RICS POLICY PAPER

Decarbonising the built environment in China

Integrating the efforts of regulators and companies

November 2023

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Glossary

Term	Definition
Building life cycle	The BS/EN 15978 standard divides the building life cycle into four stages: • Stage A: Product and construction process • Stage B: Use • Stage C: End of life • Stage D: Benefits and loads beyond the system boundary. Each stage is further divided into modules.
Carbon emissions	Although carbon dioxide is only one among a number of greenhouse gases, the term 'carbon emissions' is used throughout this paper as a proxy for human-produced greenhouse gases.
Carbon intensity	The quantity of carbon emissions associated with an activity or product, often compared to its alternatives. For example, travelling by car is more carbon-intensive than travelling by train.
Embodied carbon	The total greenhouse gas emissions and removals associated with materials and construction processes throughout the whole life cycle of a building.*
Greenhouse gases (GHGs)	Constituents of the atmosphere, both natural and anthropogenic (human-created), that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere and clouds.
Life cycle assessment (LCA)	An assessment of the environmental impact of a product or service.
Net zero whole-life carbon building	A building where the sum total of all building-related greenhouse gas emissions over a building's life cycle, both operational and embodied, is minimised; meets local carbon, energy and water targets; and, with residual offsets, equals zero.*

Term	Definition
Net zero carbon operational energy building	A building where: • no fossil fuels are used • all energy use has been minimised • it meets the local energy use target • all energy used is generated on or off site using renewables that demonstrate additionality (they are newly built for this purpose), and • any residual direct or indirect emissions from energy generation and distribution are offset (see Offset carbon emissions).*
Offset carbon emissions	Reduced or avoided emissions meant to compensate for an equivalent quantity of emissions occurring elsewhere.
Operational carbon	The GHG emissions arising from all energy and water consumed by an asset in use, over its life cycle.*
Whole life carbon emissions	The sum total of all building-related greenhouse emissions, both operational and embodied, over the life cycle of a building, including its decommission. Overall whole life carbon building performance includes separately reporting the potential benefit from future energy recovery, reuse and recycling.*

* Definitions adapted from RICS' Whole life carbon assessment for the built environment, 2nd edition, 2023.

Introduction

This paper presents the current progress of decarbonisation in China's built environment, including an overview of energy consumption and carbon emissions from the building sector (comprising construction and real estate) and a description of the policy landscape. It then identifies policy gaps and solutions to facilitate the decarbonisation process in China.

China's current carbon emissions landscape

At present, Chinese construction and real estate enterprises are characterised by high carbon intensity, pronounced differences in the occurrence of emissions at different stages and significant economic impacts.

High carbon intensity

In 2020, the energy consumption of the entire building sector in China was 18.48 TWh (2.27bn tons of standard coal; figure taken from *2022 Research Report on Energy Consumption and Carbon Emissions in Chinese Construction*), accounting for 45.5% of the total energy consumption of the country. Consumption during the stages of product manufacturing, construction and operation accounted for 48.9%, 4.45% and 46.7% of the total energy consumption across the building life cycle, respectively. This indicates the significant potential to achieve carbon reductions at the national level by reducing emissions from buildings and related industries.

Different carbon emission trends at different stages

Two trends are affecting carbon emissions from buildings. The first is the slowdown in new projects over recent years, which reduced the absolute volume of carbon emissions from the construction process. As shown in Figure 1, the growth rate of new housing (by area) has been relatively flat in the last decade.

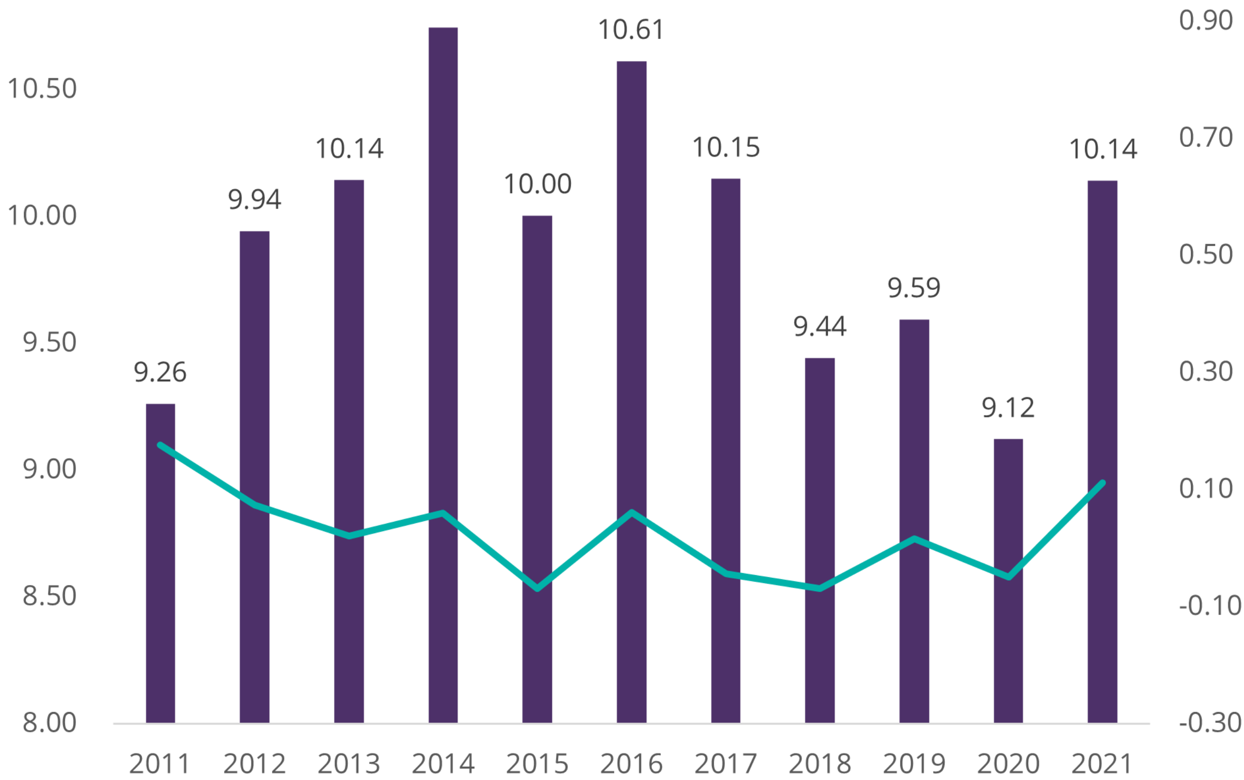

Figure 1: Completed area and growth rate of real estate development enterprises in 2011–2021 (data source: National Bureau of Statistics)

On the other hand, the intensity of carbon emissions from the operation of buildings has been increasing, influenced by the rise in installation rates of residential air conditioning, hot water units and electrical appliances, and the expanding coverage of central heating in regions with cold winters. According to the *2022 Research Report on Building Energy Consumption and Carbon Emissions in China*, the average national growth rate of carbon emissions from building operations from 2015 to 2020 was steadily positive, at +3.3% per year for urban residential units and +2.9% for public and commercial buildings. Growth is most evident in colder regions, with the highest numbers recorded among northern cities.

Significant economic impacts

In 2021, the building sector accounted for 13.8% of China's GDP according to the China Statistical Yearbook 2022, which is a significant share of the national economy. According to the *2022 China Ecological Environment Status Bulletin* released by the Ministry of Ecology and Environment on 29 May 2023, carbon emission intensity per 1 yuan of China's GDP in 2022 decreased by 0.8% compared to 2021, while the energy intensity per 1 yuan of GDP decreased by 0.1% compared to 2021. This can be attributed to the gradual implementation of emissions reduction policies in China in recent years. When it comes to the built environment, the delivery of carbon reductions by the building sector will also need to balance the potential impact on the overall economic growth of other related industries.

Desired future state

On 22 September 2021, the State Council of the Central Committee of the Communist Party of China unveiled *Opinions on the Country's Work to Achieve Carbon Peak and Carbon Neutrality Targets* under the New Development Philosophy. The document clearly states that the realisation of the 'dual carbon' target (carbon peaking in 2030 and carbon neutrality in 2060) requires a concerted effort by both the government and the market. The government will drive the achievement of the dual carbon target by improving laws and regulations. With respect to the market mechanism, emissions will be reduced by the establishment of a national carbon trading market.

The document also outlines the dual carbon strategy for the construction sector, setting guidelines for urban and rural areas. This includes a push for energy-efficient buildings by raising energy standards for new constructions and transforming existing buildings into low-energy ones. Other measures include applying energy-efficiency ratings to buildings and beginning to assess carbon impact at the design stage.

Current and planned policy measures

Regulation of the building sector in China is implemented through several layers of administrative bodies. Generally, guidelines are set out by the central government while specific policy measures are stipulated at the provincial and lower levels. This allows adaptation to different contexts across Chinese regions to balance the goals of economic development and decarbonisation, but it creates a complex policy landscape.

Development of Chinese building codes at the national level involves different bodies (such as the China Academy of Building Research), and includes contributions from academia and industry stakeholders through a consultation process. The codes set out mandatory and voluntary energy-efficiency measures for different building types and are tailored to specific climate zones, which vary greatly across China.

The initial standard for calculating carbon emissions in the construction sector traces back to *GB/T 50378-2014 Green Building Evaluation Standard*. This introduced operational carbon calculations per unit of building area, and pioneered the adoption of carbon assessment in construction. The Standard evaluates the ‘greenness’ of a building through a scoring system based on seven categories of performance, each with a maximum number of points that can be scored. Buildings are awarded an overall ranking between 0 and 3 stars, with a requirement to gain at least 40 points to be graded as ‘1-star’. The updated *GB/T 50378-2019* increased the relative weight of the carbon performance. The standard mainly addresses operational carbon, and enforcement is mostly at the local government level.

To remedy the lack of assessment of embodied carbon, in 2019 the Ministry of Housing and Urban-Rural Development introduced *GB/T 51366-2019 Building Carbon Emission Calculation Standard*. This clarified definitions, assessment boundaries and emission factors, as well as detailing calculation methods across the building life cycle.

GB/T 51366-2019 offers a comprehensive method covering emissions from the operational phase, construction and demolition, as well as the production and transportation of materials. It serves as the principal reference for carbon accounting in China’s construction sector.

To facilitate the assessment of operational energy, *GB 55015-2021 General Specification for Building Energy Conservation and Utilization of Renewable Energy* was published in 2021. This standard grades a building's energy performance as a percentage, the higher the better.

On the basis of *GB/T 50378-2019* and *GB/T 51366-2019*, in 2022 the Ministry of Housing and Urban-Rural Development released the *Carbon Peak Implementation Plan for Urban and Rural Construction*, which is directed to local authorities and comprises four main strategies:

1. Optimising urban structure and layout by retrofitting existing buildings for low-carbon emissions and actively pursuing low-carbon urban development.

2. Improving urban buildings' electricity use. By 2025, it is anticipated that renewable energy supply in urban buildings will reach 8%. By 2030, 65% of energy demand from buildings will be met with electricity, and full electrification (100% of energy demand met with electricity) must be achieved for at least 20% of existing projects country-wide.

3. Promoting low-carbon construction by adopting modern methods of construction and energy-efficient equipment, with stringent controls over construction waste on sites.

4. Increasing the adoption of *GB/T 50378-2019*. By 2025, newly-constructed public buildings need to meet or exceed a one-star rating. By 2030, in severely cold regions new residential buildings need their energy-saving performance to be rated above 83% according to *GB 55015-2021 General Specification for Building Energy Conservation and Utilization of Renewable Energy*. By the same year, cities at the prefecture level and above need to see an improvement of over 20% in public building energy efficiency.

Policies at municipal level

As the central government increases its focus on decarbonisation, provincial and municipal governments – particularly in economically-advanced regions – have taken the lead in promoting and regulating decarbonisation initiatives locally. For example, in December 2022 Beijing released its *Green Development Plan for Civil Buildings (2022–2025)*. Key targets for 2025 include:

- All new homes to achieve at least a two-star *Green Building Evaluation Standard* rating, with a strong push for public buildings to match this.
- Prefabricated buildings to account for 55% of new constructions.
- Green building material use (as defined in the *Green Building Evaluation Standard*) in new constructions to hit 70%.
- 5 million square meters of ultra-low-operational-energy buildings to be delivered.
- 30 million square meters of public buildings to be retrofitted to improve their energy efficiency.
- 800,000 kW of building-integrated photovoltaics to be deployed.
- 45 million square meters of residential buildings to be equipped with heat pump systems.
- Complete upgrades for buildings constructed before 2000.

Similarly, as an example of an initiative in a more inland region, the city of Chongqing set out measures to promote green buildings through *2022 Chongqing Green and Low-Carbon Building Demonstration Projects and Funding Management Measures*, where financial subsidies are granted to four types of 'green and low-carbon building demonstration projects'. The document identifies the specific departments in charge of these demonstration projects, sets out the implementation requirements, and also details the specific requirements for the application, review, approval and management processes.

Gap analysis

Decarbonisation practices in China still face hurdles, as policymakers are still exploring ways to facilitate the transformation.

Whole life carbon assessment is not common practice in China

Despite the assessment methods provided by the standards described previously, adoption has been far from satisfying. According to the RICS Sustainability Report 2022, more than 65% of Chinese respondents indicated that they do not measure carbon emissions during the operational period of a project. Similarly, 66% of respondents indicated that they do not measure carbon emissions from construction materials on their projects. It is worth noting that the lack of harmonised measurement standards and tools is identified as the biggest reason hindering carbon measurement in the feedback from Chinese respondents, accounting for 47% of all responses. This suggests that an improvement in the practicality of methodologies and instruments for carbon assessment is necessary.

Country-level carbon monitoring and regulatory systems have not been established

As mentioned previously, current policy efforts focus on identifying the most suitable and efficient ways to decarbonise the industry. Pilot programs are concentrated in more developed regions (accounting for 5 out of 34 Chinese provinces), rarely touching second- and third-tier cities. This indicates that the current system is missing out the larger part of the country. Moreover, within the pilot programs the responsibility for assessing carbon emissions from buildings is unclear, and no clear reporting methods are applied to reflect the building projects' carbon footprints. Therefore, building decarbonisation is currently highly dependent on companies' self-motivation, without a clear feedback mechanism from either the market or regulators.

Sustainable investment falls short

According to the latest IEA statistics, in 2022 China accounted for about 14% of global investment in energy efficiency in buildings. This proportion was the same as in 2021, and is slightly lower than the United States (16%) but far less than Europe (53%). The central government has set rules for publicly-listed firms and the banking industry (Evaluation Scheme for Green Finance of Banking Financial Institutions) to disclose sustainability-related indicators. However, there are no specific programs for developers and landlords to access green finance streams. Considering that the sector is capital-instensive, the lack of respective supporting measures hinders efforts to promote decarbonisation in the built environment.

Policy recommendations

In order to accelerate the decarbonisation of the built environment and ensure that China can meet its dual carbon target, RICS recommends the following measures.

Encourage embodied carbon assessment and reporting at the national level

The scale of the Chinese building sector makes it difficult to efficiently monitor carbon footprints solely by the regulator. Cross-region sourcing of building materials also makes it hard to accurately measure emissions throughout the building life cycle without a national database of suppliers' emissions. Collecting such information would entail tremendous effort. Therefore, it would be helpful for the regulators to encourage self-reporting and gathering information through either surveys or company voluntary disclosure.

Here, we can point to the success of the Whole life carbon assessment for the built environment RICS professional standard as an example of an assessment and reporting method that has been widely adopted, largely on a voluntary basis, by the building sector in the UK, in the absence of a mandate at the national level. To ensure that a similar method can become common practice across China, it is essential for the methodology to be clear and user-friendly, so that it can be used by companies and professionals who are not equipped with an academic level of understanding of life cycle assessments.

RICS can also point to the Built Environment Carbon Database initiative in the UK as an example of a digital platform that provides a place to report and retrieve both product-level emissions data and project-level carbon footprints.

Eventually, embodied carbon will need to be regulated through appropriate limits to be enforced at the design and construction stages, but the first steps towards this goal are achieving the widespread adoption of assessment practices and building a robust body of evidence on the amounts of emissions embodied in different materials and building types.

Improve existing codes and standards covering operational carbon, and enforce their adoption across regions

As China progresses towards a carbon peak in 2030 and neutrality in 2060, the operational performance of buildings will need to be steadily improved to deliver the necessary carbon reductions in line with those targets. Low-energy and low-carbon design will need to become common practice across all regions of China, through the combined effect of regulation and market-based mechanisms. As enforcement and verification of building codes and standards remain challenging, regional and local authorities will need to invest in their workforce to ensure they have the right skills and resources to regulate and monitor such a large market.

Establish carbon reduction pathways and measures for existing buildings

Currently, there is no clear direction on how to regulate the improvement of existing buildings. Local policies are primarily experimental and tilted towards new projects, but clear limits on carbon emissions during each stage of the building life cycle have yet to be established.

For existing structures, customised energy-saving upgrades are essential. Given the vast number of these buildings and their unique challenges, professional services should be consulted. As summarised by our colleague from Vanke-CushWake in their *White Paper on Commercial Real Estate Decarbonisation in China*, green retrofit methods are recommended, minimising waste while maximising sustainable materials. Appropriate combinations of efficient HVAC systems, renewable energy sources, enhanced insulation, features like green roofs and smart systems are required to regulate and monitor energy consumption.

Conclusions

Due to the many ‘inflexible’ constraints in property construction and operation, such as the inevitable high-intensity carbon emissions from building construction and materials, and the continuous carbon emissions from air conditioning, lighting and network servers during daily operations, the decarbonisation journey in the built environment cannot be achieved overnight. The dynamic and ever-evolving economy in China adds to the complexity.

This therefore requires collective wisdom from academia and the business world, as well as appropriate policy guidance. This paper combines efforts from industry leaders in China and academic experts. The policy gaps identified and the solutions proposed in this paper will help enable the smooth transition of the building sector in China towards a more sustainable and low-carbon future.

Delivering confidence

We are RICS. Everything we do is designed to effect positive change in the built and natural environments. Through our respected global standards, leading professional progression and our trusted data and insight, we promote and enforce the highest professional standards in the development and management of land, real estate, construction and infrastructure. Our work with others provides a foundation for confident markets, pioneers better places to live and work and is a force for positive social impact.

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