[For immediate release]

Transition to EAFs and Decommissioning of Blast Furnaces Essential for Japanese Steel Industry to Achieve Emissions Reduction Goals

Transition Asia's Analysis Reveals Japanese Steel's Carbon Budget Overshoot from 2019 to 2050

- Transition Asia analysis of the announced corporate plans and policies by the three largest steel companies in Japan shows that they **surpass their corporate 1.5°C carbon budgets by substantial margins**. Nippon Steel, JFE and Kobe Steel are projected to **exceed their carbon budgets by 821 $MtCO_2$, 527 $MtCO_2$ and 137 $MtCO_2$, respectively, between 2019 and 2050.**
- Japanese steel companies' current decarbonisation approach is not designed to sufficiently reduce emissions in alignment with the scale required to operate within a 1.5°C pathway.
- Transition Asia projects the renewable energy required for robust green steel development in Japan to be a feasible amount - with **1TWh of renewable energy by 2031 and 38TWh by 2050**.

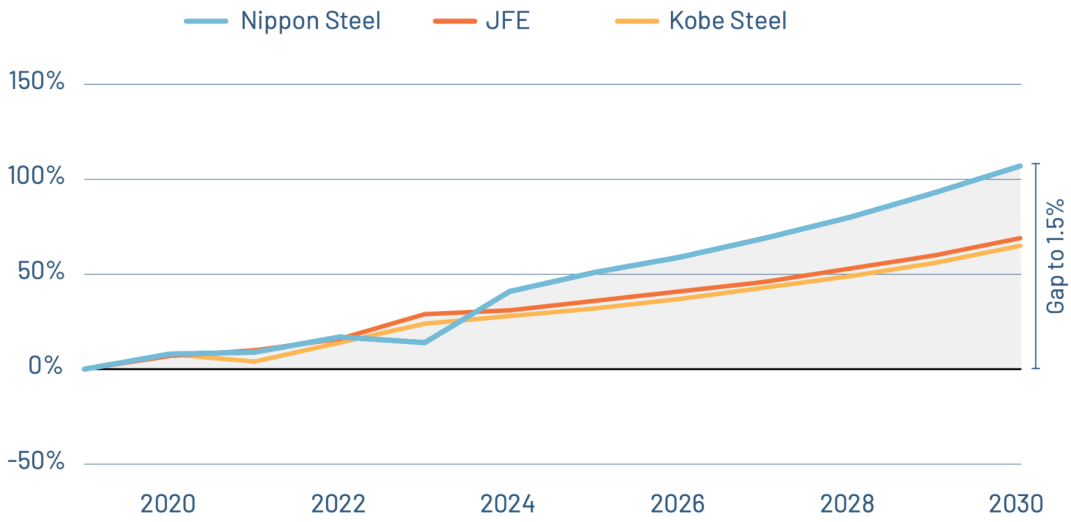
Japan, 16 November 2023 - **Transition Asia ("TA")**, **a non-profit think tank** that focuses on driving 1.5°C-aligned corporate climate action, today published a research report tracking the decarbonisation progress and evaluating the emission reduction strategies and plans of Japan's "Big Three" steel companies: **Nippon Steel Corporation (Nippon Steel)**, **JFE Holdings (JFE)**, and **KOBELCO (Kobe Steel)**. The report also offers recommendations for the nation to become a competitive player in green steel on regional and global stages.

Big gaps in carbon intensity between disclosed corporate targets and a 1.5°C pathway

These three steel companies in Japan have set decarbonisation targets with a focus on reducing their emissions 30% by 2030, relative to a baseline year of 2013. These companies have also established long-term decarbonisation targets (covering Scopes 1 and 2), aiming to achieve carbon neutrality by 2050. **In 2023, Nippon Steel leads in reducing emissions, having achieved a significant 61% reduction toward its 2030 target, while JFE and Kobe Steel have reached 32% and 38% of their respective 2030 targets.**

In TA's analysis, carbon intensity is defined as the ratio of steel emissions to steel production. To calculate steel emissions, TA utilises a blend of historical data spanning from 2019 to 2021 and forecasted data ranging from 2022 to 2030.

Figure 1: The Big Three's gaps in carbon intensity between disclosed targets and 1.5°C pathway (gap %)



Source: Transition Asia analysis

Under their existing targets and strategies, all three companies are falling short of the necessary emissions reductions required to stay on course with a 1.5°C pathway. **Nippon Steel is projected to face the largest gap, with emissions intensity forecasted to be a staggering 107% above the 2030 1.5°C benchmark. JFE follows closely behind with a 69% gap, while Kobe Steel is left with a 65% deviation from the required 1.5°C emissions intensity.** While these companies have disclosed planned reductions in steel production, TA analysis suggests that their current efforts are insufficient and would need to nearly halve between 2019 and 2030 to align with a 1.5°C pathway.

COURSE50 is not fit for a net zero future

In the pursuit of emissions reductions, steel companies have endorsed the development of retrofitted technologies for BFs. In Japan, the most well-known and prominent solutions for achieving such reductions is via a technology called COURSE50.

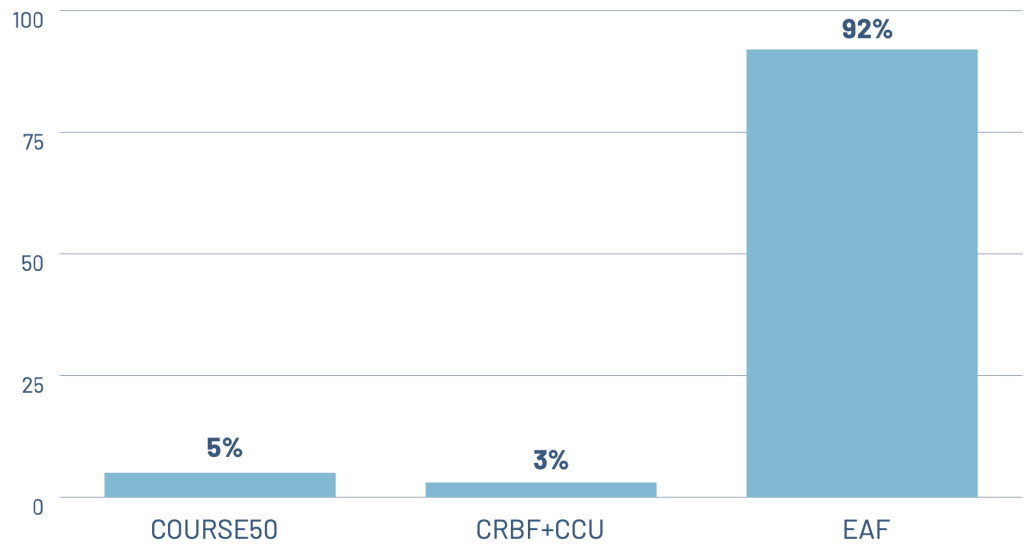
COURSE50 is a technology under development by the three largest Japanese steelmakers (Nippon Steel, JFE and Kobe Steel). The core of the technology is injecting hydrogen back to BFs, which is retrieved from by-product gas emitted from the BFs. Injected hydrogen works as a reducing agent for iron ore and partially replaces the primary reducing agent, i.e. coking coal. This will bring a 10 % emission reduction in comparison to full coke-based iron making. Additionally, COURSE50 will employ carbon capture and storage (CCS) technology and the aggregated emissions reduction effectiveness is a maximum of 30 % in total. COURSE50 is planned to be developed into SuperCOURSE50, ready for commercial operation around 2050. Companies are hoping that this

technology will result in emissions reductions of up to 50 % compared with conventional BF-BOF steel, which still leaves a large gap from meeting the aforementioned definitions for green steel.

COURSE50 remains an unproven at scale and high cost technology that has been under development since 2008 and is still not expected to be in commercial operation until 2030 - an expected development timeline of more than 20 years. Its carbon reduction effectiveness is only a theoretical 30%. Moreover, 20% of that 30% is reliant on CCS, known for being technologically and economically challenging due to low BF CO_2 concentrations, amine volatility and the additional energy requirements for the equipment.

While Nippon Steel relies heavily on COURSE50 and SuperCOURSE50, JFE, on the other hand, is betting heavily on carbon capture recycling technology for their BFs, which is planned for rollout in 2030. This technology aims to capture and recycle carbon emissions, offering a potential reduction of up to 20% per tonne of steel, a solution that is also short-term in emissions reduction focus. Meanwhile, Kobe Steel is taking the least action, reducing emissions by producing "lower-carbon" products in their BFs and exploring the use of artificial intelligence to enhance operational efficiencies, but not providing many details on any of the potential emissions reduction expectations.

Figure 2: Carbon reduction effect of different technologies between 2030 and 2050



Source: Transition Asia analysis

Emission Trajectories Exceed Budgets, Urgent Shift to EAFs Needed

The Big Three's Stated Policies Pathways put them on trajectories that are far off a 1.5°C pathway and show that **total emissions between 2019 and 2050 exceed Nippon Steel, JFE and Kobe Steel's corporate carbon budgets by more than 821 MtCO2, 527 MtCO2 and 137 MtCO2, respectively**. This is further evidence that the current technologies employed and planned are nowhere close to delivering the needed emissions reductions.

To navigate this critical juncture successfully, these steel industry leaders must intensify their efforts, explore proven technologies and collaborate extensively with stakeholders across the value chain. It is clear that the only currently and likely technologically feasible way to decarbonise the Japanese steel industry is to build EAFs.

Regional Competitors Outpace Japan in EAF Adoption Targets

Japan's leading steel companies, Nippon Steel, JFE, and Kobe Steel, have yet to make a substantial shift towards harnessing the emissions reductions offered by EAF technology. Nippon Steel's target of having EAFs account for only 8% of their steel production by 2030 lags behind regional competitors like China, which aim for EAFs to make up 15% and 20% of their production by 2025 and 2030. Similarly, the United States has seen significant CO2 reductions in its steel sector, with the expansion of EAFs powered by renewable energy, emitting only half the CO2 per tonne of steel produced compared to Japan. The absence of a cohesive policy and strategic planning in Japan leaves its steel companies susceptible to global industry trends and unprepared for decarbonization demands.

Limited Renewable Energy Availability in Japan

Japan's grid emission factor, which represents carbon emissions per unit of electricity generated, remains notably high in comparison to other G7 nations. The Japanese government's efforts to deploy RE have been relatively lacklustre, and the country continues to rely heavily on imported fossil fuels as a significant energy source. Securing RE to power scrap-charged EAFs emerges as the most expeditious and cost-efficient strategy for substantial progress in green steel production. Transition Asia has assessed the future RE requirements for the development of green steel in Japan, estimating the need for 1TWh of RE electricity by 2031 and 38TWh by 2050. We firmly believe that achieving this level of power is attainable for companies in the short term.

Rethinking Japan's Scrap Market

A healthy scrap market is conducive to EAF market growth, as an EAF can be charged with 100 % recycled material. With Japan serving as a net exporter of scrap steel, its domestic scrap availability is limited. In response, significant technological advancements have emerged to address the challenge of impurities in recycled materials. One innovative solution involves

simultaneously charging direct reduced iron (DRI) and scrap into electric arc furnaces (EAFs), enabling steelmakers to make use of lower-grade scrap without massive facility investments. To realise this potential, local stakeholders must ensure a stable supply of DRI. Furthermore, the development of Japan's scrap market to reduce contamination by "tramp" elements can provide additional incentives for the adoption of EAF technology. Companies should explore solutions to increase the use of scrap steel, while policymakers should focus on making scrap steel a more attractive investment within the country.

Likely future of steel production

Considering that the steel industry is already largely dominated by multinational corporations, the most competitively priced decarbonised steel is likely to originate from regions with abundant and cost-effective RE production and iron ore resources. This will drive Japanese steel companies to look outside Japan and toward other countries in which to build greenfield H_2-DRI-EAF plants that have access to the key steelmaking feedstocks.

While BF-BOF processes have led to highly integrated steel mills, there's an opportunity with DRI technology. DRI can be compacted into hot briquetted iron (HBI) at high temperatures, offering storage and transportation at costs similar to iron ore. This opens up a strategic possibility for Japanese steel producers: separating HBI production from EAF steelmaking and expanding the latter to cater to Japan's green steel market. A similar geographic separation of H2-DRI from EAF has been implemented by ArcelorMittal in Spain, showcasing the potential of this approach. In this context, Japanese steel companies can expand investment into large-scale EAFs within Japan while simultaneously continuing to develop and expand overseas steel operations.

Transition Asia's call for action

Transition Asia's analysis of the plans and policies announced by the Big Three reveals a significant overshooting of their corporate 1.5°C carbon budgets between 2019 and 2050. This overshoot is largely attributed to their heavy reliance on BF-based steel production, which locks in emissions on a trajectory to surpass the carbon budget. To rectify this, it's imperative to integrate large-scale EAFs into their steel production, while discontinuing BF re-linings and devising plans for asset decommissioning.

Achieving this transition requires collaboration between industry and the Japanese government, especially concerning the procurement of renewable energy (RE) and the availability of scrap materials domestically. Companies must take an active role in securing Power Purchase Agreements (PPAs) for their production facilities and advocate for a quicker transition to RE. Simultaneously, the government must expedite RE delivery, promote the adoption of EAFs, discourage BF re-linings, and facilitate a more dynamic domestic scrap market.

Lauren Huleatt, Programme Manager and Investor Lead at Transition Asia commented, " The plea for more time and capital should not be the standard behaviour for steel companies when it comes

to decarbonisation at this point. In an era where proven technologies are being adopted globally, persistent delays in adopting low-carbon technology is not a sustainable approach. The investment community has witnessed the unfortunate lagging by companies on climate commitments, and it is high time we address these concerns with the urgency they deserve. The global market is advancing, and so should our dedication to the transition in the region. We should not mistake stalling tactics for progress; instead, we must adapt with the innovation that is readily available to shape a responsible and forward-looking future for the steel industry. "

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Notes to Editor

About Transition Asia

Founded in 2021, Transition Asia is a non-profit think tank that focuses on driving 1.5°C-aligned corporate climate action in East Asia through in-depth sectoral and policy analysis, investor insights, and strategic engagement. Transition Asia works with corporate, finance, and policy stakeholders across the globe to achieve transformative change for a net-zero, resilient future. Visit transitionasia.org to learn more.

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