



APERC Annual Conference 2026

Japanese steel industry initiatives:

Decarbonization and GX* Steel

*green transformation

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Decarbonization initiatives in the Japanese steel industry

Basic Policy of the Japanese steel industry on Carbon Neutrality

On 15 February 2021, the Japan Iron and Steel Federation published its ‘Basic Policy of the Japan Steel Industry on 2050 Carbon Neutrality aimed by the Japanese government.’

1. We supports the 2050 carbon neutrality goal and aims to produce zero-carbon steel.
2. It will pursue multi technology pathways including COURSE50, ferro coke, CCUS, hydrogen-based iron making, biomass etc..
3. Hydrogen-based iron making is a major challenge requiring new technology and significant investment.
4. Success depends on stable, low-cost supplies of carbon-free hydrogen and electricity, and viable CCUS implementation.
5. We urge government support through funding, infrastructure, public understanding, and fair international competition

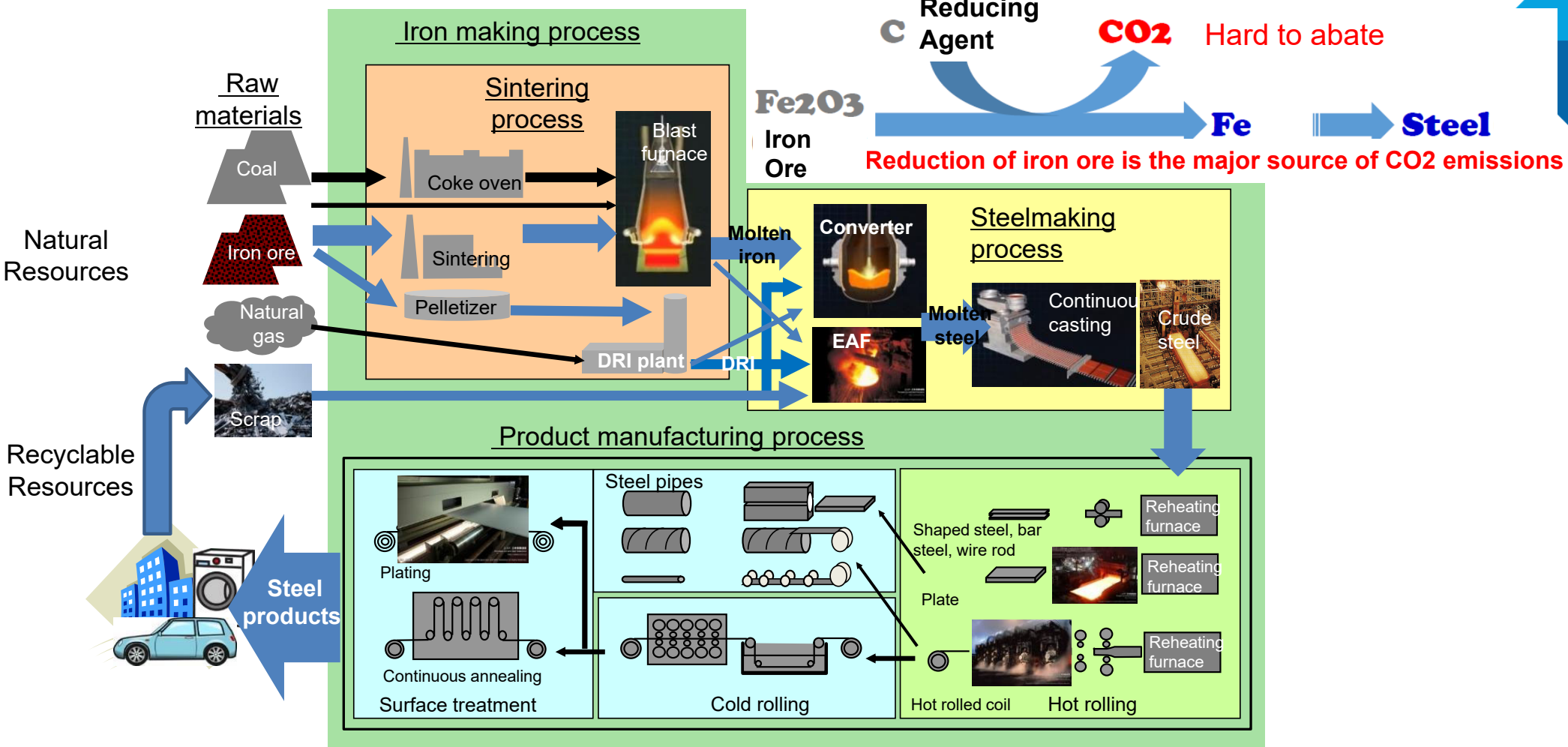
Refs. Carbon neutrality targets of Japanese steelmakers

Nippon Steel: 30% reduction by 2030, CN by 2050 (the base year: 2013)

JFE Steel: over 30% reduction by 2030, CN by 2050 (the base year: 2013)

Kobe Steel: 30-40% reduction by 2030, CN by 2050 (the base year: 2013)

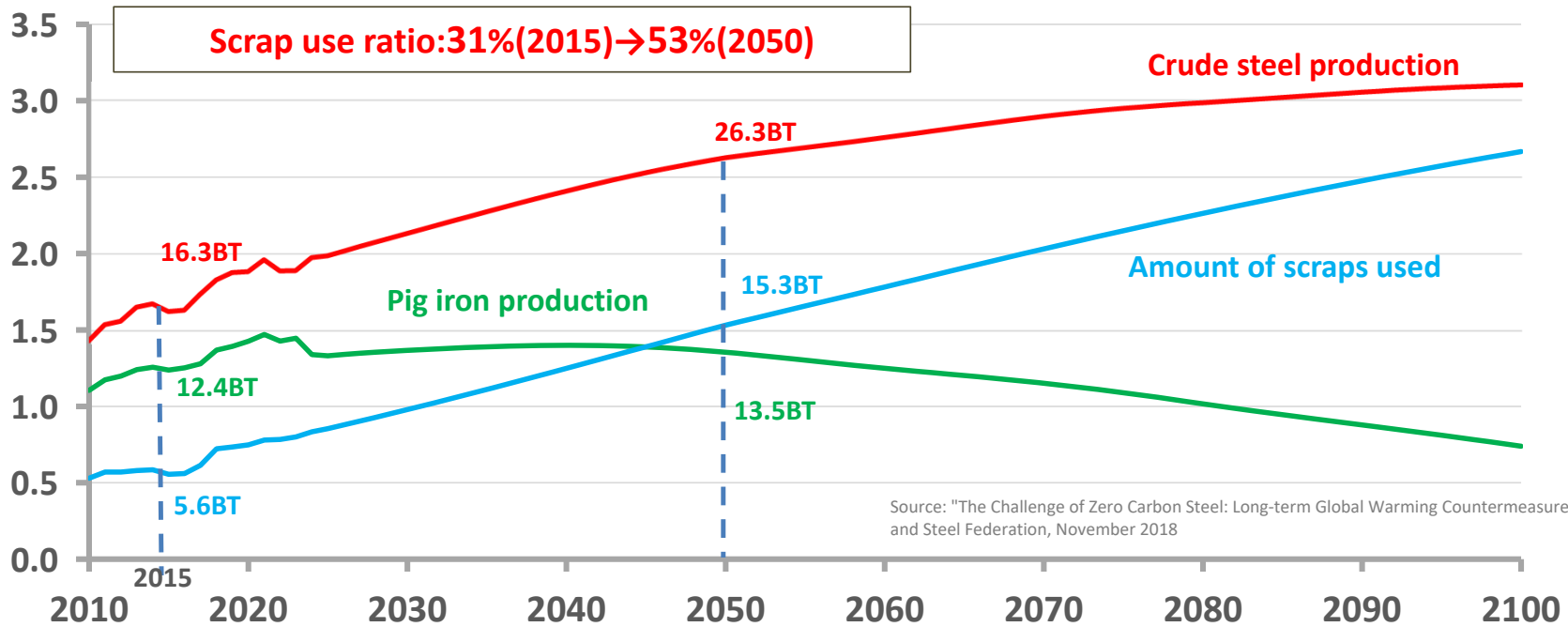
Conventional steel making processes



Direction of innovative technology development

- Global steel demand will continue to expand due to population growth and economic development in developing countries. In order to respond to the steel demand, many countries will need to maintain pig iron production at nearly current levels even in 2050.

Steel Production and scrap usage(BTs/Y)



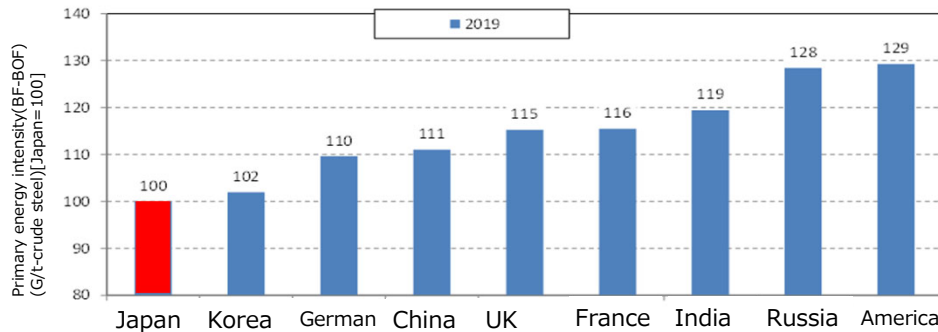
Source: "The Challenge of Zero Carbon Steel: Long-term Global Warming Countermeasures," Japan Iron and Steel Federation, November 2018

Decarbonization of iron ore reduction processes with high CO2 emission intensity is key to achieving carbon neutrality in the steel sector.

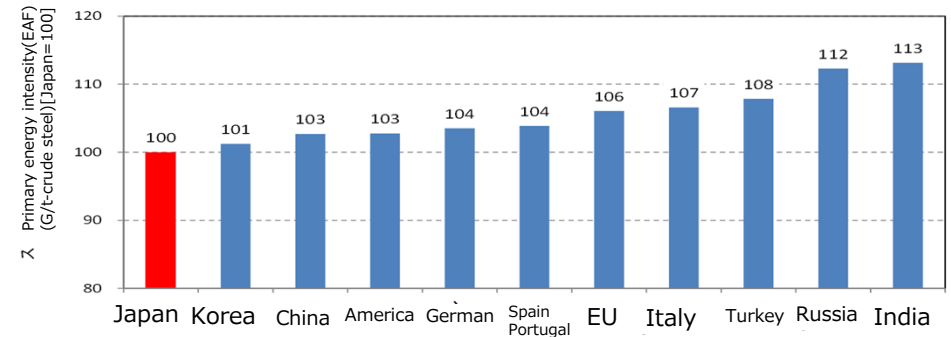
Direction of innovative technology development

- In the Japanese steel industry, energy-saving and high-efficiency technologies such as CDQ (coke dry quenching) and TRT (top pressure regeneration) have been introduced, achieving the world's highest level of energy efficiency. The potential for further CO₂ reduction through existing energy-saving and efficiency measures is limited.
- To achieve carbon neutrality, it is necessary to challenge the innovative technologies listed on the following pages, in addition to existing initiatives.

Estimate of Steel Industry (BF-BOF) Energy Efficiency (2019, Japan=100)



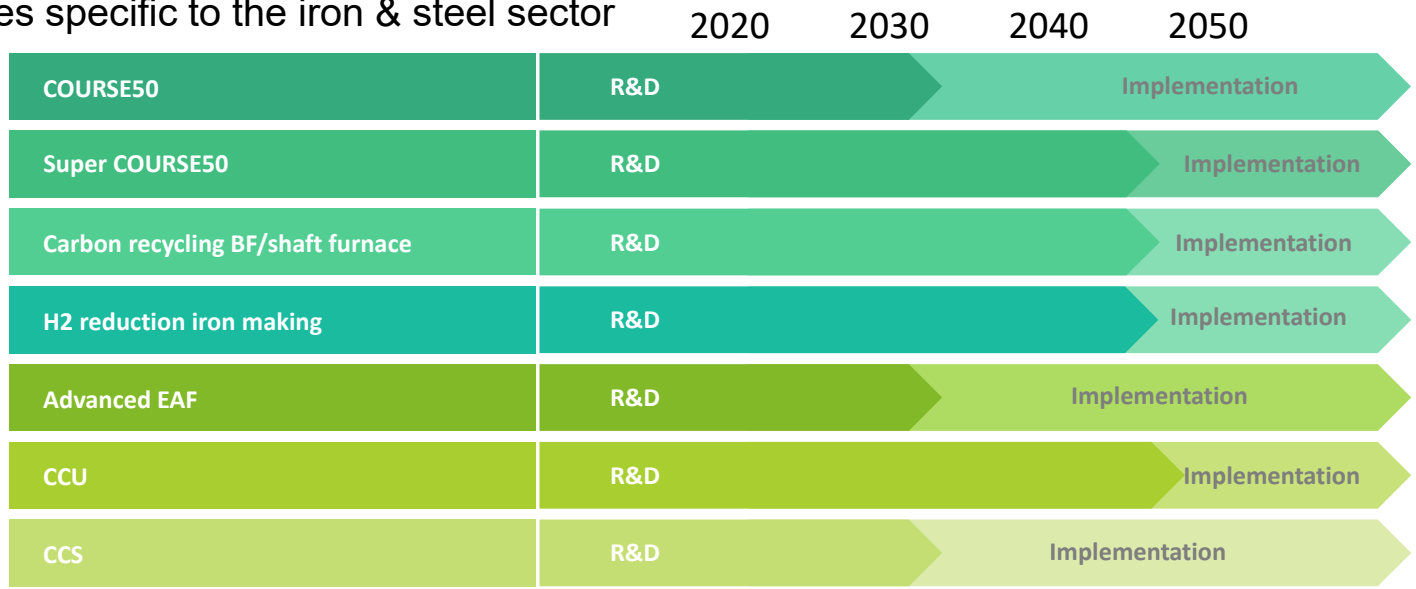
Estimate of Steel Industry (EAF) Energy Efficiency (2019, Japan=100)



Roadmap for innovative technology development

It will take a long time to develop and introduce innovative technologies and establish carbon-free electricity and carbon-free hydrogen supply chains.

Technologies specific to the iron & steel sector

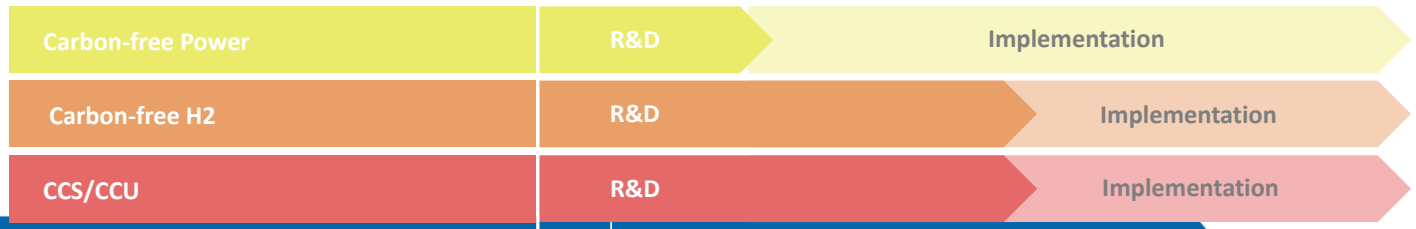


Low-carbon technologies for primary iron making

Technologies for the use of solid reduced iron and scrap

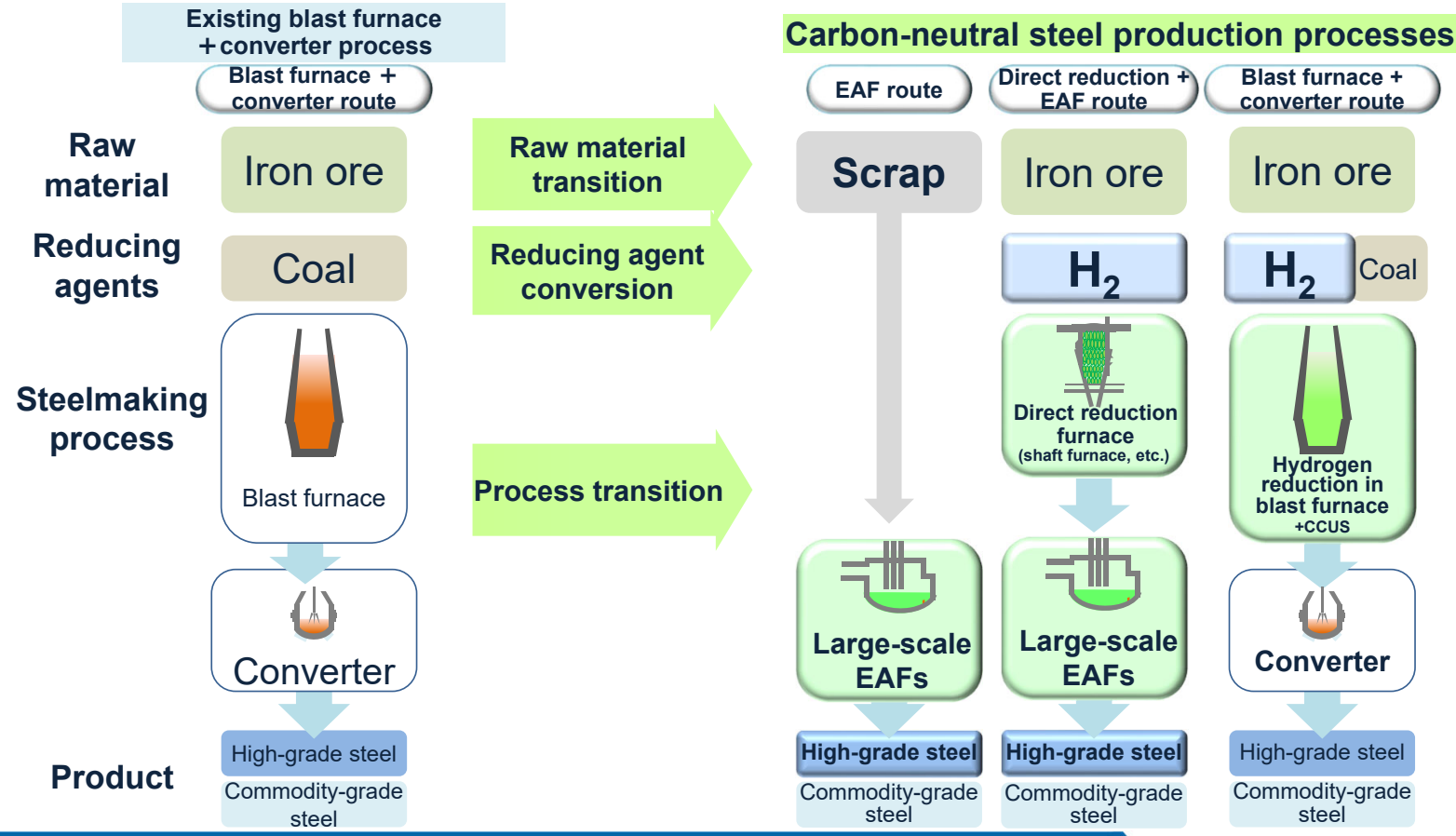
Decarbonization technologies for BF utilization

Common infrastructure for society



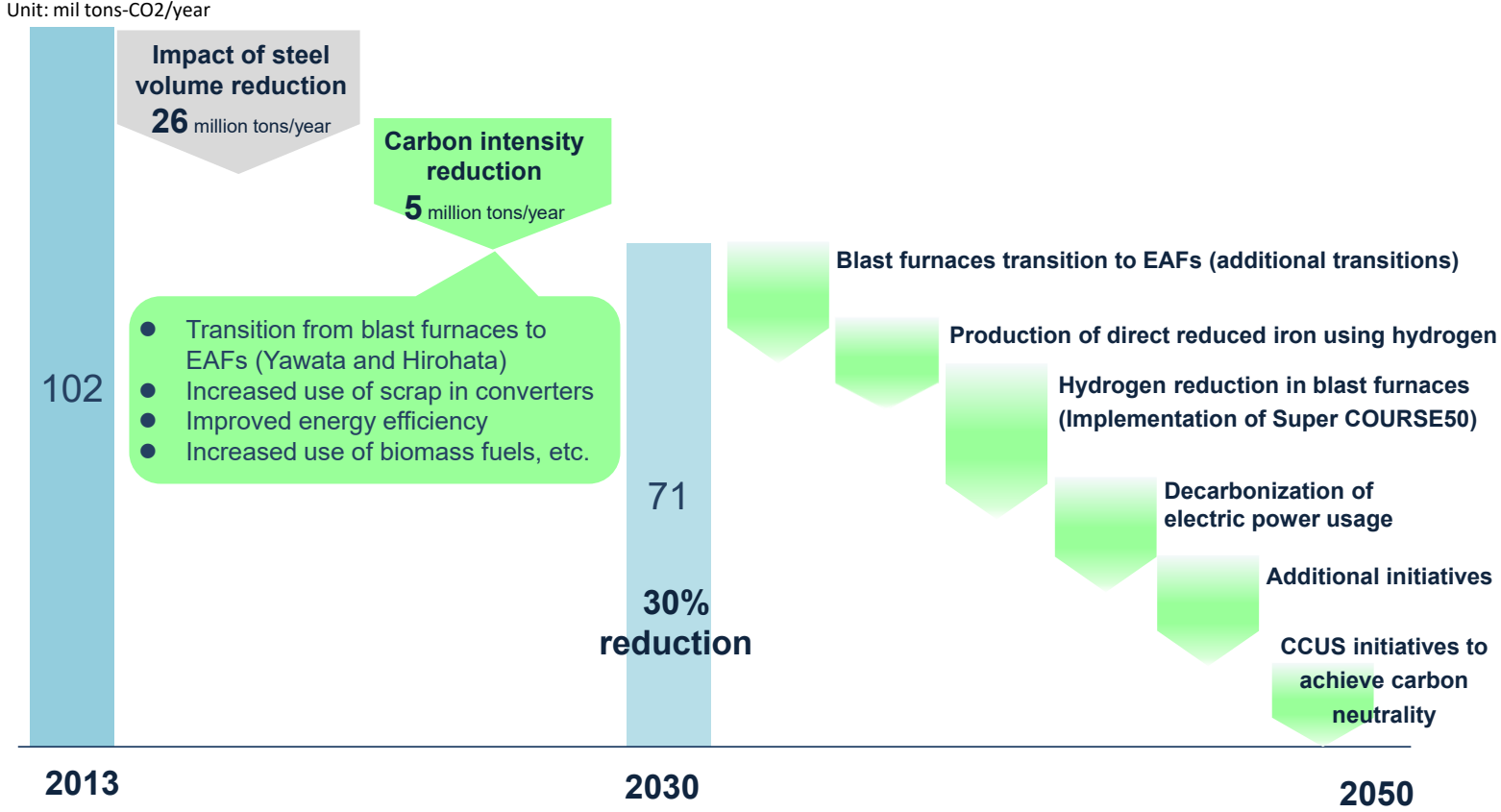
Nippon Steel's carbon-neutral steel production processes

Necessary to pursue a multi-pathway that combines “hydrogen reduction in blast furnace + CCUS” and “hydrogen direct reduction + EAFs”



Technology Implementation Roadmap to Achieve CN by 2050

Steadily advancing towards full implementation of the multi-pathway CO₂ reduction technologies to achieve 30% reduction by 2030 and carbon neutrality by 2050.



The challenges of realising green steel

- Since the Paris Agreement came into effect, global steel companies have been announcing their plans to achieve carbon neutrality by 2050 and publishing their decarbonisation projects.
- However, recently, European steel manufacturers that had been aiming to achieve direct hydrogen reduction by 2030 have revised their plans.
- The main reason for this is not so much overcoming technical challenges, but rather the lack of a market for green steel (it cannot be traded at a high price), in addition to delays in developing hydrogen infrastructure and soaring energy prices, including natural gas.

ArcelorMittal cancels two green hydrogen-based steel projects in Germany, despite attracting €1.3bn of subsidies

'Even with the financial support, the business case for moving ahead with this transformation is not strong enough', says industrial giant

Rachel Parkes
Deputy Editor

Published 20 June 2025, 22:12

Steel giant ArcelorMittal has cancelled plans to partially decarbonise two of its steel plants in Germany — and has revoked its claim to €1.3bn (\$1.5bn) in subsidies from the country's federal and local governments to do so.

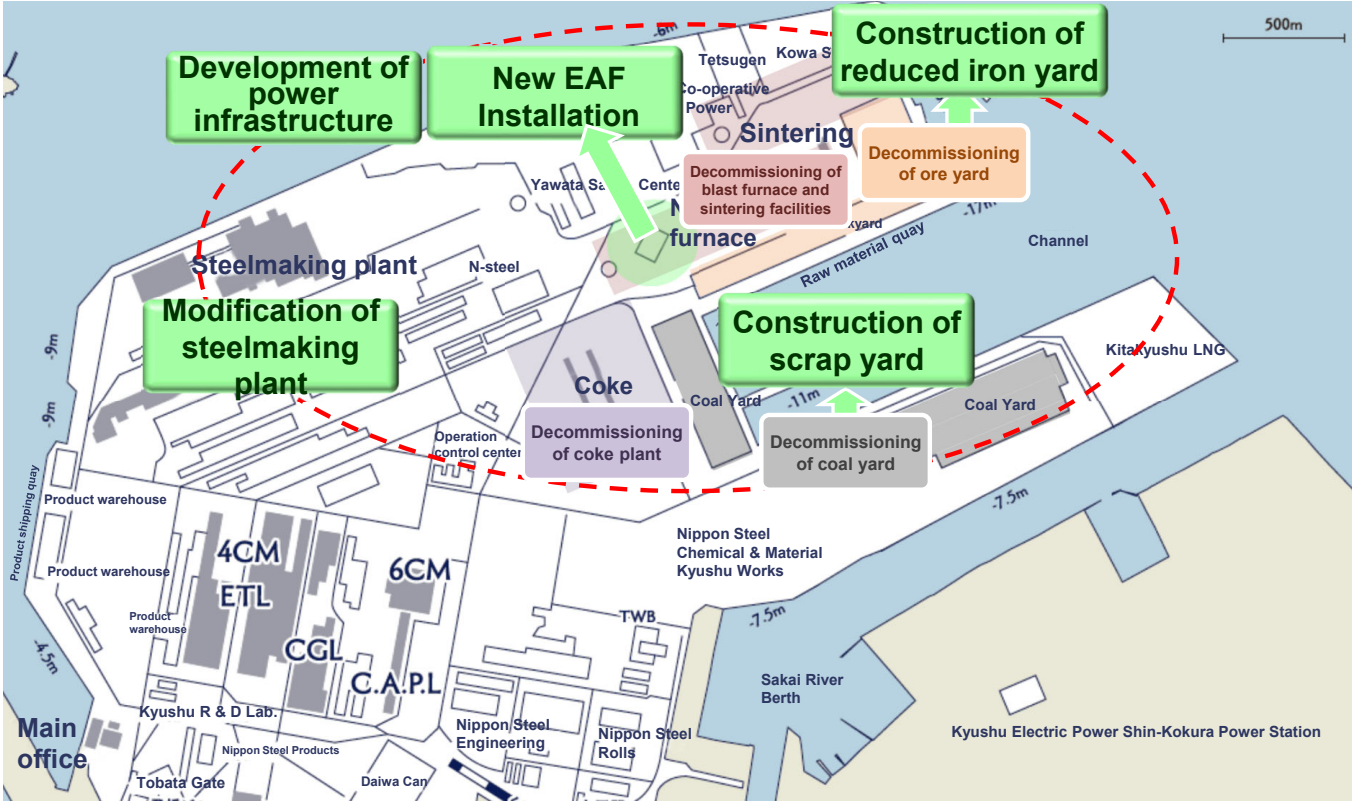
The Luxembourg-based steel giant had originally planned to construct one green-hydrogen-fired direct-reduced iron (DRI) plant and three electric arc furnaces (EAFs) across two of its steel plants in Bremen in northwest Germany, and Eisenhüttenstadt, close to the border with Poland in the east — with both facilities using the DRI.

ArcelorMittal had already warned in November last year that it was pausing all investment decisions on green steel investment in Europe, due to high costs.

source: <https://www.hydrogeninsight.com/>

Converting even one BF to an EAF requires enormous investment

A mega project to transform and revitalize the birthplace of modern steelmaking.
Project's investment will redevelop approximately 50% of the total area of the Yawata Area.
Total land area of Yawata Area: Approximately 7 million m² (equivalent to around 150 Tokyo Domes)



Massive investments and high OPEX of decarbonization

R&D

Massive investment required to achieve carbon neutrality through the world's pioneering development and implementation of breakthrough technologies.

[1] Enormous research and development costs for technology development

Promoting the development of various carbon-neutral technologies, including breakthrough technologies supported by the Green Innovation Fund, as well as proprietary technologies.

CAPEX

[2] Enormous equipment investment for commercial implementation

Investments for the implementation of breakthrough technologies after establishing their feasibility, as well as in decarbonization of electric power and CCUS.

OPEX

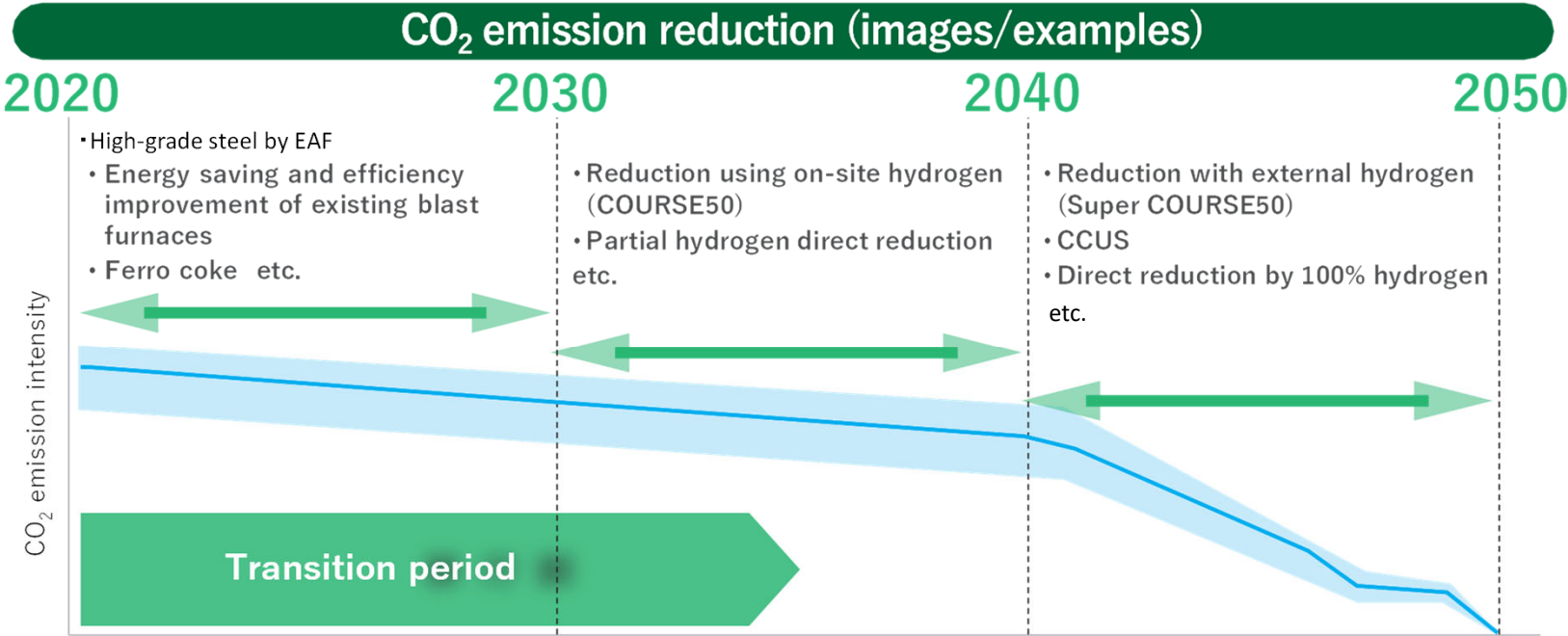
Compared to conventional processes, operational costs will also increase.

The high cost burden of decarbonized raw materials and decarbonized energy will further add to the overall expenditures.

CAPEX = Capital Expenditure
OPEX = Operating Expense

The main problem is that costs are rising even though product quality remains unchanged

- Decarbonization of the steelmaking process requires a lot of time to develop and implement innovative technologies and establish supply chains of clean raw materials and clean energy
- Steel products with significantly reduced CO₂ emissions by innovative steelmaking technology have not yet been manufactured worldwide and are expected to be ready for commercialization around 2040.



Source: JISF based on METI documents

Towards the creation of a GX steel market

- The JISF's Green Steel is a method whereby GHG reduction credits are generated from GHG projects implemented within an organisation, 'emission reduction certificates' are issued for products requested by consumers, and the steel products supplied together with the certificates.
- In recent years, domestic and international steel manufacturers have begun branding and supplying Green Steel using the same method, with sales volumes gradually increasing. Additionally, other industries are developing green products using similar methods.
- The JISF's Green Steel approach is a unique mechanism that can promote innovative steel manufacturing processes during the transition period while responding to growing customer demand for green products.

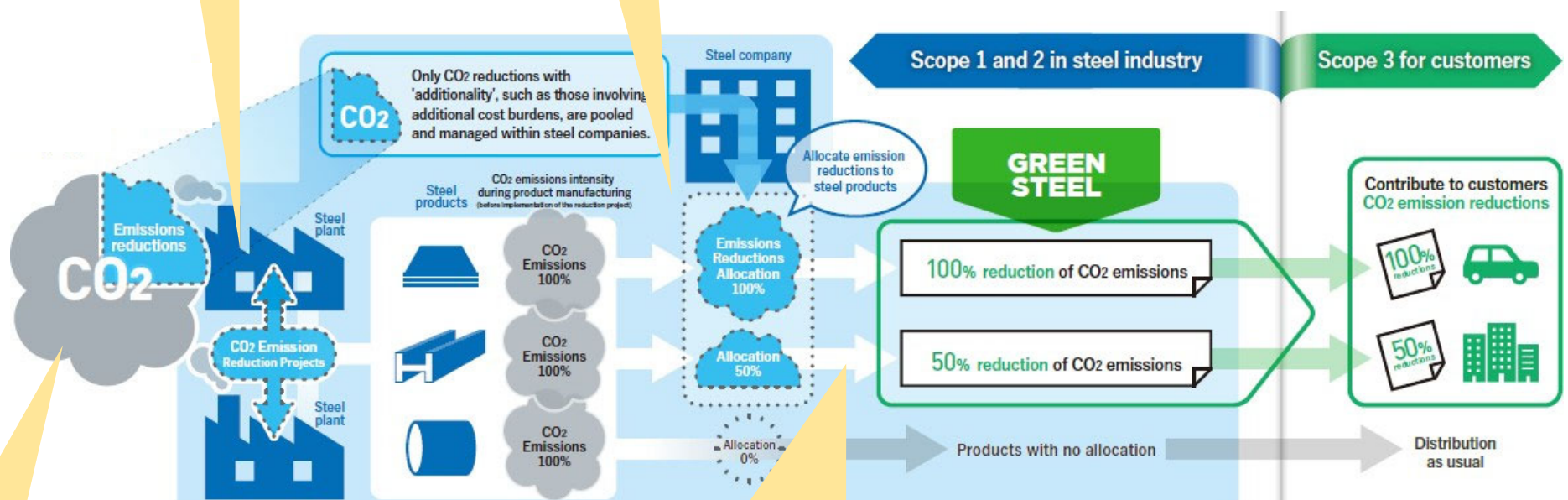
Examples of green steel brands



The JISF's Green Steel approach

STEP 1: Identify the GHG reduction projects to be applied the green steel approach

STEP 3: Issue "emission reduction certificate" sourced from the account and attach the certificate to specific steel products



STEP 2: The amount of emission reduction achieved by the projects is correctly measured and verified by a third party, and pooled in an organization's account

STEP 4: Green-steel products are sold at prices that properly reflect the GHG reduction effects. The product and the certificate are inseparable, and the certificate alone will not be distributed.

The environmental value of "Green Steel" is reflected in the customer's Scope 3 and product level emissions

Governmental project

“NSCarbolex® Neutral (Nippon Steel)” and “Kobenable® Steel (Kobe Steel)” used in bridge construction work ordered by the Kyushu Regional Development Bureau of the Ministry of Land, Infrastructure, Transport and Tourism of Japan.

This project was contracted under the comprehensive evaluation bidding system that includes factors other than price. In response to this, Yokogawa Bridge Corporation proposed “use of green steel” as one of the technical proposals and won the bid.



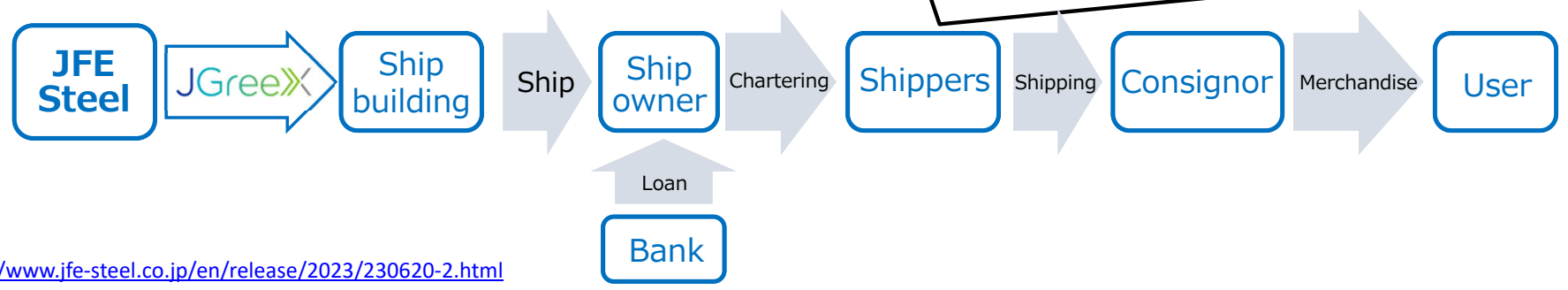
https://www.nipponsteel.com/news/20240222_100.html
https://www.kobelco.co.jp/releases/1214476_15541.html

Shipbuilding & Marine Transportation

Large Cargo Ships to be Made Exclusively with JFE Steel's JGreeX™ (JFE Steel) Green Steel -Collaboration with shippers aimed at sharing CO₂-reduction costs across society-

JFE Steel's "JGreeX™" green steel products have been selected for exclusive use in the construction of dry bulk carriers (large cargo ships). Under the business model established this time, participating shipping companies and shipowners will require that shipbuilders exclusively use "JGreeX™". All parties involved in the new business model will share the associated costs of reducing CO₂ emissions. JFE Steel, which itself is also engaged in shipping activities, will support the business model as both a shipper and a steelmaker, contributing to the realization of a distributed model in which the costs of CO₂ reduction are shared across the entire supply chain within a sustainable framework.

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|--|---|--|
| NYK Bulk & Projects Carriers Ltd.
Kawasaki Kisen Kaisha, Ltd.
KAWASAKI KINKAI KISEN KAISHA, LTD. | MOL Drybulk Ltd.
Daiichi Chuo Kisen Kaisha
Daiichi Chuo Kinkai Kaisha | TOKO KAIUN KAISHA, LTD.
EASTERN CAR LINER, LTD. |
|--|---|--|



<https://www.jfe-steel.co.jp/en/release/2023/230620-2.html>

Domestic policy regarding green steel

- ✓ Implementing the “Support Program for Energy and Manufacturing Process Transition in Hard-to-Abate Sector” (Hard to Abate Subsidy) utilizing GX transition bonds.
- ✓ Supporting efforts to reduce CO2 emissions through: ① transitioning from coal to natural gas or other fuels, and ② transitioning manufacturing processes and raw materials.
- ✓ In fiscal years 2024 and 2025, a total of approximately 900 billion yen will be allocated. This will subsidize the necessary CAPEX costs for emissions reduction in the steel and materials industries (subsidy rate: 1/3).

Nippon Steel

- Closing a BF and converting it to innovative EAF at Yawata area
 - Expanding and restarting EAF at Hirohata area and Yamaguchi area
- Approx. 868.7 billion yen in investment, with approx. 251.4 billion yen in support (1/3 subsidized).

JFE steel

- ✓ Closing a BF and converting it to an innovative EAF at the Kurashiki area
- Approx. 329.4 billion yen in investment, with approx. 104.5 billion yen in support (1/3 subsidized).

*About innovative EAFs

Conventional EAFs emit less CO2 per ton of steel than BF, but they can only produce a limited types of steel.

In contrast, innovative EAFs are designed to reduce emissions in the same way as conventional EAFs, while enabling the production of a wide range of steel products similar to those produced by BF.

Source: Ministry of Economy, Trade and Industry

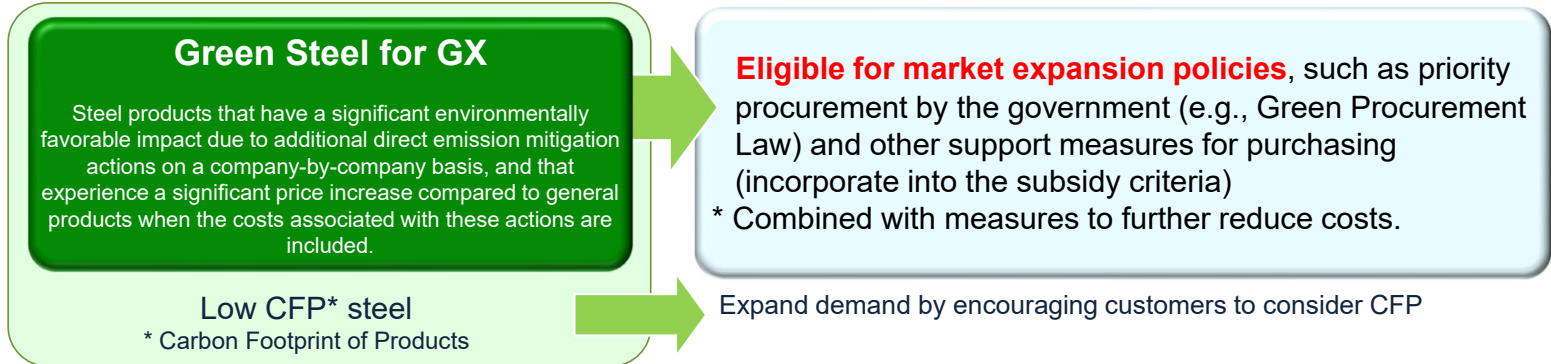
Towards the creation of a market for 'GX Steel'

Proposal of comprehensive public-private measures for creating the GX Steel market at the Study Group on Green Steel for Green Transformation (GX) , organized by the Ministry of Economy, Trade and Industry (METI)

Collaboration among experts, the steel industry, and demand-side industries to examine the necessity of GX in the steel industry, the necessity of quantifying GX value, and the necessity of ensuring consistency with international discussions. (Scheduled to be held five times from October 2024 to January 2025)

Based on the Summary of the 5th Study Group on Green Steel for GX Promotion by METI in January 2025

Concept of support for Green Steel for GX and low CFP steel



Comprehensive public-private measures

- Promoting GX value and reflecting it in international standards
- Enhancing the utilization of CFPs for steel products
- Providing support to the demand side
- Providing support to the supply side

The creation of a GX product market was positioned as a key element of the GX strategy in the government's 'GX2040 Vision' (Cabinet approved in February 2025)

The Study Group on Green Steel for GX, organized by METI, has classified GX Steel as a key target for demand-side support.

Progress has been made for preferential procurement and purchase support for GX Steel by the government.

Revision of the Act on Promoting Green Procurement
(The revision was approved by the Cabinet on January 28, 2025)

The Basic Policy of the Act on Promoting Green Procurement has been revised to prioritize the procurement of products utilizing Green Steel in accordance with the Japan Iron and Steel Federation Green Steel Guidelines.

Additional CEV subsidy* measures for vehicles using GX Steel
(Announced by METI on January 27, 2025)

A new measure has been introduced to increase subsidies by up to ¥50,000 to stimulate demand for steel to promote GX, including steel produced via innovative EAFs. This measure is scheduled for implementation starting in FY2025.

*CEV subsidy is designed to promote the introduction of clean energy vehicles. A government program that supports the adoption of clean energy vehicles such as EVs, PHEVs, and FCVs. It also facilitates the development of essential charging and hydrogen refueling infrastructure necessary for their widespread use.

Drive GX investments to advance decarbonization of the steelmaking process, which will enable stable supplies of GX Steel to customers and contribute to customer's Scope 3 emissions reduction.

Summary

- Japanese blast furnace companies have established roadmaps for achieving carbon neutrality by 2050. They are currently vigorously promoting the development of innovative technologies (electrification, hydrogenation) to overcome various challenges.
- However, achieving green steel will require a significant amount of time and enormous costs. Meanwhile, the market is seeking the prompt supply of GX steel.
- Furthermore, during the transition period until green steel is realised, significant investment and increases in operating costs are unavoidable. As a result, the establishment of a GX steel market is essential for the steel industry's transition, and public-private initiatives to form a GX steel market have begun.
- For the steel CoC approach, industry guidelines are being established to ensure transparency in methodologies. Meanwhile, discussions on the international standardisation of the CoC approach are progressing rapidly to support decarbonisation in hard-to-abate sectors across the entire supply chain.
- The success or failure of the GX steel market will determine the success or failure of the steel industry's carbon neutrality efforts.

Thank you for your attention!