal in terms of urban environmental sustainability for sustainable urban environs in China.



INTRODUCTION

The COVID-19 pandemic has spurred a cross-examination of the way we live. Simultaneously, along with climate change, sustainability is up front and centre and on everyone's minds at all times.

The urban area and its associated design, planning, development and operation, plays and will continue to play a big role in bringing transformational change to address the changing way we live as well as our changing climate. To increase awareness and bring about beneficial living and urban environmental sustainability change that results in sustainable urban environs, in this report we will look at the following topics:

- A change for the good;
 - The 15-minute city;
 - What's happening in China;
 - Policy;
 - General urban planning;
 - Urban public space;
 - Transit-oriented development (TOD);
 - Ecological solutions, and;
 - Net-zero buildings.
- 



A CHANGE FOR THE GOOD

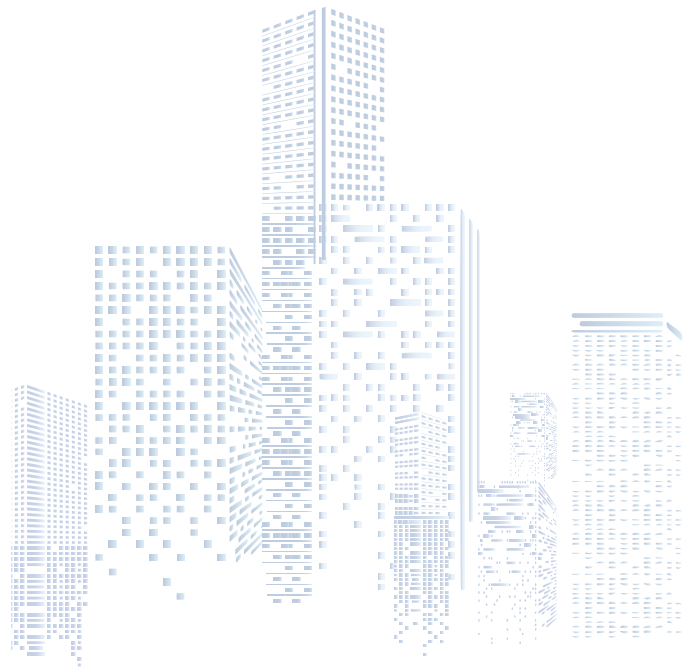
The COVID-19 pandemic has prompted a questioning of our traditional ways of living, with many employees globally now working remotely and spending a greater period of their time living within a few kilometres of their homes. At the same time, with our climate today transforming and changing at a rapid pace, sustainability is at the top of the agenda in terms of decisions made, how we act and what we do on a daily basis.

According to the Intergovernmental Panel on Climate Change 6th Assessment report and the Nationally Determined Contributions Synthesis report by the UN Framework Convention on Climate Change, global temperatures are expected to increase by 2.7°C by 2050, which is higher than the 1.5°C rise pledged in the Paris Agreement.

Such a temperature rise will have significant implications for urban communities around the world, including China, with infrastructure, property and citizen's livelihoods being affected the most by continuing severe climate events in the future.

The quest for economic stability, liveability, and greenhouse gas (GHG) emissions reduction will be a testing endeavour, but because more than 60% of global greenhouse gases originate from cities, by doing more and bringing more change for the good, urban communities themselves will benefit.

To bring about beneficial urban environmental sustainability change that results in sustainable urban environs, one concept cities in China can look to adopt and implement is the '15-minute city' concept. Let's now examine what this concept means.

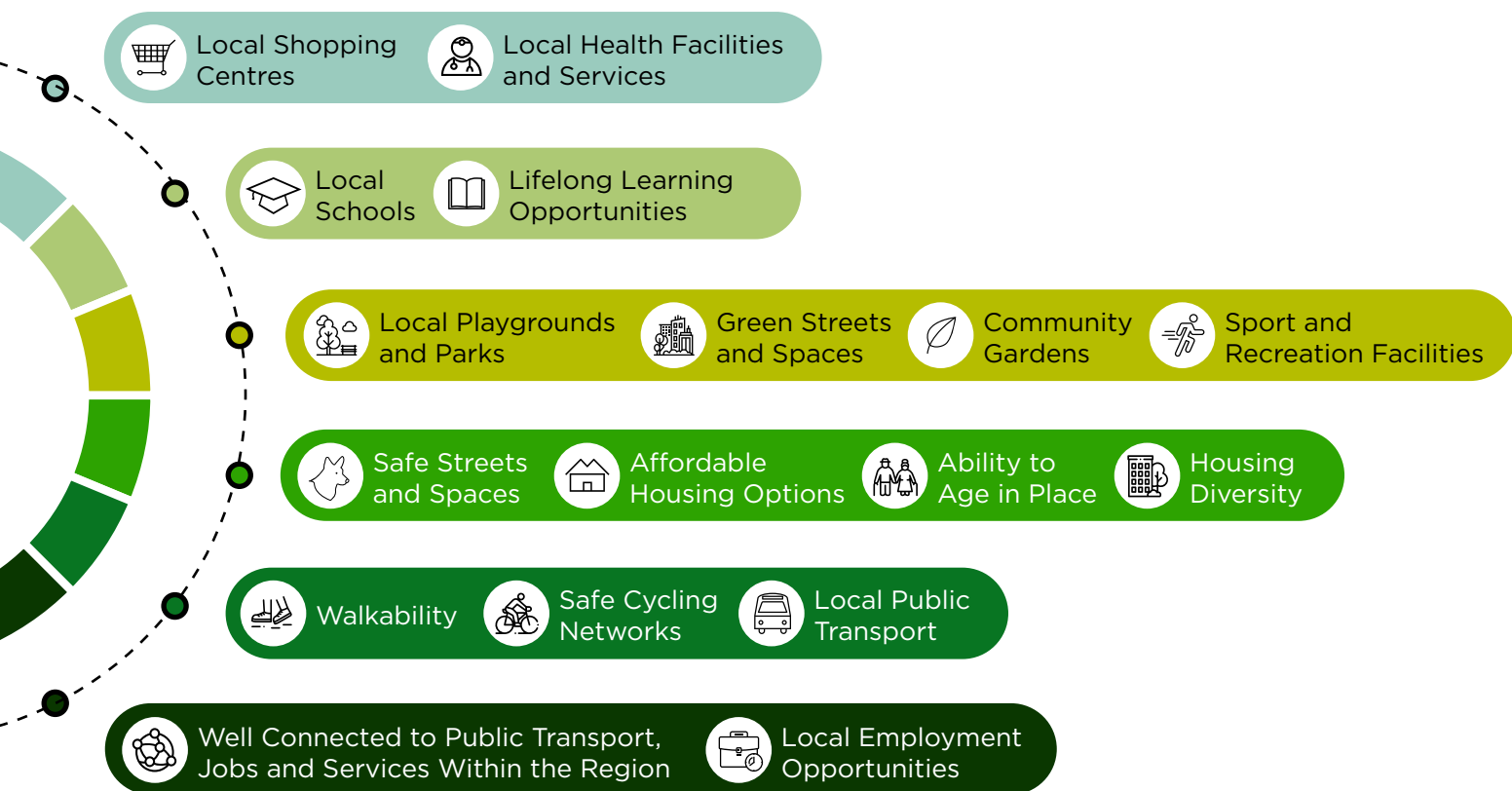


THE 15-MINUTE CITY

The 15-minute city is a fresh concept that promotes both urban environmental sustainability and urban liveability.

In a nutshell, the concept requires cities to be planned in such a way whereby citizens of all ages, backgrounds, and abilities in all parts of the urban area are able to gain access to their daily needs, such as lodging, employment, sustenance, health, education, culture and leisure and all be accessible within the distance of a 15-minute walk or bicycle ride (Figure 1).

Figure 1: Urban vicinity elements considered within the 15-minute city model



Source: *bee smart city*, Cushman & Wakefield Research

The concept champions a city which has a plethora of walkable self-sustaining liveable neighbourhoods and fewer private automobiles (Figure 2).

Figure 2:

The 15-minute city: A shift away from private automobiles to walkable urban environs



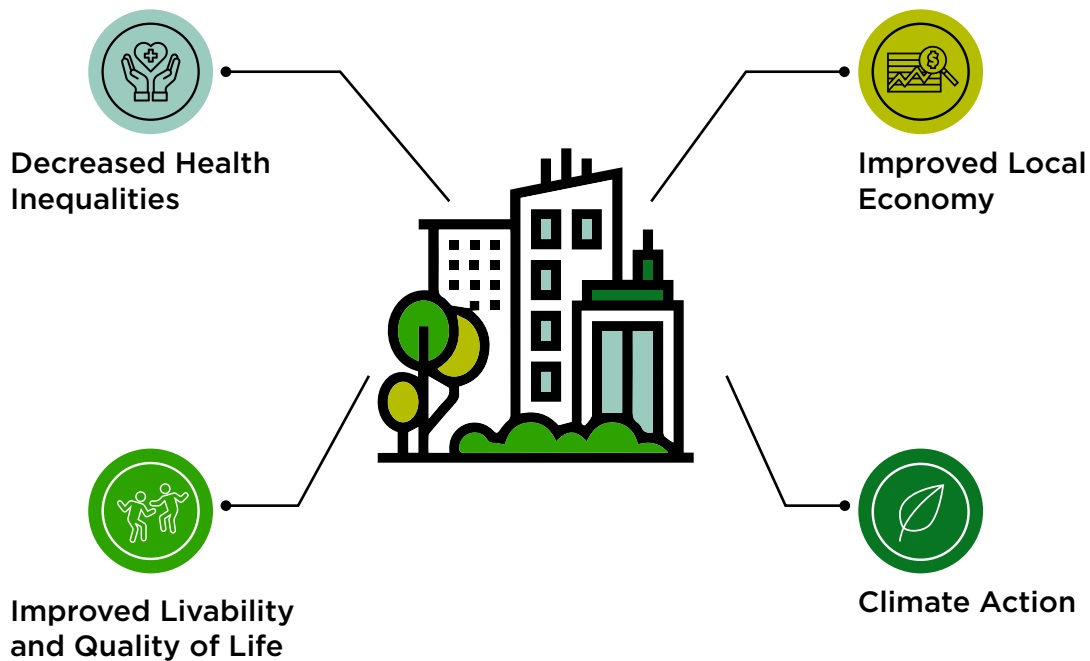
Source: Architonic, Cushman & Wakefield Research

By advocating this concept, concept-implementing cities are able to lessen their use of fossil fuels, augment the quality of life for citizens and continue to push the city's vitality, creativity, diversity and inventiveness for the common good.

The advantages of the 15-minute city are many and include:

- **Enhanced sustainability** – Includes reduced GHG emissions from private automobiles, more green areas, a lessened urban heat-island effect, reduced occurrence of flooding, and greater biodiversity.
- **Augmented liveability and health** – Includes cleaner air, greater access to green and beautiful areas, strengthened intra-community relationships, less travel time, more leisure time for physical and mental recreational pursuits.
- **A more even-handed and all-encompassing city** – Includes more public spaces, more neighbourhood businesses, more socialising, interaction and decision making at the neighbourhood level and a stronger sense of community.
- **A shot in the arm for the local economy** – Means more customers for local shops, more local job opportunities, and more productive use of local commercial buildings and space (Figure 3).

Figure 3: Upshots for a typical 15-minute city



Source: Ramboll UK, Cushman & Wakefield Research

The 15-minute City – In a little more detail

As defined by Carlos Moreno, the 15-minute city is founded on:

- Six fundamental human requisites;
- Three key aims or features, and;
- Four leading principles.

The three aims or features are:

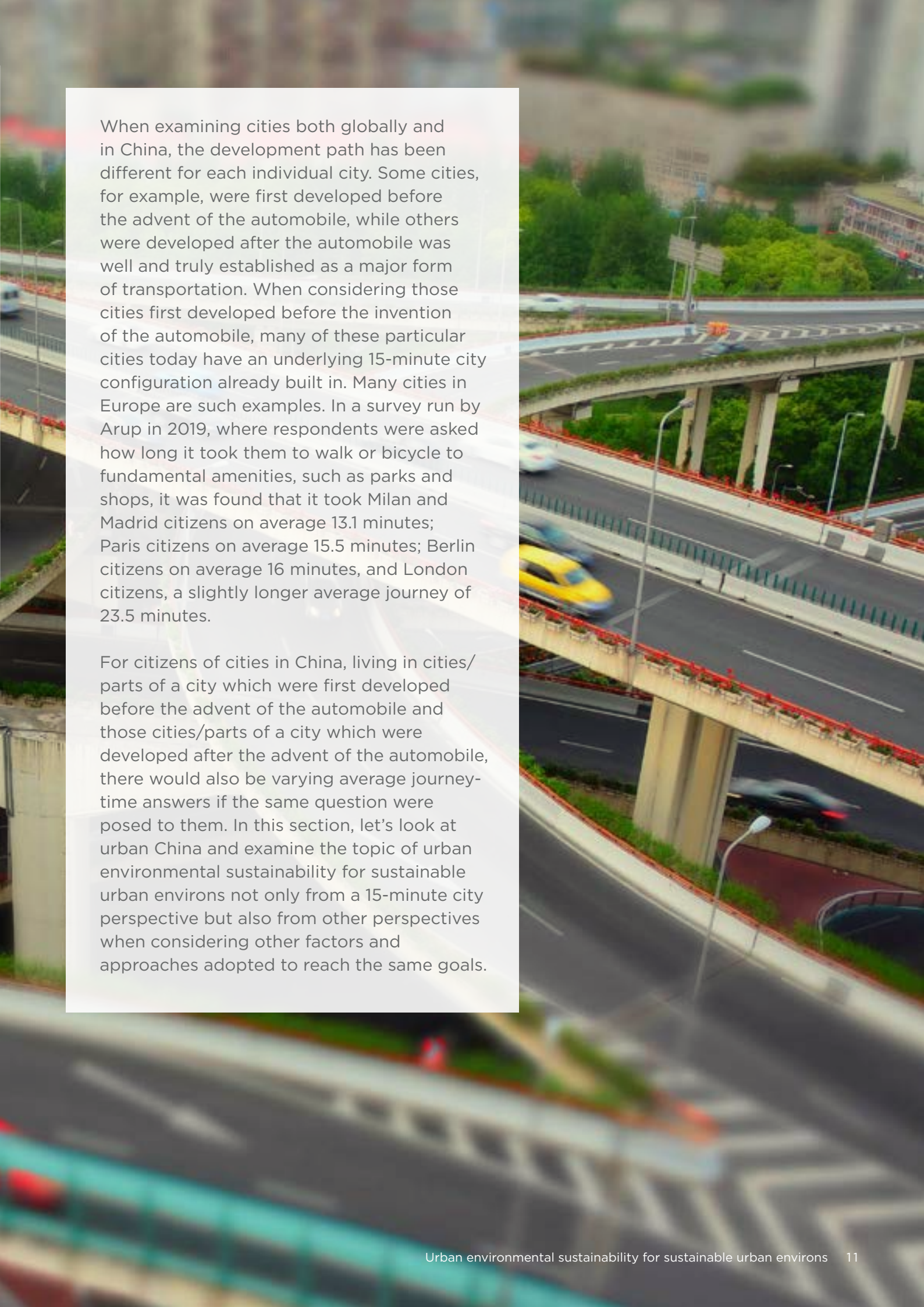
- The pace and tempo of the city should follow human beings, not automobiles;
- Each space should serve a variety of purposes, and;
- Neighbourhoods should be designed for citizens to live in, to work in, and to thrive in.

The six requisites are:

1. **Living** – Lodging;
2. **Working** – Employment;
3. **Supplying** – Sustenance;
4. **Caring** – Health;
5. **Learning** – Education, and;
6. **Enjoying** – Culture and leisure.

The four leading principles are:

- **Ecology** – for a green, biodiverse and environmentally sustainable city;
- **Proximity** – to live within self-sustaining communities;
- **Solidarity** – to strengthen the connection between citizens;
- **Participation** – to enhance citizen engagement in the continued transformation of their neighbourhoods.



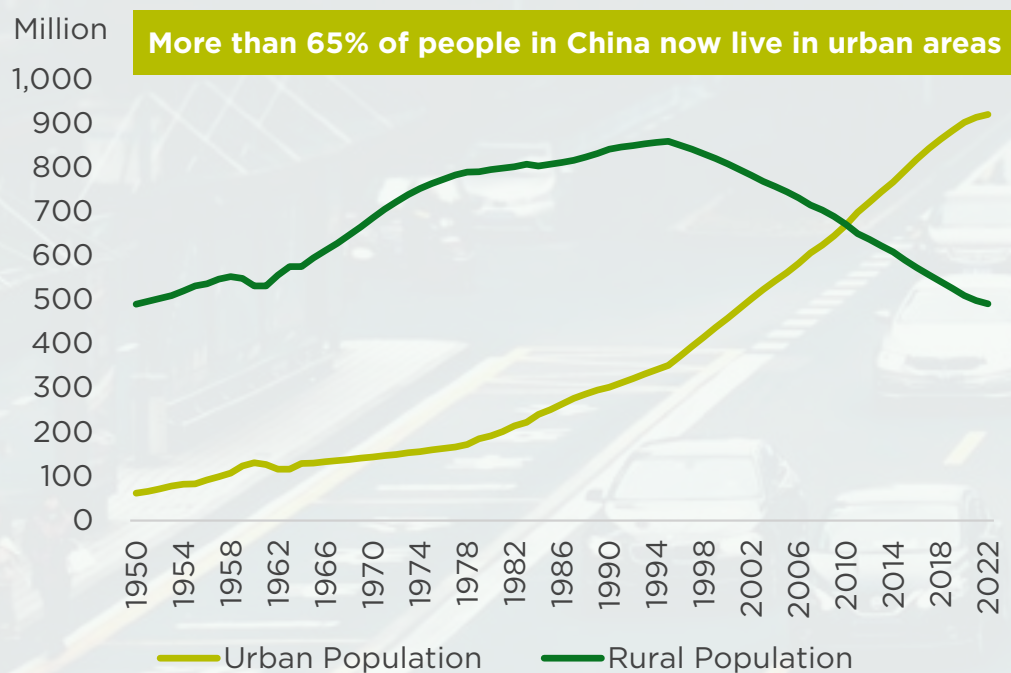
When examining cities both globally and in China, the development path has been different for each individual city. Some cities, for example, were first developed before the advent of the automobile, while others were developed after the automobile was well and truly established as a major form of transportation. When considering those cities first developed before the invention of the automobile, many of these particular cities today have an underlying 15-minute city configuration already built in. Many cities in Europe are such examples. In a survey run by Arup in 2019, where respondents were asked how long it took them to walk or bicycle to fundamental amenities, such as parks and shops, it was found that it took Milan and Madrid citizens on average 13.1 minutes; Paris citizens on average 15.5 minutes; Berlin citizens on average 16 minutes, and London citizens, a slightly longer average journey of 23.5 minutes.

For citizens of cities in China, living in cities/parts of a city which were first developed before the advent of the automobile and those cities/parts of a city which were developed after the advent of the automobile, there would also be varying average journey-time answers if the same question were posed to them. In this section, let's look at urban China and examine the topic of urban environmental sustainability for sustainable urban environs not only from a 15-minute city perspective but also from other perspectives when considering other factors and approaches adopted to reach the same goals.

WHAT'S HAPPENING IN CHINA?

Over the last few decades, the pace and unparalleled magnitude of urbanisation has remade China's urban environment. At the same time, it has generated both opportunities and challenges for the country's sustainable urban development (Figure 4).

Figure 4: China's urban and rural population change (1950-2022)



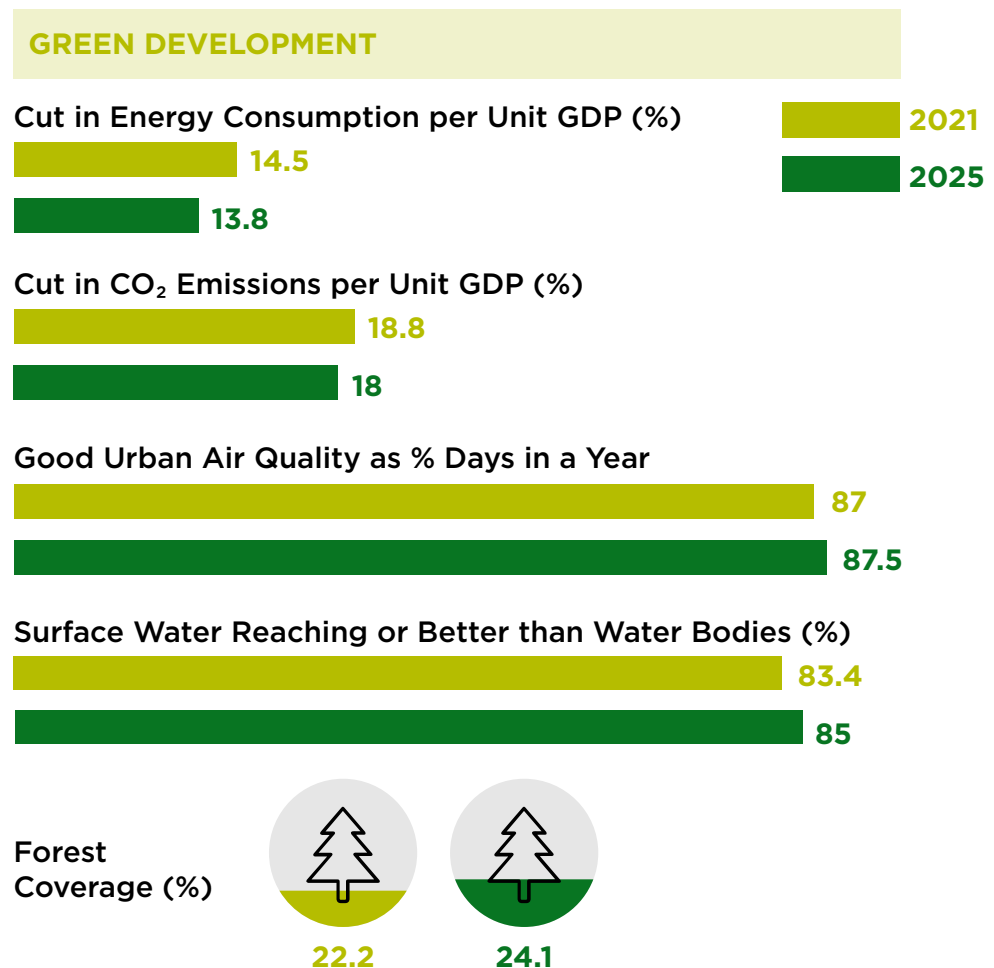
Source: National Bureau of Statistics (China), Cushman & Wakefield Research

Into the future, how China continues to develop its cities will have many outcomes for its urban citizens, including outcomes related to their quality of life, their access to amenities and services, their social equity status and the amount of GHG emissions they individually produce. In short, China's future urban development outlook will largely rest on making sure cities in the country are as all-encompassing, accessible, even-handed and sustainable as they can possibly be. When suitably implemented, the 15-minute city urban planning concept can go a long way in ensuring cities in China can achieve these goals.

POLICY

When considering general urban planning and development in China, one always has to begin with policy. One overriding policy that is trying to transition China's development to be more people-centred especially when urbanisation is considered is China's 14th Five-Year Plan and Long-Term Targets for 2035, which was published in April 2021. Moreover the plan also put a figure on both a carbon intensity goal and a given GHG carbon emissions cap so that economic growth and social development do not further add to global warming (Figure 5).

Figure 5:
China's 14th Five-Year Plan: Headline sustainability goals



Source: Cushman & Wakefield Research

The 14th Five-Year Plan is an opportunity not just to mitigate climate change, but also to plan, design and build more sustainable urban environs in China, with the 15-minute city concept being a key feature.

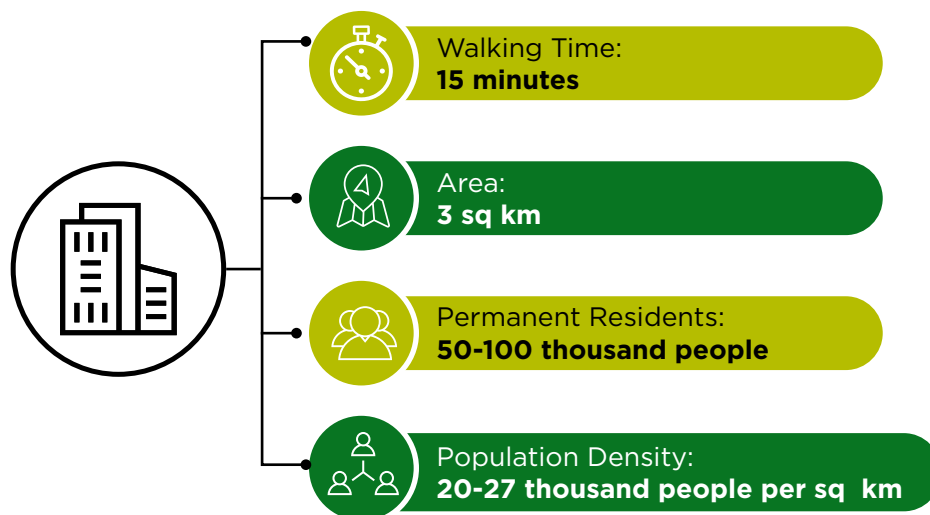
GENERAL URBAN PLANNING

When it comes to planning sustainable urban environs in China, the 15-minute city concept has been already adopted by some cities in China, such as Shanghai and Beijing. In these cities, within particular designated areas, all the core amenities and services are now within walkable access to all citizens living in the area. Today, in these cities, walkability and access to all basic amenities and services for all citizens in an area is fast becoming the basis for general city planning when looking to build new urban areas or renovate/regenerate existing urban areas.

Just as in the case of universal 15-minute city concept adopted in other cities around the globe, the ones adopted and implemented in Beijing and Shanghai are:

- Welcomed by citizens who don't have an automobile;
- Inspire new businesses to open close by, and;
- Help lessen GHG emissions through the avoidance of superfluous travel (Figure 6).

Figure 6: Shanghai's 15-minute city areas



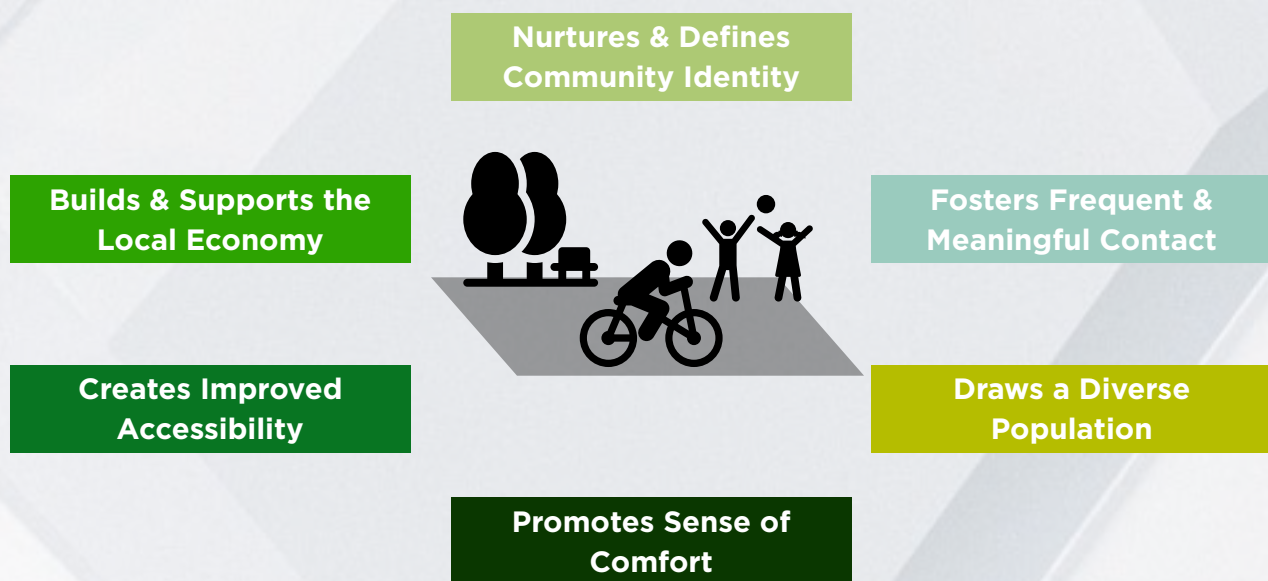
Source: Shanghai Urban Planning and Land Resources Administration Bureau, Cushman & Wakefield Research

URBAN PUBLIC SPACE

When specifically considering urban public space in China in relation to sustainable 15-minute city urban environs, the aim for local governments is to generate all-inclusive citizen-friendly settings that are also economically workable. It's not just a matter of simply planning, designing and incorporating a public space which is accessible by a short walk; ideally it must

be a placemaking approach that produces community ownership of public spaces from space planning to space operation and management. Ultimately, the approach adopted should produce a public space which a 15-minute walkable community and visitors alike wish to be active in and wish to spend time in again and again (Figure 7).

Figure 7: The benefits of good placemaking



Source: Project for Public Spaces, Cushman & Wakefield Research

Placemaking is an all-embracing procedure to the planning, design and management of urban public space. Placemaking examines the current qualities and strengths a local community possesses. This, together with the community and via best-practice placemaking concepts, then expedites the formation and establishment of urban public space that rouses experience and amplifies citizens' health, happiness, and wellbeing.

Effective placemaking is equally a process and a line of thinking that applies urban design principles. Placemaking can be directed by an official authority and propelled at the grass roots level. Involving all interested parties, best-practice placemaking can enhance underused urban public space to augment the built environment experience at the pedestrian level.



Good placemaking needs the wide involvement of a number of participants to design and operate projects and activities because these elements need to be suitable and befitting to the community experience to make the place work to its full potential. This quality singlehandedly distinguishes placemaking from various other community development, economic development and infrastructure development actions and endeavours.

Given its multidimensional character and its importance to the community experience, getting the planning and execution right really matters. According to the Homes and Community Agency in the UK, there are eight themes where placemaking have a significant change impact. These eight themes are:

- Governance;
- Accessibility;
- Services;
- Environment;
- Equity;
- Economy;
- Housing and the built environment, and;
- Society and culture (Figure 8).

Figure 8: Eight key themes where good placemaking can have a positive bearing

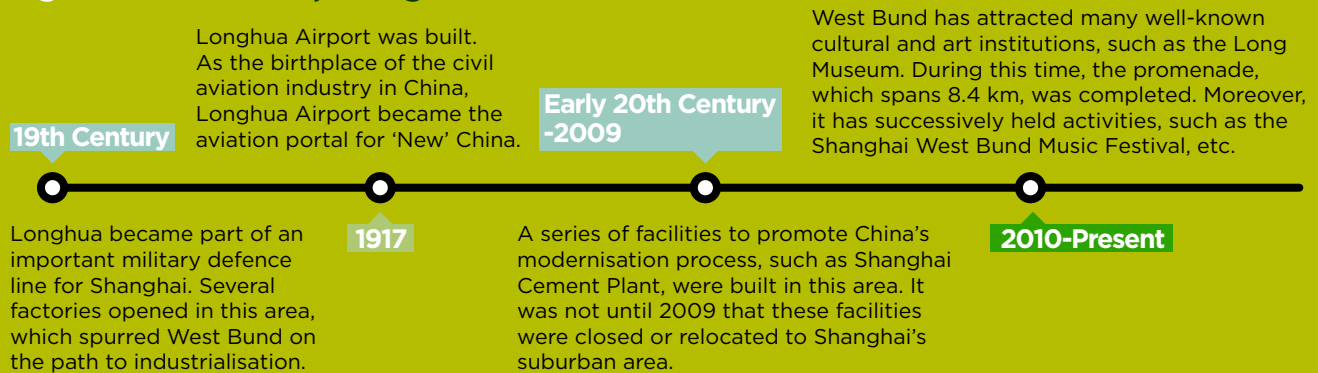


Source:
Homes and Communities Agency UK, Cushman & Wakefield Research



In China, one development which includes many of the themes outlined in Figure 8, is walkable, offers a multitude of placemaking inspired activities and is a place that draws both local residents and visitors as well as investment to boost the local economy is West Bund in Shanghai (Figure 9 and Case study 1 in the Appendix).

Figure 9: West Bund, Shanghai timeline



Source: Cushman & Wakefield Research

Ahead, a 'place-led' method will inspire a sense of purpose in China, and the planning and management of urban public spaces will be executed by an all-encompassing assemblage of people that foster social capital, shared values, a sense of ownership and a more enriched experience of the place and the city as a whole by urban citizens within their walkable and sustainable urban environs.



TRANSIT-ORIENTED DEVELOPMENT (TOD)

To interconnect sustainable individual 15-minute urban environs within a city, it is essential for cities in general, including those in China, to have a well-planned and efficient overall public transport system that is easily accessible, is convenient and cuts both journey times and air pollution levels for all their citizens.

One resolution that a number of cities in China have implemented or are looking to implement is transit-oriented development (TOD). National level encouragement and backing in China for TOD is growing,

including TOD planning and development, TOD financing, and land set aside for TOD use.

TOD essentially maximises the amount of residential, business and leisure space within walking distance of public transport. It also encourages an interdependent bond between compact urban development and public transportation. Moreover, TOD aspires to increase public transport usage by lessening the use of automobiles, which in turn augments environmental sustainability within the urban area (Figure 10).

Figure 10: The advantages of TOD



Mobility Benefits

- Increase access to jobs and amenities city wide
- Improve access to a low-cost transport solution (public transit/walkable urban space/bicycle infrastructure)
- Reduce automobile-dependency

Social Benefits

- Revitalise neighbourhoods
- Promote social equity through creation of mixed-income housing near transit
- Increase accessibility for less mobile
- Improve health and increase physical activity through creation of walkable neighbourhoods

Environmental Benefits

- Lower air pollution and GHG emissions by reducing automobile-dependency and urban sprawl
- Reduce energy consumption
- Conservation of green and natural spaces

Economic Benefits

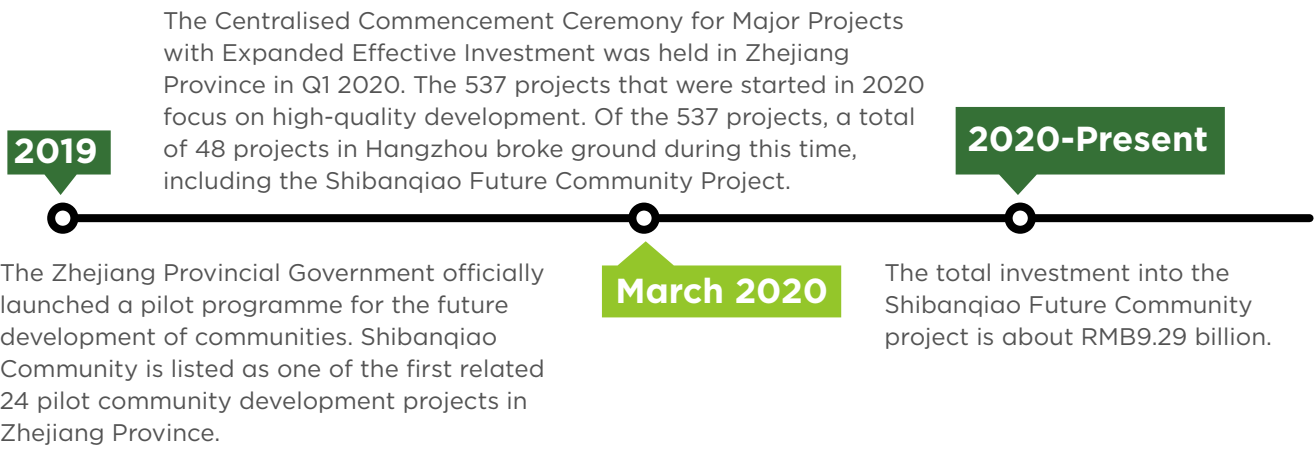
- Increase agglomeration and access to employees
- Encourage economic resilience through diversity
- Energise the local economy
- Increase property values along corridors to help fund needed infrastructure
- Reduce infrastructure costs
- Reduce transport costs

Source: WRI, Cushman & Wakefield Research



TOD more often than not includes a central transportation hub (such as a train station with bus stops) which is bounded by mixed-use development incorporating commercial and residential properties. In addition, TOD is intended to be walkable. A good example of an overall TOD project which is walkable is the Shibangqiao Future Community in Hangzhou (Figure 11 and Case study 2 in the Appendix).

Figure 11: Shibangqiao Future Community, Hangzhou timeline



Source: Cushman & Wakefield Consulting, Cushman & Wakefield Research

ECOLOGICAL SOLUTIONS

As mentioned previously, given one of its 'four leading principles' is centred on ecology, the 15-minute city concept places much emphasis on the need for more green areas, a lessening of the urban heat-island effect, a reduction of the occurrence of flooding, and greater biodiversity.

For example, at the UN Biodiversity Conference held in Kunming, the Dapeng Peninsula in Shenzhen, which experiences recurrent typhoons and storm surges, was designated as the pilot area which centres its development on ecology.

In terms of the mitigation of flooding, the Ministry of Finance, the Ministry of Housing and Urban-Rural Development, and the Ministry of Water Resources studied and selected 20 cities to plan and activate pilot sponge city projects in. Once fully initiated, these sponge city projects will go a long way to soak up excess water and not allow this water to behave as damaging uncontrolled runoff water (Figure 12).

Figure 12: Elements to a simple sponge city system



Source: Cushman & Wakefield Research

Moreover, one of the 15-minute city concept's 'six requisites' is focused on 'supplying'; in other words a need and a drive for self-sustaining sustenance or food production in the form of urban agriculture.

One urban planning model which can certainly assist in this, and which is being adopted and implemented in China is ecological-oriented development (EOD). Following on from this, according to MIT and its 10 directional principles for EOD, one important principle is the maximisation of on-site food production and China is also seriously looking to this when it comes to 15-minute city planning and urban agriculture (Figure 13).

Figure 13:

10 directional principles for EOD

1 COMPLETE the WASTE and WATER CYCLE



Treat 100% of water and waste (sewer, grey water and storm water) on-site and at all scales.

2 INTEGRATE INFRASTRUCTURE SYSTEMS



From embedded and ubiquitous digital technologies to EcoEngineering, infrastructure systems and buildings should enhance system flows and combine delivery methods.

3 DESIGN for EFFICIENT ENERGY



Utilise on-site renewable energy technologies in conjunction with site orientation and planning to maximise benefits of passive and climatic power conservation.

4 MAXIMISE ON-SITE FOOD PRODUCTION



Increase self-reliance and local food production especially of fruits and vegetables.

5 ENHANCE MOBILITY and CIRCULATION



Use new modes of transportation that reduce energy consumption from local to regional, from personal to shared. Reshape and organise the circulation patterns to correspond to new travel modes and behaviour.

6 RESTORE STREAMS and RIVERS



Enhance and rehabilitate existing waterways. Restore and protect the watershed integrity and enhance it by using technology.

7 RE-ESTABLISH HABITAT and WILDLIFE



Retain, construct and restore ecological matrices to support animal species, vegetation and topographical features. Conserve and protect existing features during construction. Connect local level networks to regional systems.

8 INCORPORATE INNOVATIVE MATERIALS



Use building materials and site products (pavers, walls, etc) that reduce energy consumption (local materials) and have the potential to adapt to changes.

9 PRESERVE CULTURE and HERITAGE



Integrate local values through preservation, protection and integration into new building and landscape design.

10 VALUE EQUITY, HEALTH and HAPPINESS



Improve living and working environments for all demographic and age groups.

Source: Massachusetts Institute of Technology (MIT), Sekisui House, Cushman & Wakefield Research



China's Research Centre for Protected Agriculture & Environmental Engineering (CPAE), part of the Chinese Academy of Agricultural Sciences, in Beijing is one such organisation that recognises the importance of farming in the urban area. Today, the Centre has no fewer than 40 research institutes which are studying all aspects of indoor and vertical urban farming, greenhouse engineering, plant factories, hydroponics and energy efficiency.

The Centre recognises that given the climate changeability in China vertical farms in the region need to be proficient in producing food during the winter when temperatures can get as low as -55 degrees centigrade in the northern-most provinces.

Subsequently, with developed technology, such as hydroponics, LED lighting, heat pumps and active heat storage, compared to traditional farming, a developed urban farm with natural solar light can improve productivity per unit area by between two and ten times. With artificial light this increases to 40 times and by including vertical farming techniques this can reach a productivity improvement of more than 1,000 times that of a conventional farm.

When properly integrated into a 15-minute city plan, urban agriculture can generate many advantages, including social and cultural benefits, health and wellbeing improvement, a better environment and more enhanced local economic and community development (Figure 14).

Figure 14: Advantages of urban agriculture

SOCIAL & CULTURAL	HEALTH & WELLBEING	ENVIRONMENT	ECONOMIC & COMMUNITY DEVELOPMENT
- Creates community cohesion - Provides green space for community members to gather - Can strengthen social connections and intergenerational relationships - Can foster cultural expression and maintenance of cultural heritage - Can help to develop a sense of belonging	- Increases access to fresh, organic, and culturally appropriate produce - Increases preferences for and consumption of fruits and vegetables - Mitigates food insecurity - Increases food system resilience by maintaining access to food in times of crisis - Source of physical activity - Mental health & therapeutic benefits	- Increases biodiversity, including pollinator habitat - Reduces energy and resource inputs - Reduction in greenhouse gas emissions and air pollution - Carbon sequestration by vegetation and crops - Temperature regulation in urban areas	- Creates opportunities for youth education and development - Increases property values - Employment training & opportunities - Entrepreneurial urban agriculture activity can attract capital and create business opportunities - Creates opportunities to learn about agriculture, nutrition and sustainability
 Community Garden  Home Garden	 Market Garden  Urban Farm	 Hydroponics, Aquaponics, and Aquaculture  Farmers Markets and Community Supported Agriculture	 School Garden

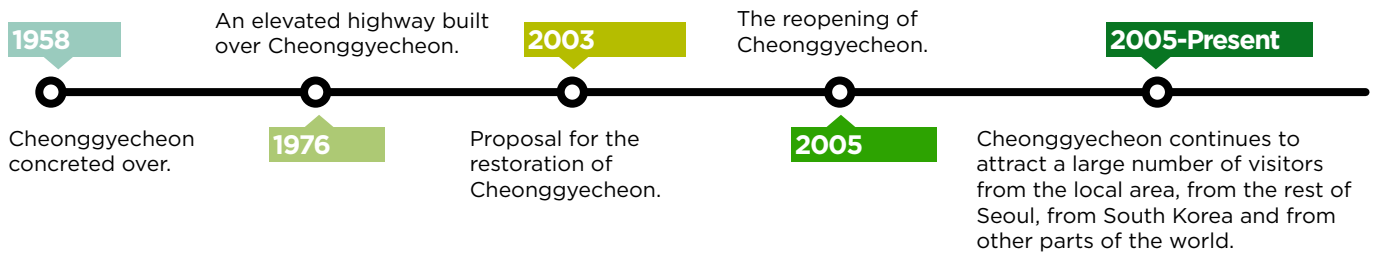
Source: University of Florida, Cushman & Wakefield Research

Again, according to MIT and its 10 directional principles for EOD, two further important principles are the restoration of rivers and streams and the re-establishment of habitat and wildlife. Beyond, these natural green spaces also reduce relative temperatures in the city, thereby enhancing liveability. This is due to greenery shading the city streets and thus reducing the 'heat island effect'.

One international EOD project where we can see such improvements at work is the rejuvenation of Cheonggyecheon in Seoul, South Korea (Figure 15 and Case study 3 in the Appendix).

Figure 15:

Cheonggyecheon, Seoul



Source: Cushman & Wakefield Research

Cheonggyecheon involved a massive urban public restoration project undertaken by the Seoul Metropolitan Government in which a concreted-over drainage system was converted into a vibrant public recreation space. The 10.9 km sewage stream, which was underneath an elevated highway, carried a mass amount of rubbish and was an unpleasant site for the city. The restoration project called for the removal of the highway and revitalisation of the stream into the 'Cheonggyecheon Culture Belt'. Through a new network system, a pedestrian road connects the stream with surrounding historic property assets, and traffic flow measures were implemented to reduce congestion and improve the general usage of the highway.

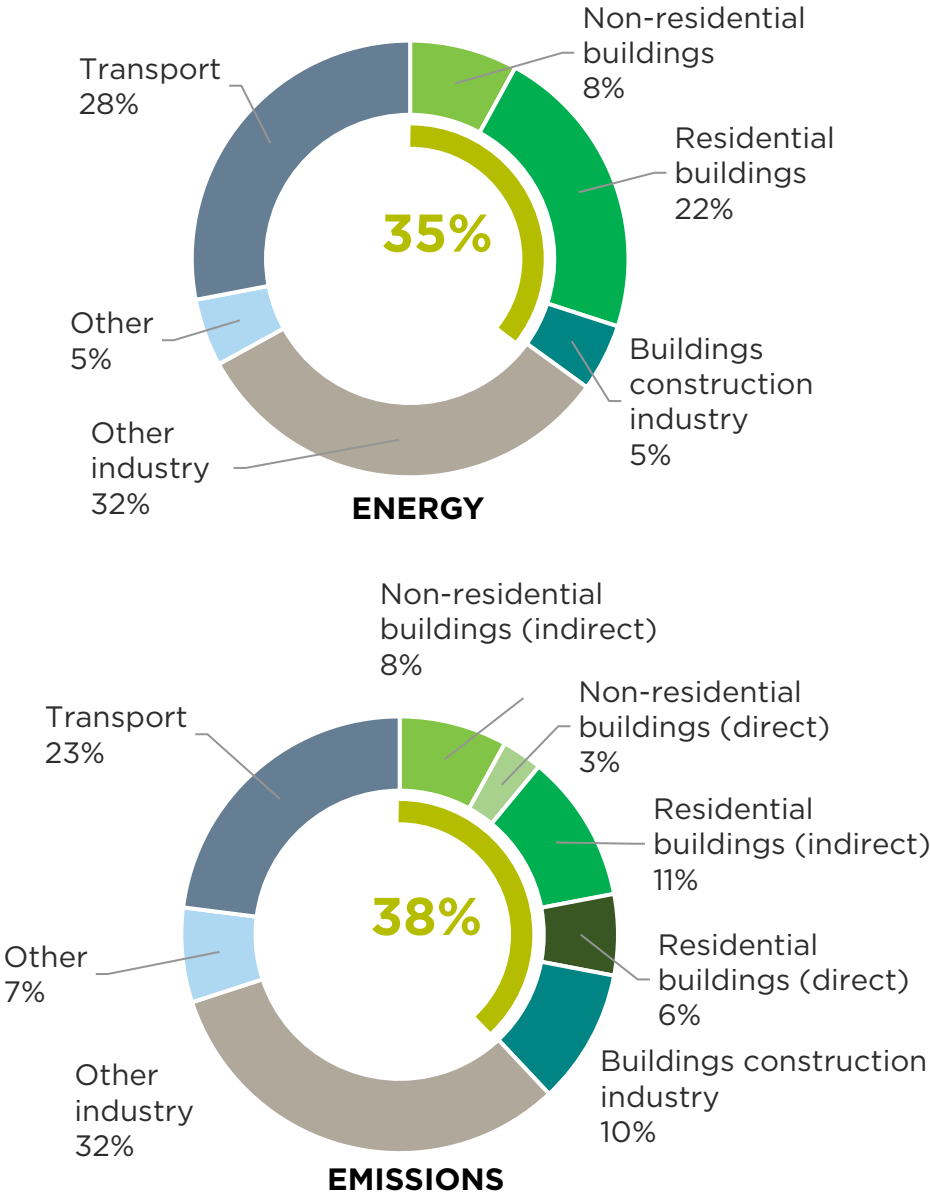
The case of Cheonggyecheon illustrates that even sites that feel beyond repair can be looked at anew through conversion to new and better use. In turn, such efforts can change a community for the better, providing a walkable public space for residents and boosting the surrounding community by attracting shops, businesses and other commercial activity. The converted stream now provides the city of Seoul with clean water and even helps cool down the nearby temperature by as much as 3.6 degrees centigrade. Overall, this EOD-related project has resulted in the provision of flood protection and has increased biodiversity in the area by as much as 639%. Importantly, the project has enhanced liveability of the surrounding community and returned the natural environment to the city centre.



NET ZERO BUILDINGS

According to 'The 2020 Global Status Report for Buildings and Construction' report by the United Nations, while global building energy consumption in 2019 remained steady on an annual basis, energy-related carbon dioxide emissions increased to 9.95 Gt in 2019. When adding emissions from the building construction industry on top of operational emissions, the building sector was responsible for 38% of total global energy-related carbon dioxide emissions (Figure 16).

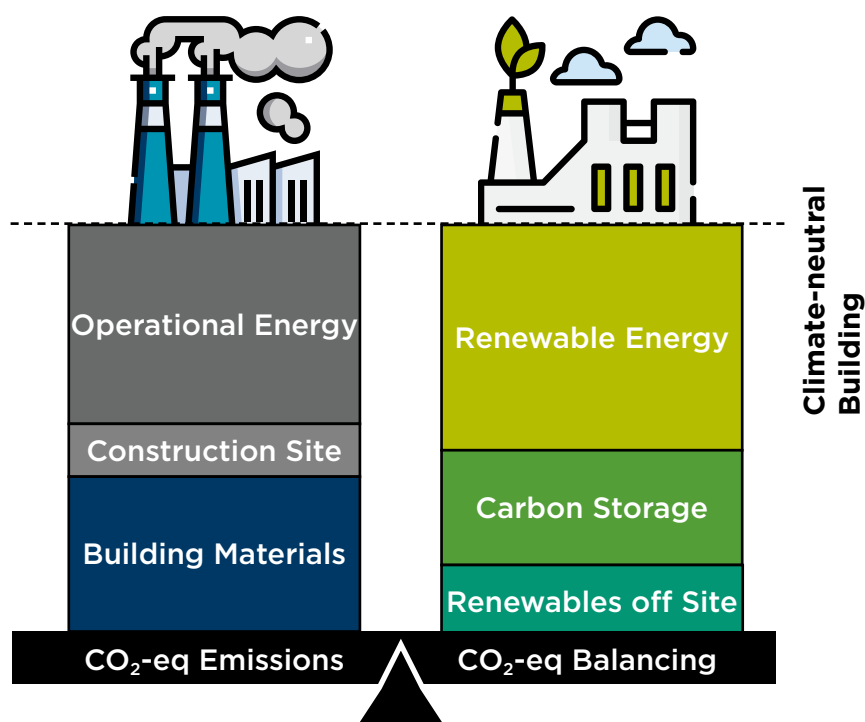
Figure 16: Global industry energy consumption and energy-related carbon dioxide emissions (2019)



Source: IEA, UN, Cushman & Wakefield Research

In China, the urban built environment is no different. It is one of the principal sources of GHG emissions in the country. In order to reduce the amount of energy used by, and carbon emissions from, buildings in China, including buildings in walkable 15-minute city precincts, it will be important to take the next step and go carbon neutral, which requires a 'carbon balance' to be established (Figure 17).

Figure 17:
Finding a balance for a climate neutral building



Source: White Arkitekter, Cushman & Wakefield Research

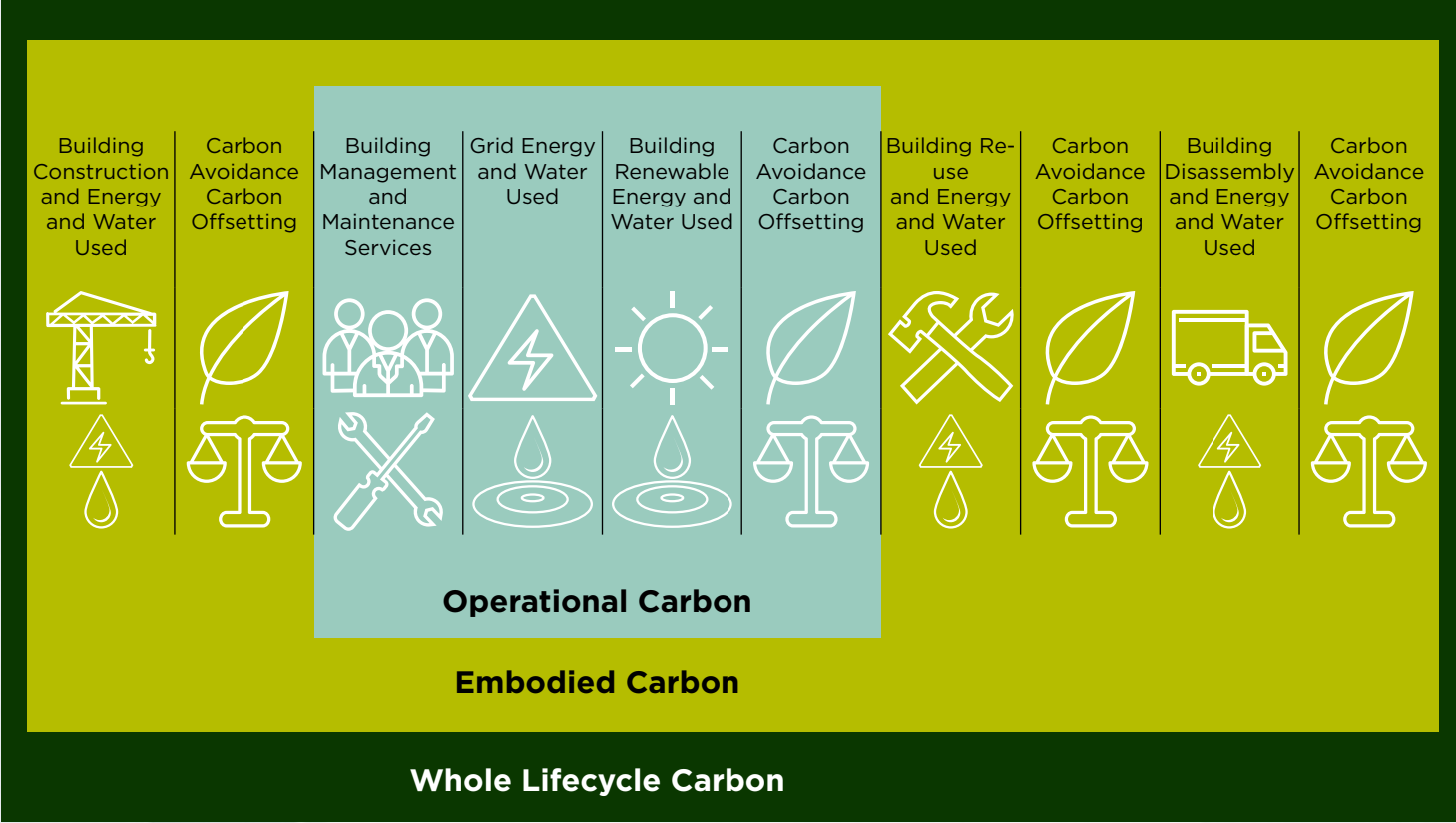
Looking at whole building lifecycle carbon, the amount of energy and water used during a building's lifespan needs to be considered. When ruminating on this, many aspects about a building project have to be assessed, including:

- The proposed use of the building;
- The proposed design of the building;
- The proposed building systems, plant and machinery used in the building;
- The extraction of the building materials;
- The processing and manufacturing of the building materials;
- The transportation of the new building materials;
- The construction of the building;
- The operation, management and maintenance of the building;
- The re-use/disassembly of the building (if known);
- The transportation of the old building materials;
- The recycling of the old building materials, and;
- The landsite where the rest of the old building materials will be deposited.

Before building, operating and re-using/dismantling a building, it will be important for building investors, developers, owners and users in China, to execute on the right whole-building lifecycle approach and to do this, the following elements will also need to be taken into consideration:

- Carbon offsetting;
- Carbon avoidance;
- Embodied carbon, and;
- Operational carbon (Figure 18).

Figure 18: Whole building lifecycle carbon



Source: Cushman & Wakefield Research

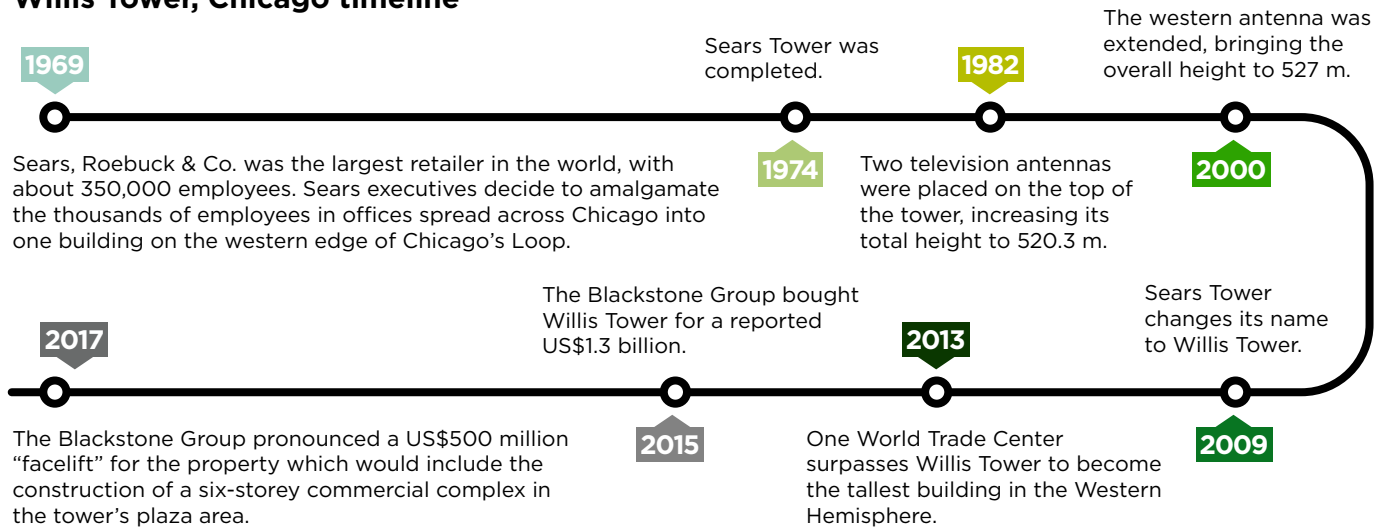
Additionally, the COVID-19 outbreak has brought to the attention of investors, developers, owners and users of real estate space in China the importance of building health and safety, building wellness and wellbeing, and smart building technology.

Moving on from technology, operating efficiently is the next step from operating clever. Once all the smart building meters and systems, plant and machinery are installed and operating, it will be important for an investor, developer or landlord in China to make sure, (with the help of a professional property/facilities management consultant if needed), that this equipment

remains relevant, up-to-date and in good working order at all times. It will also be important that the building’s property management staff thoroughly understand the workings and how to operate all the systems and equipment at any one time. By ensuring this, carbon emissions arising from inefficient building systems and equipment can be avoided. One building that is now undertaking an extensive building plant and machinery refitment programme is Willis Tower in Chicago. Once fully completed the building hopes to run on 100% renewable energy (Figure 19 and Case study 4 in the Appendix).

Figure 19:

Willis Tower, Chicago timeline

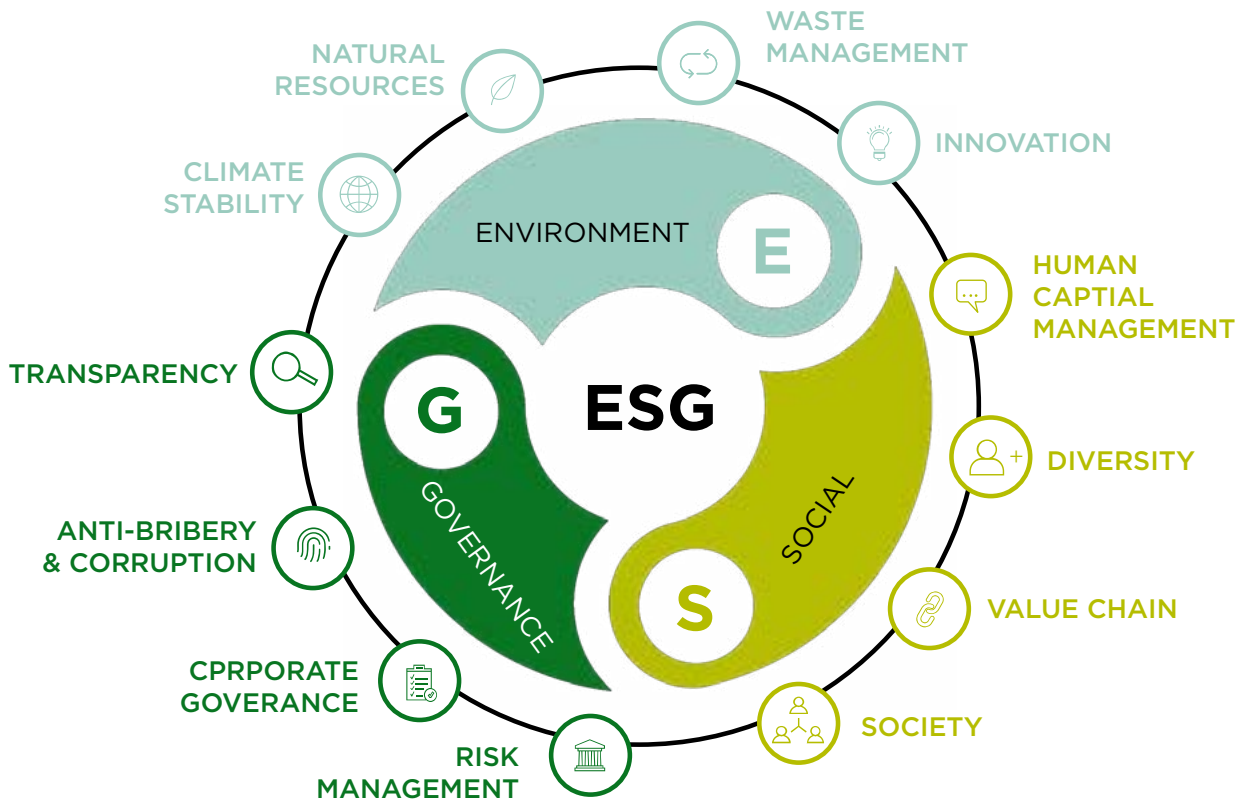


Source: Cushman & Wakefield Research

Much of the attention has also been brought about by a further push by authorities for environmentally sustainable development as well as by investment capital that is environmental, social and governance (ESG) principals-driven and/or environmental sustainability-driven, such as green financing capital (Figure 20).



Figure 20: Selected criteria behind ESG

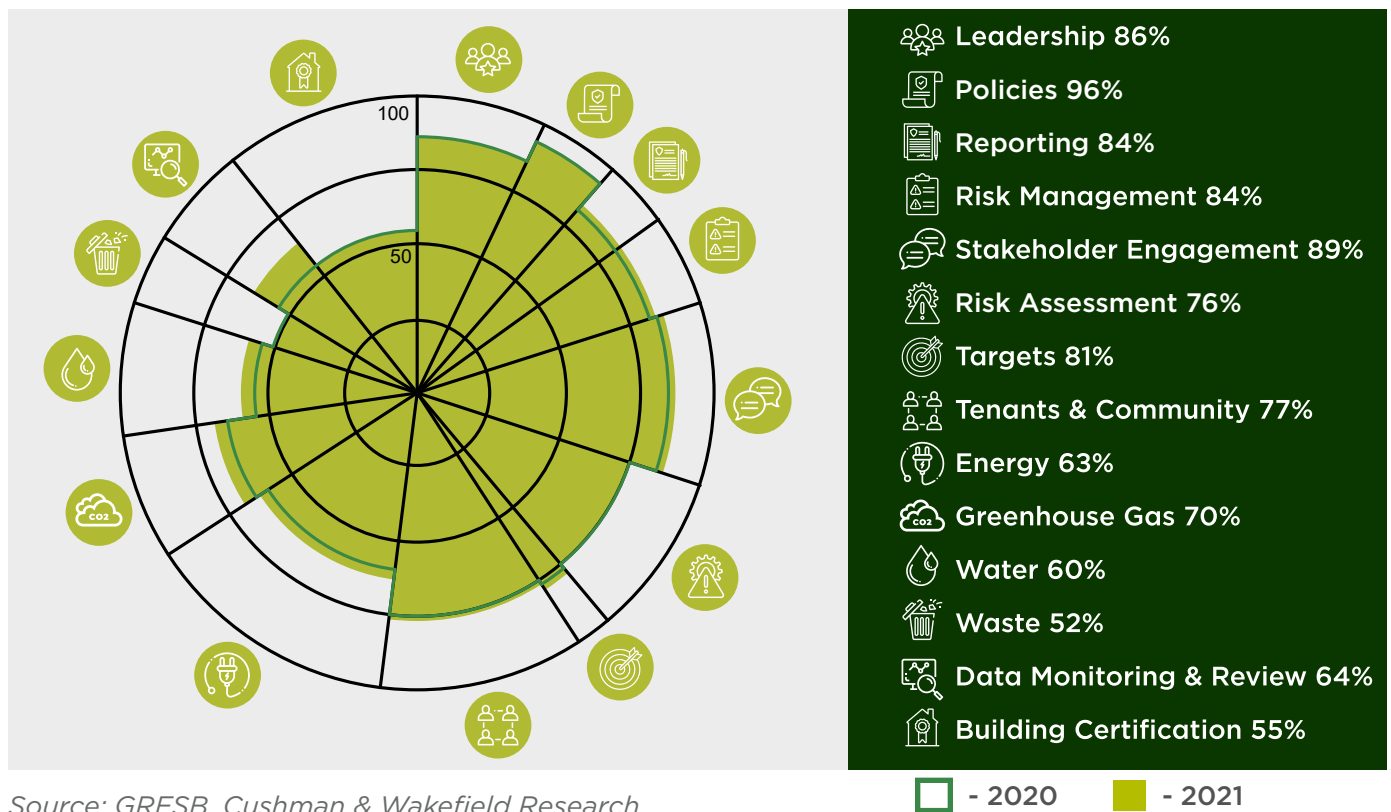


Source: BWFA, Cushman & Wakefield Research

Given the 'green' development momentum of late, these drivers are increasingly going to become key influencers in the development and operational decision making of building investors, developers, owners and users in China.

In addition, more and more real estate developers and real estate fund companies have joined the Global Real Estate Sustainability Benchmark (GRESB) (Figure 21).

Figure 21:
GRESB rating and score example



Some companies operating in China have been participating in the assessment for many years. Having said this, green building in China is still continually developing and growing and alongside this development and growth, GRESB will be used more in the country for measuring the sustainability performance of real estate companies and real estate funds because:

- It incorporates a rounded methodology;
- It has a clear assessment goal;
- It is an international like-for-like standard that can be used in different jurisdictions across the globe, and;
- It is a standard that is continually evolving.

Finally, when considering optimal carbon neutrality solutions for buildings in China, there needs to be collective and early involvement of all professionals within a design team. In addition, the 15-minute city concept is not just about how we move around but also about how we live on a daily basis, such as how we utilise buildings. Multiple-use buildings which can also accommodate a mix of living and commercial space are ideal in terms of urban environmental sustainability for walkable sustainable urban environs in China.

KEY TAKEAWAYS

- To bring about beneficial urban environmental sustainability change that results in sustainable urban environs, one concept cities in China can look to adopt and implement is the '15-minute city' concept.
- The 15-minute city is a fresh concept that promotes both urban environmental sustainability and urban liveability.
- One overriding policy that is trying to transition China's development to be more people-centred especially when urbanisation is considered is China's 14th Five-Year Plan and Long-Term Targets for 2035, which was published in April 2021.
- When it comes to planning sustainable urban environs in China, the 15-minute city concept has been already adopted by some cities in China, such as Shanghai and Beijing.
- When specifically considering urban public space in China in relation to sustainable 15-minute city urban environs, the aim for local governments is to generate all-inclusive citizen-friendly settings that are also economically workable.
- To interconnect sustainable 15-minute urban environs, it is essential for cities in general, including those in China, to have a well-planned and efficient overall public transport system that is easily accessible, is convenient and cuts both journey times and air pollution levels for all their citizens.
- The 15-minute city concept also places much emphasis on the need for more green areas, a lessening of the urban heat-island effect, a reduction of the occurrence of flooding, and greater biodiversity.
- Finally, in order to reduce the amount of energy used by, and carbon emissions from, buildings in China, including buildings in walkable 15-minute city precincts, it will additionally be important to take the next step and go carbon neutral, which requires a 'carbon balance' to be established.



Shanghai West Bund

The rebirth of a disused industrial area

Summary:

Shanghai's West Bund was a brownfield site that is now a public space populated by green areas, walkways and renovated buildings. It has now become one of the most dynamic waterfronts in core Shanghai.

2003 - Present



Timeline of major events/milestones reached:



Overview:

West Bund has undergone a development rebirth in recent years and has become an important public space in Shanghai. With an area of 9.4 sq km and a waterfront length of 11.4 km, it is the largest single designated area along the Huangpu River in core Shanghai. The total real estate development volume is estimated to be over 9 million sq m.

Impact:

- West Bund now has over 281,000 sq m of integrated green space. The vegetation planted is such that the public can enjoy different landscapes and seasonal flowers;
- West Bund has won many awards and honours, such as “the most beautiful running route in Shanghai” and China Habitat Environment Example Prize;
- Over 20 cultural and art venues are to be found in West Bund. The area can host nearly 100 high-quality international events every year.

How it was done:

- Landscaping, building renovation, integration of the waterfront and walkway routes in and around West Bund were key to the area's planning and design;
- The disused runway at the old Longhua Airport was converted into a 'runway' park, interspersed with water features and green space;
- Retaining the original appearance and features of the structure, the Yuz Museum was transformed from an old Shanghai Aircraft Factory hanger;

- Well-known cultural and art institutions, such as Long Museum, Yuz Museum and Tank Shanghai (a park transformed from five preserved fuel storage tanks) were successfully assimilated;
- High quality events and activities, such as the West Bund Music Festival, the West Bund Food Festival and the Shanghai West Bund Biennial Festival for Architecture and Contemporary Art are held in West Bund.

Results:

- West Bund has been successfully transformed from a disused industrial site and an abandoned airport into one of the most vibrant and dynamic public spaces in Shanghai;
- Nowadays, the area is a multi-functional recreation park. People can explore the city's history and culture while walking, jogging or cycling.

Key takeaways:

- West Bund is a continuation of Shanghai's overall plan to have a connected riverfront walkway. It has become a unique and indispensable part of the Shanghai Riverside Promenade;
- The existing landscaping in West Bund plays an important ecological role in greening Shanghai's urban area;
- Being a public space, West Bund is designed to be easily accessible and welcoming to all.

Hangzhou Shibaoqiao Future Community

Realising the transformation from 'building houses' to 'building living'

Summary:

Shibaoqiao Future Community is a TOD development which focuses on walkable liveability and the neighbourhood, education, citizen health, entrepreneurship, construction quality, transportation, low-carbon development, service and governance.

2019 - Present



Timeline of major events/milestones reached:



Overview:

By sorting out the existing problems of Wangjiang New Town area in Hangzhou's Shangcheng District and by looking for the reasons for the improvement of regional human settlement value, the project will carry out the reconstruction of business form and the upgrading of functional positioning, so as to make the community a liveable harbour for residents.

Impact:

- The one-stop neighbourhood centre offers fun for all ages and provides an all-round community governance service;
- The talent employee apartments are equipped with high frequency living amenities;
- The neighbourhood cultural park focuses on art exhibition, theme shows and is a community cultural landmark;
- The nursing centre, provides a comprehensive range of health services to the local community;
- All components within the overall project are walkable.

How it was done:

- In terms of spatial distribution, according to the principle of intensive and efficient use of space, Wangjiang sub-district will be subdivided and restructured into six main functional elements, including the neighbourhood, governance, services, health, education, and start-up businesses;
- The Future Community will incorporate IoT to provide greater operational efficiency between on and off-line community service functions;

- In terms of low-carbon energy conservation, the project's residential housing will introduce quasi-passive housing technology to reduce energy consumption. Photovoltaic power generation will be used to power public space lighting. In addition, the project will utilise a comprehensive rainwater collection system to irrigate the common area landscaping, and pollution-free kitchen waste will be employed to fertilise the rooftop gardens. Finally, the overall project will be walkable, thus cutting the need to use automobiles and therefore further reduce GHG emissions.

Results:

- The creation of a walkable neighbourhood with all main amenities and services close at hand;
- In the future, entrepreneurship services, functional workspace and talent employee apartments are expected to boost employment within the neighbourhood and enhance the notion of a live/work community;
- Apart from the development being walkable, other features within the development which make it green include photovoltaic panels on buildings for energy generation, smart building systems for energy conservation, an integrated comprehensive recycling programme and utilisation of water-saving schemes, such as greywater recycling.

Key takeaways:

- As a walkable community TOD project, the Shibangqiao Future Community aims to solve many pain points existing in traditional hub communities by improving the happiness index of community residents and implementing optimised low-carbon green construction and operations throughout the project.

Seoul Cheonggyecheon

The creation of a green urban recreation space

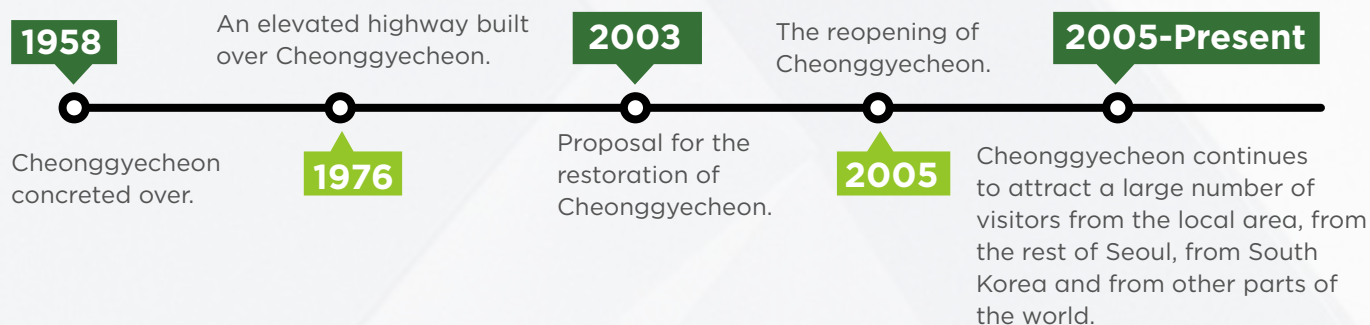
Summary:

Redevelopment of a 10.9 km creek into a modern green public recreation space

2003 – Present



Timeline of major events/milestones reached:



Overview:

Cheonggyecheon represents an impressive EOD urban renewal project, from a concreted over drainage system into a green public recreation space.

The EOD urban renewal project was regarded as a solution to address a 10.9 km sewage stream accompanying trash and waste, with an elevated highway over it. The deteriorating water environment resulted in an eyesore for the city. In 2003, the then Seoul mayor, Lee Myung-bak, initiated an EOD city regeneration project to remove the elevated highway and restore the stream. The city authority spent about \$900 million and completed the project in 2005. Since then, Cheonggyecheon has become popular among local residents and tourists alike.

Impact:

- Cheonggyecheon brings a variety of positive elements to the city of Seoul. This EOD urban renewal project has introduced a natural environment with clean water;
- The stream helps to cool down the temperature in the nearby area by as much as 3.6 degrees centigrade;
- Because Cheonggyecheon has become an important venue for cultural and economic activity, it has been a driving force for the revitalisation of downtown Seoul.

How it was done:

- Due to the deteriorating environment, the Seoul Metropolitan Government proposed an EOD urban renewal plan centring on Cheonggyecheon. The highway was removed, and traffic flow measures taken to address any arising traffic congestion;

- This EOD urban renewal project preserved the unique identity of the natural environment as in central Seoul. Additionally, the surrounding business areas were revitalised through the implementation of the latest information technology systems. Moreover, the plan encouraged a pedestrian-friendly road network connecting the stream with the surrounding historic property assets in Bukchon, Daehangno and Jungdong. This network system is called the 'Cheonggyecheon Culture Belt'.

Results:

- The EOD urban renewal project provides proven flood protection and, between 2003 and 2008, biodiversity in the locality has increased by as much as 639%. On a daily basis around 64,000 visitors came to Cheonggyecheon's public recreation space;
- It is a successful case study for a number of other major cities in terms of the preservation of an urban creek and its natural ecosystem.

Key takeaways:

- The Cheonggyecheon EOD restoration project demonstrates a number of positives in terms of enhancing community liveability and economic revitalisation through the renewal of a brownfield site;
- Due to a range of urban issues, including overbuild, natural ecosystems and the natural environment have been overlooked for some time by mega-cities around the world. Re-greening is now a movement that is addressing some of these issues by bringing the natural environment back to the centre of the city for all citizens to enjoy.

Chicago. U.S.A. Willis Tower

To be powered by 100% renewable energy

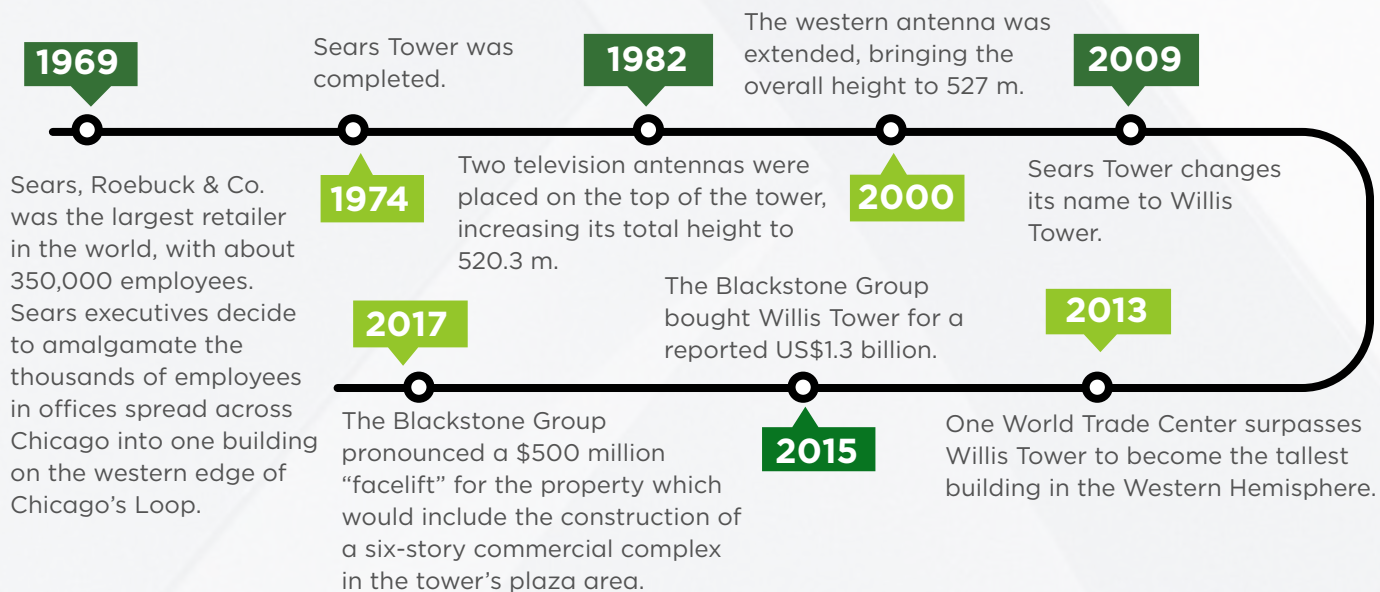
Summary:

The landmark Willis Tower in Chicago has added sustainable elements even after being bestowed with a LEED Platinum certification. The 110-story office tower, which is the largest building in the U.S. to have been granted the certification, is also expected to be powered by 100% renewable energy throughout a multi-year partnership with Texas-based Dynergy.

1969 – Present



Timeline of major events/milestones reached:



Overview:

- Willis Tower is undertaking widespread upgrading and infrastructure retrofitting;
- These changes include retrofitting the HVAC system, installing motion sensors, placing lighting control panels in tenant areas, and converting to LED fixtures;
- A thorough improvement of the building's automation system is anticipated to offer improved temperature control, HVAC sequencing, and energy monitoring;
- Plans call for updating chillers, retrofitting cooling towers, and supplanting obsolete variable frequency drives with new ones that can interconnect with the building automation system;
- The tower also plans to be 100% powered by renewable energy in the future.

Impact:

- Willis Tower has become the largest office building to be granted the Energy Star certification;
- This means it uses an average 35% less energy than a standard building;
- This has helped Willis Tower to secure efficiencies, reduce operating costs, and enjoy higher net rentals;
- It has also added value by actually helping to raise building occupancy.

How it was done:

- Some retrofit projects in Willis Tower can take six months, while others are scheduled to take up to six years;
- So far, Willis Tower has retrofitted a 4,800-ton chiller and a 1,400-ton chiller;
- The three remaining chillers are slated to be retrofitted over the next three years;
- Willis Tower is also undertaking a modernisation of its lift system and this specific project is expected to be completed in five years' time.

Results:

- The chiller retrofit helped Willis Tower realise electric savings from .9 watts a ton to .6 watts per ton;
- By supplanting the cooling tower media, gear boxes, fan blades, and VFDs, this facilitated the provision of cooler water to the chiller plant;
- Willis Tower anticipates 20% to 30% in cost savings from all these collective improvements.

Key takeaways:

- Willis Tower is embarking on comprehensive programme of upgrading and infrastructure retrofitting;
- Willis Tower foresees 20% to 30% in cost savings from all these combined enhancements;
- The tower also intends to be 100% powered by renewable energy in the future.

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