

JAPAN'S CONSTRUCTION INDUSTRY CAN EMBRACE LOW-CARBON STEEL TO CURB SCOPE 3 EMISSIONS

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The use of low carbon electric arc furnace (EAF)-based steel has the potential to significantly reduce upstream emissions for the construction sector. Steel demand in the Japanese construction sector accounts for approximately 30% of Japanese steel production, second only to the automobile industry.¹ In high-rise buildings, steel-related CO₂ emissions make up nearly 30% of CO₂ emissions during the construction phase, so using low carbon steel has the potential to make a significant contribution to decarbonising the construction industry.² Additionally, our analysis of the “green premium” for low carbon steel suggests an immaterial additional cost to overall real estate prices.³ Hence, low carbon steel should gain more prominence as a decarbonisation option for the construction industry.

PRIORITY OF LOW CARBON STEEL AS A DECARBONISATION LEVER SHOULD BE INCREASED

Steel emissions account for 30% of the CO₂ emissions during the construction phase. The use of EAF steel can reduce the total Scope 3 CO₂ emissions by about 10% on average for general contractors and about 7% on average for developers—equivalent to or greater than the combined average Scope 1 and 2 emissions for these companies.⁴ Despite the encouraging potential of low carbon steel to decarbonise construction company supply chains, the sector has made limited progress in adopting low carbon steel.

Japanese construction firms have been focusing on Zero Energy Building (ZEB) / Zero Energy House (ZEH) buildings, highlighting a focus on the emission reduction during building use rather than the construction itself.⁵ Taking a deeper look at the construction materials the key construction companies are focused on, the main targets only cover concrete and wood, with steel noticeably absent from the Japan Federation of Construction Contractors' (JFCC) focus.

1 <https://www.jsf.or.jp/data/tokei/index.html>

2 https://www.mitsuifudosan.co.jp/english/esg_csr/carbon_neutral/pdf/20231018_03.pdf

3 <https://transitionasia.org/green-steel-economics-japan-factsheet/>

4 Transition Asia analysis

5 [Buildings/Houses that aims to achieve zero annual primary energy consumption by reducing energy consumption and introducing renewable energy.](#)

Table 1: Steel Decarbonisation Measures of the Top 5 General Contractors by Sales & the Industry Group of Major General Contractors

Measures	Industry group*	Companies				
	Japan Federation of Construction Contractors ⁶	Obayashi ⁷	Kajima ⁸	Shimizu ⁹	Taisei ^{10 11}	Takenaka ^{12 13}
2030 target	CO ₂ emissions during construction phase: - 40% (compared to FY2013)	Scope 1+2: - 46.2% Scope 3: - 27.5% (compared to FY2019)	Scope 1+2: - 42% Scope 3: - 25% (compared to FY2021)	CO ₂ emissions during construction phase: - 70% (compared to FY1990)	Scope 1+2: - 40% Scope 3: - 20% (compared to FY2019)	Scope 1+2: - 46.2% Scope 3: - 27.5% (compared to FY2019)
Low carbon steel identified as key decarbonisation lever	-	✓	✓	-	✓	✓
Collaborative initiatives with EAF companies	-	-	-	-	✓	✓
EAF Steel Target	-	-	✓	-	-	-

*An industry group of about 150 general contractors operating nationwide, centred on large companies

Source: TA and companies annual reports

In FY2018 in Japan, 61% of steel bars and 98% of H beams, both of which are primarily used in the construction sector, were produced in electric arc furnaces (EAF).¹⁴ Our analysis estimates that CO₂ emissions per tonne of crude steel (tcs) produced by EAFs using grid-based electricity is 0.35t-CO₂/tcs. In contrast, using blast furnaces (BF-BOF) results in 1.77t-CO₂/tcs, which is nearly five times that of EAFs.

Since the majority of Japan's EAF steel is not powered by electricity derived from renewable energy (RE), the reduction in steel-related CO₂ emissions is not yet reaching its full potential. If EAF steel is produced with 100%RE-based electricity, the carbon intensity can be reduced to 0.05t-CO₂/tcs, achieving about 86% reduction compared to production using unablated grid-based electricity. For the construction industry to further reduce Scope 3 emissions, the data is clear; they need to require steelmakers to use only RE when making EAF steel.

6 https://www.nikkenren.com/kankyoku/jimukyoku/img/1689681933944/cn_roadmap_202307.pdf

7 <https://www.obayashi.co.jp/sustainability/upload/img/green-guide2018.pdf>

8 https://www.kajima.co.jp/sustainability/policy/vision/pdf/kajima_environmental_vision2050plus.pdf

9 <https://www.shimz.co.jp/company/csr/environment/performance/eco/>

10 https://www.taisei.co.jp/about_us/wn/2022/220909_8933.html

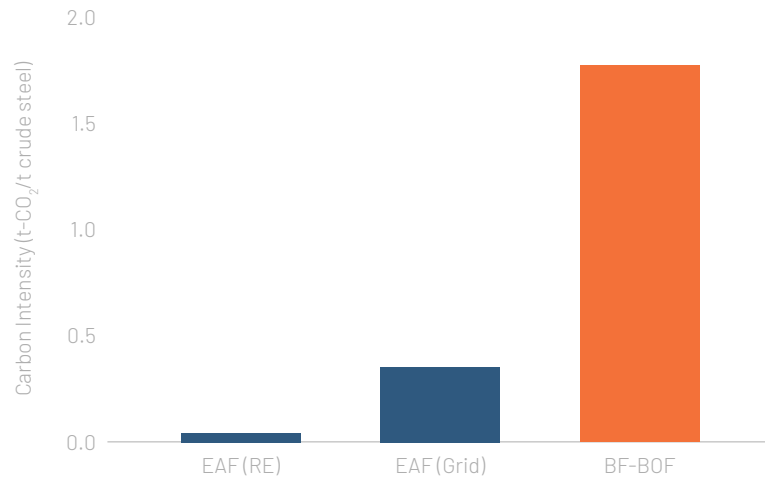
11 https://www.taisei.co.jp/about_us/wn/2023/230407_9373.html

12 https://www.takenaka.co.jp/takenaka_e/sustainability/environment/carbon-neutral/

13 <https://www.takenaka.co.jp/news/2023/12/03/>

14 <https://www.tokyosteel.co.jp/assets/docs/products/qa.pdf>

Figure 1. CO₂ Emissions Per Tonne of Crude Steel Produced by Each Steelmaking Method in Japan



Source: Transition Asia

WHY CONTRACTORS SHOULD USE LOW CARBON STEEL

The use of low-carbon steel is currently a lower priority for decarbonisation in the construction industry. However, since upstream Scope 3 CO₂ emissions typically account for 30–45% or more of total emissions, and RE-EAF steel can significantly reduce these emissions with minimal financial impact, we believe that prioritising the strategic use of low-carbon steel is essential.

Taisei Corporation and Takenaka Corporation are the only two major construction firms who have already launched initiatives in cooperation with EAF companies.^{11,13} As part of Taisei Corporation’s initiative, they will ensure that the EAF is powered by RE (RE-EAF), further reducing emissions from their steel consumption. Lastly, Kajima Corporation’s target for the use of low carbon steel is to have 20% of its steel frames made from EAF steel by 2030.⁸ These initiatives represent an encouraging start within the industry to reduce steel related emissions, however more can be done.

Steel accounts for a large proportion of construction materials, averaging at around 16% per unit of floor area, Transition Asia analysis suggests that the associated green premium from the use of low carbon steel is not a material additional cost compared to the overall sales cost of real estate in Japan, at less than \$5 per m² of the building.^{3, 15} Moreover, our conversations with the Japanese EAF industry suggest low-carbon steel on average carries only a 6% green premium, making it already more affordable than the steel produced by major BF-BOF companies using the mass balance approach, which comes with a green premium of around 40%.¹⁶ Therefore, reducing upstream Scope 3 emissions is already achievable without significantly raising overall construction costs.

Globally, developers are increasingly taking steps to address embodied carbon and we are seeing this trend emerge in Japan, starting with Tokyo. The use of EAF steel is already one of part of the evaluation criterion in environmental certification systems

¹⁵ Transition Asia analysis

¹⁶ <https://www.nikkei.com/article/DGXZ00UC313WY0R30C24A700000/>

such as “DBJ Green Building” and “LEED.” Similar initiatives are planned for Tokyo and are expected to expand across Japan. As a result, using low-carbon steel can enhance the value of buildings, as environmentally certified properties typically command higher rents, with rent premiums increasing alongside higher certification levels.¹⁷

In fact, several major construction companies have proactively begun reducing steel-related emissions. For example, Taisei Corporation and Takenaka Corporation are the only two major construction firms who have already launched initiatives in cooperation with EAF companies.^{11,13} As part of Taisei Corporation’s initiative, they aim to further reduce emissions from their steel consumption by using steel produced in RE-EAF, which significantly lowers emissions during the steelmaking process. Lastly, Kajima Corporation’s target for the use of low carbon steel is to have 20% of its steel frames made from EAF steel by 2030.⁸ We hope more construction companies will follow suit, sending a stronger positive signal to policymakers and steelmakers further up the supply chain.

The potential of low-carbon steel remains limited unless RE usage increases. Transition Asia recommends the following steps to overcome this challenge:

1. Construction companies should prioritise the use of EAF steel and collaborate with EAF producers to secure advance procurement of RE-EAF steel, which would help maximise CO₂ reductions.
2. The construction industry, including JFCC, should set specific targets for RE-EAF steel as part of broader decarbonisation strategies. This would drive corporate action and send a strong signal to Japanese steelmakers, reinforcing the demand for low-carbon steel products.

¹⁷ <https://www.smtb.jp/-/media/tb/about/corporate/release/pdf/220720.pdf>

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OUR TEAM

Head of Impact

Lauren Huleatt lauren@transitionasia.org

ESG Junior Research Fellow

Akira Kanno akira@transitionasia.org

Communications Specialist

Monica Wong monica@transitionasia.org

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