

EMBODIED CARBON IN BUILDINGS: WHY CHINA'S GREEN TRANSITION NEEDS CROSS-SECTOR COMMITMENT

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As Q3 2025 ends, China's steel sector still falls short of meeting its annual carbon reduction targets.¹ We have yet to see meaningful reductions in steel production capacity from coal-based blast furnaces (BFs), nor have we observed strong policy or financial support for scaling up electric-based steelmaking. The so-called "green steel premium"—the additional cost of low-carbon steel—remains a significant barrier to transitioning the sector toward low-carbon production.²

On top of businesses having to adapt to meet decarbonisation targets, certain sectors are facing challenging factors economically. One of China's largest steel consumers, the construction sector, is a prime example, as property developers, who set project requirements, and construction companies, who carry them out, are largely focused on business survival, leaving little incentive to prioritise embodied carbon reduction.³ Encouragingly, momentum is building within the ecosystem, with some stakeholders demonstrating a willingness to go further than the minimum and take stronger action in the face of headwinds.⁴

FROM STEEL TO STRUCTURES: EMBODIED CARBON IN BUILDINGS

China's property sector accounts for more than half of total domestic steel use and real estate drives about 36% of demand in 2024, making it one of the key consuming sectors of steel.^{5 6}

According to the Research Report on Carbon Emissions in the Field of Urban and Rural Development in China 《中国城乡建设领域碳排放研究报告》, emissions from steel used in construction and housing reached a staggering 930 million tonnes of CO₂ in 2022. This accounted for 52% of all emissions from building materials—far exceeding those from cement (15%) and aluminium (12%). Steel-related emissions also made up 22% of the total carbon footprint of China's building and housing construction that year. These figures underscore the scale of the challenge and the urgency of addressing it.⁷

From a life-cycle emissions perspective, buildings generate two major types of carbon: operational emissions (from energy use during building operation) and embodied emissions (from material production and construction). Steel-related emissions fall into the latter category and are typically classified as Scope 3 in greenhouse gas accounting.

1 <https://energyandcleanair.org/publication/closing-the-loop-from-stalled-green-steel-targets-to-a-strategic-reset-in-china/>

2 https://transitionasia.org/greensteleeconomics_es/

3 <https://www.shfe.com.cn/services/marketresearch/magazine/202504/W020250806549294697924.pdf>

4 <https://asia.uli.org/research-and-publications/sustainability/uli-greenprint-initiative/>

5 <https://www.shfe.com.cn/services/marketresearch/magazine/202408/W020240814416403826908.pdf>

6 <https://www.shfe.com.cn/services/marketresearch/magazine/202504/W020250806549294697924.pdf>

7 <https://cmsfiles.zhongkefu.com.cn/cmsossjianzhujieneng/upload/file/20250120/1737310863233732.pdf>

These embodied emissions are effectively “locked in” once the materials are produced—meaning that when steel is used in construction, its carbon footprint becomes a permanent part of the building’s life-cycle emissions and cannot easily be reduced or offset through later improvements in operational efficiency.

Given the irreversible nature of embodied carbon, it is essential to evaluate and manage material-related emissions as part of the construction sector’s low-carbon transition. Prioritising the use of low-carbon steel is a key strategy for reducing embodied carbon and enabling deeper decarbonisation across the industry.

THE GREEN STEEL PREMIUM HAS LIMITED IMPACT ON TOTAL BUILDING COSTS

In the absence of external financial support, the additional cost of producing low-carbon steel is reflected in product pricing and passed on to downstream consumers - which is referred to as the green steel premium.

According to our Green Steel Economics Report, producing near-zero-emissions steel via the hydrogen-based DRI-EAF (H₂-DRI) route with green hydrogen priced at USD 5/kg results in a green steel premium of around 40%, or an additional USD 225 (approx. RMB 1,600) per tonne. This estimate reflects production costs only and does not account for final pricing or impacts on end users, in which case the total construction cost would increase by roughly USD 563 (≈RMB 4,000) for a 50-square-metre residential unit built entirely with this type of steel, indicating a relatively limited impact on overall project costs.⁸

As low-carbon steelmaking technologies continue to mature and demand signals increase production, and with greater support from governments and the financial sector, the green steel premium is expected to decline.⁹ Research by Asia Research & Engagement (ARE) estimates that by 2030, the cost increase associated with green steel could drop to as little as 0.4%–4% of total construction costs—further enhancing its economic viability as part of the construction sector’s decarbonisation strategy.¹⁰

EARLY DAYS FOR STEEL-CONSTRUCTION DECARBONISATION

A Meaningful Commercial First Step Toward Collaboration

In November 2024, a significant milestone marked a shift in the construction sector’s approach to green steel when property developer, Hang Lung Properties announced that it would use low-carbon steel supplied by Baosteel for Plaza 66 Pavilion Extension in Shanghai. This included 1,171 tonnes of BeyondECO[®] low-carbon structural plates (with emissions as low as 1.68 tCO_{2e}/t compared to the industry average of 2.32 tCO_{2e}/t for BF-BOF) and 325 tonnes of BeyondECO[®] reinforcing bars (produced using 100% renewable

⁸ <https://transitionasia.org/green-steel-economics-china-factsheet/>

⁹ <https://mp.weixin.qq.com/s/F1F23tMm0F3XSb0ytDWucA>

¹⁰ https://asiareengage.com/wp-content/uploads/2024/12/Autos-Buildings-Renewables_Finding-Chinas-Green-Steel-Buyers-1.pdf

energy and 60% recycled scrap, with emissions of only 0.892 tCO₂e/t).¹¹ This was the first commercial real estate project in Mainland China to use nearly all low-carbon steel for structural components—a pioneering adoption of low-carbon steel in construction.¹²

This development is an encouraging step forward, representing both a breakthrough in commercial use of low-carbon steel in China and a meaningful example of cross-sector collaboration. The partnership between Baosteel and Hang Lung provides a valuable real-world case of how steel and construction stakeholders can work together to reduce embodied carbon in buildings.

Stakeholder Group Driving Steel–Construction Collaboration Begins to Take Shape

Momentum among property developers to explore low-carbon steel appears to be gaining traction. A growing coalition of stakeholders—including NGOs, property developers and industry bodies such as China Iron and Steel Association (CISA), Urban Land Institute and World Steel Association—have begun low carbon steel standard building and convening meetings and roundtables to promote the adoption of low-carbon steel in the property sector.^{13 14} These initiatives aim to shape demand for low-carbon materials, supporting decarbonisation across both the real estate and steel industries.

Such collaborative platforms are vital for establishing shared standards and a common framework for action. By fostering dialogue and knowledge exchange, they help transform ambition into implementation by laying the groundwork for a more efficient and sustainable partnership model between the two sectors.

MOVING FORWARD TOGETHER: SHARED CHALLENGES, SHARED GOALS

The steel and real estate sectors are two cornerstones of China’s economic development. A collaborative push toward decarbonisation between these industries is not only strategic but also essential for achieving China’s national climate goals.

While there is growing alignment in vision and commitment, meaningful collaboration still faces several challenges. These shared obstacles must be addressed to turn ambition into tangible progress:

1. Managing the Green Steel Premium for Informed Choices and Carbon Reduction

While its cost impact on downstream users may be limited, the green steel premium remains a central challenge. Any transition pathway comes with costs, but for green steel to gain traction it must be recognised as a viable option rather than an added burden. To this end, China’s advantage in renewable energy provides a strong foundation, as using green electricity in steelmaking can significantly improve its carbon profile. This enables property developers, policymakers, and end users to reduce embodied carbon across construction and other sectors.

¹¹ <https://worldsteel.org/wider-sustainability/sustainability-indicators/>

¹² <https://www.hanglung.com/en-us/media/press-releases/2024/20241127>

¹³ <https://finance.sina.com.cn/roll/2025-02-18/doc-inekwyzc5755408.shtml>

¹⁴ <https://asia.uli.org/research-and-publications/sustainability/uli-greenprint-initiative/>

2. Aligning the Real Estate Value Chain for Green Steel Demand

The construction ecosystem is highly fragmented, with multiple layers of intermediaries across the value chain. Project timelines can span several years—from initial concept to completion—making alignment and coordination difficult. Relying on a few top real estate developers to drive demand for green steel is unlikely to generate sufficient momentum.

Property developers, contractors and end users vary in their understanding of and motivation for decarbonisation. Effective awareness-building platforms, paired with financial incentives, are essential to broaden participation and foster shared ownership of climate goals. Linking green steel consumption with relevant green building certifications and public procurement can also play a catalytic role by sending strong market signals and setting examples for private actors to follow.

3. Unleashing Transformation Through Layered Incentives

For the low-carbon transition to move from incremental progress to transformative change, we need multi-tiered incentives. As an example, policies like carbon taxes and emissions caps can curb high-carbon behaviours. Furthermore, green subsidies, transition finance and consumer incentives can drive innovation and participation. We hope that a synergy of regulation and market incentives will soon emerge, guiding the steel-construction ecosystem toward a mutually beneficial, low-carbon future.

CONCLUSION

The path to low-carbon steel in China will require more than just technical solutions—it demands commitment across the value chain. By highlighting the steps needed for adoption in the construction sector, we hope to drive wider attention to embodied carbon and strengthen collaboration that brings a genuinely low-carbon future within reach.

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ABOUT TRANSITION ASIA

Founded in 2021, Transition Asia is a non-profit think tank dedicated to accelerating decarbonisation in Asia's materials and heavy industries to achieve the 1.5°C climate goal. Our multidisciplinary team combines diverse perspectives, experience and expertise, underpinned by a strong research foundation in Asia and a nuanced understanding of the region. Using analytical models and in-depth assessments, we evaluate and monitor corporations' decarbonisation efforts and actions. By engaging with stakeholders across sectors—including corporates, investors, policymakers and civil society organisations—we facilitate informed and impactful discussions that drive sustainable, low-carbon transitions aligned with a 1.5°C future.

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