# Environment: Executive Summary

The JFE Group strives to maintain its businesses in harmony with the environment for the prosperity of society. We have positioned climate change as a key management concern in our pursuit of becoming the top runner in carbon neutrality technology development by 2035 toward achieving carbon neutrality by 2050. To this end, we are reducing greenhouse gas emissions in the steel business and expanding our contribution to reducing greenhouse gas emissions in society as a whole, centered on the engineering business. The entire Group is working in concert to establish an environmental management framework, and we have identified climate change, transition to a circular economy, and biodiversity conservation and nature positive as key issues under our Eighth Medium-term Business Plan (FY2025–FY2027). We are committed to resolving global environmental concerns.

The JFE Group systematically addresses climate change by incorporating the Task Force on Climate-related Financial Disclosures (TCFD) philosophy in its management strategies. In the steel business, we have created a roadmap for achieving carbon neutrality by 2050 and are working to reduce greenhouse gas emissions (GHG) toward short-, medium-, and long-term targets. In FY2024, we achieved a 23% reduction against the target of an 18% reduction in greenhouse gas emissions compared to FY2013. Our efforts targeting a reduction of more than 30% by FY2030 include introducing innovative electric arc furnaces and using direct reduced iron. Furthermore, to achieve carbon neutrality by 2050, we are pursuing the parallel development of ultra-innovative technologies, including a carbon-recycling blast furnace, to establish these technologies around 2035. The shift to steelmaking processes that achieve carbon neutrality, however, entails enormous costs, and creating markets for products with environmental value (GX products), such as green steel, and gaining support from the government and others will be indispensable. To this end, since FY2023 we have been supplying JGreeX™, a variety of green-steel products that, compared to conventional products, significantly lowers GHG emissions in the steelmaking process based on the mass balance approach, and we are expanding sales to a variety of sectors. To support investment, we applied for a program of the Ministry of Economy, Trade and Industry and secured support for the introduction of an innovative electric arc furnace at the Kurashiki district of the West Japan Works. In the engineering business, we are working to expand our contributions to reducing GHG emissions in society by constructing renewable energy power generation facilities, including offshore wind power generation. In FY2024, we achieved our target of contributing to a 12 million tonne reduction in GHG emissions in society, and we are expanding initiatives for achieving reductions of 20 million tonnes in FY2030 and 30 million tonnes in FY2035.

The transition to a circular economy is also positioned as a key theme, and we are coordinating our steel, engineering, and trading businesses and value chain to expand the use of recycled resources, improve the efficiency of waste resource utilization, and convert waste into resources.

In addition, we are promoting initiatives for biodiversity conservation and nature positive, assessing the dependencies and impacts between our business activities and natural capital, and advancing disclosures in line with the TNFD. These efforts mainly include monitoring and conservation activities around production sites and initiatives to improve the marine environment by using steel slag products.

In regard to the blast furnace site and other facilities suspended in FY2023 at JFE Steel's East Japan Works (Keihin District), we are focusing on converting the land for public and highly public-interest use, contributing to the sustainable development of local communities and society by establishing new industries and creating jobs for the next 100 years.

Targets and Results for Environment-Related Material Issues of Corporate Management

› FY2024 KPI Results and FY2025 KPIs (P. 19)

## Key Initiatives


- Environmental Management Initiatives (P. 46)
- Initiatives to Address Climate Change Issues (P. 53)
- Policy Engagement Initiatives (P. 90)
- Scenario Analysis in Line With the TCFD Recommendations (P. 113)
- Initiatives to Transition to a Circular Economy (P. 124)
- Biodiversity Conservation and Nature Positive (P. 151)

# Environmental Management

## Basic Policy

JFE Group companies are developing innovative technologies and international cooperation for the protection of the global environment by operating in harmony with the global environment, as well as protecting it, in accordance with the Group's environmental philosophy and policy.

### Environmental Philosophy

The JFE Group puts top priority on protecting and enhancing the global environment to maintain its business in harmony with the environment and ultimately for the prosperity of society as a whole.

### Environmental Strategies

1. Reduce the environmental impact of all businesses
2. Contribute through technologies and products
3. Contribute through businesses for resource conservation and energy efficiency
4. Communicate with society
5. Facilitate international cooperation

## Management Structure

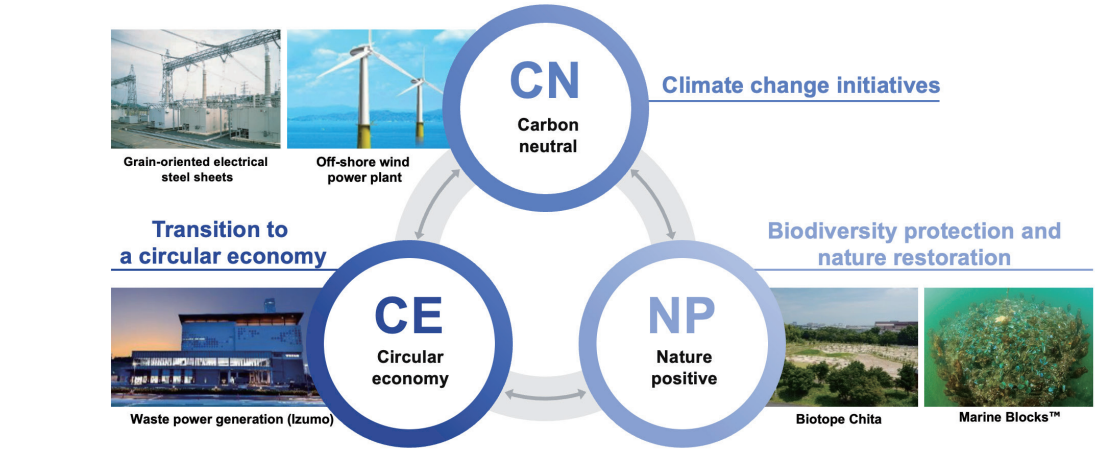
### Framework for Environmental Management

The JFE Group Environmental Committee, chaired by the president of JFE Holdings and operating under the JFE Group Sustainability Council, sets goals for environmental protection, monitors the progress of these initiatives and works to improve the Group's overall environmental performance. Key issues for corporate management such as climate change are deliberated at the Group Management Strategy Committee as well and reported to the Board of Directors. The board oversees environmental challenges by discussing the reported material. Additionally, specialized committees set up by JFE Group operating companies and affiliates implement specific activities.

We will continue to place top priority on addressing climate change from the perspective of business continuity and are striving to achieve carbon neutrality by 2050. In addition to addressing climate change, our Eighth Medium-term Business Plan designates the transition to a circular economy as well as biodiversity conservaion and nature positive as key issues, and we will actively contribute to resolving global environmental concerns.

## Environmental Philosophy

The JFE Group puts top priority on protecting and enhancing the global environment to maintain its business in harmony with the environment and ultimately for the prosperity of society as a whole.

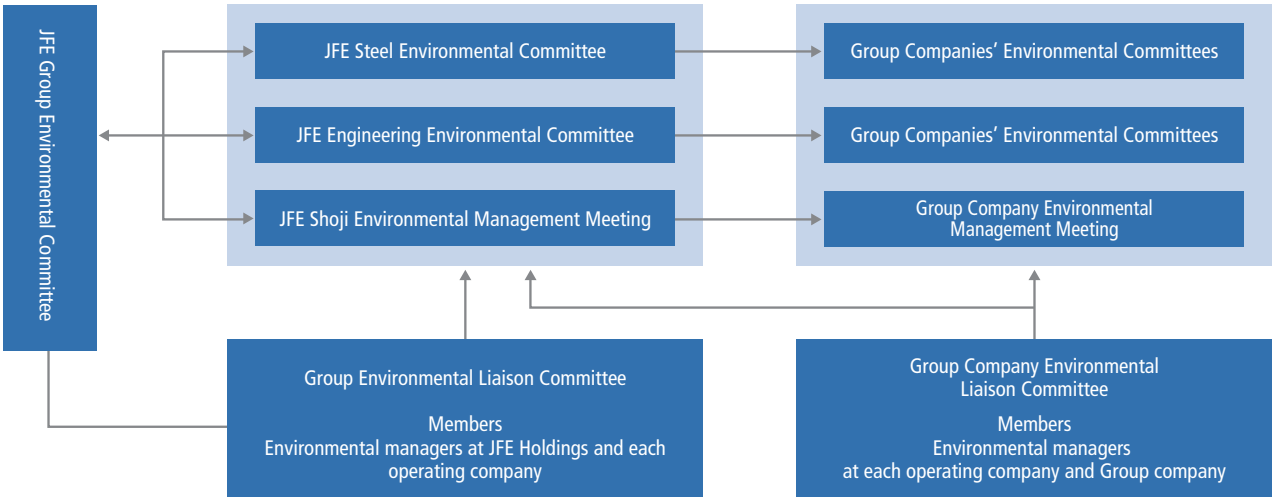



Based on the Ministry of the Environment's "State of the Environment, the Economy, and Society and Direction of Environmental Policies" (January 2023)

Building an environmental management system as a unified group, setting "climate change issues" as well as "transition to a circular economy" and "biodiversity conservation" as important issues in the Eighth Medium-term Business Plan. Actively contributing to solving global environmental issues.

For further details, please refer to:
- System for Promoting Sustainability (P. 10)
- Eighth Medium-term Business Plan (P. 25)
- JFE Group Environmental Vision for 2050 (P. 53)

### Environmental Management System



# Initiatives

## Environmental Management System

Acquiring ISO 14001 certification is a key part of every JFE Group company's environmental program. In accordance with the requirements of ISO 14001, each registered organization reviews its environmental policy, legal requirements, and progress toward achieving last year's targets and activities, and then formulates and communicates environmental targets and action plans for the coming year. In addition to periodic reporting and reviews within the organization, audits are conducted as necessary to confirm results. Annual results are evaluated through management reviews, and deliberation on future initiatives incorporates these findings into next year's plans.

All global production sites of JFE Steel and JFE Engineering and major offices of JFE Shoji have been certified, encompassing 66% of 43,243 employees at 82 companies covered in this report and 52% of all sites. In FY2024, there were no major violations of environmental laws or regulations by Group companies (air, water, soil, etc.) that resulted in a fine or other penalty.

For quantitative data related to ISO 14001 for each business, please refer to:

› List of ISO 14001-certified companies (https://www.jfe-holdings.co.jp/common/pdf/sustainability/environment/env_manage/iso14001.pdf)

### ST Environmental Committee and Environment Management Committees Provide Appropriate Management Supervision

JFE Steel maintains Environment Management Departments at its head office and in each business office, as well as an Environmental Committee, chaired by its president, and Environment Management Committees in each local office. In addition, the Management Committee deliberates and sets materialities and KPIs, including those related to the environment, and evaluates performance. In FY2024, we achieved our target of reducing $CO_2$ emissions by more than 18% compared to FY2013, and by stimulating demand for green steel, we expanded the adoption of JGreeX™ and received orders across all sectors, thereby achieving our environmental KPIs. Starting in FY2025, we will set new materialities and KPIs related to the circular economy, biodiversity conservaion, and nature positive activities, and follow through to take action.

› Environmental Management System (Environmental Strategies) (Japanese only) (https://www.jfe-steel.co.jp/research/environment.html)
› FY2024 KPI Results and FY2025 KPIs (P. 19)

### EN Environmental Committee Oversees Environmental Management

JFE Engineering maintains an Environment Management Department at each of its major locations, including production sites and branch offices as well as all divisions in charge of products. The Environmental Committee, chaired by the president, oversees environmental management for the entire company. Under its Environmental Management System, JFE Engineering works to minimize environmental impact at production sites, branch offices and construction sites and contribute to environmental protection through all products and services. The major strategies for FY2025 are (1) promote environmental contribution through products for mitigating global warming and climate change, (2) promote environmental protection, effective energy conservation, and resource recycling in business activities, and (3) ensure thorough compliance with environmental laws and regulations. We are reflecting these strategies into the related operations. These strategies are incorporated into related operations and are addressed.

### SH Expand ISO 14001 Certification Acquisition Coverage

JFE Shoji obtained ISO 14001 certification for its head office, Osaka branch, and Nagoya branch in 2000 and later expanded the scope of certification to all domestic offices. JFE Shoji also applies the same environmental management system to domestic Group companies, promoting the same environment management activities and striving for the same certification. Overseas coil centers are also planning to acquire ISO 14001 certification.

# Environmental Audit

In addition to the regular internal and external audits at ISO 14001-certified sites, the audit and environment departments at each operating company's head office conduct independent environmental audits at their production sites.

## ST Conduct Detailed Audits

Once a year, JFE Steel's Audit Department and the Environment, Disaster Prevention and Recycling Department conduct an environmental audit at each operational site. JFE Steel categorizes Group companies based on the result of risk assessment considering owned equipment and conducts detailed audits every one to five years using checklists.

In FY2024, we conducted audits of 17 Group company sites.

Document audit at a domestic Group company on-site audit at a domestic Group company

On-site audit at a domestic Group company

## EN Conduct Audits to Confirm Compliance with Environmental Laws and Regulations

JFE Engineering places top priority on complying with environmental laws and regulations.

For JFE Engineering's production sites in Japan (Tsurumi, Tsu, and Kasaoka), the Safety and Environment Department conducts environmental law compliance audits as well as internal audits of the environmental management system. In addition, the department annually audits about 50 locations selected from construction sites in Japan and Group companies to confirm compliance with environmental laws and regulations. Furthermore, at JFE Engineering, environmental inspections are conducted at approximately 70 locations annually (including about 30 construction sites and plant operation sites) to evaluate the effectiveness of initiatives for improving environmental performance and take remedial action. Annual environmental inspections to confirm compliance with environmental laws are conducted by the departments responsible for all construction, and self-checks of legal compliance are carried out every year at production sites (Tsurumi, Tsu, and Kasaoka).

## SH Conduct Internal Audits and Environmental Audits

The JFE Shoji Group conducts internal environmental audits once a year for ISO 14001-certified Group companies, and environmental audits are conducted once every three years for non-certified group companies to confirm on-site compliance with laws and regulations. In FY2024, we conducted internal audits of all 54 ISO-certified organizations and an environmental audit of one non-certified company.

For quantitative data related to environmental audits, please refer to:
› Environmental Data (P. 255)

# Environmental Education

The JFE Group actively provides education to foster a corporate culture of environmental protection. Education at operating companies includes training for new recruits and newly promoted employees as well as specific environmental-protection training by position and job.

For Groupwide environmental training, we hold an annual Review Session on Environment-Related Laws and Regulations, to which lawyers specialized in environment-related laws and regulations are invited to give lectures on the latest information related to the enactment and revision of these laws, as well as associated violations and court decisions. Employees from wide-ranging departments, including the environment, disaster prevention, legal affairs, general affairs, and manufacturing departments of the operating companies and their group companies, who are involved in environment-related activities, attend these annual sessions as the basis for planning their activities, such as educating employees and raising awareness about the Group's policies and initiatives.

## ST Promote Pollution Control Managers Acquire Qualifications

JFE Steel encourages employees to obtain qualifications as pollution-control managers. A training program for environmental managers at Group companies was launched in FY2011. In addition, JFE Steel provides employees with training to ensure compliance with environmental laws, disseminates information about regulatory revisions at its Environmental Liaison Committee meetings for Group companies, and organizes brush-up training in waste management skills for on-site personnel.

## EN Provide General Environmental Education

JFE Engineering educates all employees about environmental issues to increase their understanding of the company's policies and initiatives. To ensure proper environmental management at production and construction sites, training is often tailored to specific employee operations, helping to enhance their capabilities. In FY2024, we revised the distributed video materials for environmental law education to make them easier to use and encouraged greater participation.

## SH Provide General Environmental Training and Specialized Training for Internal Audit Staff

JFE Shoji provides all employees with general environmental training in compliance with ISO 14001 and specialized training for internal audit staff. All employees within the scope of certification receive a pocket-size ISO Employee Card to carry with them so they can check the details of ISO 14001 activities at any time. In addition, each company performs a self-check using its own extensive checklist to ensure understanding and rigorous compliance with environmental laws. Also, JFE Shoji provides environmental training to new executives and information about revised laws and regulations to environmental management personnel.

# Environmental Impact Reduction Initiatives

The JFE Group regards co-existence and mutual prosperity with local communities, the global environment, and society at large as a critical managerial challenge in terms of business continuity. It strives to control air and water pollutant emissions and aggressively invests in environmental protection. Related internal controls and education are steadily being strengthened as well. Also, the transfer and widespread application of proprietary technologies, mainly in developing countries, contribute to pollution prevention on a global scale.

For quantitative data related to reducing environmental impact, please refer to:
› Environmental Data (P. 255)

## Controlling Air Emissions

### ST Initiatives to Further Reduce SOx and NOx Emissions

JFE Steel is installing low-nitrogen oxides (NOx) burners in reheat furnaces, switching to low-sulfur fuels and deploying desulfurization and denitration devices in sintering plants, all major sources of sulfur oxides (SOx) and NOx emissions. It has concluded agreements with local administrations that stipulate conditions that are stricter than the total volume restrictions required by the Air Pollution Control Law. The company is continuing to further control emissions at a level that is less than the amount set forth in the agreement. In addition, the company suppresses dust dispersion through measures that include enhancing on-site cleaning, installing sprinklers and windbreak fences in raw material yards, and improving the performance of dust collectors.

### EN Appropriate Management in Place to Restrict SOx and NOx Emissions

To ensure compliance with the Air Pollution Control Law and relevant local regulations, JFE Engineering properly manages facilities that emit soot and smoke at its Yokohama head office, Tsurumi works, and Tsu works, so NOx and SOx emissions from those facilities are maintained at a level sufficiently lower than the total annual volume restriction (NOx: 18,000 $Nm^3$, SOx: 100 $Nm^3$).

Environmental protection efforts are underway at construction sites and plant operation sites through the strict use of construction machinery and on-site vehicles in compliance with the Automotive NOx and PM Law and the Act on Regulation, Etc. of Emissions From Non-road Special Motor Vehicles (Off-Road Vehicle Law).

In addition, we strive to prevent leakage at the aforementioned sites and temporary locations such as construction sites by inspecting equipment using fluorocarbons and ensuring proper disposal in accordance with the Fluorocarbons Emission Control Act.

## Management of Chemical Substances and Emission Control

### ST Initiatives to Reduce VOC Emissions

JFE Steel lowers its environmental impact by voluntarily reducing the chemical substances it releases. Release and transfer amounts of substances subject to Japan's Law concerning Pollutant Release and Transfer Register (PRTR Law) are reported in accordance with the law.

The Japan Iron and Steel Federation formulated a voluntary action plan to reduce VOC emissions by 30% from FY2000 levels by FY2010. As part of this action plan, JFE Steel set a target for reducing emissions to 1,078 tonnes or less. As a result of our initiatives, we achieved a significant reduction that exceeded the 30% reduction target in FY2010 and have been consistently cutting VOC emissions, by more than 50%. Going forward, we will continue to maintain the emissions below 1,078 tonnes and take the necessary steps to prevent any increase.

Emissions of benzene and dichloromethane are kept at low levels. We will continue to set targets for the two substances and maintain low emissions levels.

### EN Management of Chemical Substances in Accordance with the PRTR Law

Major chemical substances subject to the PRTR Law for the JFE Engineering works in Tsurumi, Tsu, and Kasaoka include organic solvents such as xylene used for painting products, manganese and its compounds generated during welding. We report the release and transfer amounts of these substances in accordance with the law.

### PCB Waste Management at JFE

Polychlorinated biphenyl (PCB) waste is properly stored and managed at the JFE Group's facilities. High-concentration PCB waste has been treated under the guidelines set by the Japan Environmental Storage & Safety Corporation (JESCO), and the treatment is almost completed. Low-concentration PCB waste is being treated under contracts with certified detoxification contractors. The Yokohama Eco Clean Plant of J&T Recycling Corporation treats insulating oil contaminated with slight amounts of PCB, helping to reduce pollutants both in and outside the JFE Group.

## Environmental Accounting

### Basic Policy

The JFE Group is saving energy and reducing its environmental impacts by making its production facilities increasingly efficient and introducing more environmentally friendly equipment. Any equipment or facilities related to energy conservation and environmental protection are categorized as environmental investment, while all activities related to environmental protection and impact reduction are categorized as environmental expenses.

Through these environmental investments and expenses, we are working to lower unit-based $CO_2$ emissions to prevent global warming and to reduce final-disposal waste by maintaining a high recycling rate to effectively use natural resources. We are also striving to reduce emissions of pollutants into the water and air, which contributes to environmental protection and ensures thorough compliance with statutory regulations concerning exhaust gas emissions and discharged water.

For quantitative data related to environmental accounting, please refer to:

› Environmental Data (P. 255)

### Related Links

› Material Flow (P. 255)
› JFE Steel: Environmental Initiatives (Japanese only) (https://www.jfe-steel.co.jp/research/environment.html)
› JFE Engineering: 360° JFE Engineering—Protecting Natural Environments (https://www.jfe-eng.co.jp/en/360_jfe_engineering/#env)
› JFE Shoji: Environment Management (https://www.jfe-shoji.co.jp/en/sustainability/environment/)

# Initiatives to Address Climate Change Issues

## Basic Policy

Climate change is a critical business concern for the JFE Group from the perspective of business continuity. Our steel business, which emits 99.9% of the Group's total $CO_2$ emissions, has been developing various technologies for saving energy and reducing these emissions. We have applied these technologies to steel manufacturing processes to enable production with low levels of $CO_2$ emission intensity.

Furthermore, the JFE Group has developed and maintains a variety of products and technologies that contribute to reducing GHG emissions, including high-performance steel materials that save energy when customers use them, as well as renewable energy power generation. We will continue to develop and promote the widespread use of these processes and products. We consider this an opportunity to apply the technologies we have fostered across the globe and at the same time contribute to tackling climate change.

JFE announced its endorsement for the TCFD recommendations in May 2019 and has identified climate change-related issues based on the scenario analysis advocated in the TCFD to formulate strategies for sustainable growth. The JFE Group will be a top runner for the development of carbon neutral technologies and formulated the JFE Group Environmental Vision for 2050 toward achieving carbon neutrality in 2050. We will actively work on reducing GHG emissions and contributing to GHG reductions.

### JFE Group Environmental Vision for 2050

The JFE Group intends to strengthen sustainability through solutions that address global climate change issues while restructuring its business in response to changes in the environment surrounding the steel business.

In 2021, we positioned climate change as a top-priority issue in the Seventh Medium-term Business Plan (FY2021–FY2024) and formulated the JFE Group Environmental Vision for 2050 toward achieving carbon neutrality by that year. We will continue to regard it as a top priority under the Eighth Medium-term Business Plan (FY2025–FY2027) and will implement related initiatives.

We will systematically address climate change by reflecting the TCFD's principles in the business strategies of our JFE Group Environmental Vision for 2050. In the steel business, we will reduce GHG emissions by 18% from FY2013 levels by the end of FY2024. In addition, we have announced targets for our steel business of reducing GHG emissions by FY2027 by 24% and by FY2030 by 30% or more, compared to FY2013.

To explore all possibilities for realizing carbon neutrality in 2050, we will take on the challenge of developing ultra-innovative technologies such as carbon-recycling blast furnaces developed with our proprietary technology while also adopting a multitrack approach for pursuing other technologies. In our engineering business, we will widen our contribution to the reduction of GHG in society as a whole by expanding and advancing renewable power generation and carbon-recycling technologies, supplying high-performance steel products, and other initiatives. Furthermore, we will apply Group strengths to accelerate the commercialization of our offshore wind-power business.

The development of process technologies that minimize GHG emissions while enabling the mass production of high-quality, high-performance steel products is essential for the sustainable development of society. Efforts for achieving carbon neutrality will inevitably entail substantial costs for research and development and renewed facilities. We believe it will be necessary to consider how society will bear these costs and what support can be provided by the government and other sources.

Given the ambitious target of achieving carbon neutrality by 2050, we hope to lead the way in establishing the necessary decarbonization technologies at the earliest possible stage, based on developing a decarbonization infrastructure and realizing a global equal footing.

## JFE Group Environmental Vision for 2050

- **Climate change is a critical business concern for JFE, and we are aiming to achieve carbon neutrality by 2050.**
- **We will accelerate our research and development of new technologies and pursue ultra-innovative technologies.**
- **We will seek business opportunities that allow us to enhance corporate value by contributing to $CO_2$ emissions reduction across society.**
- **The principles of TCFD will be reflected in our business strategies and systematically deployed.**

**The Target of Reducing GHG Emissions in FY2027 (Eighth Medium-term Business Plan Initiatives)**

- Reduce steel-business GHG emissions in FY2027 by 24%, compared to FY2013 (steel business).

**The Target of Reducing GHG Emissions in FY2030**

- Reduce steel-business GHG emissions in FY2030 by 30% or more, compared to FY2013 (steel business).

**Initiatives for Carbon Neutrality by 2050**

❶ Reduce steel-business GHG emissions

- Pursue ultra-innovative technology for carbon-recycling blast furnaces and CCU.
- Develop hydrogen-based ironmaking direct reduction technology.
- Leverage top-class electric arc furnace technology for high-quality, high-performance steel manufacturing and for high efficiency, ensure early implementation, etc.
- Develop transitional technologies for carbon neutrality, including increased use of steel scrap in converters, energy savings, and low-carbon energy transformations.

❷ Expand contributions to GHG emissions reduction in society

- Engineering business: Expand and develop renewable energy power generation and carbon-recycling technologies. (Reduce GHG emissions by 13.5 million tonnes in FY2027, 20 million tonnes in FY2030, and 30 million tonnes in FY2035.)
- Steel business: Develop and market eco-products and eco-solutions.
- Trading business: Increase trading in biomass fuels, steel scrap, etc., and strengthen business in supply chain management for eco-products.

❸ Offshore wind-power generation business (Groupwide effort to accelerate commercialization of the offshore wind-power business)

- Engineering business: Manufacture monopiles and other seabed-fixed structures for offshore wind-power generation.
- Steel business: Produce large, heavy plates using the No. 7 continuous casting machine at the Kurashiki District of the West Japan Works.
- Trading business: Carry out supply chain management for steel materials and processed products.
- Shipbuilding business: Manufacture offshore wind power generation floating structures and construct work vessels.
- Groupwide: Operation and maintenance (O&M) making maximum use of Group resources.

Notes.

1. Carbon-recycling blast furnace: A technology that converts $CO_2$ from the blast furnace into methane, which is then used as reducing material in the blast furnace
2. CCU: Carbon dioxide capture and utilization
3. Transitional technologies: Technologies that advance the transition to carbon neutrality

› **Eighth Medium-term Business Plan** (P. 25)

› **JFE Group Environmental Vision for 2050, Presentation Material** (https://www.jfe-holdings.co.jp/en/common/pdf/investor/climate/2021-210525-release01.pdf)

› **JFE Group Environmental Management Strategy, Presentation Material**
(https://www.jfe-holdings.co.jp/en/common/pdf/investor/climate/environmental-management-strategy250529-01.pdf)

# Information Disclosure Based on TCFD Recommendations

On May 27, 2019, JFE Holdings announced its endorsement for the final report of the Task Force on Climate-related Financial Disclosures (TCFD)*.

TCFD TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES

*The TCFD was established by the Financial Stability Board (FSB) at the request of G20 finance ministers and central bank governors.

Climate-related risks and opportunities may have a significant impact on medium- to long-term corporate finance. The TCFD was established by the Financial Stability Board at the request of the G20 for reducing the risk of instability in the financial market. The TCFD considers disclosure frameworks that enable the financial markets to appropriately assess climate-related risks and opportunities and releases its findings as a final recommendations report.

Recognizing the importance of investors' and others' accurate understanding of how climate-related risks and opportunities may affect the financial condition of investee companies when making financial decisions, the TCFD recommends disclosure of information regarding the four core elements of organizational management: governance, strategy, risk management, and metrics and targets.

The JFE Group promotes the disclosure of climate-related information in line with international frameworks such as the TCFD, thereby enhancing the reliability and transparency of its initiatives for stakeholders, including investors, customers, employees, and local communities.

In addition, the International Sustainability Standards Board (ISSB), established by the IFRS Foundation*, has succeeded in the achievements of the TCFD and formulated international standards for the integrated disclosure of financial and non-financial information. In Japan, the Sustainability Standards Board of Japan (SSBJ) has formulated disclosure standards based on the ISSB standards, which were published in March 2025. The application of these standards is scheduled to be phased in from 2027, and the JFE Group is also preparing to comply.

*A private, nonprofit organization responsible for developing International Financial Reporting Standards (IFRS)

For the TCFD content index, please refer to:

› Guideline Content Indices (P. 297)

# Governance (Management Structure: JFE Group)

In the process of identifying material issues, the perspective of financial impact taking into account recent social and economic trends has become a key factor in addition to the conventional perspective of management through smooth PDCA cycles. In particular, initiatives such as reducing GHG emissions in the steelmaking process and developing and providing products that contribute to reducing GHG emissions are now recognized as being directly linked to corporate value and sustainable growth.

Accordingly, in formulating the Eighth Medium-term Business Plan, we reviewed material issues by selecting items of greater managerial importance, considering economic aspects, including financial impact. In this process, we emphasize the impact of responses to climate change on the Company's medium- to long-term competitiveness, and we have positioned reducing the JFE Group's GHG emissions and contributing to reducing GHG emissions in society as a whole as material issues, continuing from the Seventh Medium-term Business Plan, as initiatives for achieving carbon neutrality by 2050.

As the framework overseeing initiatives to address climate change, the JFE Group has established a cross-sectional JFE Group Environmental Committee under the JFE Group Sustainability Council, chaired by the president of JFE Holdings. This committee discusses setting goals for environmental protection, monitors the progress of these initiatives, and works to improve the Group's overall environmental performance as well as risk assessment and responses.

Particularly important management themes requiring deliberation are discussed at the Group Management Strategy Committee, and the content of these discussions is reported to the Board of Directors, which fulfills its supervisory function through discussions on environmental issues, including climate change.

**Examples of climate change-related agenda items involving Board of Directors decisions and reports**

- Declaration of endorsement for the final TCFD recommendation report
- Information disclosure consistent with TCFD recommendations (scenario analysis, financial impact, and other information)
- Formulation of the Seventh Medium-term Business Plan, JFE Group Environmental Vision for 2050
- Review the $CO_2$ emissions reduction target for FY2030.
- Use of climate-related metrics to determine executive remuneration
- Formulation of GHG emissions reduction targets and contribution targets under the Eighth Medium-term Business Plan
- Decision-making on capital investment for GHG emissions reduction

› Corporate Governance System (P. 233)
› Framework for Environmental Management (P. 47)

# Risk Management

JFE Holdings is responsible for comprehensive risk management in accordance with its Basic Policy for Building Internal Control Systems.

Climate-related risks and opportunities are identified, assessed, and reviewed at the corporate level through scenario analysis in line with the framework recommended by the TCFD. The results of these analyses are appropriately reported in accordance with the aforementioned governance framework.

Furthermore, key factors affecting business are selected, and the results of a detailed analysis of their impacts are used in formulating business strategies, including the Medium-term Business Plan.

## Monitoring Method for Risks

The JFE Group monitors risks that could affect management at the JFE Group Sustainability Council, Group Management Strategy Committee, and Management Committee. Measures are implemented based on a quarterly report on climate change-related risks deliberated by the specialized committees of each Group company (e.g., the Environmental Committee). In addition, the JFE Group Environmental Committee consolidates information related to risks, strengthens management systems, and strives to reduce the frequency and impact of risks. Moreover, the JFE Group promotes initiatives to maximize climate-related opportunities.

### Countermeasures Based on Monitoring

1. Groupwide deliberations
2. Monitoring penetration of policies within the Group
3. Monitoring deployment of policies throughout the Group

› System for Promoting Sustainability (P. 10)
› Risk Management (P. 251)
› Framework for Environmental Management (P. 46)

# JFE Group's Strategy for Addressing Climate Change Issues

The JFE Group integrates climate change-related risks and opportunities as follows. The JFE Group formulated the Seventh Medium-term Business Plan (FY2021–FY2024) and positioned responses to climate change as top-priority issues for achieving the Group's medium-to long-term sustainable growth and enhancing corporate value. In the **Eighth Medium-term Business Plan** (FY2025–FY2027), the Group continues to identify responses to climate change as a top priority and is pursuing related initiatives.

In addition, the Group formulated the **JFE Group Environmental Vision for 2050** toward achieving carbon neutrality by 2050, as a key initiative for environmental and social sustainability. Through this vision, we have incorporated climate change initiatives into our business strategies and reflected the TCFD philosophy in our environmental management strategy. JFE Vision 2035, the JFE Group's long-term vision, sets forth the goal of systematically addressing climate change issues and becoming a top runner in carbon neutral technology development. Consistent with TCFD recommendations, we conduct scenario analysis as part of our information disclosure to identify and evaluate key factors affecting the business. These risks and opportunities are reflected in management strategies and used for decision-making. The JFE Group Environmental Vision for 2050 identifies three strategic pillars for achieving carbon neutrality: **"reducing GHG emissions in the steel business," "expanding contributions to reducing GHG emissions throughout society,"** and **"initiatives for the offshore wind power generation business."**

We also communicate our climate change initiatives through briefings and other channels to strengthen relationships of trust with our stakeholders.

For related materials, please refer to:

› Scenario Analysis in Line With the TCFD Recommendations (P. 113)

› JFE Group Environmental Vision for 2050, Presentation Material (https://www.jfe-holdings.co.jp/en/common/pdf/investor/climate/2021-210525-release01.pdf)

› JFE Group Long-Term Vision "JFE Vision 2035", Eighth Medium-term Business Plan ( FY2025–FY2027) (https://www.jfe-holdings.co.jp/uploads/2024-chuuki250508-01e.pdf)

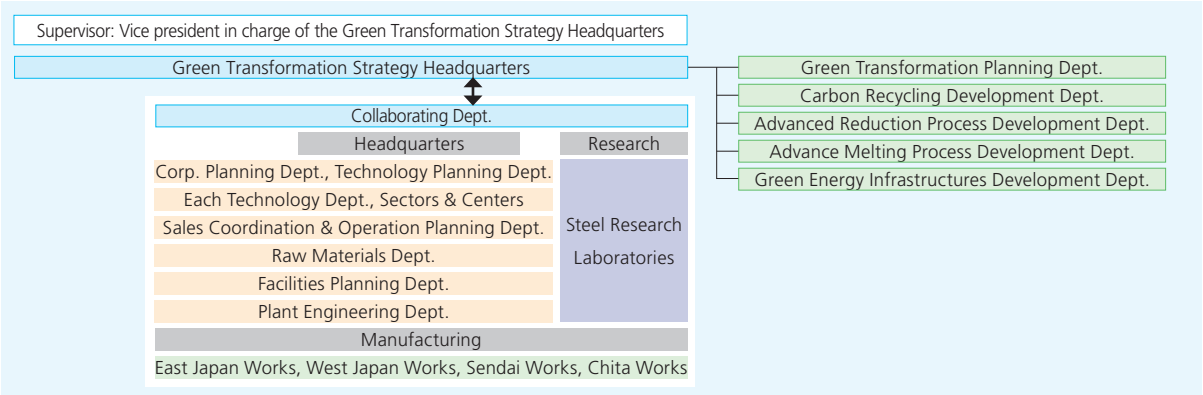
› JFE Group Environmental Management Strategy, Presentation (https://www.jfe-holdings.co.jp/en/common/pdf/investor/climate/environmental-management-strategy250529-01.pdf)

## Initiatives for Achieving Carbon Neutrality in the Steel Business

### Promotion Structure

The key for ensuring JFE Steel's sustainable growth is to develop and implement a medium- to long-term strategy for realizing Green Transformation (GX). In April 2024, the Green Transformation Strategy Headquarters was established to formulate and promote a Companywide strategy to realize GX. The office is comprised of the Green Transformation Planning Department and departments responsible for developing technologies, specifically the Carbon Recycling Development Department, the Advanced Reduction Process Development Department, the Advanced Melting Process Development Department, and the Green Energy Infrastructures Development Department. Under this structure, JFE Steel will conduct and manage carbon neutrality technology development and investment as well as address issues such as market development for expanding sales of green steel and strengthening cooperation with government authorities.

**JFE Steel's Management Structure to Promote Carbon Neutrality**



## Steel Business Initiatives for Achieving GHG Emissions Reduction Targets

The JFE Group has adopted a multi-pronged approach to achieve carbon neutrality by 2050, including the development of ultra-innovative technologies. We have set a target in the steel business for reducing GHG emissions by 24% by FY2027 and by at least 30% by FY2030, compared to FY2013. We regard the period through 2030 as a transition phase, during which we will steadfastly implement plans to achieve our GHG reduction targets, mainly by expanding the application of low-carbon technologies focused on "reducing," while accelerating research and development of ultra-innovative technologies in preparation for the innovation phase after 2030. In the innovation phase, we will advance initiatives for the wise use of resources, including the commercialization of carbon-recycling blast furnaces that leverage our proprietary carbon-recycling technology and direct reduction steelmaking, as well as the expansion of CCU applications. Furthermore, we will undertake $CO_2$ sequestration through CCS to create a carbon-neutral society together with local communities and industrial complexes. We will achieve carbon neutrality through initiatives under these three themes.

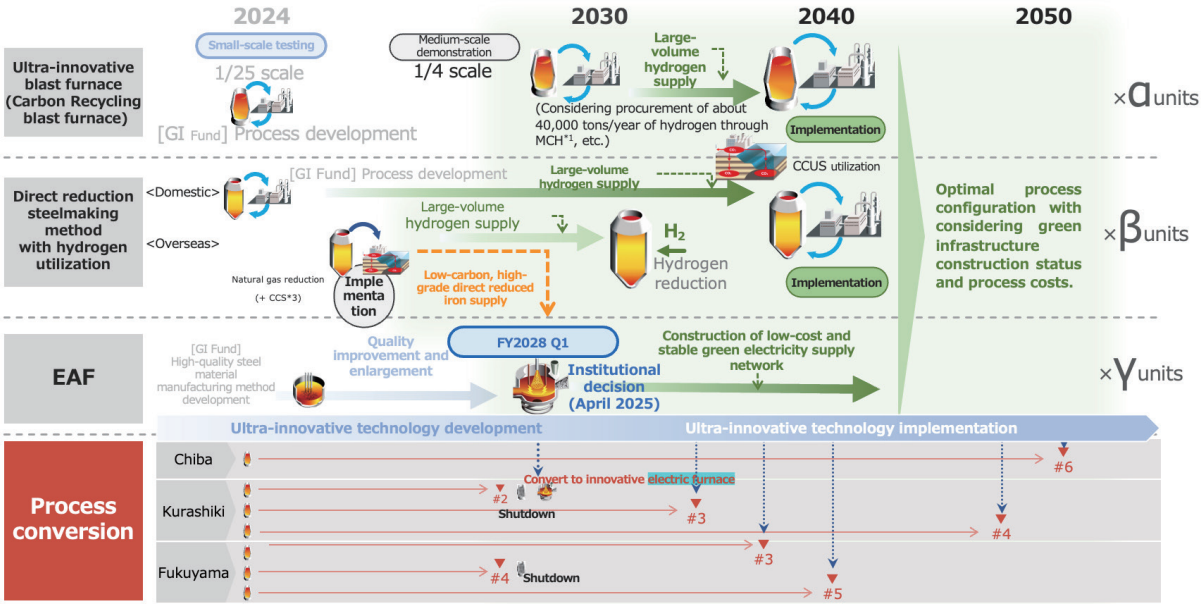
## Roadmap to Carbon Neutrality

JFE Steel announced its GHG reduction plan through FY2030 at the JFE Group Environmental Management Strategy Briefing on May 29, 2025. We have targeted a 24% reduction by FY2027 as an interim milestone toward a reduction of at least 30% by FY2030. GX investments that are expected to contribute significantly to achieving the FY2030 target, such as the Kurashiki innovative electric arc furnace and investments in the use of direct reduced iron in a blast furnace, have, for the most part, already been formally approved.

We are advancing phased and strategic initiatives to achieve carbon neutrality in our steel business by 2050. First, we are working on research and development of innovative low-carbon technologies utilizing public support such as the Green Innovation Fund. Targeted for completion around 2035, these efforts are intended to establish ultra-innovative technologies, such as carbon recycling blast furnaces, the use of hydrogen in the direct reduced iron method, and the development of production methods for high-quality, high-performance products using electric arc furnaces, that fundamentally reimagine conventional manufacturing processes.

The state of energy infrastructure will be a crucial factor in addition to the development of ultra-innovative technology for achieving carbon neutrality. Just as essential will be our response to external changes, such as the development of hydrogen supply networks and the stable securing of decarbonized electric power. Furthermore, market demand for green steel and the rising environmental awareness of customers will also be key indicators for the transformation of the steelmaking process. We will pursue this transformation with optimal timing by comprehensively taking these factors into account.

**Roadmap to Carbon Neutrality in 2050**




*1 Methylcyclohexane: A type of hydrogen carrier, a liquid made by adding hydrogen to toluene

*2 Carbon dioxide capture and storage

> Source: May 29, 2025 JFE Group Environmental Management Strategy Presentation Materials
(https://www.jfe-holdings.co.jp/en/common/pdf/investor/climate/environmental-management-strategy250529-01.pdf)

## JFE Group's Strategy and Alignment with the Paris Agreement

Transition Finance toward decarbonization in the iron and steel sector, published by the Japanese Ministry of Economy, Trade, and Industry (METI), is consistent with Japan's emissions reduction targets based on and therefore aligned with the Paris Agreement. The roadmap sets out a pathway to achieve carbon neutrality by accelerating decarbonization through the introduction of innovative technologies starting in the 2040s, assuming the development of a hydrogen supply infrastructure and CCUS.

In 2022, the JFE Group issued transition bonds through a public offering. During the evaluation process for this issuance, the Group's initiatives were certified by a third party as being aligned with METI's roadmap and, by extension, the Paris Agreement.

> METI: Technology Roadmap for Transition Finance in the Iron and Steel Sector
(https://www.meti.go.jp/policy/energy_environment/global_warming/transition/transition_finance_technology_roadmap_iron_and_steel_eng.pdf)

> METI: Transition Finance Case Study
(https://www.meti.go.jp/policy/energy_environment/global_warming/transition/transition_finance_case_study_jfehd_eng.pdf)

## Metrics and Targets (Plans and Results for GHG Reduction in the Steel Business)

The JFE Group is promoting the JISF's Commitment to a Low Carbon Society, which focuses on the Three Ecos initiatives and the development of innovative new iron and steelmaking processes. Phase I of the plan was completed in 2020. It was rebranded as the JISF's Carbon Neutrality Action Plan, and the Phase II target (FY2030 target) was revised to a 30% reduction in energy-derived $CO_2$ emissions in FY2030, compared to FY2013. JFE Steel is aggressively pursuing the achievement of this goal.

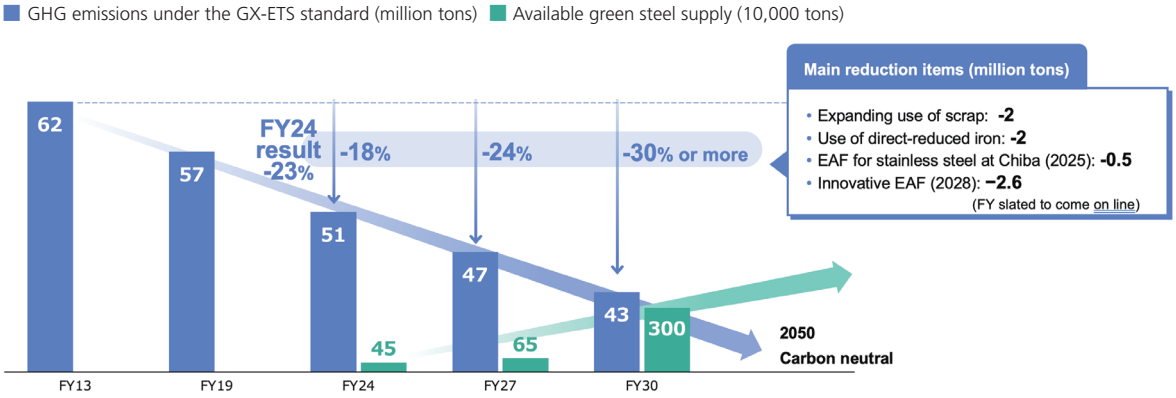
In addition, JISF formulated and announced the Long-term Vision for Climate Change Mitigation, which looks ahead to 2030 and beyond, in 2018, which is intended to realize zero-carbon steel. JFE Steel played a key role in formulating this vision. Furthermore, in 2021, the JISF announced the Basic Policy of the Japan Steel Industry on 2050 Carbon Neutrality sought by the Japanese government, declaring that the Japanese iron and steel industry will boldly take on the challenge of realizing zero-carbon steel.

As the JFE Group, we have declared our intention to reduce GHG emissions in the steel business in FY2030 by at least 30% compared to FY2013 and to achieve carbon neutrality by 2050.

Major Group companies of JFE Steel have formulated GHG reduction targets at the same level as JFE Steel.

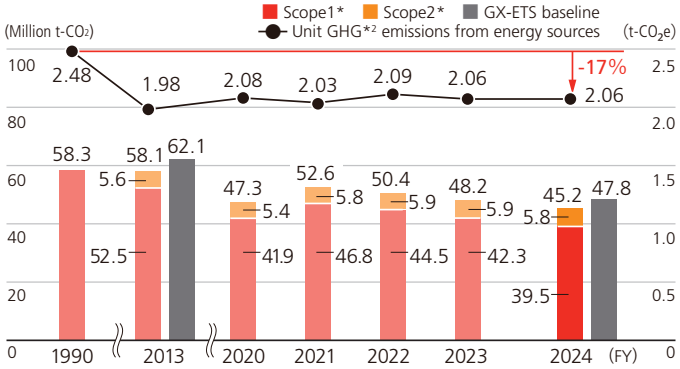
In May 2025, we formulated our long-term vision, JFE Vision 2035, expressing our aspirations for the future, and the Eighth Medium-term Business Plan (FY2025–FY2027) to drive growth strategies toward JFE Group's aspiration. To achieve these plans, we will install an innovative electric arc furnace at the Kurashiki District of the West Japan Works to build a system for the mass supply of green steel. In addition, we will steadily reduce GHG emissions in the steel business by developing ultra-innovative carbon neutral technologies. By uniting all Group companies in Japan and overseas to incorporate efforts to address climate change into our business strategies, the Group will systematically reduce GHG emissions by reflecting the TCFD's principles in its management strategies.

**Domestic Steel Business: GHG Emissions Reduction Plan**




## Steel Business GHG Emissions

**GHG Emissions from Energy Sources and Unit GHG Emissions of JFE Steel**




*1 FY2013 figure includes data for JFE Bars & Shapes Corporation's Sendai Works.

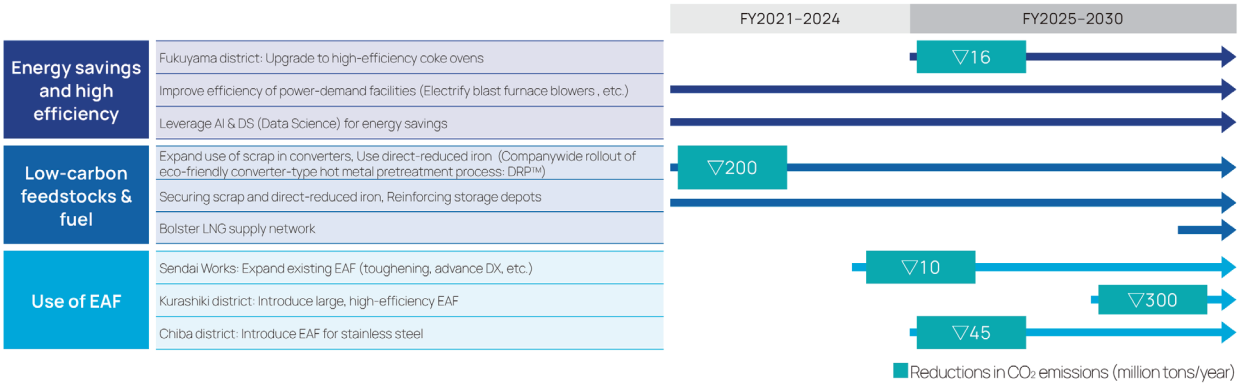
*2 Under the JISF Carbon Neutrality Action Plan standards, emissions are limited to $CO_2$ only.

For quantitative data for the JFE Group's GHG emissions, please refer to:

› Environmental Data (P. 255)

## FY2030 Initiatives for Achieving GHG Emissions Reduction Targets

Our multi-pronged approach for achieving carbon neutrality by 2050 includes developing ultra-innovative technologies. We have defined the period up to 2030 as a transition phase, to be followed by an innovation phase. In the transition phase, the steel business is promoting energy-saving and high-efficiency improvements in existing processes and the use of electric arc furnace technology. By FY2024, we had authorized investments of approximately 0.4 trillion yen for reducing GHG, and in terms of achieving the FY2030 targets, investments have, for the most part, already been institutionally approved for delivering substantial emission reductions, such as the innovative electric arc furnace at the Kurashiki District of the West Japan Works and the use of direct reduced iron in the blast furnace at the Chiba District of the East Japan Works. We will continue to steadily promote the authorization and execution of necessary financing and investments toward achieving the reduction targets.

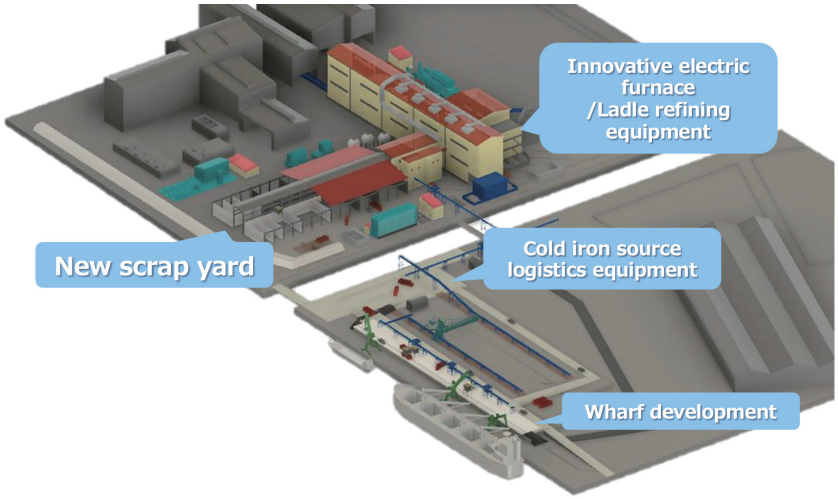



## Development of Electric Arc Furnace Process Technology

The electric arc furnace is one of JFE Steel's technology development efforts for carbon neutral steelmaking in which products are manufactured by melting steel scrap and direct-reduced iron in an electric arc furnace. So far, we have managed to reduce GHG emissions from this steelmaking process to one-quarter of the blast furnace-converter method. We are also striving to eliminate GHG emissions generated by the electric arc furnace process in the future by using the aforementioned hydrogen-direct reduced iron as the raw material and non-fossil electricity.

Although the electric arc furnace process has the advantage of reducing GHG emissions, there are two major problems compared to the blast furnace-converter method: the productivity of the electric arc furnace process in general is about 30% lower than that of the blast furnace-converter method, and the use of scrap as the raw material inevitably increases the concentration of impurities, which limits the production of high-quality, high-performance steel products. JFE Steel has also been developing technologies to address these issues. We have theoretically established high-quality and high-efficiency technologies using existing electric arc furnaces and laboratory tests. Consequently, in April 2025, we decided to convert the No. 2 blast furnace at the West Japan Works (Kurashiki District), scheduled for refurbishment in FY2027, into an innovative electric arc furnace. This innovative electric arc furnace will be the largest in the world, enabling us to establish a mass supply system for high-quality, high-performance steel products not possible with conventional large-scale electric arc furnaces. We want to be the first in the industry to do so and secure the top share in the domestic green steel market.

**Conceptual image of the innovative electric arc furnace and related facilities at the Kurashiki District**



### Using Electric Arc Furnaces to Increase the Use of Scrap

JFE Steel completed upgrading electric arc furnace production capacity at the Sendai Works in FY2024 by reinforcing the electric arc furnace, boosting capacity through DX, upgrading cargo handling facilities, and improving the load handling equipment by approximately 140,000 tonnes per year. This is expected to result in a reduction of approximately 0.10 million tonnes of GHG emissions per year.

Furthermore, we will install a new electric arc furnace in the Chiba district for stainless steel production. This will allow the facility to replace part of the feedstock from molten iron from blast furnaces with scrap and thus reduce GHG emissions. This could increase by up to six times the volume of scrap used, and we expect to reduce GHG emissions by a maximum of about 450,000 tonnes per year.

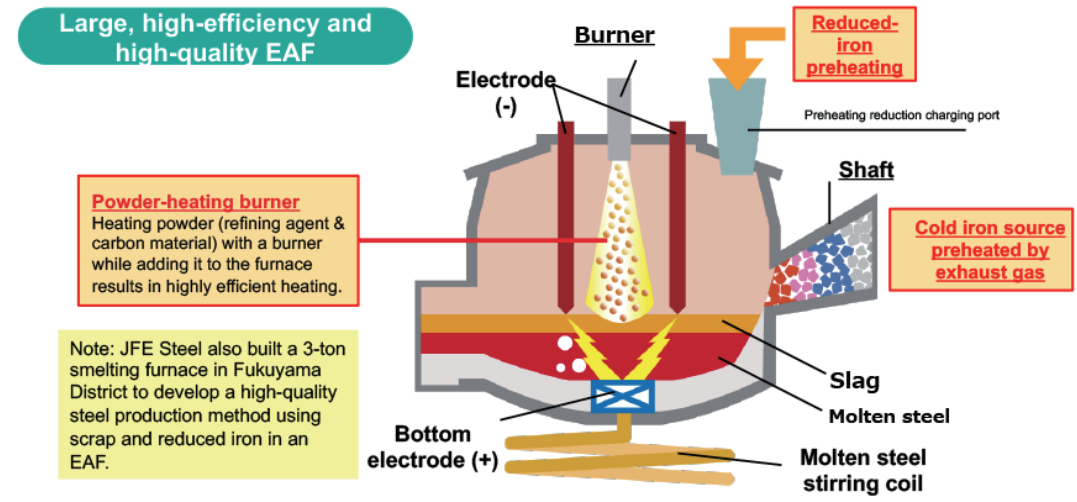
As mentioned above, we will suspend one blast furnace at the Kurashiki District and convert it into an innovative electric arc furnace to further expand the use of scrap.

### Overview of Demonstration Tests for Developing Manufacturing Methods of High-Quality Steel Products in Electric Arc Furnaces

We are developing a process that reduces the electric arc furnace's melting power consumption and also enables high-speed melting of cold iron sources (scrap and direct reduced iron). We will verify the following during demonstration tests.

- Optimal methods for preheating and feeding direct reduced iron
- Methods for using heating burners
- Optimal methods for molten steel stirring

**Research and Development for Electric Arc Furnaces**




### Manufacturing Higher-Grade Steel Using the Electric Arc Furnace Process

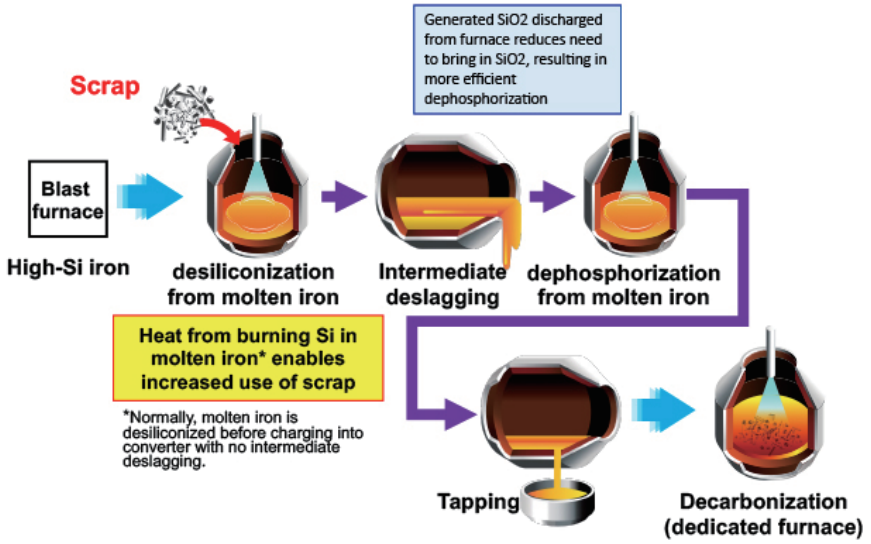
The electric arc furnace process uses scrap and direct reduced iron as raw materials. The higher concentration of impurities in these materials, such as copper, causes material degradation, including surface defects and reduced workability in steel sheets and deterioration of properties in electrical steel sheets. We are working on two technologies to address the issue, one to remove impurities and another to detoxify impurities, so that we can use the electric arc furnace process to produce high-quality steel products such as steel sheets for automobiles and electrical steel sheets.

## Increased Use of Scrap Iron in Steelmaking

JFE Steel introduced the Double-slag Refining Process (DRP™), an eco-friendly converter-type molten-iron pretreatment process, at all of its sites in 2021, thereby increasing the amount of scrap iron to be used in converters and reducing GHG emissions.

DRP makes full use of silicon in molten iron as a heat source, thereby increasing the amount of scrap iron to be used in converters. It allows reducing the molten-iron blending ratio (molten iron vs. scrap charged into the converter) to 82%, down from 90% through conventional methods. The Company introduced this process in all of its steelmaking facilities, and the increased use of scrap iron in converters enabled us to reduce annual GHG emissions by approximately 1.15 million tonnes in FY2023. We will continue to develop technologies to further expand the use of scrap.

**Eco-friendly converter-type molten iron pretreatment process DRP™: Double-slag Refining Process**




## East Japan Works (Chiba District) to Produce Stainless Steel with Electric Arc Furnace

JFE Steel has decided to install a new electric arc furnace at the No. 4 steelmaking shop at the East Japan Works (Chiba district) in the second half of FY2025 (planned). Scrap melting capacity is expected to increase to approximately 300 kilotonnes per year (planned), up to six times the amount compared to conventional processes, with GHG emissions expected to be reduced by up to about 450 kilotonnes per year. We have defined the period up to 2030 as a transition phase toward carbon neutrality and view the electric arc furnace process as an effective means for reducing GHG emissions. Looking ahead, we will continue our multi-pronged development of ultra-innovative technologies and steadily advance toward realizing carbon neutrality.

## Feasibility Study on New Venture Business to Secure Direct Reduced Iron Supply

In the transition phase up to 2030, we expect a shortage in domestic scrap supply. The use of direct-reduced iron is considered an effective way to supplement this in the production of high-quality steel using electric arc furnaces and in the reduction of GHG emissions from blast furnaces.

JFE Steel is conducting detailed feasibility studies with EMSTEEL, the largest steel producer in the UAE, and ITOCHU Corporation to establish a supply chain of direct reduced iron with low carbon emissions. After the business scheme is finalized, we will begin producing direct-reduced iron (approximately 2.5 million tonnes per year) under a joint venture to be established in the UAE. As the largest off-taker, we will secure a long-term and stable supply of direct-reduced iron, mainly for the innovative electric arc furnace at the West Japan Works (Kurashiki District), which is scheduled to begin operation in FY2028.

- Overview of EMSTEEL
  Company name: EMSTEEL
  Representative: HE Engineer Saeed Ghumran Al Remeithi (Group CEO)
  Business: Steel

**The memorandum exchange ceremony held in Abu Dhabi, United Arab Emirates, in the presence of then Prime Minister Fumio Kishida (July 17, 2023)**


## Adoption status of green steel products

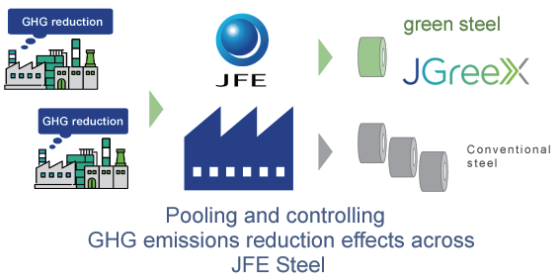
**Name origin: JFE + Green + GX**
We invited the relevant departments to propose names and selected this name from the suggestions because it clearly expresses being a green steel product provided by JFE Steel.
**Logo design:**
The logo combines the letter X with an arrow to express our intention to move forward toward carbon neutrality.

In the first half of FY2023, JFE Steel began supplying JGreeX™, a brand of green steel products that significantly reduce GHG emissions in the steelmaking process compared to conventional products. With the current technology, it is difficult to quickly supply green steel products with significantly lower or zero emissions, so the reductions associated with our technologies are allocated to steel products by applying the mass balance approach* and then supplied as green steel products. With regard to the volume of GHG emission reductions and the emission intensity of each product, we have obtained a third-party certification from Nippon Kaiji Kyokai (ClassNK), which verified 1.15 million tonnes of GHG emission reductions in FY2023. In FY2024, public-private initiatives to stimulate demand for green steel products contributed to expanded adoption of JGreeX™ across all sectors.

Reduction of GHG emissions throughout the supply chain is rapidly progressing, and with steadfast efforts, we hope to achieve a reduction of at least 30% in FY2030, while further reducing GHG emissions through the wider application of low-carbon, energy-saving, and high-efficiency technologies. At the same time, we will contribute to the decarbonization of society as a whole by expanding the supply capacity of JGreeX™ to 3 million tonnes per year.

*Consolidate the environmental value of GHG emission reductions from the entire product manufacturing process, allocate the value to some steel products, and regard them as having low GHG emission intensity.

**Overview of the steel mass balance approach**




STEP.1
Calculate the emissions intensity of any steel product to apply this approach
STEP.2
Identify emissions reduction projects and determine their emissions reduction levels
STEP.3
Issue a reduction certificate based on the determined reduction level, grant the certificate, and supply steel materials.

*This certificate and the GHG emission reductions listed in this certificate do not represent carbon credits and cannot be transferred or sold to third parties.
*The scope of GHG emissions calculation is within the scope of Scope 1, Scope 2 and Scope 3.
*Reduction allocations are within the scope of Scope 1 and Scope 2.

**Overview of green steel JGreeX™**

| | |
|---|---|
| Supply start | First half of FY2023 |
| Supply capacity | Approx. 500 kilotonnes (FY2024) |
| Target products | All steel products produced by JFE Steel |
| Certification body | Nippon Kaiji Kyokai (ClassNK) |

**Overview of green steel JGreeX™ adoption**


**JGreeX™ Sales Performance (September 2024 Onward)**

| Application Field | Details | Timing | URL |
|---|---|---|---|
| Construction | Logistics warehouse in Vietnam | November 2024 | https://www.jfe-steel.co.jp/en/release/2024/11/241115.html |
| | Domestic bridge construction | November 2024 | https://www.jfe-steel.co.jp/release/2024/11/241108-1.html (Japanese only) |
| | Bridge construction in Yokohama City | November 2024 | https://www.jfe-steel.co.jp/release/2024/11/241108-2.html (Japanese only) |
| | High-strength bolts for construction | March 2025 | https://www.jfe-steel.co.jp/release/2025/03/250326.html (Japanese only) |
| | Overhead crane | July 2025 | https://www.jfe-steel.co.jp/en/release/2025/07/250707.html |
| Shipbuilding | Dry bulk carrier | September 2024 | https://www.jfe-steel.co.jp/en/release/2024/09/240930-2.html |
| | General cargo ship | June 2025 | https://www.jfe-steel.co.jp/en/release/2025/06/250612.html |
| Plant | Large industrial transformer | February 2025 | https://www.jfe-steel.co.jp/release/2025/02/250203.html (Japanese only) |
| Industrial machinery | Motor surface mounters | September 2024 | https://www.jfe-steel.co.jp/en/release/2024/09/240903.html |
| Steel pipe | Sales to steel pipe and tube trading companies | January 2025 | https://www.jfe-steel.co.jp/en/release/2025/01/250129.html |
| Steel sheets and steel pipes | Memorandum of understanding (MOU) with manufacturer | September 2025 | https://www.jfe-steel.co.jp/en/release/2024/09/240924.html |
| Automotive | Automotive components | June 2025 | https://www.jfe-steel.co.jp/en/release/2025/04/250424-2.html |

## Initiatives for Achieving Carbon Neutrality by 2050

We engage in a multi-pronged approach to developing ultra-innovative technologies, such as carbon-recycling blast furnaces (CR blast furnaces), hydrogen steelmaking (direct reduction), and electric arc furnace process (high-efficiency, large-scale electric arc furnaces), to achieve carbon neutrality by 2050, as announced in the JFE Group Environmental Vision for 2050. We are particularly focused on a technology that combines a CR blast furnace and CCU, which allows us to efficiently mass-produce high-grade steel and reuse the GHG in the blast furnace. This technology is focused on achieving net zero emissions by using the remaining GHG, which cannot be fully reused to manufacture basic chemicals such as methanol.

### Demonstration Tests for NEDO Project (GREINS) for Hydrogen Utilization in Iron and Steelmaking Processes

JFE Steel formed a consortium with Nippon Steel Corporation, Kobe Steel, Ltd., and the Japan Research and Development Center for Metals and jointly commissioned the Green Innovation Fund Project (GREINS) of the New Energy and Industrial Technology Development Organization (NEDO) for Hydrogen Utilization in Iron and Steelmaking Processes, and work toward achieving carbon neutrality by 2050.

In order to further advance the development of ultra-innovative technologies to achieve carbon neutrality by 2050, JFE Steel has decided to construct all the necessary facilities for the demonstration tests for the project centrally in the East Japan Works (Chiba district) to increase the efficiency of the development effort. We will work together with consortium members to accelerate the development of ultra-innovative technologies.

Details of the Planned Demonstration Tests

- Carbon-recycling pilot blast furnace (150 $m^3$)
  Start construction in 2023, initiate demonstration tests in May 2025, complete demonstration tests by FY2026.
- Direct reduction compact bench pilot furnace
  Start construction in 2023, initiate demonstration tests in December 2024, complete demonstration tests by FY2026.
- Pilot electric arc furnace (10 t pilot furnace)
  Start construction in 2023, initiate demonstration tests in February 2025, complete demonstration tests by FY2025.

Details for each are as follows.

### Carbon-recycling blast furnaces

#### Technical Features of a CR Blast Furnace

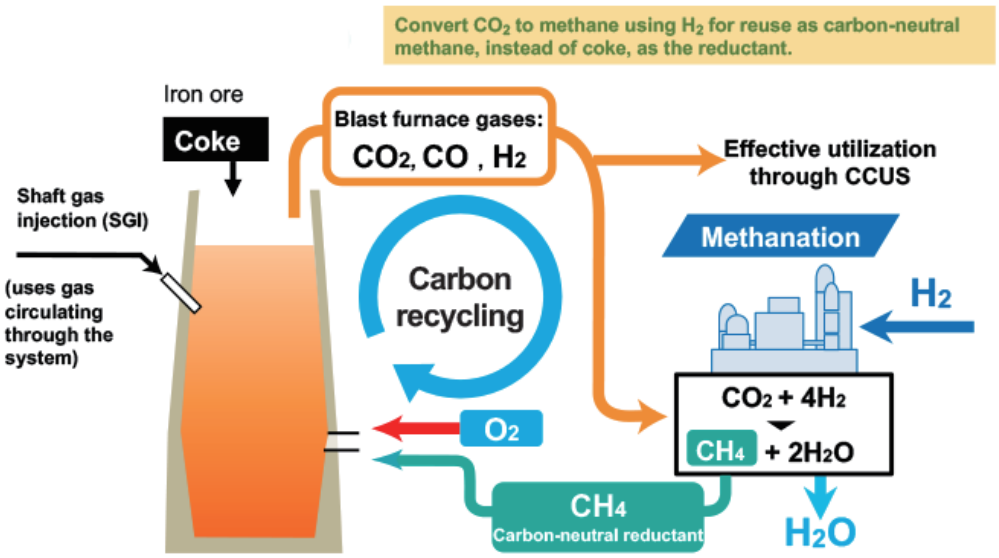
The CR blast furnace incorporates an ultra-innovative technology that converts $CO_2$ gas through methanation in the furnace exhaust gas into carbon neutral methane, which is then reused as reducing material in the furnace. The technology is expected to reduce $CO_2$ emissions by 50% compared to conventional blast furnaces and to ultimately help achieve carbon neutrality by leveraging CCU/CCUS. The thermal efficiency of the process can be further enhanced by replacing the air blown into the blast furnace with pure oxygen, allowing the energy used to heat the nitrogen in the air to then be used to heat methane. In addition, the lack of nitrogen facilitates the separation of $CO_2$, so the equipment necessary to separate $CO_2$ for methanation can be more compact and efficient while effectively using gas at CCUS.

#### Overview of the Demonstration Tests

We are planning to develop a process that converts the $CO_2$ produced in the blast furnace into methane using hydrogen, allowing the carbon to be repeatedly used in the furnace as a reducing agent and thus reducing $CO_2$ emissions. We will verify the following during demonstration tests. We will verify the following during demonstration tests.

- Methods for blowing a large volume of methane along with oxygen into the furnace
- Applications for the heating burner that uses the circulation gas
- Methods for linking the operations of the furnace and the methanation facility that converts $CO_2$ from the blast furnace gases to methane

**Overview of Carbon-Recycling Direct Furnaces**




## Development of Direct Hydrogen Reduction Technology (Carbon-Recycling Direct Reduction Process)

Hydrogen reduction ironmaking technology is another steelmaking process that the JFE Group is working on to achieve carbon neutrality. With this technology, the natural gas currently used in direct reduction ironmaking is replaced by 100% hydrogen to eliminate $CO_2$ emissions when iron ore is reduced.

### Technology for Processing Raw Materials

Currently, the only raw material that can be used for direct reduction ironmaking is high-grade iron ore. Its production volume, however, is limited, and we expect it will become even more difficult to obtain in the future if direct reduction ironmaking were to expand worldwide.

To address this, JFE and one of its iron ore suppliers, BHP, are collaborating in the development of a new raw material processing technology for low- and medium-grade ores, which are currently used as raw materials for blast furnaces due to their large production volume. We are hoping that this new technology will allow us to use low- and medium-grade ores as raw materials for direct reduction ironmaking, thus expanding the raw material sourcing for direct reduction ironmaking.

### Technology for Pre-Heating Raw Materials, Technology for Heating Hydrogen Gas

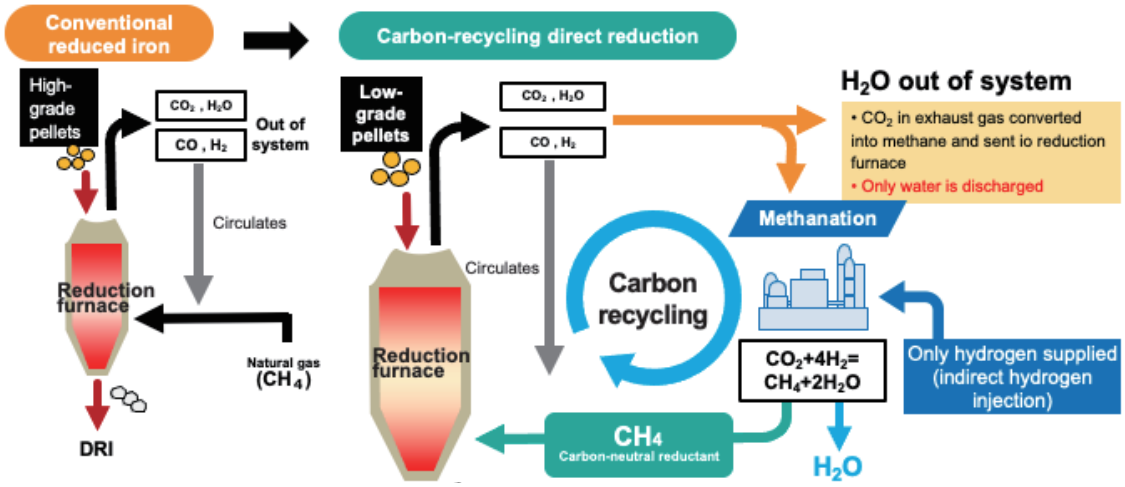
One challenge of hydrogen reduction is that the reduction of iron ore by hydrogen is an endothermic reaction, which means that heat must be applied externally for the reaction to proceed. A sufficient reduction reaction may not take place if there is not enough heat. Thus, technologies for heating raw materials and hydrogen gas must be developed.

### Overview of the Demonstration Tests

We are developing a process to convert the $CO_2$ produced in the direct-reduction furnace into methane using hydrogen, allowing the carbon to be repeatedly used in the furnace as the reducing agent and thus reducing $CO_2$ emissions. We will verify the following during demonstration tests.

- Optimal methods for recycling $CO_2$ through methanation
- Methods for using low-grade ores

**Carbon-Recycling Direct Reduction Process**

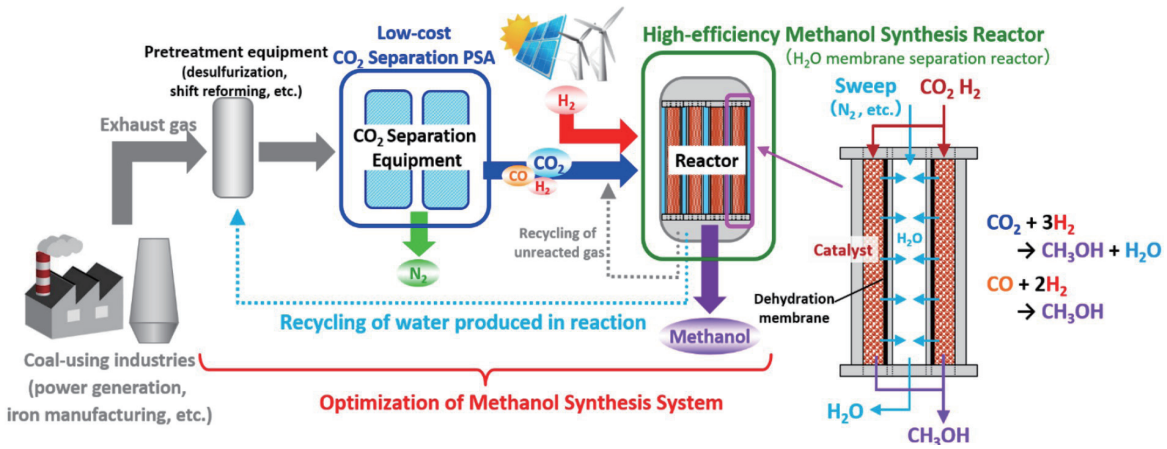



## CCUS Initiatives

### Development of an Optimal System for Methanol Synthesis Using $CO_2$

JFE Steel is working on the Optimum System for Methanol Synthesis Using $CO_2$, an R&D project, in collaboration with the Research Institute of Innovative Technology for the Earth (RITE) (see figure). On-site construction of a test facility commenced in FY2022 in the Fukuyama district of the West Japan Works, with operations scheduled to start in FY2023 and integrated practical application tests to be completed by the end of FY2025. The project focuses on establishing an optimal overall methanol synthetic system, mainly by developing technologies for low-cost $CO_2$ separation and high-efficiency methanol synthesis. The ultimate goal is to combine this newly established system with carbon-recycling blast furnaces and other ironmaking processes to achieve large-scale CCU process.

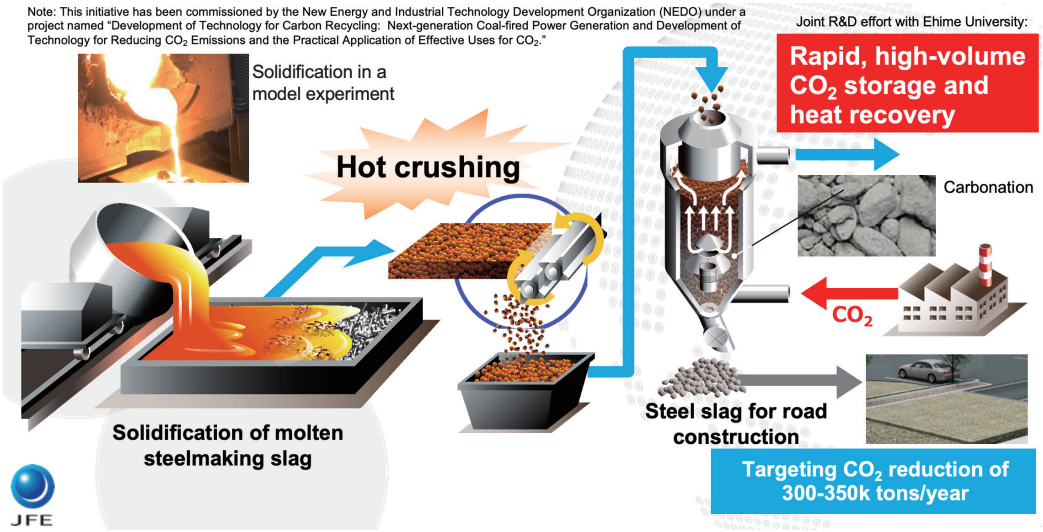
**Methanol Synthesis Flow Using $CO_2$**




### Innovative $CO_2$ Sequestration Technology through Quick, Large-Quantity Carbonation of Steel Slag

JFE Steel is also collaborating with Ehime University to promote the NEDO project: Innovative $CO_2$ Sequestration Technology through Quick, Large-quantity Carbonation of Steel Slag. We have already confirmed the process principle, constructed facilities for demonstration testing at the Chiba District of the East Japan Works, and commenced tests in FY2025. Through this research and development, we will sequester the $CO_2$ generated from ironmaking processes, such as carbon-recycling blast furnaces, and from nearby thermal power plants in slag, while at the same time verifying technologies for recovering sensible heat from high-temperature slag and converting the steel slag to roadbed materials and other products.

**Quick, Large-Quantity Carbonation Flow of Steel Slag**




## Studies Toward Realizing CCS

In its public solicitation for FY2024, concerning Engineering Design Work for Advanced CCS Projects, the Japan Organization for Metals and Energy Security (JOGMEC) selected the Offshore Sarawak CCS Project (for the Kurashiki District of the West Japan Works) and the Northern Offshore of Peninsular Malaysia CCS Project (for the Chiba District of the East Japan Works), in which JFE Steel participates, and we are promoting studies aimed at realizing CCS. In addition, we are conducting our own study at the Fukuyama District of the West Japan Works. In FY2024, we examined optimal facility configurations and costs for each advanced CCS project, and JFE Steel conducted feasibility studies on $CO_2$ separation and capture, liquefaction, temporary storage, and shipping facilities (Chiba District: separation and capture only). Going forward, we will advance studies for project implementation at the EPC (Engineering, Procurement, and Construction) phase, on the assumption that government support will be secured.

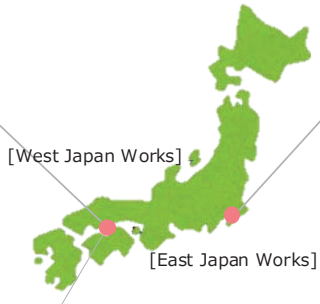
**Overview of CCS Projects under Consideration at Each District**

| Advanced CCS | Kurashiki: Offshore Sarawak CCS (Malaysia CCS Project) | | |
|---|---|---|---|
| Transportation/ Storage Destination | Malaysia | JFE's Capture Volume | **1.3** million tons-$CO_2$/year |

- Japan Petroleum Exploration Co., Ltd.
- JGC Holdings Corporation
- Kawasaki Kisen Kaisha, Ltd.
- JFE Steel Corporation
- Mitsubishi Gas Chemical Co., Inc.
- Mitsubishi Chemical Corporation
- The Chugoku Electric Power Co., Inc.
- Nippon Gas Line Co., Ltd.
- PETRONAS CCS Ventures Sdn. Bhd.

| Advanced CCS | Chiba: Northern Offshore of Peninsular Malaysia CCS | | |
|---|---|---|---|
| Transportation/ Storage Destination | Malaysia | JFE's Capture Volume | **0.7** million tons-$CO_2$/year |

- Mitsubishi Corporation
- ENEOS Corporation
- ENEOS Xplora Inc.
- JFE Steel Corporation
- Cosmo Oil Co., Ltd.
- NIPPON SHOKUBAI CO., LTD.
- PETRONAS CCS Solutions Sdn. Bhd.




| Independent FS | Fukuyama: Setouchi / Shikoku $CO_2$ Hub Concept | | |
|---|---|---|---|
| Transportation/ Storage Destination | Australia | JFE's Capture Volume | **0.7** million tons-$CO_2$/year |

- Sumitomo Corporation
- JFE Steel Corporation
- Sumitomo Osaka Cement Co., Ltd.
- Kawasaki Kisen Kaisha, Ltd.

JFE's assumed roadmap (Fiscal year)

| | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 onwards |
|---|---|---|---|---|---|---|---|---|
| Kurashiki | Pre-Feed | FEED | ☆ | EPC | | | | CCS start |
| Chiba | FS | Pre-Feed/FEED | ☆ | EPC | | | | CCS start |
| Fukuyama | FS | Pre-Feed/FEED | ☆ | | | | | |

※ For final investment decisions, the concrete government support is necessary (☆)

› JFE Group Environmental Management Strategy, Presentation Material, P. 25
(https://www.jfe-holdings.co.jp/en/common/pdf/investor/climate/environmental-management-strategy250529-01.pdf)

› JFE Steel Carbon Neutrality Strategy Briefing Presentation Material P. 19
(https://www.jfe-steel.co.jp/en/company/pdf/en_carbon-neutral-strategy_231108_1.pdf)

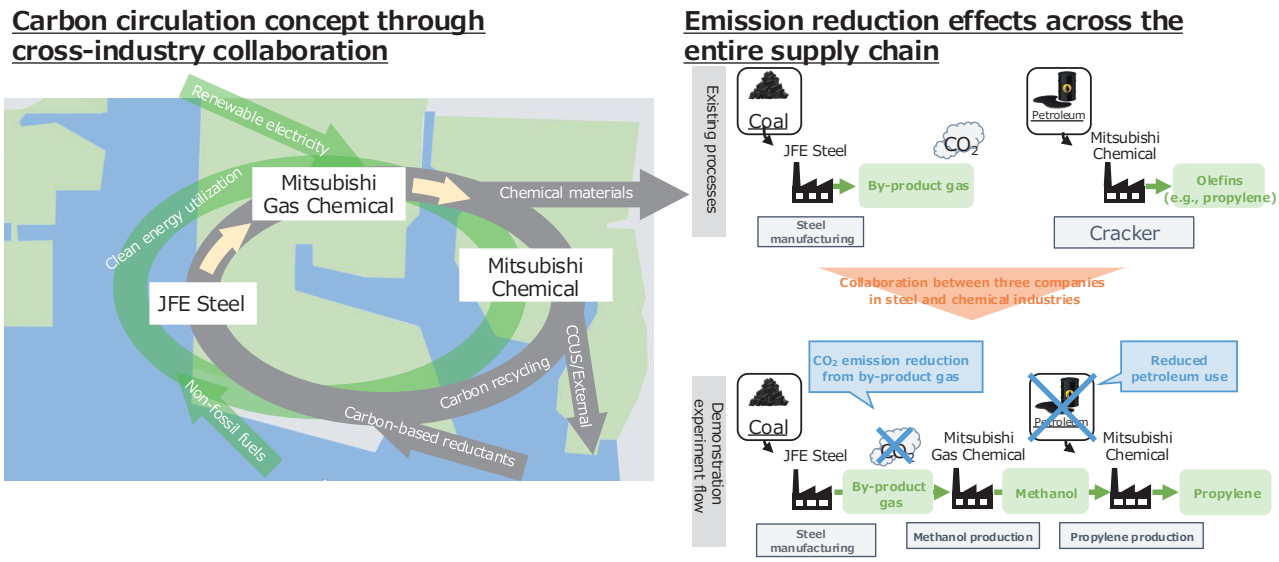
### Initiatives for Inter-Company Collaboration at the Mizushima Complex

ENEOS Corporation and JFE Steel are advancing the materialization of joint studies on the utilization of $CO_2$-free hydrogen at the Mizushima Complex (Kurashiki City, Okayama Prefecture) as a hydrogen procurement initiative.

In addition, JFE Steel Corporation, Mitsubishi Gas Chemical Company, Inc. (Mitsubishi Gas Chemical), and Mitsubishi Chemical Corporation (Mitsubishi Chemical) have signed a memorandum of understanding concerning a demonstration project at the Mizushima Complex (Kurashiki City, Okayama Prefecture).

A new initiative within the Mizushima Complex promotes collaboration among Hard-to-Abate industries (industries where GHG emissions are difficult to reduce). By utilizing $CO_2$ contained in byproduct gases from steel manufacturing processes to produce valuable chemicals, the project provides a model for collaborative $CO_2$ utilization, with the aim of launching the demonstration in FY2026. Looking ahead, the initiative intends to develop into a conceptual framework for carbon recycling through the collaboration of the steel and chemical industries. This approach is expected to reduce GHG emissions compared to traditional fossil resource-based methods for chemical production.

**Inter-Company Collaboration at the Mizushima Complex**




**List of Related Initiatives**

| Reduce $CO_2$ Emissions at JFE Steel | | |
|---|---|---|
| Carbon neutrality | Key initiatives | JFE Steel Carbon Neutrality Strategy Briefing Presentation Material P. 19 (https://www.jfe-steel.co.jp/en/company/pdf/en_carbon-neutral-strategy_231108_1.pdf) |
| | | JFE Steel Challenge to Achieve Carbon Neutrality through Green Transformation (https://www.jfe-steel.co.jp/en/movie/#movie-Corporate) |
| | Demonstration tests | Demonstration Tests for NEDO's Hydrogen Utilization in Iron and Steelmaking Processes project (Japanese only) (https://www.jfe-steel.co.jp/release/2022/06/220615-2.html) |
| Carbon-recycling blast furnace | Carbon-recycling blast furnace technology | JFE Steel Carbon Neutrality Strategy Briefing: Reducing $CO_2$ via CR Blast Furnaces (https://www.jfe-steel.co.jp/en/company/pdf/en_carbon-neutral-strategy_231108_1.pdf) |
| | | Challenge Zero: Challenge for development of super-innovative technologies focusing on Carbon-recycling Blast Furnace+CCU (https://www.challenge-zero.jp/en/casestudy/812) |
| | CCU/CCUS | Challenge Zero: Technology of $CO_2$ utilization (https://www.challenge-zero.jp/en/casestudy/391) |

| Reduce $CO_2$ Emissions at JFE Steel | | |
|---|---|---|
| New technology to process raw materials for hydrogen direct reduction ironmaking | Development of technology for hydrogen direct reduction | JFE Steel Carbon Neutrality Strategy Briefing: Hydrogen Direct Reduction (https://www.jfe-steel.co.jp/en/company/pdf/en_carbon-neutral-strategy_231108_1.pdf) |
| | Collaboration with a material supplier | JFE Steels and BHP to address decarbonization in steelmaking process (https://www.jfe-steel.co.jp/en/release/2021/210210.html) |
| Expanded use of scrap and direct reduced iron | Eco-friendly converter-type molten iron pretreatment process DRP™ | Increased Use of Scrap Iron in Steelmaking Process to Reduce $CO_2$ Emissions (https://www.jfe-steel.co.jp/en/release/2022/220621.html) |
| | | Feasibility Study on Building a Supply Chain of Direct Reduced Iron with Low Carbon Emissions (https://www.jfe-steel.co.jp/en/release/2022/220901.html) |
| | Feasibility study on new venture business to secure direct reduced iron supply | Collaboration to Establish a Supply Chain of Ferrous Raw Material with Low Carbon Emissions (https://www.jfe-steel.co.jp/en/release/2023/230718.html) |
| | Development of electric arc furnace process technology | JFE Steel Carbon Neutrality Strategy Briefing: Large, High-efficiency EAFs (https://www.jfe-steel.co.jp/en/company/pdf/carbon-neutral-strategy_231108_1.pdf) |
| | Adoption of electric arc furnace process technology | JFE Steel's Chiba District Facility to Produce Stainless Steel with Electric-arc Furnace (https://www.jfe-steel.co.jp/en/release/2023/230508-1.html) |
| | | JFE Steel to Introduce Advanced, High-Efficiency, Large-Scale Electric Arc Furnace in Japan (https://www.jfe-steel.co.jp/en/release/2025/04/250410.html) |
| $CO_2$ utilization and storage technology | $CO_2$ utilization technology | Novel Processes for Manufacturing Valuable Materials Using Coal-Derived $CO_2$ Selected for NEDO Projects (https://www.jfe-steel.co.jp/en/release/2021/211015.html) |
| | Testing for practical use | JFE Steel Moves Ahead with Testing $CO_2$-utilization Technologies Aimed at Achieving Carbon Neutrality (https://www.jfe-steel.co.jp/en/release/2022/220620-2.html) |
| | | JFE Steel, Mitsubishi Gas Chemical, and Mitsubishi Chemical Collaborate to Develop a Carbon Recycling Supply Chain at Mizushima Complex (https://www.jfe-steel.co.jp/en/release/2025/03/250324.html) |
| | Establish CCS value chain | Agreed on Joint Evaluation with JFE Steel Corporation to Establish CCS Value Chain Originated from Japan Aligned with CCS Study in Malaysia (https://www.jfe-steel.co.jp/en/release/2023/230619.html) |
| | | KEPCO and JFE Steel signed an MOU to jointly study possible CCS Projects (https://www.jfe-steel.co.jp/en/release/2023/231019.html) |
| | | The Chugoku Electric Power and Nippon Gas Line Participate in the Joint Evaluation to Establish a CCS Value Chain Originated from Japan for the CCS Project in Malaysia (https://www.jfe-steel.co.jp/en/release/2024/02/240226.html) |

# Initiatives for Greater Contribution to Reducing GHG in Society as a Whole

The JFE Group is promoting a variety of GHG reducing initiatives, such as offshore wind power generation projects and renewable energy-related fields, with a focus on the engineering business. In addition, in fields where demand is growing for eco-products such as electrical steel sheets and ultra-high-tensile steel sheets, we are collaborating with Group companies and others to maximize overall effectiveness.

## Initiatives in the Engineering Business Contributing to GHG Reduction

Demand is expected to rise for power generation plants using renewable energy sources that do not emit carbon. Through the engineering business, the JFE Group is handling the design, procurement, construction, and operation of renewable energy generation plants, including biomass, geothermal, solar, and onshore wind power. We are also working to increase the amount of power generated at waste treatment facilities in order to promote recycling and the effective use of resources.

Furthermore, we are actively engaged in the retailing of electricity, which uses these renewable energies as the main power source, supporting the establishment and operation of new regional electricity companies that focus on local production and consumption of energy using renewable sources, and in expanding the Multisite Energy Total Service (JFE-METS), which optimizes energy use for multiple sites within the same corporate group through centralized management.

As new initiatives for carbon neutrality, we are developing a technology to safely and efficiently transport large amounts of hydrogen, ammonia, and $CO_2$, and working on demonstrating a process that separates and collects $CO_2$ for reuse from the exhaust gas of waste treatment facilities.

New initiatives for material recycling include bottle-to-bottle, an effort for recycling collected PET bottles for use as raw material for bottles; recycling waste plastics by directing unsorted post-use plastics to either material recycling or chemical recycling, depending on their properties; and recycling solar panels that are discarded due to age-related deterioration.

The following key initiatives contributed to reduced GHG.

### Large-Scale Biomass Power Generation

**Construction work for the Tahara Biomass Power Plant, one of the largest woody biomass combustion power plants in Japan, with an output of 112,000 kW**

Tahara Biomass Power LLC, a joint venture between JFE Engineering Corporation, Chubu Electric Power Co., Inc., Toho Gas Co., Ltd., and Tokyo Century Corporation, has started construction work on the Tahara Biomass Power Plant. The plant, to be constructed in Tahara, Aichi Prefecture, is one of the largest woody biomass power plants in Japan, with an output of 112,000 kW, and is scheduled to start operations in September 2025.

### Food Waste Recycling Power Generation

**Completion of Hokkaido's largest food biogas power plant —Contributing to Sapporo city's zero carbon goals through local "double recycling loop"**

SAPPORO BIO FOOD RECYCLING CORPORATION, a subsidiary of J&T Recycling Corporation, of the JFE Engineering Group, constructed a new plant in Sapporo to update and expand the capacity of its food recycling power generation plant. The new plant accepts up to 100 tonnes of food waste per day and generates electricity using methane gas produced by microbial fermentation, with an output of 1,980 kW and an annual expected power generation of approximately 16,420 MWh. The electricity generated is sold through Urban Energy Corporation, a power retailing subsidiary of JFE Engineering, to promote local production and consumption of renewable energy. Furthermore, all fermentation residues generated during the treatment process are converted into fertilizer. These efforts are helping to realize a local production and consumption-based "double recycling loop" that converts food waste into clean electricity and fertilizer.

› Recycling Food Waste (P. 129)

### Multisite Energy Total Service (JFE-METS)

**The House Foods Group has agreed to adopt the Multisite Energy Total Service at 18 sites across 8 group companies, driving $CO_2$ reduction.**

JFE Engineering has signed a basic agreement with House Foods Group Inc. to provide JFE-METS. JFE Engineering has signed a basic agreement with House Foods Group Inc. to provide JFE-METS. We will install a gas cogeneration system at the House Foods Shizuoka Plant and use JFE-METS to supply surplus electricity from the system and electricity provisioned by the JFE Group to 18 sites across 8 companies in the House Foods Group nationwide. The service is expected to reduce $CO_2$ emissions by approximately 16.3% and energy consumption by approximately 21.5% (compared to FY2022) at these sites. Operations commenced in April 2024.

### CCUS

Contract received for the construction of $CO_2$ liquefaction, storage and loading/unloading facilities, a large-scale, long-distance, lower cost transportation system for liquid $CO_2$ to realize a CCUS society.

JFE Engineering has received an order from Japan CCS Co., Ltd. to construct its $CO_2$ liquefaction, storage, and loading/unloading facilities (EPC project). The EPC project is for constructing part of the facilities to be used in the NEDO project: Research, Development, and Demonstration of CCUS Technology / Large-scale CCUS demonstration testing at Tomakomai / Demonstration testing on $CO_2$ Transportation. We will be involved in the design and construction of onshore facilities capable of liquefying and storing 10 kilotonnes per year of $CO_2$ separated and recovered from coal combustion gas supplied by the Maizuru plant of The Kansai Electric Power Co., Inc.

### PET Bottle Recycling (Bottle-to-Bottle)

**Kyoei J&T Recycling Corporation's West Japan PET Bottle MR Center to start full commercial operation.**

Kyoei J&T Recycling, a subsidiary of JFE Engineering, after starting the operations of the flake manufacturing plant in October 2021, has completed construction of the pellet production line in April 2022 and commenced full-scale commercial operations at the PET bottle recycling raw material manufacturing plant (West Japan PET Bottle MR center) in Tsu, Mie Prefecture. With an annual processing capacity of 60 kilotonnes (approximately 10 million bottles per day), the plant can recycle approximately 10% of the total number of PET bottles shipped nationwide.

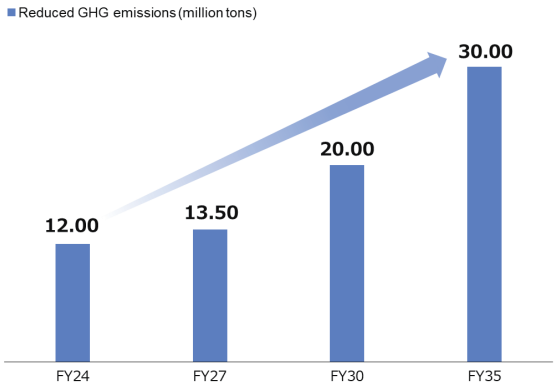
By producing flakes and pellets from used PET bottles and supplying them to bottle manufacturers, we contribute to the production of plastic bottles using 100% recycled materials, which generates 63% less $CO_2$ than the production of crude oil-derived pellets.

## Metrics and Targets (Plans and Results for Contribution to GHG Reduction in the Engineering Business)

JFE Engineering contributes to GHG emissions reductions in society as a whole through its business operations, such as expanding renewable energy generation and constructing and operating plastic and food recycling plants. In FY2024, the Company contributed to reducing 12 million tonnes of GHG emissions (a 4% increase compared to FY2023) across society. JFE Engineering will further expand its business and contribute to GHG emissions reductions of 13.5 million tonnes in FY2027, 20 million tonnes in FY2030, and 30 million tonnes in FY2035.

With regard to JFE Engineering's $CO_2$ emissions, we set a KPI of reducing $CO_2$ emissions at our plants and offices by 40% in FY2024 compared to FY2013. Since FY2021, we have introduced on-site solar power PPAs and zero-emission electricity plans at the Yokohama head office and low-emission electricity at the Tsu Works. We consequently achieved a 63% reduction in FY2024 compared to FY2013. At the same time, we are promoting energy-saving activities at our plants and offices. We will continue to steadfastly conduct business in ways that are environmentally sound, including expanding the use of renewable energy.

**Engineering Business GHG Reduction Contribution Plan**




**Expansion of waste to resources activities**

- Accumulating orders received for waste-to-energy power generation projects
- Establishing an overseas EPC track record

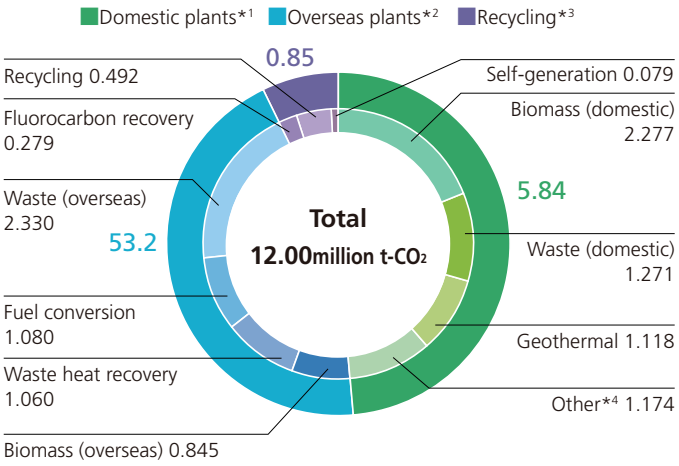
**Demonstrating and expanding the effects of offshore wind power generation projects**

- The Kasaoka Monopile Factory began operating in April 2024, and full-scale production will begin in the second half of 2025.
- Target market share: 50% of Japan's market

**Entry into the CCS business**

- Increasing orders received for EPC projects related to equipment for the liquefied transportation, storage, and shipment of $CO_2$ (Tomakomai, Kawasaki, Setouchi, etc.)

**JFE Engineering's Equivalent Contribution to $CO_2$ Reduction (FY2024)**




*1 Data cover: JFE Engineering
*2 Data cover: JFE Engineering and Standardkessel Baumgarte GmbH (SBG), a German subsidiary of JFE Engineering Corporation
*3 Data cover: J&T Recycling Corporation and JFE Urban Recycle Corporation
*4 Others: Digestion gas, geothermal, solar, wind, waste heat recovery, fuel conversion, energy service, and logistics products

For quantitative data for the JFE Engineering Group's $CO_2$ emissions, please refer to:

› Environmental Data (P. 255)

## EN JFE Engineering's Commitment through Its Business

Under its corporate purpose to "Create, Care, Connect The Foundations of Life — Just For the Earth," JFE Engineering is seeking to expand its contributions to GHG reductions, focusing on the key fields of waste to resource*1 and carbon neutrality*2. As part of our climate change initiatives, the following are some examples of carbon neutral business activities.

*1 Primarily promotes waste-to-energy power generation and recycling (food, plastics), etc.
*2 Primarily promotes renewable energy power generation and hydrogen/ammonia and CCUS, etc.

### EN The Energy Forest Project (Demonstration Project for Creating Stable and Effective Supply Systems of Woody Biomass Fuel)

The town of Yuni, located in Hokkaido, and JFE Engineering are jointly carrying out an Energy Forest Project, which will continue until the end of FY2028. This project, named the JFE Forest NEXTGATE Project and drawn up by JFE Engineering, was selected by NEDO (New Energy and Industrial Technology Development Organization), a national research and development agency, for inclusion in the FY2023 Demonstration Project on Development of New Fuel Sources Such as Fast-growing Trees on August 3, 2023. JFE Engineering is specifically engaged in pioneering research for creating a large "energy forest," involving the silviculture of trees that grow well and fast in a subarctic climate (clean larch and Sakhalin willow) on land owned by the town of Yuni.

The town of Yuni is seeking to nullify $CO_2$ emissions by 2050 under the Yuni Zero Carbon City declaration. JFE Engineering is working with the town of Yuni to contribute to carbon neutrality and prevent global warming, thereby fulfilling its corporate purpose, "Foundation of Life—Just For the Earth."


› The Town of Uni and JFE Engineering Enter into an Agreement Concerning the Energy Forest Demonstration Project
(Japanese only) (https://www.jfe-eng.co.jp/news/2024/20240520.html)

### EN Aqua Connect Namie Corporation Launches Hydroelectric Power Generation Business at the Ukedogawa Hydro Power Plant

Aqua Connect Namie Corporation, a company established through the joint investment of JFE Engineering with The Tokyo Electric Generation Co., Ltd. and the Ukedogawa Land Improvement District (the town of Namie in the district of Futaba, Fukushima Prefecture), launched its power generation business at the Ukedogawa Hydro Power Station in May 2024, becoming the first hydrogen power generation business for JFE Engineering. The business was established to take advantage of the agricultural water supplied from the Ogaki Dam to the ward of Odaka in the city of Minamisoma and to the towns of Namie and Futaba in the district of Futaba.

The Ukedogawa Hydro Power Station, with its waterwheel and power generator located at the foot of the Ogaki Dam, generates power by using the energy produced from the difference in water levels. All the power generated at this station is sold through the Feed-in Tariff System. Aqua Connect Namie Corporation is committed to operating the station safely and stably while supporting farmers in the Ukedogawa area. The company will thereby contribute to carbon neutrality and a sustainable future.


Celebrating the completed construction of the Ukedogawa Hydro Power Station

› Aqua Connect Namie Corporation Launches Power Generation Business at the Ukedogawa Hydro Power Station (Japanese only)
(https://www.jfe-eng.co.jp/news/2024/20240521.html)

## Offshore Wind Power Business Initiative

The JFE Group has positioned its offshore wind power business as a key initiative. With engineering as the core business, the Group is leveraging its diverse businesses to create synergies and deliver new added value. Specifically, we are commercializing the manufacture of offshore wind power generation foundations (monopiles, jackets) as well as O&M* services, establishing an integrated supply chain covering materials, foundation manufacturing, and O&M. We will continue to take advantage of the comprehensive strengths of the Group to commercialize this business, thereby significantly contributing to the JFE Group's efforts to achieve carbon neutrality and make progress toward the government's goal of realizing carbon neutrality.

*Operation and maintenance. Applies repair and diagnostic technologies.

**Commercialization of Offshore Wind Power Business**

- By commercializing our manufacturing of foundation structures (monopiles), we will become the forerunner in the business of offshore wind-power generation and establish a supply chain across the entire Group, including foundation manufacturing and O&M.
- We will strive to expand business in the field of renewable energy by leveraging the JFE Group's collective strengths (synergies), with JFE Engineering as the main player.

**JFE Engineering**

Manufacture seabed-fixed foundation structures for offshore wind power generation

Kasaoka Monopile Factory (operations commenced in FY2024)

**JFE Steel**

Increased production capacity and stable mass production of large and heavy plates for offshore wind power generation

Utilization of Kurashiki No. 7 Continuous Casting Machine in Kurashiki district (started operation in June 2021)

Steel supply

SCM support
Steel supply

Supply of steel slag products

SCM support

Steel supply

**JFE Shoji**

Manufacture and sale of scour protection materials for seabed-fixed foundations

JFE Shoji Akita Offshore Materials, LTD (established in FY2025)

SCM construction for steel products and processed products for offshore wind power generation contributes to Group collaboration

**Each company under the Group**

JMU*: fabrication of offshore wind turbine floats and construction of work vessels

Group-wide: O&M with maximum use of resource

*Japan Marin United Corporation (equity method affiliate)

**Technologies of Group Companies**

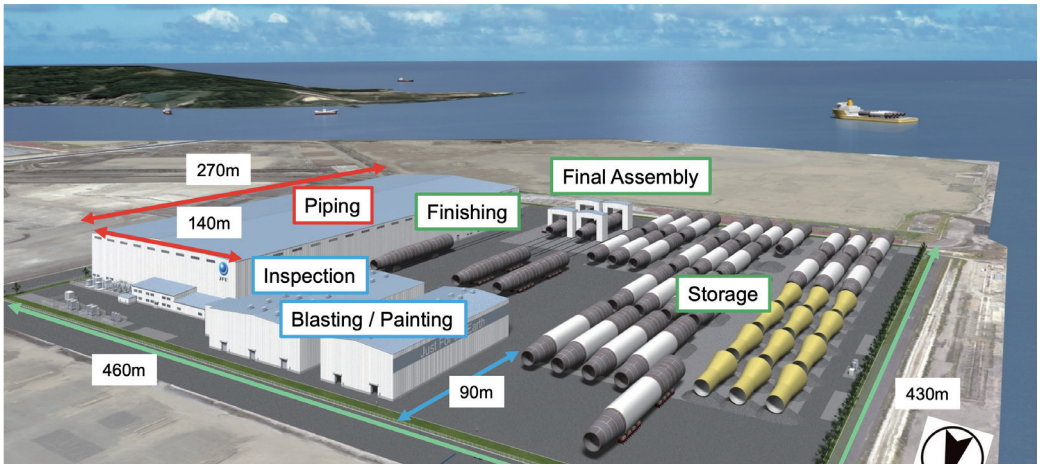
| Category | Company | Details |
|---|---|---|
| Foundation structures | JFE Engineering | Seabed foundations (monopiles, jackets, etc.) |
| | Japan Marine United | Floating foundations (semi-submersible) |
| | JFE Steel | High-quality, large and heavy steel plates, high-strength steel (reduced using HBL series steel plates) |
| | JFE Shoji | Manufacture and sale of scour protection materials for seabed-fixed foundations |
| Construction | Japan Marine United | SEP vessels (self-elevating platform) |
| | JFE Engineering | JFE-RAPID (cable laying method) |
| | | Battery systems for power storage |
| | GECOSS | Stands for large steel structures |
| | JFE Steel | Natural stone substitute materials (use of steel slags) |
| O&M (operation and maintenance) | JFE Engineering | Technologies for remote monitoring and operation |
| | JFE Advantech | Vibration measurement equipment and systems, sea monitoring tools (water quality, sea conditions) |
| | Japan Marine United | Offshore support vessels (work vessels) |
| | JFE Plant Engineering | Wind turbine maintenance (diagnosis and repair) |
| | JFE Technos | Technologies and expertise in planning, constructing, and maintaining onshore turbines |
| | JFE Techno-Research | Equipment evaluation and analysis for corrosion, fatigue, vibration, etc., diagnosis of remaining service life, strength and durability testing and evaluation techniques for large structures |
| Supply chain | JFE Shoji | Contribution to optimizing offshore wind power generation project execution |

## EN Operation of Monopile Manufacturing Base

JFE Engineering has completed construction of the monopile manufacturing plant in Kasaoka, Okayama Prefecture and operations commenced in April 2024. Monopiles are the foundational structural components for offshore wind power generation and are extremely large steel structures, approximately 10 m in diameter, 100 mm thick, and 100 m long. The plant is the only one in Japan capable of manufacturing such large structures. It was designed for production efficiency, implementing manufacturing processes based on the experiences gained in the manufacturing of large steel structures at the Tsu Works. The plant site includes extensive grounds and a quay from which manufactured structures can be directly shipped, as well as state-of-the-art equipment such as large-diameter bending machines and welding machines for extra-thick plates. When operating at full capacity, the plant is capable of manufacturing up to 100,000 tonnes annually, and it is expected to significantly contribute to the establishment of a domestic supply chain in the offshore wind power generation business and to the realization of carbon neutrality.

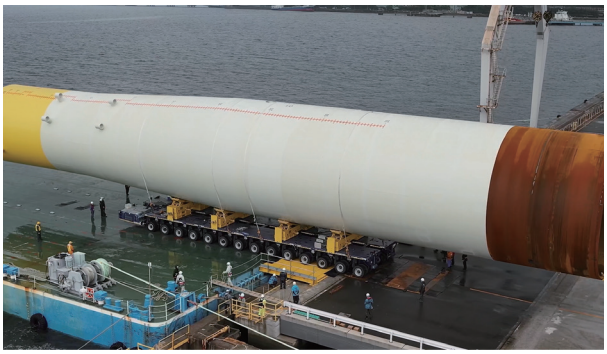
**Overview of the Kasaoka Monopile Factory**

| | | | |
|---|---|---|---|
| Construction site | Kasaoka City, Okayama Prefecture (JFE Steel West Japan Works Fukuyama area) | Investment amount | Approximately 40 billion yen* (plant building, mechanical equipment, quay reinforcement)<br>*Includes the facility reinforcement cost of the Tsu Works. |
| Construction start | June 2022 | Site area | Approximately 20 ha (includes storage area) |
| Operation start | April 2024 | Production capacity | Approximately 80,000–100,000 tonnes per year (Approx. 50 sets) |
| Length of shipping quay | 200 m (quay total length: 400 m) | Quay depth | –11 m |



Layout of Kasaoka Monopile Plant


Kasaoka Monopile Factory


Monopile prototype
(approx. 10 m diameter × 60 m length, approx. 1,000 tonnes)

### EN Offshore Wind Power Generation, a Foray into O&M through a Remote Integrated Management System

For more than 25 years since 1996, JFE Engineering has been involved in EPC for onshore wind-power stations (131 generators at 25 sites) in addition to equipment supply and associated maintenance services. JFE Engineering will fully leverage its deep, extensive expertise in onshore wind power generation as well as technologies owned by other JFE Group companies to grow and advance its O&M services for offshore wind power plants.

In October 2023, JFE Engineering launched a 20-year O&M contract for offshore wind power facilities (three generators with the max output of 7,495 kW) off the coast of Nyuzen in Toyama Prefecture. These facilities were built under Japan's first offshore wind energy project in a general sea area. JFE Engineering adopted a remote integrated management system for this project, the first of its kind in the nation for an offshore wind power project. The use of the system is allowing the company to provide systematic and preventive maintenance services and facilitate sensor management and data analysis for failure detection and diagnosis.


Nyuzen offshore wind power station (Photo by VENTI JAPAN, Inc.)

## EN Demonstration Research on Cost Reduction for Floating Offshore Wind Power Generation

JFE Engineering through a consortium in which it participates, has been selected for the Southern Akita Floating Offshore Wind Demonstration Project Aimed at Overseas Expansion via Cost Reductions, proposed under under the Green Innovation Fund* Project/Cost Reductions for Offshore Wind Power Generation/Floating Offshore Wind Power Demonstration Project (Phase 2), publicly solicited by the New Energy and Industrial Technology Development Organization (NEDO).

The consortium consists of MOWD as the leading company; Akita Floating Offshore Wind Corporation, a special purpose company in which Marubeni has invested; Tohoku Electric Power Co., Inc.; Japan Marine United Corporation; TOA CORPORATION; TOKYO SEIKO ROPE MFG. CO., LTD.; Kanden Plant Corporation; JFE Engineering Corporation; and NAKANIHON AIR Co., Ltd.

Offshore wind is expected to become a major power source of renewable energy due to its potential for large-scale generation capacity, cost reductions, and positive contributions to the local economy. In particular, the use of floating offshore wind is expected to grow rapidly as its power generation facilities can be installed in a wider range of sea areas, allowing for cost reductions at an early stage. NEDO's "Cost Reductions of Offshore Wind Power Generation" project aims to establish a technology to commercialize floating offshore wind power generation at an internationally competitive cost level by fiscal year 2030 under specific conditions.

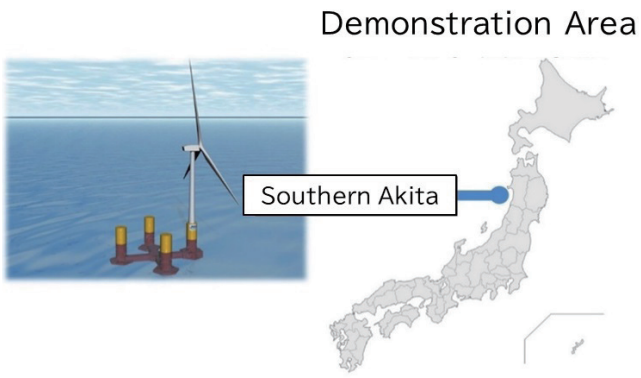
The project plans to deploy two 15 MW wind turbine on-site approximately 400 meters offshore from the southern coast of Akita Prefecture. The project period will span July 2024 to March 2031, with commercial operation scheduled to begin in autumn 2029.

JFE Engineering will pursue cost reductions for floating offshore wind power generation to both expand introduction and develop the domestic industry by establishing a domestic supply chain and human resource development toward realizing carbon neutrality.

*A fund established by NEDO under the Ministry of Economy, Trade and Industry to support companies committed to ambitious goals toward achieving carbon neutrality by 2050, providing continuous support for research, development, demonstration, and social implementation for up to ten years.

**Project Overview (Planned)**

| | |
|---|---|
| Project name | Southern Akita Floating Offshore Wind Demonstration Project Aimed at Overseas Expansion via Cost Reductions |
| Demonstration site | Southern coast of Akita Prefecture (approx. 25 km offshore, water depth approx. 400 m) |
| Turbine output | Over 15 MW |
| Number of turbines | 2 |
| Floating type | Semi-submersible |
| Project period | July 2024–March 2031 |

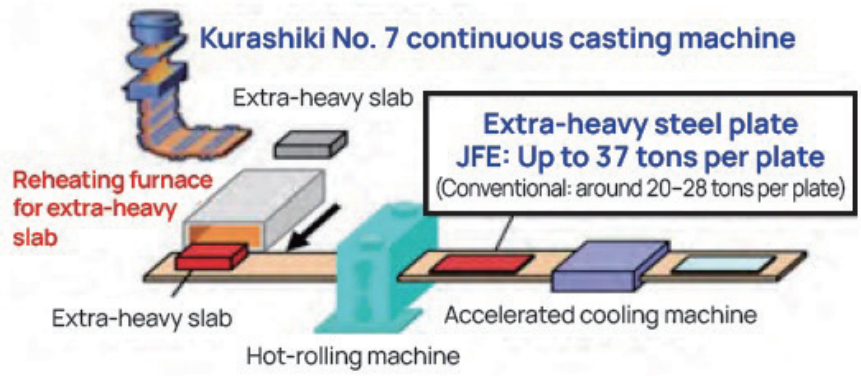



## ST Manufacture and Supply of Large and Heavy Steel Plates for Offshore Wind Power Generation

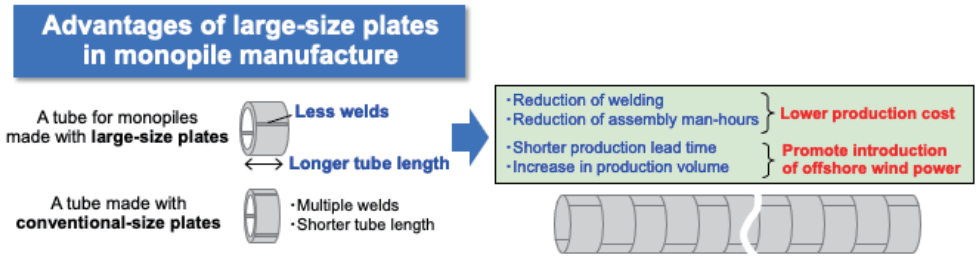
The large and heavy steel plate J-TerraPlate™, produced with the No. 7 continuous caster of the Kurashiki Plant at the JFE Steel's West Japan Works, has been increasingly adopted for monopile foundations for offshore wind power generation. Offshore wind turbines have recently grown in size, requiring larger monopiles and other foundational structures to support them. The monopiles are manufactured by welding ultra-thick steel plates, resulting in increased welding workloads that require monopile manufacturers to improve the efficiency of the operations. Using larger and heavier steel plates makes it possible to reduce the volume of welding operations, compared to conventional small-size plates, and also helps to raise process efficiency while lower manufacturing costs.

We have been investing in equipment at the plate mills and other facilities to manufacture and supply steel plates of up to 37 tonnes (previously limited to around 20 to 28 tonnes per plate in general), the largest in Asia and capable of supporting wind turbines in harsh offshore environments over the long term and in large quantities using the extra-large slabs produced with the state-of-the-art No. 7 continuous casting machine. As a result, we have established a production system for the growing global demand for large and heavy steel plates accompanying active offshore wind development worldwide.

**Manufacturing Process of Large and Heavy Steel Plates for Offshore Wind Power Generation**




**Advantages of Using Large and Heavy Steel Plates for Monopiles**




## SH Manufacture and Sale of Scour Prevention Materials for Offshore Wind Power Generation

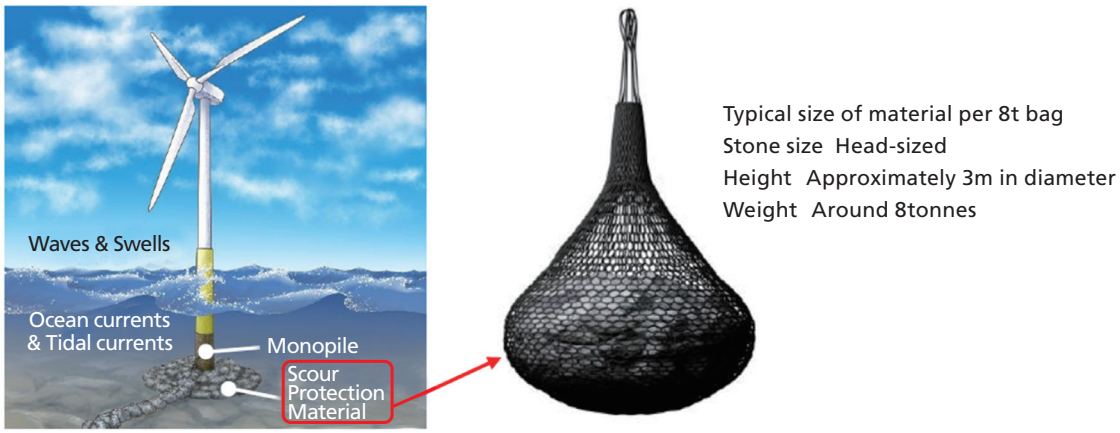
JFE Shoji established JFE Shoji Akita Offshore Materials, LTD. (JAOM), a joint venture with quarry operators, construction companies, and financial institutions in Akita Prefecture, in Oga City, Akita, to manufacture and sell scour prevention materials for offshore wind power generation.

When monopiles are driven into the seabed for offshore wind power generator projects, "scour" forms around the monopile due to waves and tidal currents, causing turbines to tilt. JAOM will base itself in Akita, where offshore wind power is expanding, to manufacture and stockpile scour prevention materials made from local natural stone and artificial stone* produced by JFE Steel, on a just-in-time basis within construction schedules.

Furthermore, the company will also pursue businesses through the expanded use of steel slag products and stone products for purposes such as forming fishing reefs and seaweed beds toward restoring the marine environment and mitigating global warming. JAOM hopes to contribute through this business to the development of Japan's offshore wind power industry and the realization of carbon neutrality and a sustainable society.

*Artificial stone manufactured by mixing steelmaking slag, a byproduct of the steelmaking process, with ground granulated blast furnace slag (a raw material for blast furnace cement) and water, then hydrating and solidifying. This artificial stone, produced by JFE Steel under the brand name Frontier Rock™, contains a high level of iron and has excellent properties for algae adhesion.

**Conceptual Diagram of Scour Protection Material**



### SH Building a Supply Chain for the Offshore Wind Power Generation Industry

Carbon neutrality initiatives are expanding worldwide to address concerns over climate change. To achieve carbon neutrality by 2050, Japan approved the Seventh Strategic Energy Plan at a Cabinet meeting in 2025, which sets targets for FY2040: a 73% reduction in greenhouse gas emissions, renewable energy accounting for 40–50% of the electricity mix, and wind power accounting for around 4.8% compared to 1.1% in FY2023.

As for offshore wind power generation, the industry is planning projects that will achieve 10 GW capacity by 2030 and 30-45 GW by 2040. Steadfast efforts are also being made to adopt a large number of internationally competitive technologies, such as the adoption of a demonstration project for a floating offshore wind power generation system under the Green Innovation Fund.

JFE Shoji is collaborating with a local enterprise that manufactures the windmill foundations in Taiwan, which is leading in the offshore wind power generation market, and have been achieving progress regarding supply chain of steel materials for foundation structures. Looking ahead, the company will capitalize on the knowledge acquired and contribute to the realization of carbon neutrality by establishing a supply chain that supports the domestic production of goods and the local economy while also meeting customer demand in the offshore wind power generation industry in Japan.

## Eco-Products and Eco-Solutions Contributing to GHG Reduction

We provide a wide range of eco-products and eco-solutions for reducing GHG by efficiently using resources and optimizing energy use through environmentally sound technological innovations.

### ST Automatic Measurement Device for Crater end position in Continuous Casting to Realize High-Quality Steel Plate

Our Crater end position Measurement Device for Continuous Casting, developed in-house, received the Minister of Economy, Trade and Industry Award at the 59th Machinery Promotion Award, organized by the Japan Society for the Promotion of Machine Industry (Chairman: Kazuaki Kama). The annual Machinery Promotion Award recognizes companies, universities, research institutions, and developers that are significantly advancing the progress and development of industrial machinery technology in Japan through outstanding R&D and the practical application of results, thereby further promoting technological development in the machinery industry. This marks our 13th Machinery Promotion Award and our third Minister of Economy, Trade and Industry Award.

#### 1. Award-winning technology

Automatic Measurement Device for Crater end position in Continuous Casting to Realize a High-Quality Heavy Plate

#### 2. Overview of development

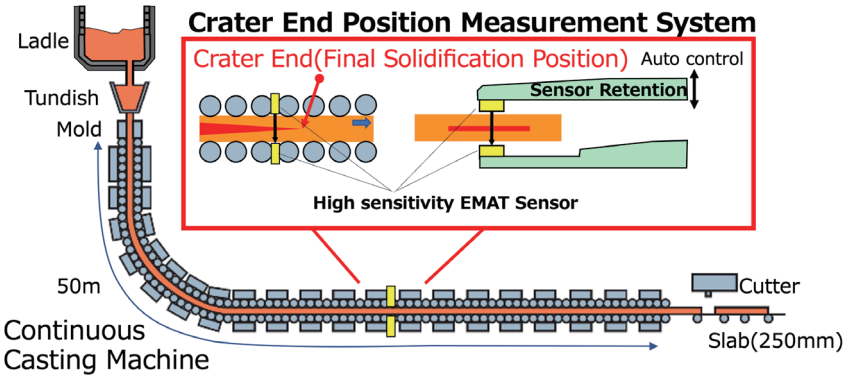
We developed the Crater end position Measurement Device, which automatically measures the crater end position in the continuous casting process (see figure). Although the crater end position in continuous casting is an extremely important index in terms of productivity and quality, it had previously been difficult to ascertain continuously and accurately . By applying the electromagnetic ultrasonic method, which enables non-contact ultrasonic transmission and reception together with Halbach array (a special magnet arrangement) and digital signal processing, we significantly improved sensitivity, achieved non-contact ultrasonic measurement, and developed a measurement technology that combines longitudinal ultrasonic waves and transverse ultrasonic waves for the crater end position. In addition, we developed an automatic control mechanism that maintains a constant distance between the hot slab and the sensor, preventing sensor contact and damage. This made it possible to automatically measure the crater end position of continuously cast slabs with surface temperatures exceeding 900°C.

The device has already been introduced to improve operations at the steelmaking plant of the West Japan Works (Fukuyama District).

This technological development made it possible to grasp the crater end position in continuous casting and control it at the appropriate position, thereby suppressing center segregation and enabling the manufacture of steel materials with improved resistance to hydrogen-induced cracking. In addition, it allowed for the manufacture of high-grade steel plates, including steel products for pipelines used in harsh corrosive environments. Customers have adopted high-grade steel plates manufactured using this device as steel materials for natural gas development pipeline projects in Southeast Asia*. We will continue to contribute to reducing environmental impact through these high-grade steel materials.

> *JFE Steel Completes First Shipment of UOE Steel Pipe for Sour Linepipe Requiring Stringent Surface-hardness Specifications(May 30, 2024)
(https://www.jfe-steel.co.jp/en/release/2024/05/240530.html)

**Fig. Crater End Position Measurement System**




> Automatic Measurement Device for Crater end position in Continuous Casting to Realize High-Quality Steel Plate Receives the Minister of Economy, Trade and Industry Award at the 59th Machinery Promotion Award (Japanese only) (https://www.jfe-steel.co.jp/release/2024/12/241220-2.html)

## ST Development of Steel Material for Sour Gas Transmission Line Pipe Containing High Concentrations of Hydrogen Sulfide

Steel material for natural gas transmission line pipe containing high concentrations of hydrogen sulfide, developed by JFE Steel, received the 71st (FY2024) Okochi Memorial Production Prize from the Okochi Memorial Foundation (Chairman: Hiroo Yamazaki, Professor Emeritus of The University of Tokyo). The Okochi Memorial Production Prize is awarded for achievements that significantly contribute to academic progress and industrial development by producing outstanding and original research results in the fields of production engineering and production technology. The award ceremony was held on March 25 at the Industry Club of Japan (Marunouchi, Tokyo).

### 1. Award-winning achievement

Development of Steel Material for Sour Gas Transmission Line Pipe Containing High Concentrations of Hydrogen Sulfide

### 2. Overview of development

Steel grade sour service pipe is suitable for pipelines that transport natural gas with high concentrations of hydrogen sulfide. It has recently become necessary to control and reduce the hardness of the pipe's extreme surface to prevent sulfide stress cracking*1, which can develop in hardened micro layers at the pipe internal surface when transporting high H2S "sour" gas*2. In addition, complete inspection and full quantity assurance of extreme surface hardness are now required for the thick steel plates used to manufacture the pipes, a requirement that has been formalized in IOGP specifications*3. Finally, to improve material safety and conserve resources, development of new center segregation control technologies is required to avoid fracture accidents caused by hydrogen-induced cracking (HIC) originating from center-segregation in the steel plate.

In response, we have developed a surface hardness control technology for both high strength and low surface hardness with a low-alloy design through advanced cooling control and a surface hardness full-surface inspection technology that enables full-quantity quality assurance by a unique non-destructive inspection. These advances strengthen resistance to sulfide stress cracking under high hydrogen sulfide environments and contribute to stable manufacturing, including quality assurance in mass production. We also worked to develop a center segregation control technology by optimizing the light reduction position using a new sensor, called a crater end meter, during slab casting, thereby achieving stabilizing steel quality by improving resistance to hydrogen-induced cracking*4.

Going forward, we will continue to improve safety, economy, and reliability by providing high-performance, high-grade steel material for sour gas transmission line pipe containing high concentrations of hydrogen sulfide, while also protecting the global environment and responding to the diverse needs of our customers.

*1 Phenomenon in which hydrogen flows into steel in a sour gas environment, deteriorating the steel and creating cracks under stress. Higher hydrogen sulfide concentrations and stress increase the likelihood of cracks.
*2 Natural gas containing hydrogen sulfide.
*3 International Association of Oil & Gas Producers (an international gas producers association led by oil majors)
*4 Phenomenon in which hydrogen that has entered steel accumulates at inclusions such as MnS, and cracks occur; cracks propagate in hardened areas due to center segregation.

> 71st (FY2024) Okochi Memorial Production Prize Awarded – Development of Steel Material for Sour Gas Transmission Line Pipe Containing High Concentrations of Hydrogen Sulfide – (Japanese only) (https://www.jfe-steel.co.jp/release/2025/02/250218.html)

## ST Development of Blast Furnace Automatic Operation Technology Contributing to Decarbonization of the Steel Industry

JFE Steel achievements in developing blast furnace automatic operation technology for advancing the decarbonization of the steel industry have been recognized with the Science and Technology Award (Development Category) of the Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology in FY2025.

### 1. Award-winning project

Development of Blast Furnace Automatic Operation Technology Contributing to Decarbonization of the Steel Industry

### 2. Project overview

This award-winning project features a technology for automating blast furnace operation using a cyber-physical system (CPS). In the steel industry, high efficiency and stable operation are extremely important for reducing $CO_2$ emissions and improving labor productivity. On the other hand, manual operation drawing upon the knowledge and experience of skilled operators has been necessary in light of the inability to directly observe or measure the internal state of the blast furnace and the significant variation in operating conditions due to fluctuations in the properties of raw materials charged into the blast furnace. We therefore constructed a digital twin based on our own model using sensor data collected from the actual process. The system uses a CPS for real-time monitoring and future prediction of equipment conditions and automatically executes optimal operating actions for controlling hot metal temperature and permeability, which are important in blast furnace operation. In this system, the physical model representing furnace reactions and heat transfer phenomena enables real-time prediction of hot metal temperature up to 12 hours into the future. We also established a permeability control method using anomaly prediction technology based on statistical methods applied to furnace pressure measurement data. This system has been put into use at blast furnace sites, leading to improved labor productivity and reduced $CO_2$ emissions.

The technology has also received the Sawamura Award of The Iron and Steel Institute of Japan (FY2020), the Technology Award of the Society of Instrument and Control Engineer (FY2020), the Outstanding Technological Development Award of The Society of Chemical Engineers, Japan (FY2020), and the Okochi Memorial Production Award (FY2023). Going forward, we will promote the CPS for the BF process and other processes and aspire to implement the system across the entire steelmaking process to realize innovative productivity improvements and stable operation.

› **FY2025 Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology – Science and Technology Award (Development Category) – Awarded: Development of Blast Furnace Automatic Operation Technology Contributing to Decarbonization of the Steel Industry (Japanese only)** (https://www.jfe-steel.co.jp/release/2025/04/250408-1.html)

## ST Hot Repair Technology for Coke Batteries

JFE Steel and its partner MEGATECH Corporation have received an order for the Hot Repair Engineering Service of Coke Battery from Ouro Branco/Minas Gerais Works, Gerdau S. A., which is one of our Solution Business products and technologies. This is JFE's first opportunity to apply this technology as a Solution Business for domestic and overseas customers.

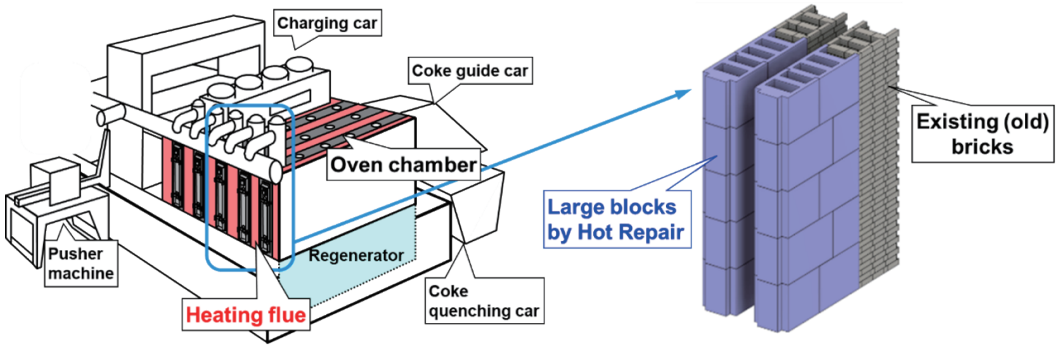
The effective repair and replacement of old coke batteries is important in the use of blast furnaces for producing steel. We have long been developing various coke battery repair technologies to extend battery life, based on our experience in operating multiple coke batteries. Gerdau's favorable impression of the more than 200 applications of the Hot Repair of Coke Battery technology in our steelworks led to this order.

We will actively provide its technologies and expertise for improving operation under the JFE Resolus™ brand of products and technologies under its Solution Business and develop sound customer relationships for the future.

*Features of Hot Repair Technology for Coke Batteries

1) Partial and selective repair of required ovens, either full rebuilding of batteries or green field projects, which require large investment.
2) JFE has developed a measurement and visualization technology for oven walls using a laser scanner that can quantitatively evaluate and visualize wall damage such as deformation and erosion to precisely identify the area to repair.
3) Large pre-casted zero-expansion blocks achieve shorter repair periods and stronger walls.
4) This technology can minimize production loss during repair work since ovens outside the repair area can continue coke production.
5) High-performance insulation material can provide a safer work environment for repair personnel.

**Outline of Coke Hot Repair Technology**




Coke oven battery overview

Detail of Heating Flue (red in left figure) and newly installed large blocks

Overview of GERDAU

- Company Name:Gerdau S.A.
- Head Office: Belo Horizonte, Minas Gerais, Brazil
- Chairman: Guilherme Chagas Gerdau Johanpeter
- Business: Steel production, sales, and scrap collection
- Established: 1901

Overview of MEGATECH

- Company Name: MEGATECH Corporation
- Head Office: Chiba Port Side Tower 26F, 1-35, Tonyacho, Chuo-ku, Chiba City, 260-0025, Japan
- Chairman and Representative Director: Nagao Shigeru
- Business: Coke oven repair, plant design, fabrication, and construction
- Established: Established as Sanyo Industry Ltd., in 1971, and renamed as MEGATECH Co., Ltd in 2000

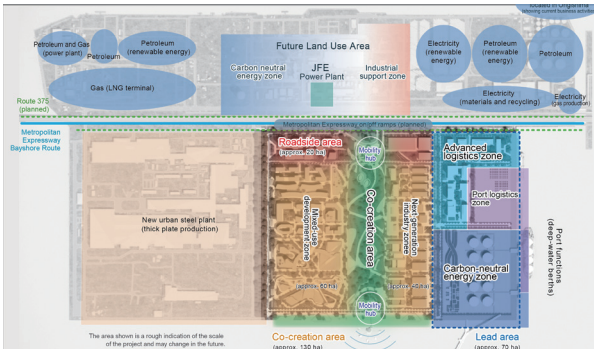
JFE Resolus

> First Implementation of Coke Hot Repair Engineering Service developed by JFE (https://www.jfe-steel.co.jp/en/release/2024/10/241029.html)

## Initiatives for Achieving Carbon Neutrality in the Keihin Waterfront Areas

JFE Holdings has released OHGISHIMA 2025 , the JFE Group's conceptual plan for the reuse of land currently occupied by JFE Steel's East Japan Works (Keihin District), following the suspension of blast furnace operations and other upstream processes there, and in accordance with Kawasaki City's land use policy. The concept is to create fields of innovation and enterprise that will address the complex challenges involved in the pursuit of carbon neutrality. Through implementation of its OHGISHIMA 2050 plan, the JFE Group aims to convert the land for use on projects that will offer significant public benefit and help address some of the key challenges Japan faces. By attracting new industries and creating jobs that will benefit the country over the next 100 years, the JFE Group hopes to contribute to the sustainable development of local communities and society as a whole.

Artist's impression of the Ohgishima district as envisioned in 2050




Land use zoning in Ohgishima

### Initiatives for Developing a Hydrogen Supply Hub in the Carbon-Neutral Energy Zone

The Lead Area of the Ohgishima district has been designated as a Carbon-neutral Energy Zone, where hydrogen supply facilities will be deployed. Dramatically improved access to these facilities will support carbon neutrality and innovation across the entire district. The location has been selected as the construction site for a liquefied hydrogen receiving terminal under the "Commercial demonstration of Liquefied Hydrogen Supply Chain," under the Green Innovation Fund Project of NEDO, being undertaken by Japan Suiso Energy, Ltd. (JSE). A land lease agreement between JFE Steel and JSE was concluded in July 2024, the transfer of the land commenced in April 2025, and construction of the hydrogen receiving terminal began in May 2025. Preparations are steadily underway toward starting commercial demonstration operations in FY2028.

The hydrogen to be supplied in the future to Ohgishima will be used to generate green electricity at JFE's in-house power plant, which will in turn be supplied to ongoing factory operations. Surplus power will also be supplied to JSE in the leading area, advanced logistics operators, and a data center in the northern part of Ohgishima that is under consideration for joint commercialization with Mitsubishi Corporation. In addition, we envision using hydrogen also as a green fuel in the reheating furnaces of the plate mill.

Starting from Ohgishima, the JFE Group plans to play a role in building a stable, economical supply chain for hydrogen and other decarbonized fuels and to contribute to realizing carbon neutrality throughout society, including the Keihin waterfront area.

Artist's impression of the hydrogen base (courtesy of Japan Suiso Energy Ltd.)

Construction commencement of the hydrogen base (May 2025)

# Adapting to Climate Change (Contribution to Achieving Societal Resilience)

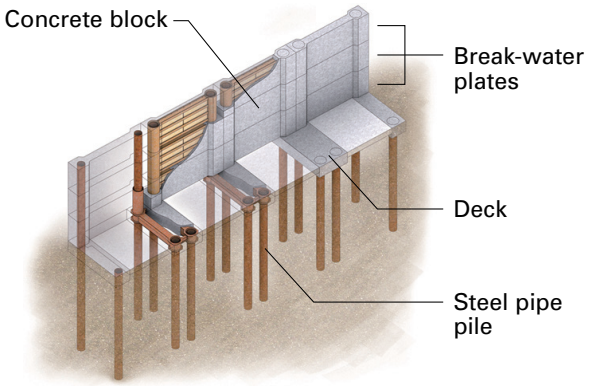
## Contributions to Disaster Prevention and Mitigation and Increased National Resilience

The JFE Group is not only focused on reducing $CO_2$ emissions (climate change mitigation); we also intend to contribute to the resilience of society in general by adapting to climate change. With infrastructure such as hybrid tide embankments and permeable steel slit dams, the Group will contribute to preventing and mitigating disaster-related damage to infrastructure that is critical to daily life and economic activities and to strengthening their resilience.

### Hybrid Tide Embankments

Hybrid tide embankments are made of steel and concrete. Because of their hybrid structure, they require shorter construction time and less space.

Concrete blocks for hybrid tide embankments are precast at a JFE Group factory, while steel pipe piles for foundations are installed at the construction site, thereby reducing the time required for on-site construction by about 60%. This arrangement does not require large amounts of materials, equipment, or workers on site, so it does not interfere with other construction work. Furthermore, compared to a conventional embankment structure, the land area occupied by the embankment can be reduced by about 80%, saving considerable space. We will continue to apply and advance our technology to further contribute to disaster prevention in the region.




Cross section

Hybrid tide embankments

› JFE Engineering Infrastructure Using Steel Structures (Japanese only) (https://www.jfe-eng.co.jp/products/bridge/co01.html)

### Permeable Steel Slit Dams

A permeable steel slit dam is a steel pipe structure installed in a river to trap debris flows.
Made of strong steel pipes to withstand the impact of driftwood and huge debris, it has large openings to let water and sediment to pass through, which prevents the water level from rising upstream during floods and also ensuring that debris does not flow downstream. Since it does not block the flow of water, unlike a dam, it can be shaped to the slope of a riverbed to protect the ecosystem. The JFE Group is working to expand the use of permeable steel slit dams by reducing installation costs and shortening the construction period through structural innovations.

Permeable steel slit dams

### Terre Armée Method

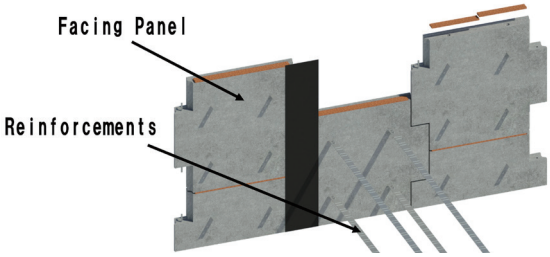
The Terre Armée method involves reinforced soil wall construction in which layers of steel reinforcements are laid within an embankment to create a vertically strong structure with excellent earthquake resistance.
The robust yet flexible structure formed by interaction between the embankment and the reinforcements helps suppress sediment-related disasters from increasingly severe natural hazards (heavy rainfall and major earthquakes) and supports the maintenance of critical lifelines.

JFE Shoji Terre One Corporation, a subsidiary of JFE Shoji, is working to commercialize low-carbon facing panels that use blast furnace slag generated by JFE Steel as facing materials for the Terre Armée method. This is expected to reduce $CO_2$ emissions by 70% compared to ordinary concrete, differentiating the product as an environmentally friendly solution.

Going forward, we will contribute to building disaster-resistant roads and communities by promoting the Terre Armée method and expanding sales of other products that contribute to disaster prevention and mitigation and strengthen national resilience.

External view of the Terre Armée method

**Internal structure of the Terre Armée method**



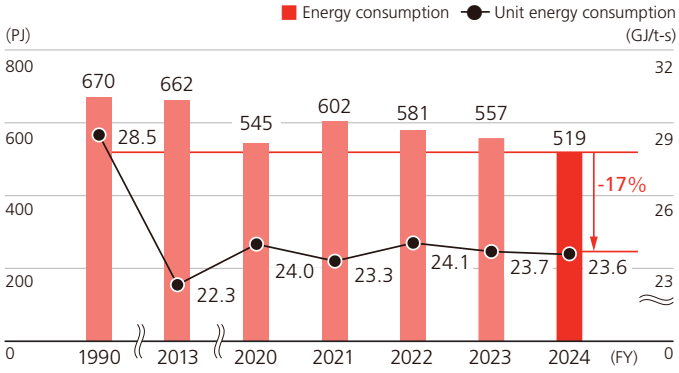

# Initiatives to Reduce Energy Consumption

Reducing energy consumption is a core initiative of our response to climate change. The JFE Group is working to improve energy efficiency in our business activities and reduce GHG emissions by introducing renewable energy and optimizing facilities.

## Initiatives in the Steel Business

In addition to introducing high-efficiency facilities, we have been working to reduce energy consumption in the steelmaking process by actively applying digital solutions (DS) and IoT technologies. These initiatives improve production efficiency and optimize energy use, representing important steps toward building a sustainable manufacturing framework. Going forward, we will continue pursuing technological innovation and on-site improvement to further enhance energy efficiency.

**Energy Consumption and Unit Energy Consumption of JFE Steel**




Note: FY2013 figure includes data for the Sendai Works of JFE Bars & Shapes Corporation.

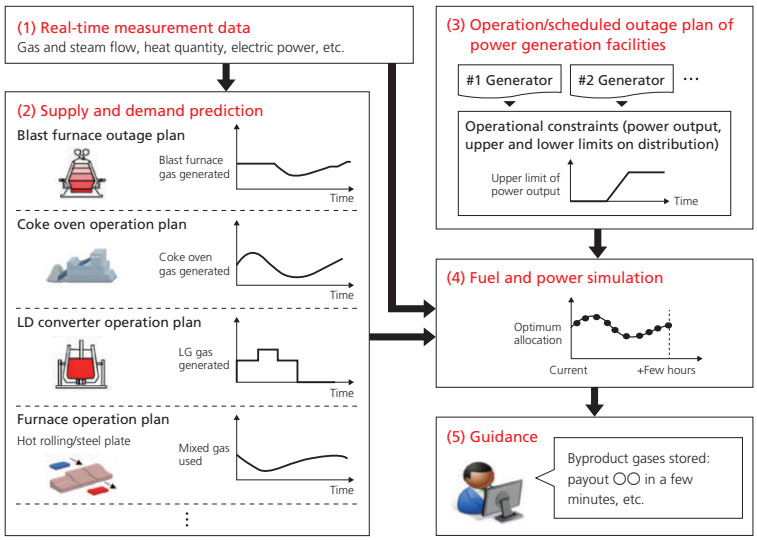
### ST Fuel and Power Operation Guidance System for Steelworks

JFE Steel developed a fuel and power operation guidance system for steelworks and succeeded in saving energy and reducing $CO_2$ as well as fuel and power by optimizing the fuel, steam, and electric power used in the steelmaking process.

Previously, operators determined various factors such as the distribution of byproduct gas to each process, amount of fuel (heavy oil, city gas, etc.) and electricity to purchase, and the amount of byproduct gas stored, taking into account energy demand and supply (amount generated and used) as well as the operating conditions of power generation facilities, to minimize cost and energy loss. However, it was difficult to use this method to accurately estimate the change in energy demand and supply. The guidance system (diagram 1) developed by JFE Steel uses voluminous real-time measurement data (1) obtained through a cyber physical system (CPS)* and the precise production plans of each factory to predict future demand and supply with high accuracy (2), and by taking into account information such as in-house power generation capacity (3), fuel and power simulation allows for the calculation of the optimal operating conditions with the lowest possible purchase from external sources (4), and the results are fed back to guide the operator (5). The system's development was awarded the Academic Award (Technical Division) of the 2022 Japan Institute of Energy Award. JFE Steel established the JFE Digital Transformation Center (JDXC™) to promote CPS within the manufacturing process and other digital transformation initiatives to achieve innovative production improvements as well as stable operations. We remain committed to realizing a sustainable society by adopting digital transformation to address the various issues identified at production sites.

*A system that brings together a vast amount of sensor information about physical space as big data in cyberspace and generates value by feeding back in real time the results analyzed by various measures for application in the physical space.

**Guidance System Overview**




› JFE Steel receives Academic Award (Technical Division) of the 2022 Japan Institute of Energy Award (Japanese only)
(https://www.jfe-steel.co.jp/release/2023/03/230301.html)

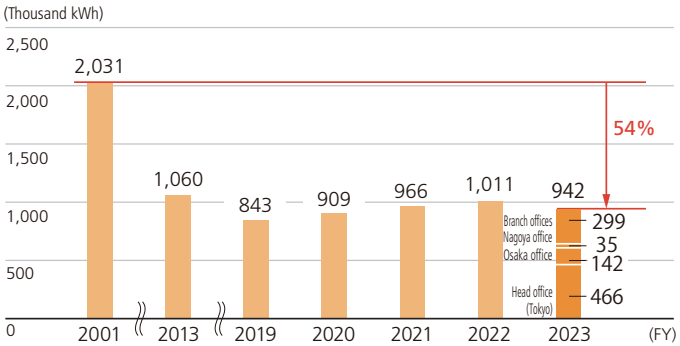
## Initiatives in the Trading Business

Under the environmental strategies formulated in 2001, JFE Shoji is continuously implementing initiatives to reduce paper and electricity consumption and strictly manage waste separation as part of its energy reduction efforts.

In terms of reducing paper consumption, the company continues to use recycled paper to conserve natural resources, and we also ensure that documents are printed in black and white using both sides of the paper. We are also promoting paperless meetings through the use of large monitors and web conferencing systems. Consequently, the amount of paper used per employee is on a downward trend. As for electricity consumption, JFE Shoji is reducing its environmental impact by introducing motion-sensor lighting and energy-saving equipment through office renovations, implementing leave-on-time days, improving operational efficiencies through robotic process automation (RPA), and other measures.

Furthermore, the company has established a new goal in the domestic operating companies to reduce $CO_2$ emissions by installing solar panels and purchasing electricity derived from renewable energy sources. Going forward, in addition to procuring renewable energy-derived electricity through solar panel installation, we will begin procuring non-fossil certificates derived from additional renewable energy by introducing off-site PPAs. Domestic group companies reduced $CO_2$ emissions in FY2024 by 32.4% compared to FY2019 through ongoing efforts to reduce electricity usage and a decline in emission factors.

**Electric Power Consumption by JFE Shoji**




For quantitative data for the JFE Shoji Group's $CO_2$ emissions, please refer to:
› Environmental Data (P. 255)

# Policy Engagement

## Basic Approach to Policy Engagement on Climate Change Issues

The JFE Group has identified climate change as a top priority and formulated both the JFE Group Environmental Vision for 2050 to achieve carbon neutrality by 2050 and its long-term JFE Vision 2035. To realize these aspirations, JFE Steel is focusing on the early implementation of ultra-innovative technologies and expanding the supply of green steel. However, long-term technology development, investment in the construction of large-scale decarbonization infrastructure, and ensuring investment predictability by creating demand for green steel and other Green Transformation (GX) products require bold and powerful industrial policies from the government as well as collaboration with society, including stakeholders. We therefore actively recommend policies through the Company and related organizations and disclose the results of our lobbying activities.

In particular, JFE Steel not only seeks to enhance corporate value but also contributes to the realization of carbon neutrality, which in turn will contribute to sustainable development worldwide. Accordingly, the Company makes recommendations regarding Japan's climate change policies as well as GX and energy policies, taking into account the Paris Agreement, and proactively engages in and contributes to activities through industry associations.

In addition, each Group company participating in industry associations and initiatives regularly informs the Group's thinking, direction, stance, and influence, and reviews its proposals and participation. Key decisions are discussed at the Group Management Strategy Committee and further deliberated and decided at the Board of Directors.

## Stance on Major Policies

The JFE Group views government GX policies as a key framework for realizing a sustainable society. We support the GX2040 Vision and are developing our business activities and environmental strategies in alignment with the directions of these policies. Our stance on GX policies and specific initiatives are described below.

### GX Policies

The government's GX2040 Vision presents long-term directions and policy guidelines to enhance investment predictability for GX as a national strategy toward achieving both a decarbonized society and industrial development.

In the steel business, bold and powerful government support is required for long-term technology development, increased operating costs associated with process transitions, and infrastructure development to meet higher electricity demand. Also essential are support systems for building hydrogen and ammonia supply chains as decarbonized fuel infrastructure, promoting CCUS, and creating markets that properly value GX products, such as green steel. We will strive Companywide and through industry associations to recommend policies and promote public understanding to ensure the directions set forth in this vision are advanced as concrete policies.

## Energy Policy

The principle of "S+3E" in the government's 7th Strategic Energy Plan stands for safety as a major premise, energy security as the highest priority, and improvement of economic efficiency and compatibility with the environment, in concert with policies calling for the transition of renewable energy into a mainstay power source and for maximizing the use of nuclear power.

The reduction of byproduct gas previously used as an energy source will significantly boost electricity demand in the steel business's decarbonization efforts, particularly in process transitions at integrated blast furnace steelworks. Therefore, the stable, medium- to long-term supply of decarbonized power, realization of internationally competitive industrial electricity prices, and the development and rebuilding of transmission infrastructure will be essential. The construction of hydrogen and ammonia supply chains as decarbonized fuel infrastructure is also necessary. We will work Companywide and through industry associations to recommend policies and promote public understanding to ensure that concrete policies are advanced in line with this plan.

## Carbon Pricing

The government's growth-oriented carbon pricing scheme calls for the full-scale launch of the GX-ETS emissions trading system (GX-ETS) in FY2026 and the introduction of a fossil fuel surcharge system in FY2028. Under this policy package, the government is committed to large-scale support for technology development and capital investment for decarbonization while gradually introducing carbon pricing. We support this policy that encourages taking on the challenge of developing innovative technologies for carbon neutrality.

We will make the necessary policy recommendations Companywide and through industry associations based on this scheme to introduce effective systems for developing and implementing innovative technologies in the Japanese steel industry while maintaining and enhancing international competitiveness. In addition, we believe that ensuring investment predictability for GX requires that both the introduction of carbon pricing as well as policies to create markets for GX products proceed in tandem.

## Creation of GX Product Markets

Products arising from the transition into decarbonization processes (defining GX products as those producing reduced GHG emissions over their life cycle through decarbonization investments) typically carry higher costs, so it is unlikely that demand will spontaneously emerge through market forces alone. Coordinated action will be needed to create a market environment that recognizes GX value. Specific measures include public-private initiatives to stimulate demand and mechanisms that ensure that GX value is recognized and incentivized throughout the entire supply chain. These steps are essential to support widespread adoption of GX products.

For the steel industry in particular, from the perspective of ensuring the necessary investment predictability for decarbonization, the actual emission reductions from the Company's own efforts must be understood and recognized as GX value, which in turn will depend upon promoting understanding and creating transparent and reliable communication guidelines. JFE Steel is recommending policies and raising public awareness to ensure the advance of concrete initiatives by both the public and private sectors to expand GX product markets while also actively participating in rule and standard-setting efforts in domestic and international industry associations and global initiatives.

## Initiatives to Materialize Demand Creation Measures

JFE Steel is collaborating through its participation in industry associations to take concrete action for boosting green steel demand by recommending policies and engaging in activities to raise awareness targeting the government and relevant organizations.

In March 2024, the Ministry of Economy, Trade and Industry (METI) published the Interim Summary of the Study Group on GX Product Markets for Demand Creation Contributing to Industrial Competitiveness Enhancement and Emission Reduction. This report suggests "Reduced Emissions of Product" as a new GX value and emphasizes the importance of monetizing actual emission reductions resulting from a company's efforts.

At the Study Group on Green Steel for Green Transformation hosted by METI in November 2024, we made recommendations on the need to create demand for green steel as well as the required policy support. The summary report of this study group confirmed a common understanding of the need for early action to create demand and clarified the definition of "Green Steel for GX." It also established a policy direction in which the government places priority on policies such as preferential procurement and purchase support for steel products that reflect the value of emission reductions in the steelmaking process. Specifically, beginning in FY2025, these policies will be implemented by reflecting the criteria for products subject to preferential procurement under the Act on Promoting Green Procurement and by reflecting additional criteria for subsidies to promote the introduction of clean energy vehicles.

In addition, as a result of activities in the Rules Working Group of the GX League in which JFE Steel participated, a framework for the GX Acceleration Declaration was launched, whereby companies voluntarily declare their procurement of GX products and disclose and evaluate the content. Based on this initiative, JFE Steel has declared its procurement of GX products and is actively promoting the creation of private sector demand as well.

- **METI: Interim Summary of the Study Group on GX Product Markets for Demand Creation Contributing to Industrial Competitiveness Enhancement and Emission Reduction (Japanese only** (https://www.meti.go.jp/shingikai/energy_environment/gx_product/20240326_report.html)
- **METI: Consolidated Summary of the Study Group on Green Steel for Green Transformation**
  (https://www.meti.go.jp/english/press/2025/pdf/0123_001a.pdfl)

**GX Acceleration Declaration**

- **METI: GX Acceleration Declaration Framework Newly Launched as Effort to Encourage Companies Proactively Engaging in Creation of a Market for GX** (https://www.meti.go.jp/english/press/2024/1206_001.html)
- **JFE Steel GX Acceleration Declaration (Japanese only)** (https://www.jfe-steel.co.jp/release/2024/12/241220-3.html)

## Initiatives for Setting Rules and Standards in Japan and Overseas

The Japan Iron and Steel Federation (JISF) has taken the lead globally by formulating and publishing guidelines for green steel that reflect the value of reduced emissions. At the World Steel Association, guidelines on steel products using the Chain of Custody* approaches were also formulated and published based on the JISF guidelines. JFE Steel is actively participating in and promoting rulemaking in these industry organizations.

In addition, discussions on standardization are also progressing at international organizations such as the International Organization for Standardization (ISO), the GHG Protocol, and the Science Based Targets initiative, and JFE Steel is involved either on its own behalf or through industry associations.

*A framework for tracking and recording how products and raw materials move and are managed through the supply chain.

- **Japan Iron and Steel Federation: Guidelines on Green Steel (Japanese only)**
  (https://www.jisf.or.jp/business/ondanka/kouken/greensteel/documents/JISFGSguidelinev3.1final.pdf)
- **World Steel Association: GHG chain of custody approaches in the steel industry**
  (https://worldsteel.org/climate-action/chain-of-custody/)

# Lobbying Activities and Outcomes

The JFE Group is contributing to the realization of a carbon-neutral society by advancing the development of ultra-innovative technologies and the transformation of the steelmaking process. At the same time, it is actively engaging in policy formation to enhance the sustainability of society as a whole. In particular, we hope to accelerate decarbonization and industrial competitiveness through constructive lobbying efforts that reflect the realities of the industry regarding national strategies such as GX and energy policies and by ensuring their inclusion in institutional design.

Specific outcomes of these activities include the incorporation of the Group's recommendations into policies such as the GX2040 Vision and the 7th Strategic Energy Plan, as well as the receipt of government support such as subsidies for capital investment and research and development supporting the social implementation of innovative technologies. We also regard these initiatives as part of our social responsibility that extends beyond corporate boundaries, contributing to the building of a sustainable future.

## Public Policy Engagement and Outcomes

The role of companies in realizing a sustainable society goes beyond business activities alone. As a member of the industrial sector, the JFE Group is actively involved in policy formation that contributes to the construction of a decarbonized society and actively engages in policy advocacy to promote effective institutional design.

### The 8th GX Implementation Council

In February 2023, the cabinet approved the Basic Policy for the Realization of GX to simultaneously achieve three goals through GX: decarbonization, stable energy supply, and economic growth. In July of the same year, the cabinet also approved the Strategy for Promoting Structural Transition based on Decarbonization (GX Promotion Strategy). Growth-oriented Carbon Pricing (CP) Concepts is the decarbonization initiative based on this strategy and is currently being actively pursued toward its realization and implementation.

At the 8th GX Implementation Council, held in November 2023, JFE Steel's President Kitano (then-Chairman of the Japan Iron and Steel Federation) explained the efforts being made by the Japanese steel industry to achieve carbon neutrality, and he called for long-term government support measures corresponding to the support provided by the government in Europe, the U.S., and China for the huge research and development and capital investment costs. He also expressed the need for long term government support for converting to innovative processes and dealing with the increase in operational costs for non-fossil fuels, electricity, and other sources, as actions for stimulating demand for green steel materials with high environmental value through, for example, public procurement, measures to ensure the international competitiveness of industrial electricity prices, and support for building new infrastructures, including a hydrogen supply chain and a CCS scheme.

These recommendations were reflected in the GX2040 Vision, approved by the cabinet in February 2025, in the form of visualizing GX value and active procurement of GX products and services, and positioned as concrete policies encouraging the formation of GX markets. The vision also clearly stated that GX investment will be advanced for hard-to-abate, high-emission industries such as steel, including conversion to innovative electric arc furnaces and introduction of steelmaking processes utilizing hydrogen.

> Cabinet Secretariat: the 8th GX Implementation Council (Japanese only) (https://www.cas.go.jp/jp/seisaku/gx_jikkou_kaigi/dai8/index.html)

### 56th Meeting of the Advisory Committee for Natural Resources and Energy's Strategic Policy Subcommittee

The 56th Meeting of the Advisory Committee for Natural Resources and Energy's Strategic Policy Subcommittee was held on June 6, 2024 to embark on formulating Japan's 7th Strategic Energy Plan. At this meeting, JFE Holdings' President Kitano gave a presentation entitled Energy Policy to Help JFE Steel Achieve Decarbonization, during which he recommended policies to promote the use of green steel products and energy policies to reduce uncertainty from the business environment related to GX.

The president announced a plan to make an investment decision during FY2024, assuming government support, on the process conversion to an innovative electric arc furnace under consideration at the Kurashiki District of the West Japan Works of JFE Steel, and expressed the intention to build a mass production system for high-quality, high-function green steel products that could not be produced with conventional electric arc furnaces. He also emphasized that policies to promote the use of green steel products are indispensable for Japanese manufacturing to enhance its international competitiveness in this area, in addition to measures supporting capital investment and operating costs. Challenges include the development and reconstruction of transmission infrastructure, establishing a stable supply system for decarbonized power sources, and developing a supply infrastructure for non-fossil fuels such as hydrogen and ammonia. He called for the government to proactively deploy policies and promote decarbonization as a national GX strategy to seize this opportunity to revitalize the Japanese economy.

These recommendations, in addition to the GX2040 Vision described above, were also confirmed to have influenced policy formulation, as the 7th Strategic Energy Plan, approved by the Cabinet in February 2025 explicitly stated the necessity of securing electricity supply capacity and strengthening power grids (including intra-regional trunk systems), developing supply infrastructure for non-fossil fuels, and promoting policies for introducing decarbonization technologies.

> **Agency for Natural Resourced and Energy: 56th Meeting of the Advisory Committee for Natural Resources and Energy's Strategic Policy Subcommittee (Japanese only)**
(https://www.enecho.meti.go.jp/committee/council/basic_policy_subcommittee/2024/056/)

### Study Group on Green Steel for GX

At the 3rd meeting of the Study Group on Green Steel for GX, hosted by the Ministry of Economy, Trade and Industry in November 2024, Hiroyuki Tezuka, Fellow of JFE Steel, spoke about the necessity of green steel, the status of formulating green steel guidelines in Japan and the World Steel Association, and policy advocacy activities at COP29 and other forums. He also introduced the status of rulemaking for the dissemination of green steel and emphasized the importance of assigning environmental value to emission reductions during the carbon-neutral transition period.

As mentioned above, as a result of these proposals, the summary of the Study Group clarified the definition of "green steel" for promoting GX and confirmed the government's policy to prioritize measures such as preferential procurement and purchasing support for steel products that reflect the value of emission reductions in the steelmaking process. Specifically, beginning in FY2025, these policies will be implemented through updates to the criteria for products subject to preferential procurement under the Act on Promoting Green Procurement, as well as to the additional criteria for subsidies promoting the introduction of clean energy vehicles. These institutional reforms are driving market formation and demand expansion for green steel and represent an example of GX efforts by JFE Steel and the steel industry being reflected in national policy.

> **3rd Study Group on Green Steel for Green Transformation (November 25, 2024) (Japanese only)**
(https://www.meti.go.jp/english/press/2025/pdf/0123_001a.pdfl)

## Overview of Government Support

Efforts to achieve carbon neutrality require both the research and development of innovative technologies and large-scale capital investment, which are beyond the capacity of companies to pursue on their own. The JFE Group is actively using policy support frameworks established under Japan's GX initiatives to accelerate decarbonization.

## Adoption under the Energy and Manufacturing Process Conversion Support Program for Industries in a Hard-to-Abate Sector

Realizing a carbon-neutral society in Japan while also reviving economic growth will depend upon reliably linking research and development outcomes to domestic capital investment. In particular, the practical application of decarbonization technologies in the steel industry requires massive investment accompanied by process conversion, without prospects for increased revenue through higher production volumes. For this reason, we have repeatedly emphasized the extreme difficulty for private companies to make such investment decisions on their own.

In light of this, the government established the Energy and Manufacturing Process Conversion Support Program for Industries in Hard-to-Abate Industries to subsidize a portion of the capital investment required for fuel conversion in in-house power generation facilities and the conversion of manufacturing processes that meet requirements such as $CO_2$ reduction effects, in industries such as steel, chemicals, paper and pulp, and cement. This program uses GX transition bonds and aims to support both the practical realization of carbon neutrality and the strengthening of industrial competitiveness.

In addition, the tax credit for promoting domestic production in strategic sectors was introduced to promote domestic production in strategically important industries, including GX. The system is intended to enhance industrial competitiveness by providing tax credits to support fields such as green steel, where initial investment as well as production and sales costs are high. In regard to the innovative electric arc furnace (high-efficiency, large-scale electric arc furnace) that we have been considering for introduction at the Kurashiki District of the West Japan Works during the transition period toward carbon neutrality, our project was selected under this program on December 20, 2024, and officially approved following the subsidy grant decision on April 9, 2025. In addition to the innovative electric arc furnace, new installations will include secondary refining equipment, cold iron logistics facilities, wharf development, and power receiving and distribution facilities. The total investment will amount to 329.4 billion yen, with government support capped at 104.5 billion yen. We plan to commence production in the first quarter of FY2028 and will promptly advance construction of the innovative electric arc furnace. Furthermore, we will enhance our supply capacity for green steel and strive to achieve both emission reductions and business growth by also using the support of the tax credit for promoting domestic production in strategic sectors.

## Adoption Status for the Green Innovation Fund Projects

The JFE Group is fully leveraging the New Energy and Industrial Technology Development Organization (NEDO)'s Green Innovation Fund project, and we are conducting research and development in collaboration with other companies in the industry toward realizing carbon neutrality. JFE Steel is working on a NEDO project called Utilizing Hydrogen in Steelmaking Processes (GREINS), while JFE Engineering is focusing on carbon neutrality in the material cycles and waste management sector as well as on lowering the cost of offshore wind power generation.

### Utilizing Hydrogen in Steelmaking Processes (GREINS)

JFE Steel formed a consortium with Nippon Steel Corporation, Kobe Steel, Ltd., and the Japan Research and Development Center for Metals and jointly commissioned the Utilizing Hydrogen in Steelmaking Processes (GREINS) project to achieve progress toward carbon neutrality by 2050. The project scale is approximately 573.7 billion yen*1, and the four companies involved are receiving a total of approximately 449.9 billion yen*2 of financial support.

*1 Source: Project summary document (May 24, 2024) on NEDO's Utilizing Hydrogen in Steelmaking (GREINS) project
*2 This includes incentives subject to change depending on project progress and other factors at each stage gate.

### COURSE50

In the area of developing hydrogen reduction technologies that use in-house hydrogen, we intend to achieve a 30% reduction of $CO_2$ emissions through hydrogen reduction along with separation and capture of $CO_2$ from blast furnace gases. The first facility is expected to come online by 2030, followed by other plants by 2050. JFE Steel is in charge of examining the combustion behavior of pulverized coal and reduction furnace gas and evaluating the entire process.

- Project scale: Approx. 72.7 billion yen*1, Financial support scale: Approx. 43.6 billion yen*2 (total for the four companies)

*1 The project scale is calculated based on the level of financial support and the subsidy rate.
*2 This includes incentives subject to change depending on project progress and other factors at each stage gate.

## Carbon-Recycling Blast Furnaces

In the area of developing low-carbon technologies using $CO_2$ contained in externally sourced hydrogen or blast furnace exhaust gas by developing and combining these technologies with other low-carbon techniques, such as using biomass and direct reduced iron as raw materials, we hope to achieve a greater than 50% reduction of $CO_2$ emissions from the blast furnace steelmaking process by 2030 through the use of medium-scale test blast furnaces, which are larger than one-fifth the size of a full-scale furnace. JFE Steel is in charge of developing carbon recycling blast furnace operation technology and elemental technology as well as overall process evaluation and review, and in May 2025, a small-scale test blast furnace was fired up and began operation.

- Project scale: Approx. 285.3 billion yen*1, Financial support scale: Approx. 238.6 billion yen*2 (total for the four companies)

*1 Project scale is based on the level of financial support and subsidy rate.
*2 This includes incentives subject to change depending on project progress and other factors at each stage gate.

## Direct Reduction Compact Bench Pilot Furnace

In the area of developing direct hydrogen reduction technology, we intend to demonstrate the method using medium-scale test blast furnaces, which are larger than one-fifth the size of a full-size furnace, applying a technology for directly reducing the $CO_2$ emissions of low-grade iron ore with hydrogen by more than 50%, compared to the current blast furnace method, by 2030. JFE Steel is in charge of examining operational fluctuations and wide-ranging methanation reaction characteristics using the new bench pilot furnace, investigating reduction pulverization and gas composition that both suppresses clustering and achieves a high reduction rate, evaluating the microstructure using high-precision equipment, determining gas composition and the level of iron ore reduction and carbonization, and optimizing shape and forming. The bench test began operation in December 2024 and successfully produced direct reduced iron continuously from low-grade pellets using 100% hydrogen.

- Project scale: Approx. 136.9 billion yen*1, Financial support scale: Approx. 114.1 billion yen*2 (total amount for the four companies)

*1 Project scale based on the level of financial support and subsidy rate.
*2 This includes incentives subject to change depending on project progress and other factors at each stage gate.

## Pilot Electric Arc Furnaces

In a project for developing impurity removal technology for electric arc furnaces using direct reduced iron, demonstrations of a large scale electric arc furnace process (processing capacity of approximately 300 tonnes) will be conducted to verify its control of the concentration of impurities (components affecting the product) to the same level as standard blast furnace methods (phosphorus 150 ppm, nitrogen 40 ppm or less), toward the goal of manufacturing high-grade steel suitable for car body panels and other components with the directly reduced iron made from low-grade iron ore. JFE Steel is in charge of evaluating and examining the new heat sources and scrap iron preheating using a small-scale test electric arc furnace with a capacity of 10 tonnes and developing technologies for dephosphorization and denitrification of molten steel using an ex-core refining furnace with a capacity of 3 tonnes. The small-scale pilot electric arc furnace began operation in February 2025, and development is making progress toward the stage gate scheduled for the end of FY2025.

- Project scale: Approx. 40.4 billion yen*1, Financial support scale: Approx. 30.6 billion yen*2 (total for the four companies)

*1 Project scale is calculated based on the level of financial support and subsidy rate.
*2 This includes incentives subject to change depending on project progress and other factors at each stage gate.

> NEDO: A new research focus under the Green Innovation Project: Hydrogen Utilization in Iron and Steelmaking Processes (Japanese only) (https://www.nedo.go.jp/news/press/AA5_101738.html)

> NEDO: Hydrogen Utilization in Iron and Steelmaking Processes (https://green-innovation.nedo.go.jp/en/project/utilization-hydrogen-steelmaking/)

> Consortium of the Green Innovation Fund Project: Utilizing Hydrogen in the Steelmaking Process (https://www.greins.jp/en/)

### Carbon Neutrality in the Material Cycles and Waste Management Sector

A project titled "Achieving Carbon Neutrality in the Waste and Resource Circulation" is underway as part of the Green Innovation Fund project administered by the New Energy and Industrial Technology Development Organization (NEDO). According to NEDO, this project is intended to minimize atmospheric emissions of carbon dioxide, methane, and other gases from waste incineration and landfill disposal, and to stably and efficiently recover carbon from waste to achieve net zero GHG emissions. It also involves development and demonstration for realizing a carbon-neutral carbon circulation system that circulates and supplies biomass-derived carbon as an industrial resource, with the goal of creating a model for social implementation.

JFE Engineering, together with Sekisui Chemical Co., Ltd., proposed a project titled Waste-to-Chemical technology development for Green Ethanol production by integration of Advanced Gasification and Biochemical Conversion technologies, in response to NEDO's call for proposals under the Green Innovation Fund Project/Achieving Carbon Neutrality in Waste and Resource Circulation, and the proposal was selected.

For details on this project, please refer to:
› Development of a Waste Chemical Recycling Technology through the Use of the Green Innovation Fund (p. 130)

### Efforts to Lower the Cost of Offshore Wind Power Generation

A project on "Cost Reductions for Offshore Wind Power Generation" is underway as part of the Green Innovation Fund project administered by the New Energy and Industrial Technology Development Organization (NEDO). According to NEDO, the aim is to achieve early cost reductions, primarily in floating offshore wind power generation, and to promote wider introduction, drawing on knowledge gained from this project and previous demonstration initiatives.

Through the consortium in which it participates, JFE Engineering jointly proposed and was selected for NEDO's Green Innovation Fund Project/Cost Reductions for Offshore Wind Power Generation/Floating Offshore Wind Power Demonstration Project (Phase 2) under the theme: "Southern Akita Floating Offshore Wind Demonstration Project Aimed at Overseas Expansion via Cost Reductions."

For further details, please refer to:
› Demonstration Research on Cost Reduction for Floating Offshore Wind Power Generation (P. 79)

## Funding Methods through Green/Transition Finance

JFE Holdings has established the Green/Transition Finance Framework and issued transition bonds through a public offering in 2022, which was selected as the first model example in the iron and steel sector under METI's Transition Finance Model Projects in FY2021. Achieving carbon neutrality will require significant, long-term investments in capital and R&D. JFE Holdings will continue to leverage transition financing and diversify its funding methods.

### Formulated the Technology Roadmap for Transition Finance in the Iron and Steel Sector

The technology roadmap for Transition Finance toward decarbonization in the iron and steel sector, published by the Japanese Ministry of Economy, Trade, and Industry (METI), outlines a path for accelerating decarbonization and achieving carbon neutrality by introducing innovative technologies, with the same assumption that social infrastructure such as hydrogen supply and CCUS will be in place by the 2040s. In the process of drawing up this roadmap, JFE Steel's Fellow, Hiroyuki Tezuka, a member of the Japan Iron and Steel Federation's Energy Technology Committee, participated as a specialist in the task force formulating the roadmap. The roadmap is aligned with Japan's nationally determined contribution (NDC) based on the Paris Agreement and is therefore aligned with the agreement.

## Green/Transition Finance Framework

The JFE Group developed this framework based on the "Green Bond Principles 2021" of the International Capital Market Association (ICMA), the "Green Loan Principles 2023" of the Loan Market Association (LMA), the Asia Pacific Loan Market Association (APLMA), the Loan Syndication & Trading Association (LSTA), the "Green Bond Guidelines (2022)," the "Green Loan Guidelines (2022)" of the Ministry of the Environment, the "Climate Transition Finance Handbook 2023" of the ICMA, and the "Basic Guidelines on Climate Transition Finance (May 2021)" of the Financial Services Agency, the Ministry of Economy, Trade and Industry, and the Ministry of the Environment. Since our initiatives have been certified by a third-party organization as being aligned with METI's roadmap, this framework of the JFE Group is also aligned with the Paris Agreement.

- **METI: Technology Roadmap for Transition Finance in the Iron and Steel Sector**
  (https://www.meti.go.jp/policy/energy_environment/global_warming/transition/transition_finance_technology_roadmap_iron_and_steel_eng.pdf)
- **METI: Transition Finance Case Study** (https://www.meti.go.jp/policy/energy_environment/global_warming/transition/transition_finance_case_study_jfehd_eng.pdf)
- **Green/Transition Finance Framework (Japanese only)** (https://www.jfe-holdings.co.jp/common/pdf/release/2024/01/240119.pdf)
- **Transition Finance Report—Funds Raised, Allocated, and Their Impact (Japanese only)**
  (https://www.jfe-holdings.co.jp/common/pdf/sustainability/environment/climate/impact_report_2024.pdf)

# Participation in External Initiatives

The JFE Group is taking responsible action toward realizing a sustainable society in response to global environmental issues such as climate change. As part of this effort, we are actively participating in major domestic and international initiatives, enhancing our ability to respond to climate change through the sharing of knowledge and collaboration. The following are the main initiatives in which we participate.

## Participation in the GX League

The Ministry of Economy, Trade and Industry has established the GX League, a forum that invites companies to work on GX; take up the challenge of GX in cooperation with the government, academic, and economic sectors; discuss how to transform the overall economic and social system; and drive the creation of new markets. Understanding that the league's objectives aligned with the JFE Group's overall approach to addressing climate change, JFE Steel has been taking part in the GX League since its establishment.

In working with the GX League, JFE Steel has been actively participating in the Rule Working Group (WG), a forum for public-private rulemaking to foster new markets and pursuing the creation and expansion of the market for GX products.

### FY2023 Initiatives

JFE Steel participated in the Working Group for Adding Value to Green Products, and in December 2023, the WG published the document: How to Add Value to Green Products. The document recognizes that, in terms of corporate investment in decarbonization, it is critically important to quantify and communicate the value of emission reductions achieved through a company's own initiatives and ensure that this value is recognized in global markets. It also presents draft guidelines for enhancing the added value of green products and outlines pioneering projects, including JFE Steel's JGreeX initiative, and introduces methods for measuring and calculating green value, allocating it effectively, and utilizing it in economic activities. Furthermore, reflecting the concepts presented in the document, the Interim Summary of the Study Group on the GX Product Market Contributing to Demand Creation for Strengthening Industrial Competitiveness and Achieving Emission Reductions, published by the Ministry of Economy, Trade and Industry in March 2024, suggested "Reduced Emissions of Product" as a new GX value.

- **Final Report for the GX League (Japanese only)** (https://gx-league.go.jp/action/wg/)
- **Document on how to Add Value to Green Products (full version, in Japanese only)**
- **Document on how to Add Value to Green Products (summary version, in Japanese only)**

### FY2024 Initiatives

JFE Steel participated in the GX Product Social Implementation Promotion WG. Following work group discussions in December 2024, the Ministry of Economy, Trade and Industry recently established the GX Acceleration Declaration to support companies engaged in creating the GX market. This framework is intended to visualize companies proactively working on the social implementation of GX products and services and establish a self-declaration mechanism for appropriately evaluating these efforts. Companies make voluntary declarations on procuring GX products as well as disclosing and evaluating their content.

JFE Steel was among the first to make a declaration after the framework was established. In addition to supplying green steel, we declared the procurement of GX products on the demand side as well, thereby playing a role in stimulating demand.

- **METI: GX Acceleration Declaration Framework Newly Launched as Effort to Encourage Companies Proactively Engaging in Creation of a Market for GX** (https://www.meti.go.jp/english/press/2024/1206_001.html)
- **JFE Steel GX Acceleration Declaration (Japanese only)** (https://www.jfe-steel.co.jp/release/2024/12/241220-3.html)

## Investment in the GX Acceleration Agency

The GX Acceleration Agency is a certified corporation established in April 2024 by the Ministry of Economy, Trade and Industry, as stipulated in the Act on Promoting a Smooth Transition to a Decarbonized Growth-oriented Economic Structure. In order to achieve GX investment of over 150 trillion yen over the next 10 years, the GX Acceleration Agency will provide financial support as debt guarantees, operate a carbon emissions trading system, and collect fossil fuel surcharges. JFE Holdings invested in the GX Acceleration Agency at the time of its establishment.

- **GX Acceleration Agency** (https://www.gxa.go.jp/en/)

## TCFD Consortium

The TCFD Consortium was established in 2019 as a forum for companies and organizations that support the TCFD recommendations to discuss effective climate-related disclosures and ways for financial institutions to make appropriate investment decisions based on them.

Guidance on Climate-related Financial Disclosures 2.0 (TCFD Guidance 2.0) and TCFD Guidance 3.0 were published as outcomes of the consortium in 2020. In 2021, the consortium also published the Transition Plan Guidebook, which outlines the basic concepts and approaches to transition plans as part of the implementation of TCFD recommendations.

JFE Holdings supports the recommendations of the final TCFD report and participates in this consortium.

## United Nations Global Compact

The JFE Group has signed the United Nations Global Compact, the world's largest sustainability initiative advocated by the United Nations, and has declared its support. We are committed to complying with and implementing the Ten Principles of the Global Compact and promoting the SDGs in order to realize a sustainable society. The JFE Group is also a member of the Global Compact Network Japan, the local network of the Global Compact. Having identified "Contribute to resolving climate change issues" as a material issue, the JFE Group is working to reduce $CO_2$ emissions. We also draw on the decarbonization initiatives of other participating companies to further advance efforts to reduce $CO_2$ emissions across the JFE Group and society as a whole.

## SPEED Research Group

The SPEED (Special Project on Eco-innovation and Eco-business for Sustainable Development) Research Group contributes to the development of eco-innovations and eco-businesses through industry-academia-government collaboration and international cooperation. JFE Holdings participates in this research group and is involved in activities such as information sharing and opinion exchange with government, universities, research institutions, and companies.

## EN Japan Climate Leaders' Partnership (JCLP)

JFE Engineering is a member of the Japan Climate Leaders' Partnership (JCLP). Established in 2009, the JCLP is a coalition of Japanese corporations that encourage the industrial community to fully recognize the urgency of climate change and take more decisive action to create a sustainable, decarbonized society. Companies fulfill their corporate responsibility by demonstrating leadership in the transition to a decarbonized society. The Company is participating in the Decarbonization Consortium, JCLP's platform for encouraging information sharing and collaboration between companies and is actively engaged in creating opportunities to learn from companies at the frontline of decarbonization efforts, and collaborating with other companies to create new solutions.

# Japan's Steel Industry Initiatives

## Japan Iron and Steel Federation (JISF) Initiatives

### Long-term Vision for Climate Change Mitigation

JFE Steel is proactively engaged in a variety of activities as a member of the Japan Iron and Steel Federation (JISF). The JISF has been focusing on achieving the goals for 2020 under its Commitment to a Low Carbon Society (renamed the Carbon Neutrality Action Plan in FY2021). Furthermore, in November 2018, the JISF formulated and published its Long-term Vision for Climate Change Mitigation for 2030 and beyond, with JFE Steel playing a central role in its development. This document lays out the industry's challenge for realizing zero-carbon steel and explains the pathway for achieving the 2°C scenario for steelmaking and the necessity of ultra-innovative technologies to achieve the 1.5°C scenario. Also, on February 15, 2021, the JISF announced the "Basic Policy of the Japan steel industry on 2050 Carbon Neutrality sought by the Japanese government," declaring that the Japanese iron and steel industry will boldly accept the challenge of realizing zero-carbon steel.

› Relevance with the JISF's Long-term Vision for Climate Change Mitigation (P. 115)

### JISF's Carbon Neutrality Action Plan

In February 2021, the JISF declared that the Japanese steel industry will boldly take on the challenge of realizing carbon neutrality. The Plan on Commitment to a Low Carbon Society was amended and renamed as the Carbon Neutrality Action Plan, and the Phase II target (2030 target) was revised. In the Eco Process of the plan, an ambitious 2030 target was set taking into account new perspectives such as the expansion of scrap use as well as the maximum introduction of best available techniques (BATs) based on energy efficiency already among the highest in the world.

Regarding Eco Product, which is intended to reduce GHG emissions at the product use stage, high-performance steel is expected to play a particularly major role in the promotion of offshore wind power and electrification of automobiles, which are among the 14 fields of the government's Green Growth Strategy. Accordingly, the Japanese initiative will accelerate practical global warming measures from a global perspective by making visible the conventional quantitative evaluation of the five types of high-performance steel.

As for Eco Solutions, the JISF will develop a system for introducing appropriate technology for transferring and spreading the production process for decarbonized steel in the Asian regions, where steel production is expected to expand. Furthermore, regarding Innovative Technology Development, the JISF will take on the challenges of technologies such as direct hydrogen reduction and high-performance steel production using electric arc furnaces under the Green Innovation Fund, in addition to COURSE 50 and ferro-coke.

**Overview of the Carbon Neutrality Action Plan**

Eco Process

Cut energy-related $CO_2$ emissions (total volume) in FY2030 by 30% compared to the FY2013 level by adopting BATs to promote energy conservation, using waste plastics, adopting innovative technologies that are currently under development and scheduled to be in use around 2030, and using raw fuel with less $CO_2$ emissions.

Eco Product

Contribute to $CO_2$ emissions reduction by domestically and internationally supplying high-performance steel. This steel will reduce $CO_2$ emissions when used in the final product. The reduction potential in 2030 is estimated to be approximately 42 million t-$CO_2$ for the five steel products that have been quantitatively evaluated for their contribution to reducing emissions.

Eco Solution

Contribute to reducing $CO_2$ emissions worldwide by transferring and spreading the Japanese steel industry's advanced energy-saving technologies and facilities to the world's steel industry. Estimated contribution on $CO_2$ emissions reduction is 80 million t-$CO_2$ in 2030.

Innovative Technology Development

Contribute to carbon neutrality by boldly developing technologies in the following four areas.

- Hydrogen reduction technology using in-house hydrogen
- Low-carbon technology using $CO_2$ contained in externally sourced hydrogen or blast furnace exhaust gas
- Direct hydrogen reduction technology
- Impurity removal technology for electric furnace using direct reduced iron

## Assessment of the FY2023 Carbon Neutrality Action Plan (Phase II) Results (JISF)

Total volume of energy-related $CO_2$ emissions in FY2023 was 148.35 million tonnes, a decrease of 46.08 million tonnes, or 23.7%, compared to FY2013. The achievement rate of the FY2030 target (to reduce by 30% from FY2013) has reached 79.0%. Energy-related $CO_2$ emissions and energy consumption are both declining, given continued energy saving efforts.

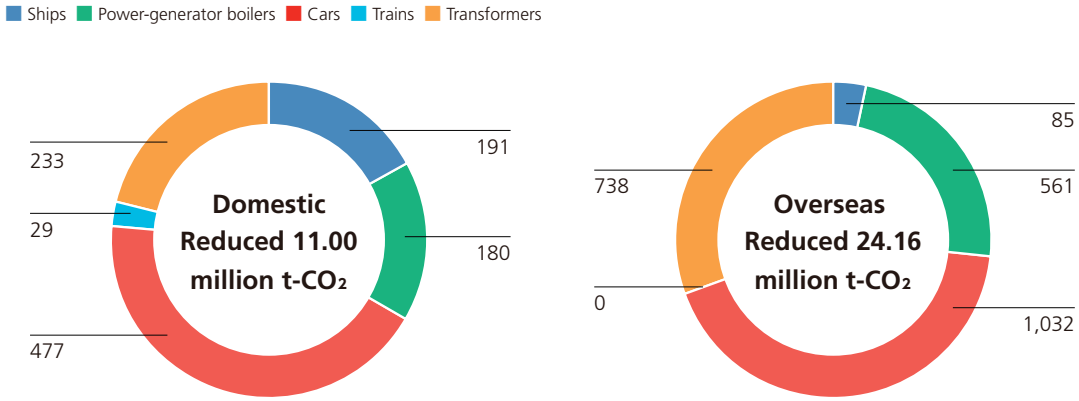
While the energy efficiency of the Japanese steel industry is among the highest in the world, vigorous efforts are made to promote greater energy savings by having businesses engaged in this effort draw upon subsidies to promote investment in saving energy and other actions.

## Reduced $CO_2$ Emissions through High-Performance Steel Materials (Effects of Eco-Products)

The Japan Iron and Steel Federation (JISF) estimates the $CO_2$ emissions reduction impact of using high-performance steel materials. It is estimated that the use of five major high-performance steel materials in cars, transformers, ships, power generation boilers, and trains in Japan and overseas* (FY2023 production: 3.85 million tonnes, 4.7% of crude steel production) helped reduce $CO_2$ emissions by 35.16 million tonnes (11.00 million tonnes in Japan, 24.16 million tonnes overseas) in FY2023.

*Calculations made by the Institute of Energy Economics, Japan. The five materials are steel sheets for automobiles, grain-oriented electrical steel sheets, thick steel sheets for shipbuilding, steel tubes for boilers, and stainless steel sheets. FY1990 is the reference point for domestic reduction figures, with FY2003 as the reference point for the overseas reduction figures for automobiles and ships, FY1998 for steel pipes for boilers, and FY1996 for electrical steel sheets.

**$CO_2$ Reduction Resulting from the Use of Five High-Performance Steel Materials in Japan and Overseas (FY2023)**




## Related Links

- The Japan Iron and Steel Federation (JISF): Climate Change Policy page (https://www.jisf.or.jp/en/activity/climate/index.html)
- The Japan Iron and Steel Federation (JISF): LCA of Steel Products page (https://www.jisf.or.jp/en/activity/lca/index.html)
- The Japan Iron and Steel Federation (JISF): Publication of ISO 20915 (https://www.jisf.or.jp/en/activity/lca/iso/index.html)
- The Japan Iron and Steel Federation (JISF): Publication of JIS Q 20915 (https://www.jisf.or.jp/en/activity/lca/iso/index.html)
- The Japan EPD Program by SuMPO (https://ecoleaf-label.jp/en/)

# Industry-Academia Collaboration Initiatives

The JFE Group is actively engaged in joint research and collaboration with universities to strengthen scientific and practical responses to climate change. We are incorporating the latest knowledge and technologies through partnerships with academic institutions and advancing efforts toward realizing a sustainable society. Below are some of the main initiatives we are pursuing in collaboration with universities.

## The University of Tokyo and 16 Organizations Announce Launch of Joint Research Initiative to Achieve a Carbon-Neutral Society Establishment of the Social Collaboration Program "Materials for Future Energy Infrastructure Trust (MEIT)"

JFE Steel, JFE Engineering, and 16 organizations including the University of Tokyo, IHI Plant Services Corporation, INPEX CORPORATION, ENEOS Xplora Inc, Kanadevia Corporation, Kawasaki Heavy Industries, Ltd., Kobe Steel, Ltd., JERA Co., Inc., TOKYO GAS NETWORK Co., Ltd., Namura Shipbuilding Co., Ltd., NIPPON STEEL ENGINEERING CO., LTD., NIPPON STEEL PIPELINE & ENGINEERING CO., LTD., NIPPON STEEL CORPORATION, Nippon Kaiji Kyokai (ClassNK), and Mitsubishi Heavy Industries, Ltd. have jointly established the Social Collaboration Program*, Materials for Future Energy Infrastructure Trust (MEIT), to scientifically elucidate and standardize the material reliability of energy infrastructure that supports a carbon-neutral society. The joint research will commence on May 1, 2025. JFE Steel, Kobe Steel, Ltd., NIPPON STEEL CORPORATION, and Nippon Kaiji Kyokai serve as the managing institutions for this program.

The purpose of the program is to evaluate the reliability of materials used in energy infrastructure and storage systems for decarbonized energy carriers such as liquefied hydrogen and ammonia, as well as in liquefied and high-pressure $CO_2$ in carbon capture and storage (CCS) projects. Through these efforts, the initiative seeks to accelerate the development of energy infrastructure for a carbon-neutral society, meet domestic demand, and strengthen international competitiveness.

*A collaborative research framework between the University of Tokyo and 16 organizations, operated with joint research expenses borne by the companies under contractual agreements with the university. This program facilitates interdisciplinary collaboration among researchers and the formation of research teams to address comprehensive societal challenges, thereby overcoming the limitations of conventional one-on-one collaborations between researchers and companies.

### Overview of the Social Collaboration Course

As society transitions to carbon neutrality, energy infrastructure is shifting significantly from fossil fuels to new systems based on hydrogen and ammonia. This includes liquefied hydrogen tanks, ammonia tanks, $CO_2$ tanks, and high-pressure $CO_2$ pipelines, all of which require material reliability evaluations to ensure long-term safety and economic viability. The program will establish material selection criteria, post-weld heat treatment omission standards, and fracture prevention criteria to optimize infrastructure construction costs and promote international standardization that contributes to a sustainable energy society.

MEIT Material Research Base for Future Energy Infrastructure Trust

Program Name: Social Collaboration Program "Materials for Future Energy Infrastructure Trust (MEIT)"
Period: May 1, 2025–April 30, 2030
Joint Research Topics:

- Development of fracture evaluation technologies and standards for large-scale liquid ammonia tanks (stress corrosion cracking prevention and omission of post-weld heat treatment).
- Development of fracture evaluation technologies and standards for large-scale liquid $CO_2$ tanks (omission of post-weld heat treatment).
- Establishment of rapid ductile fracture prevention standards for high-pressure $CO_2$ pipelines in CCS projects.
- Enhancement of reliability and evaluation technologies for next-generation materials (cost-effective stainless steel and low-nickel steel) for large-scale liquid hydrogen tanks.

Collaborating Faculty: School of Engineering, University of Tokyo

› **The University of Tokyo and 16 Organizations Announce Launch of Joint Research Initiative to Achieve a Carbon-Neutral Society Establishment of the Social Collaboration Program "Materials for Future Energy Infrastructure Trust (MEIT)"** (https://www.jfe-steel.co.jp/en/release/2025/05/250519.html)

## ST JFE Steel and Tohoku University's Collaborative Research Laboratory for Green Steel

In February 2022, JFE Steel and Tohoku University jointly established the Collaborative Research Laboratory for Green Steel within the university's Graduate School of Engineering to research eco-friendly steel materials and production methods for the carbon-neutral era. The Collaborative Research Laboratory is managed under a cross-divisional system and develops collaborations across a wide range of fields, including the development of steelmaking processes and materials. This will facilitate a multifaceted approach to resolving issues related to low-carbon steelmaking processes and to discover innovative development themes from new perspectives. Furthermore, we will dispatch young researchers to nurture highly specialized human resources who will lead the next generation of the steelmaking industry.

Collaborative Research Wing, Materials Development, Graduate School of Engineering, Tohoku University

› **JFE Steel and Tohoku Univ. Establish Collaborative Research Lab for Green Steel** (https://www.jfe-steel.co.jp/en/release/2022/220203.html)

## EN JFE Engineering Carbon Neutrality Collaborative Research Center Established at the Institute of Science Tokyo

JFE Engineering and the Institute of Science Tokyo*1 opened the JFE Engineering Carbon Neutrality Collaborative Research Center (CRC) at the Institute's Laboratory for Zero-Carbon Energy under the former Tokyo Institute of Technology (currently the Institute of Science Tokyo) on July 1, 2022. The purpose of the CRC is to promote new technologies for realizing a carbon-neutral society. The two parties are comprehensively and jointly working on technical developments in carbon neutrality, transcending the boundaries of a typical individual joint research framework in a multilayered approach to generate innovation across the wide range of fields required for realizing a carbon-neutral society.

The CRC will promote the development of new technologies to help realize a carbon-neutral society by combining JFE Engineering's engineering technologies related to plant and infrastructure construction in the fields of energy and the environment with the Institute of Science, Tokyo's advanced academic knowledge across a wide range of areas. The CRC will also continue collaborating with a variety of organizations through the Tokyo Tech GXI*2, an industry-academia partnership project run by the Institute of Science Tokyo.

*1 Tokyo Institute of Technology and Tokyo Medical and Dental University were integrated in October 2024.
*2 Intended to promote research activities that will initiate a Green Transformation (GX) society, strengthen startups, and substantiate industry-society collaboration.


Laboratory for Zero-Carbon Energy, Institute of Integrated Research (Ookayama North No. 1 Campus)

› **JFE Engineering and Tokyo Institute of Technology establish JFE Engineering Carbon Neutrality Collaborative Research Center (Japanese only)** (https://www.jfe-eng.co.jp/news/2022/20220629.html)

# Global Scale Initiatives

## Global Actions to Address Global Warming

ISO 14404 is an international standard proposed by the Japan Iron and Steel Federation (JISF) to the International Organization for Standardization (ISO) as a methodology for the globally unified calculation of $CO_2$ intensity from iron and steel production, to ultimately assess the energy efficiency of steelworks. The Japanese steel industry is addressing global warming through international public-private collaborations, including ISO 14404-based assessment of steelworks in developing countries and recommending specific technologies best suited to India and ASEAN countries. It is continuing this effort together with the Ministry of Economy, Trade and Industry (METI) in order to enhance ISO 14404 so it can be applied to steel manufacturing facilities with more complex structures.

JFE Steel is also addressing global warming by participating in international activities, such as the Japan-India Public and Private Collaborative Meeting, the Japan-ASEAN Steel Initiative, and the Japan-China Steel Industries Exchange. In addition, JFE Steel is a member of the World Steel Association's Climate Action Data Collection Programme, which uses ISO 14404 as the standard for measurement and calculation.

> WSA: Climate Action Data Collection Programme (https://worldsteel.org/climate-action/climate-action-data-collection/)

**WSA Climate Action Data Collection Programme certification**

## Efforts to Assess the Environmental Impact of the Excellent Recyclability of Steel Products

Accurately evaluating the environmental impact of products requires assessment and quantification of impact over their entire life cycles, from raw resource mining to material production, product manufacture, use, and final disposal. Life cycle assessment (LCA) is one evaluation method.

After final products such as automobiles and buildings finish their mission in society, all of their steel components can be recycled and reused. Closed-loop recycling is an excellent characteristic of steel materials. From the perspective of LCA, steel can be viewed as having an extremely low environmental impact compared to other materials.

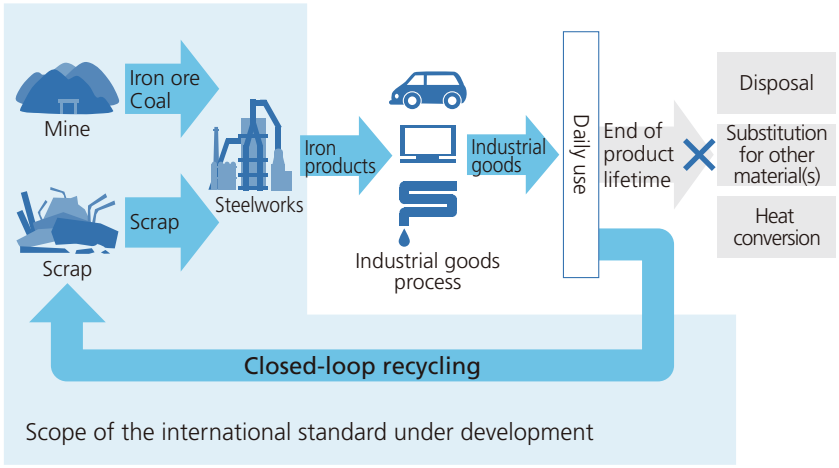
JFE Steel played a major role in the development of ISO 20915 (Life Cycle Inventory Calculation Methodology for Steel Products) and JIS Q 20915 (Life Cycle Inventory Calculation Methodology for Steel Products), initiatives led by the Japan Iron and Steel Federation (JISF), which takes into account the impact of recycling and provides life cycle inventory (LCI) calculation methods specific to steel products.

In addition, 15 Japanese manufacturers of blast furnaces and electric arc furnaces joined forces to calculate the Japanese average for LCI of different steel products. Calculations based on their FY2018 operational data were also published.

JFE Steel acquired SuMPO EPD certification for 36 product types under the SuMPO Environmental Label Program under the Sustainable Management Promotion Organization (SuMPO). These cover three types of tinplate steel sheets for cans, nine flat steel products, nine construction steel products, three types of steel plates (steel plates for marine structures and wind power, shipbuilding steel plates, and UOE pipes), four steel pipe products, and eight bar and wire rod products. We will continue to make use of SuMPO EPD labels to help customers protect the environment and strengthen communications with them.

› Value of Steel (P. 4)

**Life Cycle of Steel Materials**




## Japan-Korea Green Steel Joint SeminarProducts

The 2nd Japan-Korea Green Steel Joint Seminar was held in Tokyo on October 23, 2024, jointly organized by the Japan Iron and Steel Federation and the Korea Iron and Steel Association. The seminar was attended by representatives from both countries, including Masaaki Izumiyama, Chairman of the International Environmental Strategic Committee, the Japan Iron and Steel Federation (Nippon Steel Corporation), and Kwang-young Lee, Executive Managing Director of the Korea Iron and Steel Association, as well as guests of honor, including Manabu Nabeshima, Director of the Metals Division of the Ministry of Economy, Trade and Industry of Japan, and Seungjin Ko, Senior Deputy Director/Team Leader of the Steel Division, Metals and Ceramics Policy Division, Ministry of Trade, Industry and Energy of the Republic of Korea. A total of 53 participants, mainly from government organizations, steel companies, and academia in both Japan and South Korea, exchanged opinions on wide-ranging topics related to carbon neutrality in the steel industry.

## Public and Private Collaborative Meeting between Indian and Japanese Iron and Steel Industry

The Japan Iron and Steel Federation has held the Public and Private Collaborative Meeting between Indian and Japanese Iron and Steel Industry annually since 2011 with support from the Ministry of Economy, Trade and Industry, and JFE Steel attends this meeting every year. The purpose of this meeting is to apply the technology and experience of Japan's steel industry, which boasts the world's highest energy efficiency, to recommend policies on energy conservation and environmental protection to the Indian steel industry and promote the transfer of energy-saving and environmental protection technologies from Japan.

The FY2024 meeting was held in New Delhi, India, on January 21, 2025, with support from the Economic Research Institute for ASEAN and East Asia (ERIA). The meeting was moderated by Hiroyuki Tezuka, Secretary of the International Environmental Strategy Committee of the Japan Iron and Steel Federation and Fellow of JFE Steel. Participants included Shumpei Takagi, Deputy Director of the Metals Division of the Ministry of Economy, Trade and Industry of Japan; Vinod Kumar Tripathi, Additional Secretary of the Ministry of Steel of India; and Nuki Agya Utama, Director of Energy Policy and Head of the Asia Zero Emission Center at ERIA. About 40 participants, mainly from government organizations and steel companies in both Japan and India, engaged in lively discussions on topics related to carbon neutrality in the steel industry of both countries. JFE Steel will continue to play a major role in this meeting and contribute to $CO_2$ reduction in India by transferring Japanese energy-saving technologies.

## ASEAN-Japan Steel Initiative

In May 2014, the Japan Iron and Steel Federation and the ASEAN Iron and Steel Council (AISC) signed a memorandum of understanding to promote regional collaboration the areas of the environment, standardization, and trade. The ASEAN-Japan Steel Initiative (AJSI) was launched as a public-private environmental effort to strengthen cooperation in environmental and energy saving efforts in ASEAN countries. As part of its activities, the initiative developed a Technologies Customized List (electric arc furnaces) as well as a Technologies Customized List (blast furnaces), which include energy-saving, environmental protection, and recycling technologies for electric arc furnaces and blast furnaces suitable for the ASEAN steel industry.

On November 20, 2024, the AJSI Seminar was held in person for the first time in about four and a half years, as an AJSI activity. The event was co-hosted with the Economic Research Institute for ASEAN and East Asia (ERIA) and held as part of the Southeast Asia Iron and Steel Institute (SEAISI) event "2024 ASEAN Iron and Steel Forum: Sustainable Steel and Green Construction" in Bangkok, Thailand, from November 18 to 21. Participants included Koji Takahashi, Director of the Metals Division of the Manufacturing Industries Bureau, Ministry of Economy, Trade and Industry of Japan, Naoto Okura, Director of Research and Policy Design at ERIA, and Wee-Jin Yeoh, Secretary General of SEAISI.

At the seminar, representatives from Japan and ASEAN countries introduced initiatives and prospects for policies and technologies for carbon neutrality as well as challenges and initiatives faced by steel manufacturers.

## Japan-China Steel Industry Environmental Protection and Energy Conservation Technology Conference

This conference has been held since 2005, based on the memorandum of understanding that was signed at the Japan-China Steel Industry Environmental Protection and Energy Conservation Technology Conference, held in Beijing in July 2005 with the participation of top executives from both countries' steel industries. The purpose of the conference is to raise the level of environmental conservation and energy saving in both countries through information exchanges between technical experts from steel manufacturers in Japan and China. The importance of this conference has been growing as it helps to promote not only sound development of the steel industry in both countries but also the effective use of resources and environmental conservation.

The FY2024 event was held in Wuhan, China, in March 2025, with roughly 80 participants from both countries' steel industries. Representatives from both sides presented the status of actions toward carbon neutrality, energy conservation, $CO_2$ reduction, and environmental protection, and actively exchanged information and opinions on topics of shared interest in both countries' steel industries, such as green steel. JFE Steel will continue to participate in this conference to contribute to global carbon neutrality, energy saving, environmental action, and the sustainable development of the steel industry.

## Lecture Events (Japan)

The JFE Group delivers lectures at various events to increase awareness of our efforts to combat climate change.

- Lecture: "JFE Group Environmental Vision for 2050 — Toward the Realization of Carbon Neutrality" at the Japan Auto Parts Industries Association
  Date: July 9, 2025
  Lecturer: Hiroyuki Tezuka (Fellow, JFE Steel Corporation)

- Lecture: "JFE Steel's Initiatives for Achieving Carbon Neutrality and the Challenges" at the 8th Japan-France Green Finance Forum
  Date: April 17, 2025
  Lecturer: Hiroyuki Tezuka (Fellow, JFE Steel Corporation)

- Lecture: "JFE Steel's Initiatives for Achieving Carbon Neutrality and the Challenges" at the JPI (Japan Planning Institute) Seminar
  Date: April 8, 2025
  Lecturer: Hiroyuki Tezuka (Fellow, JFE Steel Corporation)

- Lecture: "Latest Technology in Energy and Environment in the Steel Industry and Measures against Global Warming" in the Institute of Science Tokyo's Advanced Course in Science and Technology in Energy and Environment
  Date: December 18, 2024
  Lecturer: Ikufumi Sumi (Leader, Global Environment Team, Green Transformation Strategy, JFE Steel Corporation)

- Lecture: "The Path to Decarbonization of Steel — Green Steel Contributing to the Green Transition" at the Kyoto University Graduate School of Management Energy Industry Seminar
  Date: November 27, 2024
  Lecturer: Ikufumi Sumi (Leader, Global Environment Team, Green Transformation Strategy, JFE Steel Corporation)

- Lecture: "Carbon Neutrality Initiatives" at the Bingo Urban Roundtable Lecture Meeting
  Date: October 31, 2024
  Lecturer: Hiroyuki Tezuka (Fellow, JFE Steel Corporation)

- Lecture: "JFE Steel's Initiatives for Achieving Carbon Neutrality and the Challenges" at the APAC Financial Institutions Summit 2024 - Banking
  Date: October 2, 2024
  Lecturer: Hiroyuki Tezuka (Fellow, JFE Steel Corporation)

- Lecture: Green Steel Guidelines, published under "Steel Industry Green Steel Initiatives" on the Japan Iron and Steel Federation's website
  Date of publication: April 2025 URL: https://www.jisf.or.jp/business/ondanka/kouken/greensteel/documents/JISFGSguidelinev3.1final.pdf

## Lectures Held Overseas

The JFE Group provides lectures at various events to raise awareness overseas of our efforts to address climate change.

- Lecture: "Fuel, Power, and Steam Supply-Demand Guidance System at Steelworks" at the 15th Japan-China Steel Advanced Technology Exchange Meeting for Environmental Protection and Energy-saving Meeting
  Date: March 13, 2025

- Lecturer: Katsunari Suzuki (Cyber-Physical System R&D Department, Steel Research Laboratory, JFE Steel Corporation)
  Lecture: "Efforts to Promote Green Steel — JISF Green Steel Guidelines, worldsteel Chain of Custody Guidelines" at the Japan-India Public and Private Collaborative Meeting
  Date: January 21, 2025
  Lecturer: Yoshitsugu Suzuki (Global Environment Team, Green Transformation Strategy, JFE Steel Corporation)

- Lecture: "Global Steel Decarbonization Initiatives — Necessity of Green Steel and Methodology of GHG Emission Assessment" at the ASEAN Japan Steel Initiative (AJSI) Seminar
  Date: November 20, 2024
  Lecturer: Yoshitsugu Suzuki (Global Environment Team, Green Transformation Strategy, JFE Steel Corporation)

- Lecture: "The Path to Decarbonization of Steel — Green Steel Contributing to the Green Transition" at the COP29 Japan Pavilion, Side Event Hosted by the Japan Iron and Steel Federation Conference: COP29
  Date of presentation: November 19, 2024
  Lecturer: Hiroyuki Tezuka (Fellow, JFE Steel Corporation)
  URL: https://www.jisf.or.jp/news/topics/20241018.html

## Evaluation of Alignment with Major Organizations

The JFE Group participates in various industry and economic organizations with the aims of realizing a sustainable society and enhancing corporate value. Through these affiliations, we pursue policy recommendations, share information, and address industry-wide challenges while fulfilling the social responsibilities associated with the business activities of our operating companies. The evaluation of alignment between the policies of major organizations in which the JFE Group participates and JFE's stance is presented below along with the results.

### Summary of Evaluation Results

We evaluated the consistency of the main recommendations and activities published by each organization with our aforementioned views and stance. As a result, we confirmed that the policies, stances, and policy recommendations clarified by each organization are aligned with our own views and stance. Going forward, we will continue to encourage constructive dialogue and exchanges of opinions with these organizations to ensure that our views and stance are reflected in the activities conducted by the organizations we belong to as members.

| Organization / Policy | GX Policies | Energy Policy | Carbon Pricing | Creation of GX Product Markets |
|---|---|---|---|---|
| The Japan Iron and Steel Federation | Aligned | Aligned | Aligned | Aligned |
| World Steel Association | Aligned | Aligned | Position yet to be expressed | Aligned |
| Keidanren (Japan Business Federation) | Aligned | Aligned | Aligned | Aligned |

## The Japan Iron and Steel Federation

Purpose: To promote the sound production, distribution, consumption, and trade of steel, thereby contributing to the development of the Japanese economy and the improvement of people's livelihoods.

Participation of JFE Group Officers: Vice Chairman, Masayuki Hirose, Representative Director, President and CEO of JFE Steel Corporation

| Item | Result | Basis / Reference URL, etc. |
|---|---|---|
| GX Policies | Aligned | In 2021, the Federation announced the Basic Policy of the Japan steel industry on 2050 Carbon Neutrality, in which it declared its agreement with the ambitious national policy of achieving carbon neutrality in 2050 and its own bold commitment to take on the challenge of realizing carbon neutrality in the steel industry. It has also requested the establishment of a national strategy for decarbonization, financial support to commercialize and implement the results of technology development, fostering public understanding that achieving decarbonization will involve significant costs, and building mechanisms for sharing such costs across society.<br>› **Basic Policy of the Japan steel industry on 2050 Carbon Neutrality aimed by the Japanese government (Feb. 2021)** (https://www.jisf.or.jp/en/activity/climate/documents/CN2050_eng_201210215.pdf) |
| Energy Policy | Aligned | In its comments on the draft 7th Strategic Energy Plan, the federation recognized it as a realistic plan that squarely addresses changes in the energy situation while maintaining the S+3E perspective, and that reemphasizes the importance of stable supply and economic efficiency. It also valued the fact that resource-poor Japan will have a number of options, including renewable energy, nuclear power, and decarbonized thermal power, moving away from the conventional binary view of renewables versus nuclear. It has also stated that the integration of energy policy and industrial policy is an extremely important perspective in advancing GX, and that specific policies are needed to promote decarbonization on the premise of strengthening industrial competitiveness and ensuring inexpensive and stable energy supply.<br>› **Comments on the Draft 7th Strategic Energy Plan (Japanese only)** (https://www.jisf.or.jp/news/topics/documents/7jienekian-ikenr.pdf) |
| Carbon Pricing | Aligned | In its comments on the draft GX2040 Vision, the Federation valued the Growth-oriented Carbon Pricing Concept for clearly indicating the timing of introduction and the basic framework of emission trading schemes and other systems. It stated that designing the GX-ETS system requires appropriately reflecting differences in timelines and marginal abatement costs for decarbonization by sector and designing a system that supports GX promotion in the Japanese steel industry while sustaining domestic production capacity and maintaining and strengthening international competitiveness. In addition to introducing carbon pricing, the federation has also underlined the urgency of creating a GX product market to ensure investment predictability for GX.<br>› **Comments on the Draft GX2040 Vision (Japanese only)** (https://www.jisf.or.jp/news/topics/documents/GX2040visionan-ikenr2.pdf)<br>› **Explanation Materials by The Japan Iron and Steel Federation — Working Group on Carbon Pricing toward GX (1st Meeting) (Japanese only)** (https://www.cas.go.jp/jp/seisaku/gx_jikkou_kaigi/carbon_pricing_wg/dai1/siryou4.pdf) |
| Creation of GX Product Markets | Aligned | The federation considers the creation of a GX market essential for increasing the predictability of decarbonization investments. In its comments on the draft GX2040 Vision, it valued the extensive descriptions regarding GX market creation, particularly the immediate implementation of initiatives such as visualization of GX value, public procurement, and private procurement. It has also expressed that the government's proactive initiatives, including the creation of initial demand, are extremely important for GX market creation, that clear policy directions for steadily expanding market size are required, and that more concrete measures such as regulatory and institutional measures for procurement are necessary to enhance investment predictability and that the government should present a more specific roadmap.<br>› **Comments on the Draft GX2040 Vision (Japanese only)** (https://www.jisf.or.jp/news/topics/documents/GX2040visionan-ikenr2.pdf) |

## World Steel Association

Purpose: To promote sustainability, safety, technological innovation, and human resource development in the steel industry and contribute to the overall development of the industry through international collaboration and the provision of information.

Participation of JFE Group Officers: Member of the Executive Committee — Masayuki Hirose, Representative Director, President and CEO of JFE Steel Corporation

| Item | Result | Basis / Reference URL, etc. |
|---|---|---|
| GX Policies | Aligned | In its policy paper "Climate change and production of iron and steel," worldsteel expressed its full support for the goals of the Paris Agreement and declared that it would realize industrial and social transformation by reducing $CO_2$ emissions from steel production.<br>› **Climate change and production of iron and steel (Sept. 2024)**<br>(https://worldsteel.org/wp-content/uploads/Climate_PP_September-2024-1.pdf) |
| Energy Policy | Aligned | The same policy paper recommended the utilization of low-carbon energy, such as renewable energy, nuclear power, and fossil fuels with mitigation technologies such as CCS as a technological option for the steel industry's climate change measures.<br>› **Climate change and production of iron and steel (Sep. 2024)**<br>(https://worldsteel.org/wp-content/uploads/Climate_PP_September-2024-1.pdf) |
| Carbon Pricing | Position yet to be expressed | |
| Creation of GX Product Markets | Aligned | The policy paper also noted that steel products using low-carbon technologies will be more expensive than conventional products and therefore require policy support to compete in the market. It also pointed to rising demand from customer companies for low-carbon steel products. To meet this demand, worldsteel proposed a method for allocating GHG emission reduction value to specific products (chain of custody, or CoC) and published principles and guidelines to enhance transparency and clarity regarding the application of this method.<br>› **Principles "Chain of custody approaches in the steel sector"**<br>(https://worldsteel.org/wp-content/uploads/worldsteel-chain-of-custody-principles.pdf)<br>› **worldsteel guidelines for GHG chain of custody approaches in the steel industry**<br>(https://worldsteel.org/wp-content/uploads/worldsteel-chain-of-custody-guidelines-1.pdf) |

## Keidanren (Japan Business Federation)

Purpose: To draw out the vitality of companies, individuals supporting companies, and local communities as a comprehensive economic organization, thereby contributing to the autonomous development of the Japanese economy and the improvement of people's livelihoods.

Participation of JFE Group Officers: Chairman of the Tax System Committee — Yoshihisa Kitano, Representative Director, President and CEO of JFE Holdings, Inc.

| Item | Result | Basis / Reference URL, etc. |
|---|---|---|
| GX Policies | Aligned | In its 2022 publication "Toward Green Transformation (GX)," Keidanren expressed the view that to realize carbon neutrality by 2050, Japan as a whole must create a "virtuous cycle of the economy and environment" and promote Green Transformation (GX), representing the transformation of the entire economic and social system. It also recommended that the government formulate a GX Policy Package as a grand design for GX.<br>**› Toward Green Transformation (GX) (May 2022)**<br>(https://www.keidanren.or.jp/en/policy/2022/043_point.pdf) |
| Energy Policy | Aligned | In its 2024 proposal "Recommendations for Revising the Strategic Energy Plan," Keidanren stated that ensuring safety is the fundamental premise, and that the principles of (a) energy security and stable supply, (b) economic efficiency, and (c) environmental compatibility (S+3E) must be upheld. It emphasized the need to pursue an optimal mix of diverse energy sources suited to Japan's characteristics, to further expand the introduction of renewable energy that meets the three requirements of low cost, stable supply, and business discipline, and to maximize the use of nuclear and atomic energy.<br>**› Recommendations for Revising the Strategic Energy Plan (Oct. 2024) (Japanese only)**<br>(https://www.keidanren.or.jp/policy/2024/071_honbun.pdf) |
| Carbon Pricing | Aligned | In its comments on the public consultation for the "Basic Policy for the Realization of GX," Keidanren evaluated the government's growth-oriented carbon pricing concept as a key step for achieving more than 150 trillion yen in public and private GX investment while reducing and curbing emissions. It also requested that, while fully considering technological developments and the opinions of the business community, specific system design should proceed in a way that contributes to maintaining and strengthening industrial competitiveness.<br>**› Comments on the Public Consultation for the Basic Policy for the Realization of GX (Jan. 2023) (Japanese only)** (https://www.keidanren.or.jp/policy/2023/004.html) |
| Creation of GX Product Markets | Aligned | In its comments on the public consultation for the GX2040 Vision (Draft), Keidanren stated that creating a GX market is indispensable for enhancing the predictability of GX investment. It proposed that, in addition to measures such as visualization of GX value and demand-stimulating initiatives, a specific roadmap should be formulated that specifies the timing of introducing various regulatory and institutional measures. It also emphasized that the cost increases associated with the production of GX products should be reliably reflected in product prices, and that consumers who purchase such products should accept these cost increases so that they can be fairly and equitably distributed across society as a whole.<br>**› Comments on the Public Consultation for the GX2040 Vision (Draft) (Jan. 2025) (Japanese only)**<br>(https://www.keidanren.or.jp/policy/2025/010.html) |

# Scenario Analysis in Line with the TCFD Recommendations

## Initiatives

The JFE Group intends to achieve carbon neutrality by 2050, and it leverages the scenario analysis in line with the TCFD recommendations to identify and assess climate change-related risks and opportunities and to strengthen the resilience of its organizational strategy. Please refer to the Initiatives to Address Climate Change Issues page for governance, strategy, risk management, metrics, and targets for climate change-related issues in line with the TCFD recommendations.

› Initiatives to Address Climate Change Issues (P. 53)

### Timeline of Milestones Related to Climate Change Developments and JFE's Key Initiatives

| | |
|---|---|
| 1997 | Kyoto Protocol adopted at COP3 in Kyoto |
| 2008 | JISF's Voluntary Action Plan launched |
| 2013 | JISF's Commitment to a Low Carbon Society launched |
| 2015 | Paris Agreement adopted at COP21 |
| 2017 | TCFD published the final report of its recommendations |
| 2018 | JISF announced the Long-term Vision for Climate Change Mitigation, Zero Carbon Steel |
| 2019 | JFE Group announced its endorsement for the final report of the TCFD recommendations |
| | JFE Group published a scenario analysis in line with the TCFD recommendations |
| 2020 | Keidanren launched the Challenge Zero initiative |
| | Ministry of Economy, Trade and Industry published a list entitled Companies Taking on the Zero-Emission Challenge |
| | JFE Group published its targets in its medium- to long-term vision (target for 2030 and achieving carbon neutrality by 2050) |
| | Prime Minister Suga declared Japan will achieve carbon neutrality by 2050 |
| 2021 | JISF announced the Basic Policy of the Japan Steel Industry on 2050 Carbon Neutrality Aimed by the Japanese Government |
| | JFE Group published its roadmap for achieving carbon neutrality in 2050 in the JFE Group Environmental Vision for 2050 |
| | Japanese government formulated the Green Growth Strategy Through Achieving Carbon Neutrality in 2050 |
| 2022 | JFE Group announced that the $CO_2$ emissions reduction target for FY2030 for JFE Steel has been revised upward to 30% or more compared to FY2013 |
| | JISF published the "Evaluation of the Phase I Target (FY2020 Target)" and Phase II (FY2030 target) of reducing the total volume of energy-related $CO_2$ emissions by 30% in its "Activities to Combat Global Warming—Report of JISF's Carbon Neutrality Action Plan (Commitment to a Low Carbon Society) (March 2022)" |
| 2023 | The Act Concerning the Promotion of a Smooth Transition to a Decarbonized Economic Structure (GX Promotion Act) was enacted |
| 2025 | Japanese government published GX2040 Vision |
| | JFE Group announced its long-term vision JFE Vision 2035 and the Eighth Medium-term Business Plan (FY2025–FY2027) |

The Challenge Zero (Innovation Challenges Toward a Net Zero Carbon Society) is a new joint initiative by Keidanren (Japan Business Federation) and the Japanese government for proactively publicizing and supporting companies and organizations that pursue innovative actions toward realizing a decarbonized society as the long-term goal of the Paris Agreement. The JFE Group endorses the Challenge Zero declaration and will rise to the challenge of pursuing innovation.

The Ministry of Economy, Trade and Industry (METI), in collaboration with Keidanren and the New Energy and Industrial Technology Development Organization (NEDO), has been tackling a project called the Zero-Emission Challenge. The project is preparing a list of companies generating innovation toward realizing a decarbonized society and providing investors and other stakeholders with useful information on them. The JFE Group was designated as one of approximately 600 listed and unlisted companies in the Zero-Emission Challenge, announced at the TCFD Summit 2021 as part of Japan's efforts toward achieving a decarbonized society.

The JFE Group publishes information on specific initiatives through the following website.

> **Challenge Zero** (https://www.challenge-zero.jp/en/member/34)

> **Zero-Emission Challenge** (https://www.meti.go.jp/english/press/2021/1005_002.html)

# Scenario Analysis

## Tools and Methods

Scenario analysis is used to portray an accurate understanding of climate-related risks and opportunities and assess implications to the current business strategy, thereby enabling an organization to establish strategies that reflect the results of the assessment. As our business could be significantly affected by climate change, we have created both a 1.5°C scenario and a 4°C scenario. In setting the 1.5°C scenario, we also took into account the 2°C / below 2°C scenarios*1.

All scenarios are based on those developed by the International Energy Agency (IEA). Analysis was conducted under the assumption that major emitting countries implement uniform carbon pricing to increase the feasibility of achieving the 1.5°C target.

Our goal under the long-term scenario analysis is to achieve carbon neutrality by 2050. We conducted risk assessments that take into account the 1.5°C scenario (IPCC 1.5°C Special Report) in steelmaking and the necessity of ultra-innovative technology to achieve the Shared Socioeconomic Pathways (SSP) for carbon neutrality by 2050.

<table>
<tr><th colspan="2">Selected Scenario</th><th>1.5°C Scenario</th><th>4°C Scenario</th></tr>
<tr><td rowspan="2">Reference Scenario</td><td>Transition Risks</td><td>Transition scenarios developed by the IEA<br>• IPCC Special Report on Global Warming of 1.5°C*2<br>• NZE2050</td><td>Transition scenarios developed by the IEA<br>• Stated Policies Scenario (STEPS)*3<br>• Reference Technology Scenario (RTS)*4</td></tr>
<tr><td>Physical Risk</td><td colspan="2">Climate change projection scenario developed by the Intergovernmental Panel on Climate Change (IPCC)<br>• Representative Concentration Pathways (RCP) Scenario*5<br>• Shared Socioeconomic Pathways (SSP)*6</td></tr>
<tr><td colspan="2">How Society will Look</td><td>Dynamic policies will be adopted and technical innovations will progress to limit the average temperature rise by the end of this century to 1.5°C and realize sustainable development.<br>Assume a society in which our business is affected by social changes accompanying transition to a decarbonized society.<br>• Worldwide/industry-wide uniform carbon pricing*7<br>• Increase in the ratio of sales of electric vehicles to overall vehicle sales</td><td>Despite new policies implemented in each country based on approaches under the Paris Agreement, the average temperature will rise by about 4°C by the end of this century.<br>Assume a society in which our business is affected by temperature rise and other climate change.<br>• Increase in the occurrence of flooding<br>• Sea level rise</td></tr>
</table>

*1 The Sustainable Development Scenario (SDS) and the 2℃ Scenario (2DS) are used for the 2°C / below 2°C scenarios.

*2 Source: IEA's Net Zero by 2050 — A Roadmap for the Global Energy Sector

*3 Source: IEA's World Energy Outlook 2024

*4 Source: IEA's Energy Technology Perspectives 2017

*5 Source: IPCC Fifth Assessment Report

*6 Source: IPCC Sixth Assessment Report

*7 When carbon pricing varies by country, a gap opens in international competitiveness between industries in countries with strict $CO_2$ regulations and those in countries with less strict regulations. This results in carbon leakage, where production and investment shrink in stricter countries (reducing $CO_2$ emissions) while expanding in more lenient countries (increasing $CO_2$ emissions). Accordingly, it is assumed that carbon pricing will be introduced in developed countries and some developing countries.

## Scope of Business and Period for Analysis

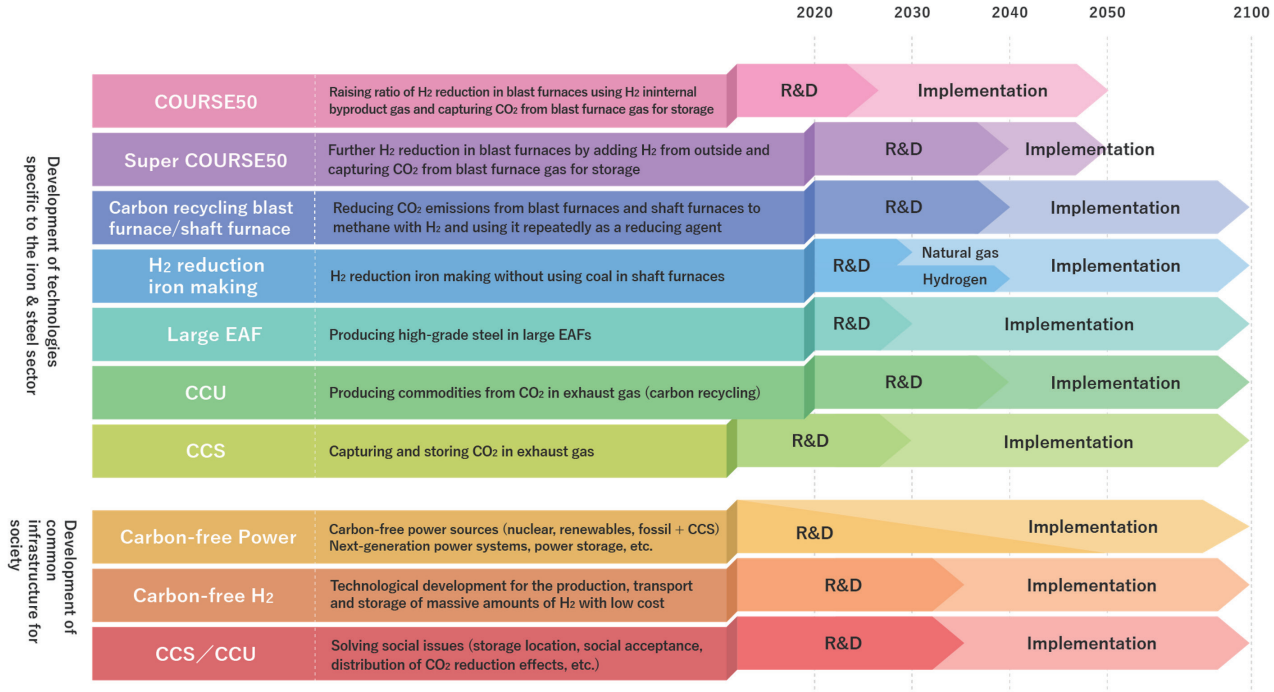
This analysis covers the following businesses: the steel business by JFE Steel, the engineering business by JFE Engineering, the trading business by JFE Shoji, and businesses carried out by some of the other Group companies. The period covered is up to 2050.

## Relevance with the JISF's Long-term Vision for Climate Change Mitigation

The Japan Iron and Steel Federation (JISF) has been working toward its Commitment to a Low Carbon Society, and Phase I of this initiative ended in FY2020. From FY2021, the effort was rebranded as the Carbon Neutrality Action Plan, and the Phase II target (FY2030 target) was revised. In November 2018, the JISF also formulated and published the Long-term Vision for Climate Change Mitigation for 2030 and beyond. JFE Steel played a central role in the formulation of this long-term vision. The vision represents the industry's challenge toward realizing zero-carbon steel and lays out the prospect of achieving the 2°C scenario for steelmaking and necessity of ultra-innovative technologies to achieve the 1.5°C scenario. Furthermore, on February 15, 2021, the JISF announced the "Basic Policy of the Japan Steel Industry on 2050 Carbon Neutrality Aimed by the Japanese Government," which declares that the Japanese iron and steel industry will boldly accept the challenge of realizing zero-carbon steel.

The JFE Group's scenario analysis is intended to ensure resiliency in our Group's business strategy during the intermediate stages of these long-term challenges.

**Efforts to Achieve Zero Carbon Steel**




› JISF: Challenges for Carbon Neutrality (https://www.carbon-neutral-steel.com/en/)

### Process to Identify Key Factors that Impact the Business

STEP 1: Examine the entire value chain from a holistic perspective and sort out factors that impact the businesses under analysis (for more information on risks and opportunities in the value chain, please refer to: › JFE Group Value Chain (P. 29)

STEP 2: Examine all factors at an overview level and identify key factors by taking into account the level of impact and stakeholder expectations and concerns

| | 1.5°C Scenario | 4°C Scenario |
|---|---|---|
| Impact on Procurement | | ❺ Unstable raw materials procurement due to increased occurrence of climatic hazards |
| Impact on Direct Operation | ❶ Decarbonization of iron and steelmaking process<br>❷ Increased needs for effective utilization of steel scrap | ❻ Damage to production bases and offices caused by climatic hazards |
| Impact on Product and Service Demand | ❸ Change in demand for automotive steel, etc.<br>❹ Increase in demand for solutions to enhance decarbonization | ❼ National resilience |


Axis for identifying key factors: • Level of impact (possibility of risks and opportunities arising × Level of impact if manifested)
• Expectations and concerns of stakeholders

## Results of Scenario Analysis

Climate change is a critical business concern for the JFE Group from the perspective of business continuity. Our steel business, which emits 99.9% of the Group's total $CO_2$ emissions, has been developing and applying energy-saving and $CO_2$ emissions reduction technologies to the steelmaking process to address decarbonization risks. At the same time, given rising demand for effective use of steel scrap, we are working to convert the steelmaking process from blast furnaces to electric arc furnaces and secure cold iron sources. Going forward, we will continue to develop processes to further reduce environmental impact, and by globally deploying our diverse technologies, we will view climate change as an opportunity and contribute to addressing related issues.

The JFE Group has developed and maintains a variety of eco-friendly products and technologies, including high-performance steel materials that contribute to energy savings when uses by customers, as well as renewable energy power generation, thereby responding to the growing demand for decarbonization solutions. Going forward, with automobiles expected to become increasingly lighter and more electrified, we will further enhance the performance of JFE's high tensile strength steel sheets and electrical steel sheets to meet the changing demand for automotive steel and contribute to the realization of a low-carbon society.

It is also important to prepare for physical risks such as unstable raw material procurement due to frequent meteorological disasters and the damage they cause. The JFE Group is strengthening its resilience to address these risks.
At the same time, we will continue to develop and disseminate the necessary technologies for achieving the long-term goal of the Paris Agreement of keeping the global average temperature increase well below 2°C compared to pre-industrial levels and limiting it to 1.5°C. We will also contribute to national resilience by supplying and constructing steel for social infrastructure in preparation for the anticipated intensification of meteorological disasters.

## Analysis Results

| | Changes in Society | Risks/Opportunities | | Expectations and Concerns of Stakeholders for the JFE Group | Strategies/Initiatives | Financial Impact (Estimate for 2030)* | |
|---|---|---|---|---|---|---|---|
| | | | | | | Details | Amount/Scale |
| 1.5/C Scenario<br>Key Factor ❶<br>**Decarbonization of Iron and Steelmaking Process** | Increasing social demand for decarbonized iron and steelmaking process | Implement innovative technology to realize decarbonization at a large scale | Opportunity | JFE will lead in the business of supplying steel materials with high environmental value by implementing innovative technologies such as electric arc furnaces | • Deploy existing low-carbon technologies<br>• Introduce large-scale electric arc furnaces capable of manufacturing high-quality steel<br>• Increase use of low-carbon direct reduced iron<br>• Develop and implement innovative technologies<br>• Conduct studies for the practical application of CCUS<br>• Expand supply capacity for JGreeX™<br>• Lobby to create demand for steel materials with high environmental value<br>• Collaborate with companies in the JISF to promote steel materials with high environmental value | Increased sales of steel materials for their environmental added value | +120 to 150 billion yen per year |
| | | | Transition risk | More investment will be needed to implement innovative technologies | • Strengthen the revenue base<br>• Secure funds for investment/technological development<br>• Lobby for government support<br>• Expand sales of JGreeX™ | GX-related investment amount between 2023–2030 | Approx. –0.6 trillion yen |
| | | Introduction of carbon pricing | Transition risk | • Financial burden will increase due to carbon pricing<br>• Emission reduction targets will be more aggressive and stricter due to environmental changes | • Establish reliable CN technologies<br>• Engage with policymakers to achieve CN | Increased carbon pricing burden | For every 1% reduction in emissions not achieved<br>–10 billion yen per year |
| 1.5/C Scenario<br>Key Factor ❷<br>**Increased Needs for Effective Utilization of Steel Scrap** | Increasing interest for electric arc furnace method for its lower $CO_2$ emissions | Higher competition and prices for cold iron sources (scrap and reduced iron) | Transition risk | The cost of purchasing cold iron sources will increase | • Collaborate with customers/users to collect scraps<br>• Establish technologies for using low-grade/difficult-to-use scrap<br>• Participate in the reduced iron supply chain project<br>• Expand scrap trading volume<br>• Reduce manufacturing cost<br>• Pass the cost to steel product prices | Increased cost of purchasing cold iron sources | Up to approx. –30 billion yen per year |
| | | Increased electricity demand due to switching from blast furnace process to electric arc furnace process | Transition risk | Increase in the electric power consumption in the steel manufacturing process (Increase in the electric power consumption due to a decrease in bi-product gas) | • Reduce manufacturing cost<br>• Pass the cost to sale prices<br>• Secure a stable supply of electricity<br>• Lobby for steel product prices | Increase in the electric power consumption by the process transition (equivalent to approx. 0.5 nuclear power plants) | Approx. –50 billion yen |
| 1.5/C Scenario<br>Key Factor ❸<br>**Change in Demand for Automotive Steel** | Shift in demand for automobiles | Changes in the product mix due to EV production, etc. | Opportunity | Sales will increase for electrical steel sheets used in EV motors | • Strengthen production capacity for electrical steel sheets<br>• Establish processing bases and supply chain structure for steel sheets globally | Increased sales of electrical steel sheets | Production capacity for top-grade non-oriented electrical steel sheets for main xEV motors will be tripled compared to FY2024 |
| | | | Opportunity | Sales will increase for high-tensile steel due to improved collision safety performance | • Expand production capacity for ultra-high-tensile strength steel sheets | Increased sales due to rise in orders for ultra-high-tensile strength steel sheets | The new hot-dip galvanizing line (CGL) will increase annual production capacity for ultra-high-tensile strength steel sheets used in vehicles by 360,000 tonnes |
| | | | Transition risk | Sales will decrease for steel materials due to a shift away from internal combustion engines and a shift toward using multi materials | • Develop high-performance products | Decreased sales of steel sheets for automobiles | Minimal impact |
| 1.5/C Scenario<br>Key Factor ❹<br>**Increase in Demand for Solutions to Enhance Decarbonization** | Transition to decarbonized society | Increase in demand for decarbonization solutions businesses | Opportunity | Renewable energy-related businesses will expand | • Expand the business undertaking the entire construction and operation of renewable energy power plants (offshore wind, geothermal, solar, etc.)<br>• Develop and implement CCUS solutions and commercialize green hydrogen and ammonia-related technologies | Sales of JFE Engineering's CN-related business | Approx. 31 billion yen per year |
| | | | Opportunity | Waste-to-resource-related businesses will expand | • Expand the business undertaking the entire construction and operation of plants that make optimal use of waste (waste-to-energy power generation, recycling, etc.) | Segment profits of JFE Engineering's waste-to-resource-related business | Approx. 37 billion yen per year |
| | | | Opportunity | Business of disseminating eco solutions (advanced energy-saving technologies developed and applied in Japan) to developing countries will expand | • Support solutions business for low-carbon steelmaking technologies | Increased sales of overseas solutions business | Tens of billions of yen |
| 4°C Scenario<br>Key Factor ❺<br>**Unstable Raw Materials Procurement due to Increased Occurrence of Climatic Hazards** | Increasingly devastating climate hazards caused by temperature rise | Raw materials procurement becomes unstable | Physical risk | • Sales will decrease due to reduced production<br>• Raw material cost will increase | • Establish alternative procurement and dispersed supplier bases, engage in stockpiling<br>• Acquire raw material rights | Decreased sales of steel materials due to raw material shortages | For every 1% decrease in annual sales volume<br>Approx. –30 billion yen/year |
| 4°C Scenario<br>Key Factor ❻<br>**Damage to Production Bases and Offices Caused by Climatic Hazards** | Increasingly devastating climate hazards caused by temperature rise | Damage to manufacturing bases from typhoons, heavy rain, and droughts | Physical risk | Sales will decrease due to reduced production | • Implement measures against flood and drought damage at manufacturing bases | Decreased production and sales due to flood and drought | No impact, as measures have already been taken |
| 4°C Scenario<br>Key Factor ❼<br>**National Resilience** | Increasingly devastating climate hazards caused by temperature rise | Strengthen infrastructures and disaster resiliency | Opportunity | Contribute to infrastructure reinforcement and longer service life | • Strengthen infrastructure reinforcement and longer service life-related businesses in Japan and overseas<br>• Strengthen sales of infrastructure-related steel materials | Increased segment profit in JFE Engineering's infrastructure construction business | Assuming the 1.5°C scenario, 12 billion yen per year, with further increase |

Note: Assessment results are estimated outcomes based on scenario analysis and do not represent actual performance.

## Overview of Scenario Analysis Assessment and JFE Group's Focus

Timeframe: **short term (2027)** ⇒until 2027 **medium term (2035)** ⇒until 2035, **long term (2050)** ⇒until 2050 (final)

## FOCUS Key Factor (1) Decarbonization of Iron and Steelmaking Process

### Implementation of innovative technologies to realize large-scale decarbonization

**Supply steel materials with high environmental value through implementation of innovative technologies such as electric arc furnaces**

**short term (2027)** **Medium term (2027)**

JFE Steel has actively sought to improve efficiency and decarbonize the iron and steelmaking processes by developing energy-saving technologies and has established process technologies boasting the world's top energy efficiency. Taking advantage of the increasing public demand for decarbonized iron and steelmaking processes, we have the capacity to supply steel products with high environmental value, manufactured by deploying the low-carbon technologies we have developed across our steelworks.

The global drive toward decarbonization is intensifying, and with rising demand to reduce GHG emissions across entire supply chains, interest is rapidly growing for low-GHG emission steel products, particularly in industries such as automotive. In the IEA's Net Zero by 2050 Scenario, the share of steel production using the electric arc furnace method is projected to increase to 37% by 2030 and 53% by 2050. Going forward, demand is expected to expand for steel products made with the electric arc furnace method, which emits fewer GHG emissions.

During this transition, JFE Steel will introduce innovative electric arc furnaces capable of producing high-performance, high-quality steel materials that could previously only be manufactured using the blast furnace process. In addition, we will cut overall GHG emissions from the steelmaking process by using direct reduced iron with low carbon emissions.

Since the first half of FY2023, we have been supplying JGreeX™, a brand of green steel products that significantly reduces GHG emissions in the steelmaking process compared to conventional products. Since it is not immediately possible to achieve zero GHG emissions, we allocate the reductions created by our emission-reduction technologies to selected steel products by applying the mass balance approach and supply them as steel products with environmental value. Going forward, we will contribute to the decarbonization of society by expanding our capacity to supply JGreeX™. To broaden public recognition of these efforts, we are actively lobbying to stimulate demand for steel products with environmental value, while promoting adoption in collaboration with other JIFS member companies.

**long term (2050)**

Over the long term, to achieve carbon neutrality by 2050, as stated in the JFE Group Environmental Vision for 2050, we are pursuing the development of carbon-recycling blast furnaces (CR blast furnaces), utilization of hydrogen through the direct hydrogen reduction method, and manufacturing methods for high-quality steel using the electric arc furnace method. In particular, the technology that combines a CR blast furnace with CCU is an ultra-innovative technology for achieving net zero $CO_2$ emissions by drastically reducing $CO_2$ emissions from the blast furnace process, enabling efficient mass production of high-grade steel and allowing the reuse of $CO_2$ in the blast furnace. As for the $CO_2$ that cannot be fully reused in the blast furnace, we are also studying the practical application of carbon capture, utilization, and storage (CCUS) technologies to pursue further reduction potential.

**More investment needed to implement innovative technologies** **short term (2027)** **medium term (2035)**

The introduction of electric arc furnaces and ultra-innovative technologies carries the risk of increased investment burden to achieve carbon neutrality. At JFE Steel, decisions on the necessary capital investments to achieve the FY2030 GHG reduction target are nearly complete, with about 0.4 trillion yen in GHG reduction investments decided between FY2021 and FY2024. In addition, we estimate that about 0.6 trillion yen of investments will be required by 2035.

Sustaining these large-scale investments will require that we strengthen our revenue base and secure funds for investment and technology development. JFE Steel is promoting research and development using external funds such as the Green Innovation Fund while also lobbying to obtain government support.

In addition, through the expanded sales of JGreeX™, a green steel product that significantly reduces GHG emissions, we will encourage the market penetration of environmentally valuable products and achieve profitability while protecting the environment. With these initiatives, we will pursue sustainable growth toward realizing a decarbonized society and securing long-term competitiveness.

long term (2050)

Although the measures to be taken under the 2°C and 1.5°C scenarios will not significantly differ, we must consider scale and scope. In the case of the 1.5°C scenario, it will be necessary to further accelerate the development and implementation of decarbonization technologies, which will require even greater research and development and capital investment expenditures. In addition, the development of infrastructure to stably supply inexpensive, abundant green hydrogen and electric power will be a prerequisite. In addressing these issues, it will be necessary for society as a whole to consider how to share the costs and for the government to formulate long-term strategies for the supply of green hydrogen and electric power, in collaboration with society.

### Financial burden will increase due to carbon pricing, and emission reductions targets will be more aggressive and stricter due to environmental changes

short term (2027) medium term (2035) long term (2050)

Various carbon pricing systems are being introduced around the world, and in Japan an emissions trading system (GX-ETS) based on the GX Promotion Act is scheduled to be fully introduced starting in FY2026 to help achieve the global goal of carbon neutrality by 2050. In Europe, discussions are progressing on the Carbon Border Adjustment Mechanism (CBAM); ahead of full implementation in 2026, a transitional period began on October 1, 2023, imposing reporting obligations on the relevant operators, and we are complying with this requirement.

Carbon pricing systems in Japan and overseas vary in unit price and the approach to taxable items, and there are currently many uncertainties. It will be necessary to appropriately anticipate impacts while monitoring future developments. On the other hand, such systems can also become important mechanisms for ensuring that steel products with environmental value are properly recognized and reflected in market pricing.

JFE Steel is proactively engaging in carbon neutrality, including making necessary recommendations to the government to ensure that the carbon pricing system is appropriately designed. In addition to its involvement in the design of such systems, the Company will continue research and development to establish reliable carbon neutrality technologies and reduce emissions grounded in technological evidence, enabling flexible and sustainable responses to changes in policy and the operating environment.

## FOCUS Key Factor (2) Increased Need for Effective Utilization of Steel Scrap

### Cost of purchasing cold iron sources (scrap/direct reduced iron) will increase

short term (2027) medium term (2035) long term (2050)

The electric arc furnace method, which has low $CO_2$ emissions, is attracting increasing global attention, and countries are introducing electric furnace facilities. At the JFE Group, in addition to maximizing the use of existing electric arc furnaces, we have decided to introduce an electric arc furnace at the East Japan Works (Chiba District) and an innovative electric arc furnace at the West Japan Works (Kurashiki District). Going forward, demand is expected to increase even further for cold iron sources such as scrap and direct reduced iron, raising concerns about the risk of higher costs for procuring the cold iron sources needed to maintain steel quality and ensure stable production. We are responding by strengthening collaboration with customers and users in scrap collection to ensure a stable supply of high-grade scrap. We are also advancing research and development to establish technologies for using low-grade and difficult-to-use scrap, to expand the amount of scrap handled and promoting the effective use of resources.

In addition, we are taking part in a Middle East direct reduced iron project to ensure stable procurement of direct reduced iron. Through these activities, we are reducing procurement risks for cold iron sources while lowering manufacturing costs.

Furthermore, based on the market evaluation of steel products with high environmental value, we are seeking to sustainably operate our business by appropriately passing these costs on to steel prices.

### Power demand will increase due to converting from blast furnace process to electric arc furnace process

short term (2027) medium term (2035) long term (2050)

Converting from blast furnaces to electric arc furnaces requires large amounts of electric power. In addition to the power needed to melt cold iron sources in electric arc furnaces, power will also be needed to make up for the heat sources previously supplied through byproduct gases generated in blast furnaces and other facilities, which had been used in reheating furnaces and elsewhere within steelworks. Since this increase in power demand involves the risk of higher manufacturing costs, we are working to reduce manufacturing costs at JFE Steel through more efficient processes and technological innovation. Furthermore, based on the market evaluation of steel products with high environmental value, we are seeking to sustainably operate our business by appropriately passing these costs on to sales prices. In addition, stable operation of the electric arc furnace process requires a large and stable supply of power at competitive prices. To this end, we are lobbying the government for stable power supply and pricing and recommending policies for institutional development and reinforcing infrastructure.

## FOCUS Key Factor (3) Change in Demand for Automotive Steel

### Changes in the product mix due to EV production and other factors

#### Sales volume of electrical steel sheets for EV motors will increase

short term (2027) medium term (2035) long term (2050)

The widening adoption of electric vehicles is expected to change the composition of steel demand. In addition to the expansion of demand for electrical steel sheets for motors, the product mix of steel is diversifying to encompass lighter-weight steel to offset the increase in weight from batteries and stronger frames to protect batteries. At the JFE Group, we view this change as an opportunity and are bolstering our ability to respond. First, as part of strengthening manufacturing capacity for electrical steel sheets, we are proceeding with construction to triple our production capacity of non-grain-oriented electrical steel sheets at the West Japan Works (Kurashiki District) compared to current levels. In addition, we are building a global processing and distribution system for electrical steel sheets to respond to the worldwide expansion of the EV market.

#### Sales volume of high-strength steel sheets will increase due to improved collision safety

short term (2027) medium term (2035) long term (2050)

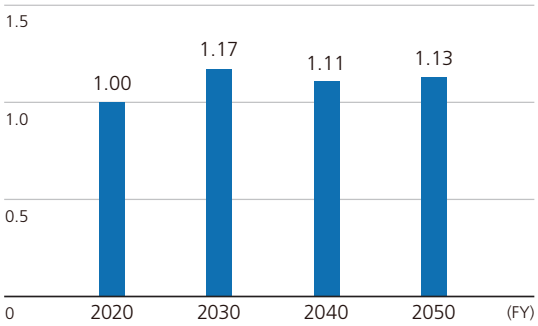
To achieve both weight reduction and collision safety performance, we have decided to construct a new continuous hot-dip galvanizing line (CGL) at the West Japan Works (Fukuyama District) to expand production capacity for ultra-high-tensile-strength steel sheets. On the product development front, in addition to the commercialization of 1.5 GPa-grade cold-rolled steel sheets, we have developed a multi-material structure that maximizes the performance of steel by incorporating a small amount of resin. This structure sandwiches a highly ductile, strongly adhesive resin between a main component made of ultra-high strength steel and a thin steel plate component, thereby achieving further weight reduction and improved collision safety in automotive body frame components.

#### Steel sales volume will decrease due to material substitution in multi-materialization

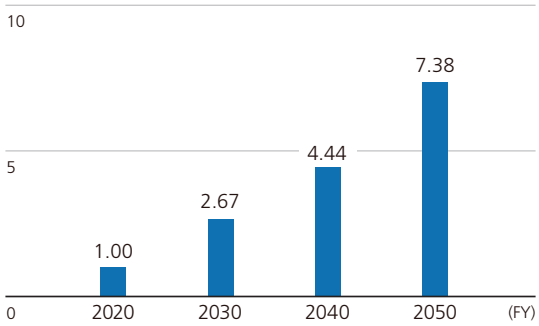
short term (2027) medium term (2035) long term (2050)

Shifting to materials such as aluminum and carbon fiber reinforced plastics (CFRP) to reduce vehicle weight poses potential risk. These materials have higher manufacturing costs than steel and generate more $CO_2$ emissions over their life cycle. In the 1.5°C scenario, which assumes the introduction of carbon pricing, the price gap between steel and these materials could further widen. As a result, while the use of multi-material designs is expected to progress to some extent in luxury vehicles, adoption by mass-market vehicles is likely to remain limited. Even if all panel components, such as the doors of luxury vehicles, were replaced with aluminum, the resulting weight reduction would affect only about 5% of the total body materials across both luxury and mass-market vehicles. Taking into account the anticipated increase in automobile production volume, the impact on steel demand for vehicle bodies is expected to remain limited.

**Estimated World Demand for Automotive Special Steel**




**Estimated World Demand for Automotive Electrical Steel Sheets**




Vertical axis: Steel demand (comparison by year with the year 2020 as 1.00)
Source: Estimated by JFE Holdings based on the reports from METI's Strategic Commission for the New Era of Automobiles

## FOCUS Key Factor (4) Increase in Demand for Solutions to Enhance Decarbonization

### Increase in demand for decarbonization solution businesses

#### Expansion of renewable energy-related business

short term (2027) | medium term (2035) | long term (2050)

Demand is expected to continue rising for power generation plants using renewable energy that does not emit carbon. In the engineering business, we are expanding operations through the integrated provision of engineering, procurement, construction, and operation and maintenance (EPC and O&M*4) for renewable energy plants, including biomass power generation*1, geothermal power generation*2, solar power generation*3, and wind power generation.
The Japanese government has positioned offshore wind power generation as a pillar of its Green Growth Strategy for realizing carbon neutrality by 2050. In this context, efforts are being promoted on a Groupwide basis, led by JFE Engineering in the manufacture of seabed-fixed foundation structures such as monopiles. We also built Japan's first monopile foundation manufacturing plant, which began operation in April 2024*5. The steel business supplies large, heavy plates, and the trading business develops supply chain management, including the provision of information on Taiwan and potential demand regions such as East and Southeast Asia.

In addition to renewable energy, we are focusing on developing and implementing carbon capture, utilization, and storage (CCUS) solutions, as well as commercializing green hydrogen and ammonia-related technologies. Strengthening these initiatives for next-generation technologies will accelerate the delivery of solutions for realizing a decarbonized society and open up business opportunities with high environmental value.

› *1 The JFE Engineering Corporation's biomass power generation (Japanese only) (https://www.jfe-eng.co.jp/products/power/ele07.html )
› *2 The JFE Engineering Corporation's geothermal power generation plant (https://www.jfe-eng.co.jp/en/products/power/gene01.html)
› *3 The JFE Engineering's solar power generation (Japanese only) (https://www.jfe-eng.co.jp/products/power/ele05.html)
The JFE Technos Corporation's solar power generation (Japanese only) (https://www.jfe-technos.co.jp/products/solar/)
*4 Engineering, procurement, and construction (EPC) and operation and maintenance (O&M) business
› *5 Completion of Japan's first manufacturing base of fixed-bottom foundation (monopile) for offshore wind turbines (https://www.jfe-eng.co.jp/en/news/2024/20240401.html)

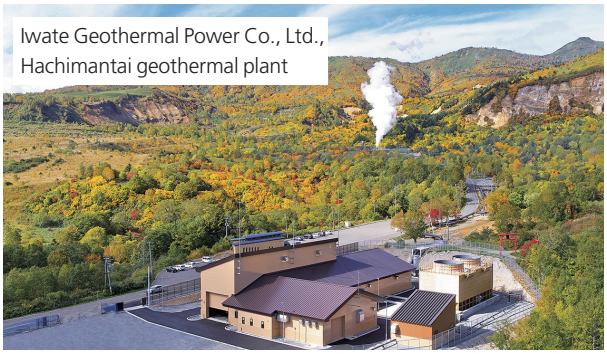
#### Expansion of waste-to-resource-related business

short term (2027) | medium term (2035) | long term (2050)

From the perspective of resource circulation and effective use, efforts are also underway at waste treatment facilities to increase power generation from waste-derived sources. The engineering business is focusing on fully automated operation*6 of waste incinerators, which makes it possible to increase power generation. In addition, we are actively engaged in the electricity retail business*7, which uses renewable energy as the main power source, and supporting the establishment and operation of new regional electricity retail companies*8, focused on local production and consumption of energy using renewable energy.

JFE Engineering is going beyond conventional energy optimization site by site to develop a Multisite Energy Total Service (JFE-METS)*9 that optimizes energy by collectively managing multiple sites. This service achieves overall energy savings and reductions in $CO_2$ by analyzing actual energy consumption at multiple sites, deploying and optimizing energy-related facilities at each site, and enabling energy interchange, including at remote sites.

Waste-to-energy power generation plant



Iwate Geothermal Power Co., Ltd., Hachimantai geothermal plant

Geothermal power generation plant

- *6 JFE Engineering's BRA-ING Pre-release (Japanese only) (https://www.jfe-eng.co.jp/news/2020/20200727.html)
- *7 Urban Energy Corporation's electricity retail business (Japanese only) (https://u-energy.jp/service/retail.html)
- *8 Urban Energy Corporation's regional electric power support business, targeting local governments (Japanese only) (https://u-energy.jp/service/municipality.html)
- Establishing regional electricity retail companies in partnership with local municipal governments (CSR Report 2022, P. 116) (https://www.jfe-holdings.co.jp/en/common/pdf/sustainability/data/2022/csr2022e.pdf)
- *9 JFE Engineering's "Multisite Energy Total Service (JFE-METS)" (Japanese only) (https://www.jfe-eng.co.jp/news/2019/PDF/20200130.pdf)

### Expansion of low-carbon businesses (eco-solutions)

short term (2027) | medium term (2035) | long term (2050)

There is ample room in the steel industry for disseminating energy-saving steel technologies (eco-solutions) in countries such as China, which accounts for about 50% of global crude steel production, as well as in India and ASEAN countries, where further economic growth and expanded production are expected. Internationally transferring and deploying advanced energy-saving technologies already in use in Japan is expected to yield a potential reduction of more than 400 million tonnes of $CO_2$ worldwide in FY2030, of which Japan's contribution is projected to be approximately 80 million tonnes of $CO_2$.

JFE Steel has launched JFE Resolus™, a solution business that applies the accumulated manufacturing and operational technologies from steelmaking to address issues faced by a wide range of industries beyond the steel industry. As the business environment and marketplace undergo significant change, we are further enhancing our own manufacturing technologies while providing the JFE Group's technologies and know-how under the JFE Resolus™ brand, working in concert with customers to achieve sustainable growth.

- JFE Steel's Solution Business (https://www.jfe-steel.co.jp/en/products/solution/)

## FOCUS Key Factor (5) Unstable Raw Material Procurement due to Increased Occurrence of Climatic Hazards

### Unstable material procurement

short term (2027) | medium term (2035) | long term (2050)

JFE Steel is taking multiple precautions against the risk of instability in the procurement of steelmaking raw materials associated with climate change. In Australia, a source of our major raw materials, the frequency of typhoons is expected to double in the future, and our ability to supply steel products could be impacted if a suspension of production and shipping operations results in a depletion of our raw material inventories. To address this risk, we are strengthening alternative procurement channels and diversifying raw material sources. Specifically, we are gaining flexibility by conducting spot procurement from Chinese port inventories, increasing procurement from nearby sources such as Indonesia, making advance purchases, and increasing the number of contracts for different grades shipped from unaffected regions of Australia. In addition, we are mitigating risks of supply interruptions by stockpiling raw materials at Philippine Sinter Corporation, a Group company, and using external yards. In addition, JFE Steel has acquired a 10% interest in the Blackwater coal mine owned by Australian steelmaking coal supplier Whitehaven Coal Limited. This is a key means for securing the stable procurement of high-quality raw materials amid increasing difficulty in developing or expanding new steelmaking coal projects.

As the decarbonization of steelmaking processes is expected to foster the diversification of required raw materials, we will continue developing and diversifying procurement sources for those raw materials with due consideration for climate change risks.

## FOCUS Key Factor (6) Damage to Production Bases and Offices Caused by Climatic Hazards

### Damage to manufacturing bases from typhoons, heavy rain, and drought

short term (2027) medium term (2035) long term (2050)

We are taking action to minimize damage with the assumption that typhoons and heavy rains will become stronger and that the incidents of disasters comparable to the torrential rain in Western Japan in 2018 will rise. JFE Steel has already implemented flood and drought countermeasures at production sites to minimize the impact of climate-related hazards, and at this point, no significant impacts are anticipated.

Specifically, we have invested approximately 6.5 billion yen in flood disaster prevention at steelworks and completed upgrades to drainage facilities and other precautions. In addition, we have invested approximately 3.5 billion yen in drought countermeasures and introduced seawater desalination equipment at several steelworks. Since the drought disaster of 1994, no severe comparable events have occurred, and we are confident that existing countermeasures are sufficient to maintain stable operations even if their frequency increases.

Furthermore, since all of our steelworks are located along the coast, inundation risks from rising sea levels must also be taken into account. However, the anticipated sea level rise of about 20–30 cm by around 2050 (70 cm by 2100 at the extreme impact of climate change) is not at the scale at which storm surge inundation would occur. Going forward, we will continue to analyze the status of climate-related hazards and strengthen required countermeasures.

## FOCUS Key Factor (7) National Resilience

### Strengthened infrastructure and disaster measures

short term (2027) medium term (2035) long term (2050)

The JFE Group takes seriously the increased frequency and severity of recent climatic hazards in Japan and overseas. Having one's daily life put in danger is a huge risk. It is our mission to promote disaster prevention and mitigation as well as national resilience to maintain vital infrastructure that is essential to daily life and economic activities.

The JFE Group is able to draw upon its collective strengths to contribute in many ways—for example, by protecting key structures from earthquakes using structural steel such as high-strength H-shaped steel and steel pipe piles as well as steel sheet piles, reinforcing embankments that are prone to bursting, and providing disaster prevention products such as hybrid tide embankments and permeable steel slit dams. Our engineering business can also handle a wide range of infrastructure construction projects, including bridges, gas, water and sewage, and pipelines.

› Hybrid Tide Embankments (P. 86)
› Permeable Steel Slit Dams (P. 86)
› Terre Armée Method (P. 87)

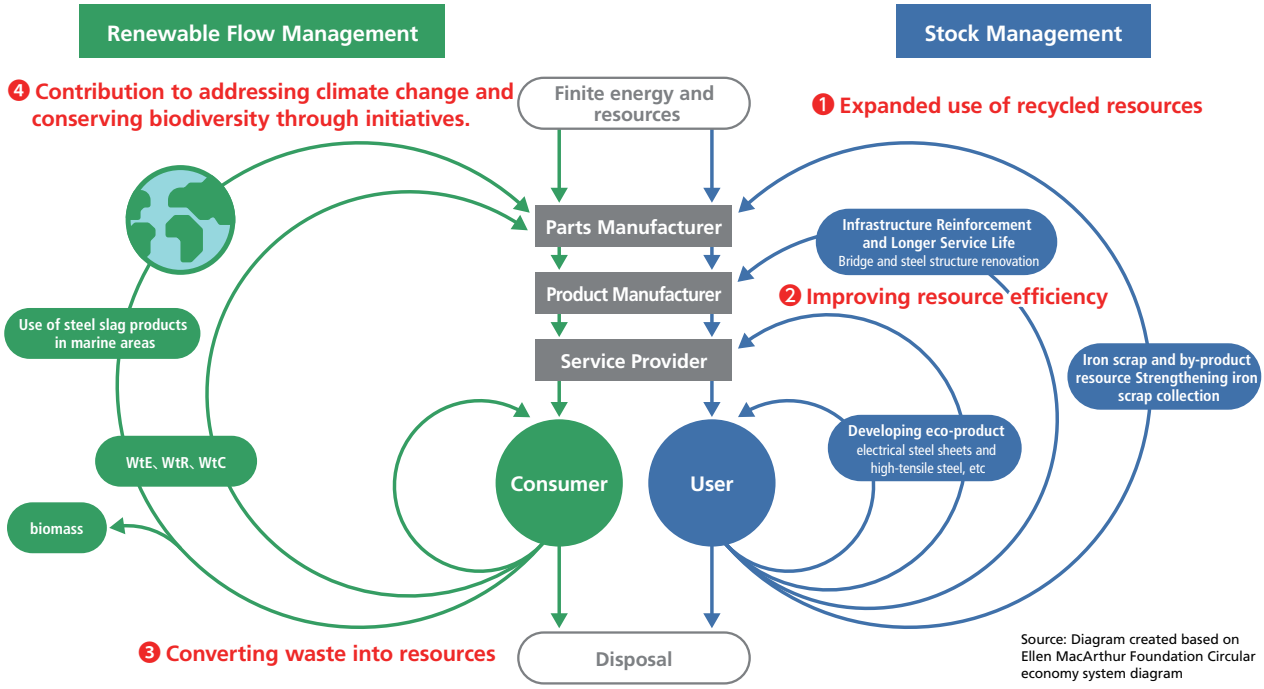
Links to information about the JFE Group Environmental Vision for 2050 and Climate Change Scenario Analysis
Commitment to a Low Carbon Society: Policy Engagement (P. 90)
Targets and Results Related to Climate Change: FY2024 KPI Results and FY2025 KPIs (P. 19)
Initiatives on Climate Change: Initiatives to Address Climate Change Issues (P. 53)

# Initiatives to Transition to a Circular Economy

## Basic Policy

The JFE Group views transition to a circular economy as indispensable for realizing a sustainable society, and we are taking action to shift the overall economic system of society from a conventional linear economy to a circular economy. In these efforts, we are using digital technologies and collaborating with government, municipalities, and customers throughout the value chain, extending beyond the Group's framework. We are promoting initiatives from three perspectives: converting byproducts and waste into resources, developing eco-product/eco-solution technologies with high resource efficiency, and expanding the use and sales of recycled resources. These activities will also contribute to addressing environmental issues such as climate change and biodiversity conservation and nature positive.

**Circular Economy Concept and Initiatives**




Source: Diagram created based on Ellen MacArthur Foundation Circular economy system diagram

Iron is easily recovered, highly recyclable, and can be infinitely recycled as raw material for the same steel products. The JFE Group is also recovering and using steel scrap as well as developing initiatives for transitioning to a circular economy.
Our steel business using recycled resources by effectively using byproduct resources such as dust, sludge, and slag generated in the steelmaking process and using waste plastics as blast furnace raw materials. We are also improving resource efficiency by providing high-quality, high-performance steel products.

Our engineering business is delivering solutions for resource circulation by constructing plant and infrastructure facilities such as biomass fuel plants for food waste and sewage sludge, and waste-to-energy plants, as well as operating and managing these facilities on consignment. In addition, we are promoting a circular economy through recycling businesses for PET bottles and plastics, and energy supply businesses.

Our trading business is procuring environmentally sound materials such as biomass fuel by drawing upon our supply chain management network.

Since the steelmaking process consumes large volumes of fresh water for cooling and cleaning products and facilities, the efficient use of water resources, taking into account the impact on water sources and surrounding stakeholders, is a key issue. In response, we are reducing water intake by building systems to purify and recycle used water as much as possible at steelworks. In addition, we are raising employee awareness of water conservation and continuously minimizing environmental impact through reduced and more efficient water use. Furthermore, we place priority on maintaining a safe and sanitary water

environment in the areas surrounding our manufacturing sites, implementing measures to protect water quality to have the least possible impact on local water resources, and actively preserving the living environment of local residents.

For details on the recycling businesses of JFE Steel and JFE Engineering, please see:
> List of JFE Group's recycling businesses (https://www.jfe-holdings.co.jp/en/common/pdf/sustainability/environment/resource/resource01.pdf)

# Governance

The JFE Group Environmental Committee, chaired by the president of JFE Holdings and operating under the JFE Group Sustainability Council, sets goals for environmental protection, monitors, and works to improve the Group's overall environmental performance. Key issues for corporate management are deliberated at the Group Management Strategy Committee as well and reported to the Board of Directors. The board oversees environmental challenges by discussing the reports. Additionally, specialized committees set up by JFE Group operating companies and affiliates implement specific activities.

> Framework for Environmental Management (P. 47)

# JFE Group Initiatives to Transition to a Circular Economy

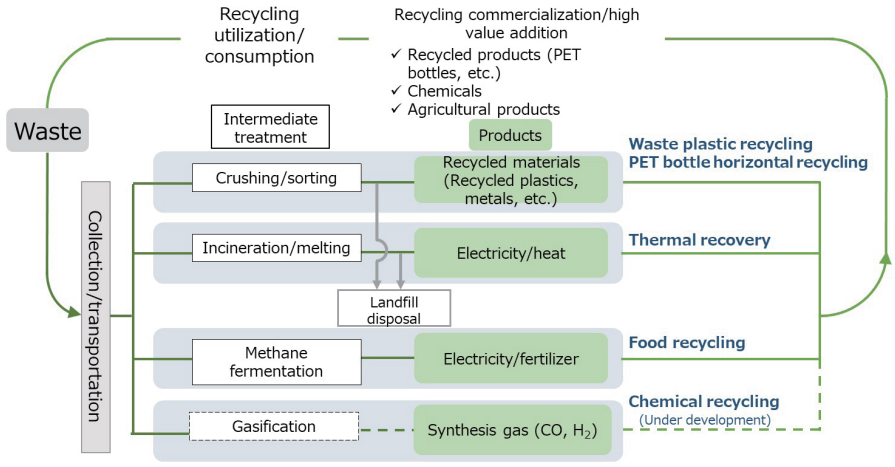
## Conversion of Byproducts and Waste into Resources

The JFE Group incorporates the circular economy concept into its business activities to ensure the responsible use of limited resources, reduce environmental impact, and realize a sustainable society. In particular, we are reusing byproducts and waste as new resources as ways to circulate resources and minimize waste.

### EN Building a Recycling Value Chain

As one of Japan's leading companies capable of providing one-stop solutions from the collection and transportation of waste to the intermediate treatment and recycling of recovered products, JFE Engineering is striving to establish a recycling value chain, including collaboration with partner companies and municipalities.

**Recycling Value Chain**



In addition, JFE Engineering is constructing and operating waste-to-energy facilities and waste treatment facilities overseas in alignment with the Ministry of the Environment's National Action Plan for Marine Plastic Litter, formulated in 2019.

Furthermore, J&T Recycling Corporation, a Group company of JFE Engineering, supports the activities of the Japan Clean Ocean Material Alliance (CLOMA), which was established to support activities that address the problem of marine plastic litter. As a member of CLOMA, the company is recycling PET bottles and plastics.

## EN Promoting Plastic Recycling

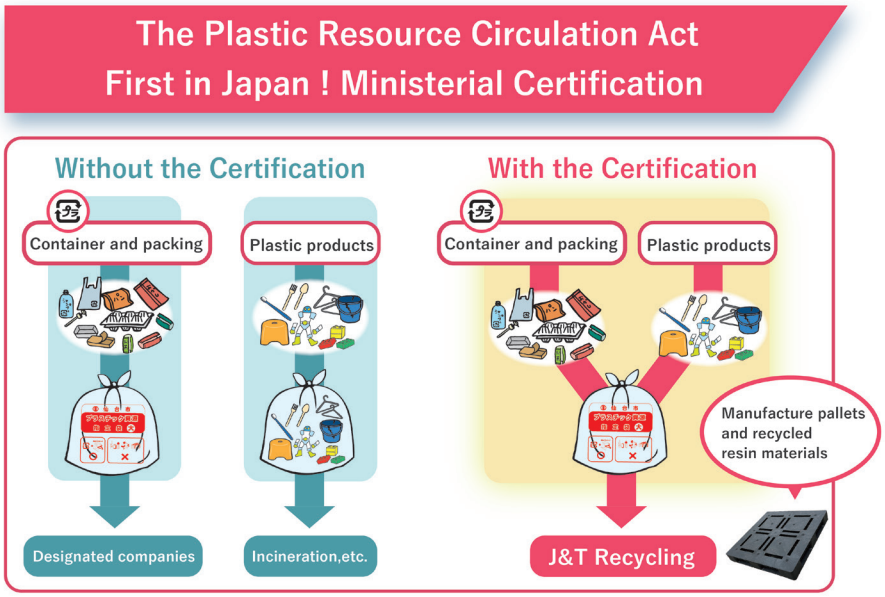
J&T Recycling Corporation joined the recycling plan formulated by Sendai City under the Plastic Resource Circulation Act in September 2022 and, for the first time in Japan, obtained certification from both the Minister of the Environment and the Minister of Economy, Trade and Industry. Following this, in April 2023, the company launched the integrated collection of plastic products. In Sendai, product plastics that had previously been incinerated can now be collected with plastic containers and packaging for more efficient recycling.

In July 2023, J&T Recycling Corporation and the JR East Group jointly established J Circular System Corporation in Kawasaki, Kanagawa Prefecture to promote plastic recycling in Japan. This facility, one of the largest in Japan, is able to process 200 tonnes of used plastics per day and is set up to handle the entire process, from sorting to recycling into new products. The plant began full-scale operation in April 2025 and can directly accept unsorted used plastics collected by municipalities and businesses. This makes it possible to recycle used plastics that had previously been incinerated because they were difficult to sort. The collected used plastics are subjected to advanced sorting, and depending on their characteristics, they are recycled as material recycling or chemical recycling in collaboration with nearby recycling businesses, thereby enhancing resource circulation.

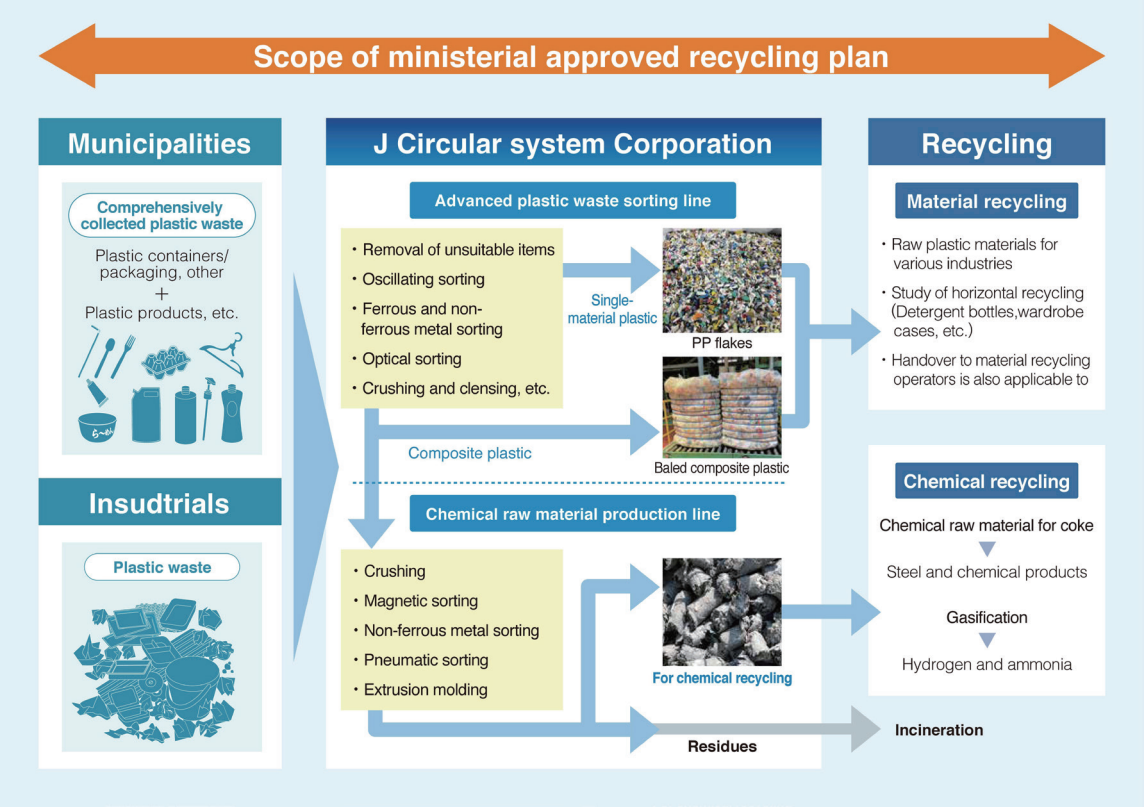
At present, recycling plans formulated under the Plastic Resource Circulation Act by Kawasaki City, Fujisawa City, and Ota Ward have received ministerial certification, and this is the first case in Japan where certification has been obtained through the collaboration of multiple municipalities and recycling businesses. With this certification, a large portion of the used plastics separated and collected as household waste from municipalities and citizens can now be recycled at this facility.

With its unprecedented recycling system, J Circular Systems aspires to become a forerunner in advanced plastic resource circulation and in promoting decarbonization while contributing to the realization of a sustainable, recycling-oriented society.

**Ministerial Certification of the Recycling Plan in Sendai City**



**Scope of Municipal Recycling Plans Related to J Circular Systems**




› Japan's First! J&T Recycling Corporation Participates in Sendai City's Plastic Waste Recycling Project (https://www.jt-kankyo.co.jp/en/topics/2022/10/20221003.html)

› J&T Recycling Corporation Establishes J Circular System Corporation—Its Plastic Recycling Facilities on the Kawasaki Waterfront Have the Largest Scale in the Tokyo Metropolitan Area (Japanese only) (https://www.jfe-eng.co.jp/news/2024/20240109.html)

## EN orizontal Recycling of PET Bottles

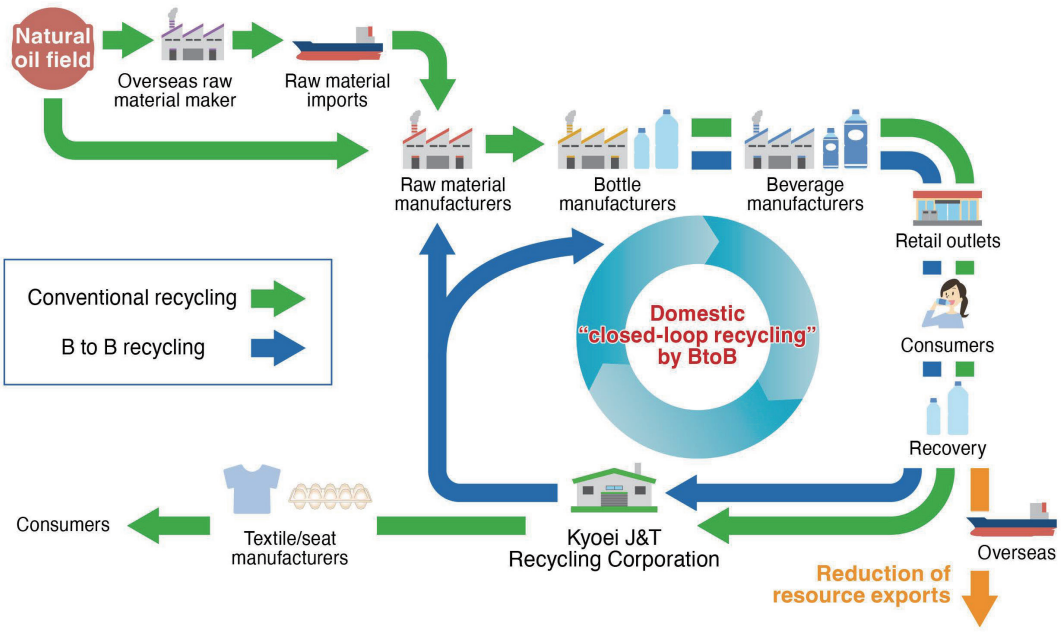
Kyoei J&T Recycling Corporation*1, a subsidiary of J&T Recycling Corporation*2, launched its flake manufacturing plant in October 2021 and completed its pellet production line in April 2022 to begin full-scale commercial operation. Its bottle-to-bottle (B-to-B) technology facilitates repeated recycling (closed-loop/horizontal recycling) an unlimited number of times, achieving a 63% reduction in $CO_2$ compared to the production of PET bottles from crude oil (calculated by Mitsubishi UFJ Research and Consulting Co., Ltd.), and was included as an example*3 of addressing resource and environmental constraints in the White Paper on Manufacturing Industries (Monozukuri) 2010, published by the Ministry of Economy, Trade and Industry.

Beverage manufacturers and retailers are pursuing a variety of ways to boost the recycling rate of PET bottles (B-to-B). In response to these needs, the B-to-B business of Kyoei J&T Recycling significantly contributes to realizing a circular economy and reducing $CO_2$ emissions by curbing the use of natural resources.

*1 A joint venture of J&T Recycling Corporation and Kyoei Sangyo Co., Ltd.
*2 A Group company of JFE Engineering
*3 By Kyoei Sangyo Co., Ltd.

Exterior of West Japan PET Bottle MR Center

**Horizontal Recycling Flow of PET Bottles**




- Kyoei J&T Recycling Corporation's West Japan PET Bottle MR Center Begins Full Commercial Operations
  (https://www.jt-kankyo.co.jp/en/topics/2022/04/20220421.html)
- Establishment of Joint Venture between J&T Recycling Corporation and Kyoei Sangyo Co., Ltd. — Construction of Japan's Largest PET Bottle Recycling Resin Plant Contributing to the Shift to B-to-B (Japanese only)
  (https://www.jfe-eng.co.jp/news/2020/20200507.html)

## EN Recycling Food Waste

Sapporo Bio Food Recycling Corporation of the J&T Recycling Corporation Group has constructed a new plant to update and expand the capacity of its food recycling power generation plant in Sapporo City, and the plant started operation in November 2024. It is Hokkaido's largest food biogas power generation facility*1, and J&T Recycling operates food recycling power generation businesses*2 at six locations nationwide, including this site.

In 2018, Sapporo City formulated the "2nd Sapporo City Basic Environmental Plan" and has been actively promoting waste reduction and resource recycling initiatives toward achieving zero carbon city status by 2050. While the progress of the plan shows significant reduction in both "household waste" and "business waste" over the past decade, the volume and utilization rate of food waste remained a challenge. To address this issue, Sapporo Bio Food Recycling has renovated its existing plant in the Sapporo Recycling Complex and significantly strengthened its processing capacity. The new plant will be capable of processing up to 100 tons per day, handling not only the existing 68 tons per day of municipal food waste from Sapporo City school meal centers but also industrial food waste from food manufacturing plants in and around Sapporo City.

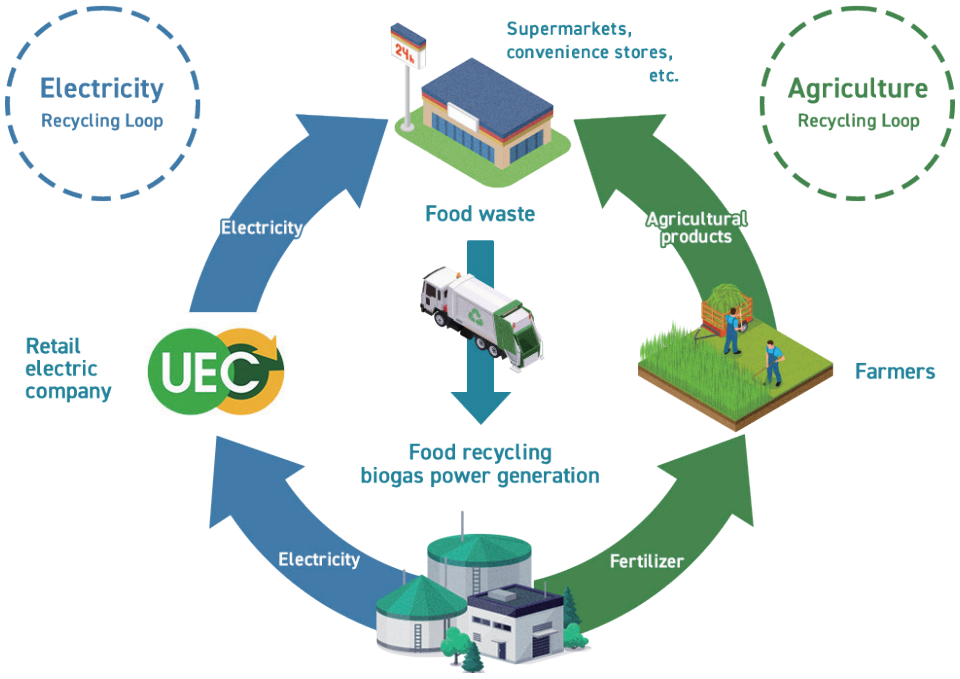
The new facility generates electricity by fermenting food waste using microorganisms and using the produced methane gas as fuel. The power output is 1,980 kW, with an expected annual power generation of approximately 16,420 MWh (equivalent to the annual electricity consumption of about 4,560 households). The generated electricity will be sold through the "Feed-in Tariff" system and through Urban Energy Corporation (UEC), JFE Engineering's retail electricity subsidiary, aiming to promote local production and consumption of renewable energy. Furthermore, the fermentation residue produced during the treatment process will be entirely converted into fertilizer. This will realize a local so-called "double recycling loop" that converts food waste into both clean power and fertilizer.

The JFE Engineering Group will continue to work with local communities to promote improved food recycling rates and local production and consumption of renewable energy, contributing to the realization of a recycling-based society.

*1 Largest biogas power generation facility using food waste as raw material in Hokkaido (according to our research)

› *2 Food recycling business of the J&T Recycling Group (https://www.jt-kankyo.co.jp/en/business/#sec03)

**Double Recycling Loop: Creating Renewable Energy and Fertilizer from Food Waste**



Food recycling power generation plant (SAPPORO BIO FOOD RECYCLING)

## EN Development of a Waste Chemical Recycling Technology (C-PhoeniX Process™) through the Use of the Green Innovation Fund

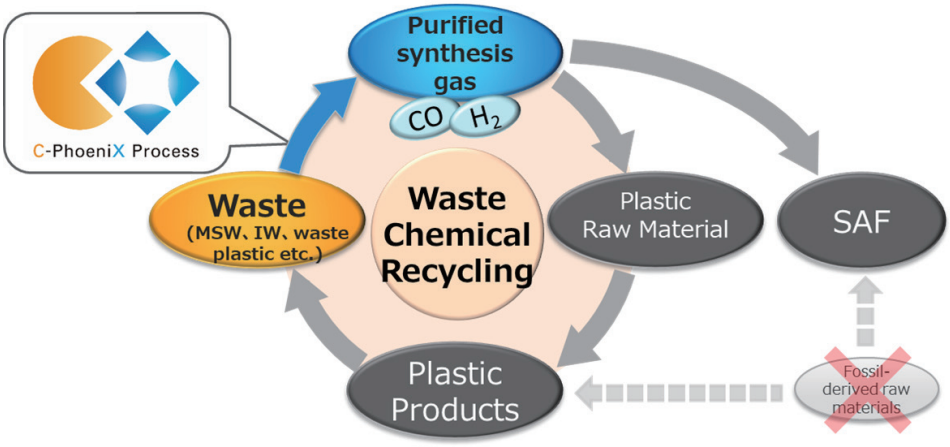
JFE Engineering responded to a public invitation to participate in the "Green Innovation Fund Project/Achieving Carbon Neutrality in Waste and Resource Circulation" project of the New Energy and Industrial Technology Development Organization (NEDO) in February 2024 and was selected*. Following more than two decades of trial and error, JFE Engineering established a technology to convert domestic and other kinds of waste into processable gases. The company's unique gasification furnace has the longest running record in the world. The company is currently developing a new gasification technology, C-PhoeniX Process™ (or CX Process™), to improve and ultimately replace the current technology for carbon neutrality.

The C-PhoeniX Process™, based on the company's accumulated technological expertise, exhibits an advanced capability to constantly produce high-quality, purified synthesis gases, consisting primarily of hydrogen and carbon monoxide, from a wide range of waste materials. Once established, this technology will be applicable to the waste-to-chemical (WtC) process, enabling many types of waste to be recycled for different purposes, including the production of plastic, sustainable aviation fuel (SAF), and hydrogen.

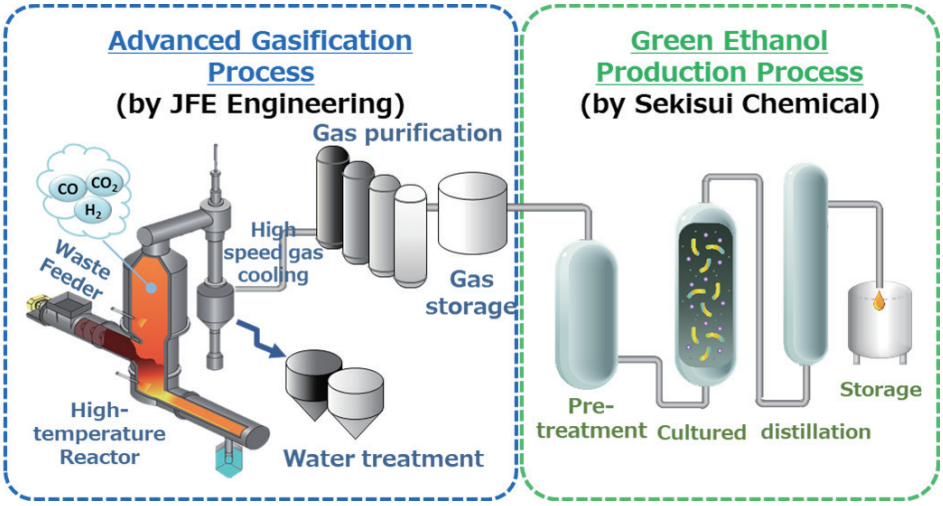
Through the use of the national Green Innovation Fund, JFE Engineering is set to develop a waste chemical recycling technology in cooperation with SEKISUI CHEMICAL Co., Ltd., which owns a technology for converting waste-originated purified synthesis gases into ethanol. In the meantime, JFE Engineering will accelerate the development of its C-PhoeniX Process™ for the advancement and social implementation of WtC. Development under the Green Innovation Projects is scheduled to be completed by the end of FY2030. JFE Engineering will deploy these two technologies, once established, overseas as well as in Japan, and will thereby contribute to the achievement of carbon neutrality by 2050.

› *NEDO launches its Green Innovation Fund Projects to Achieve Carbon Neutrality in the Waste and Resource Circulation (Japanese only) (https://www.nedo.go.jp/news/press/AA5_101724.html)

**Overview of Waste Chemical Recycling**



**Entire Process and Development Domains**



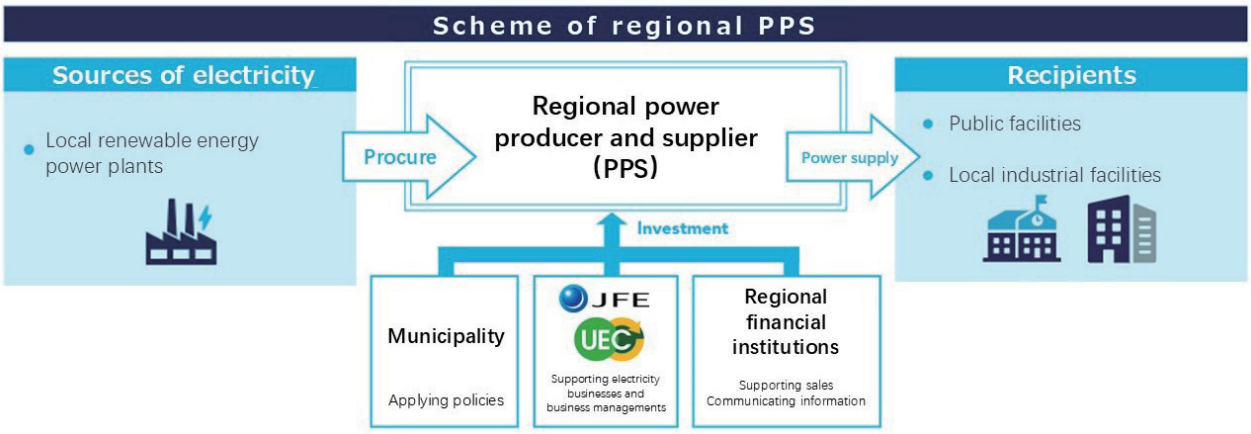

- Developing the Advanced Waste-to-Chemical Gasification Process, the "C-PhoeniX Process " Toward Practical Use in Society
  (https://www.jfe-eng.co.jp/en/news/2024/20240207.html)
- "Waste-to-Chemical Technology Development for Green Ethanol Production by Integrating Advanced Gasification and Biochemical Conversion Technologies" adopted for the NEDO Green Innovation Fund project
  (https://www.jfe-eng.co.jp/en/news/2024/20240215.html)

## EN Support for New Regional Electricity Projects

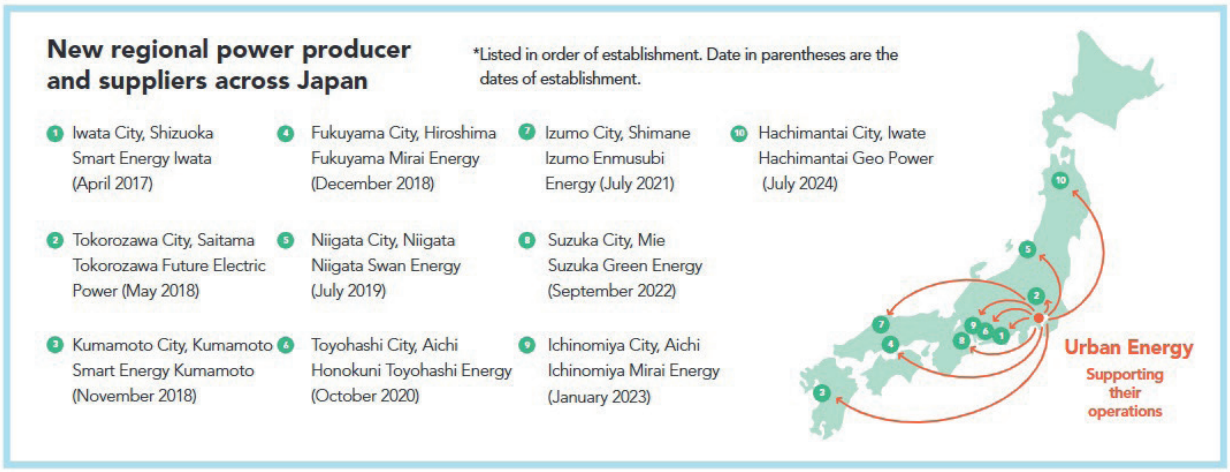
JFE Engineering is creating mechanisms for effectively using regional renewable energy sources such as wind and geothermal power and supplying electricity to local public facilities from renewable energy plants constructed by JFE Engineering, including waste-to-energy plants. These efforts support local production and consumption of energy.

Urban Energy Corporation (UEC), a subsidiary of JFE Engineering, provides consistent support for new regional electricity projects, from establishment to operation, with the goal of achieving regional decarbonization and stabilizing energy costs. Drawing on its extensive experience and expertise cultivated in the retail power business, UEC ensures stable and efficient operations, thereby contributing to the creation of sustainable communities.

**New Regional Electricity Scheme Diagram**



**Record of Support for New Regional Electricity Projects**




## EN Construction and Operation of Waste-to-Energy Plants Overseas

JFE Engineering and the Thuan Thanh Environment Joint Stock Company*1 (TT) jointly established T&J Green Energy Company Limited (T&J) to conduct a waste-to-energy business in Bac Ninh Province, Vietnam.

After the establishment of T&J, JFE Engineering was responsible for plant design, construction, and operation, while TT handled the obtaining of permits and approvals, securing the plant site, collecting and transporting waste for incineration, and treating incineration ash. The waste-to-energy plant began selling electricity in January 2024. The facility incinerates 500 tonnes per day of municipal and industrial waste with an output of 11.6 MW and an expected annual power generation of 91,872 MWh. The generated electricity is sold to Vietnam Electricity Corporation under the feed-in tariff (FIT) system.

Funding for the construction and operation of the T&J plant was provided through the equipment subsidy program under the Japanese government's Joint Crediting Mechanism (JCM),*2 together with loans from the International Finance Corporation (IFC) of the World Bank Group and the Finland–IFC Blended Finance for Climate Program. This financing package was based on recognizing the project's proper waste treatment and an expected reduction of approximately 600,000 tonnes of GHG emissions over 15 years. The project was implemented in cooperation between the governments of Vietnam and Japan. Both companies plan to use this project as a pilot for launching similar efforts.

Drawing from the JFE Engineering Group's experience in the construction and operation of waste treatment plants, we will continue to contribute to the realization of a resource-recycling society by promoting business planning, construction, and operation in this field in Japan and overseas.

*1 A major recycling company in Vietnam is comprehensively engaged in waste incineration and other recycling businesses.
*2 Refinanced by a local bank at present.

Waste-to-Energy Facility in Bac Ninh Province, Vietnam

## ST Utilization of Byproducts Generated in the Steelmaking Process (Dust, Sludge, Slag)

JFE Steel carefully controls the generation and emission of iron and steelmaking slag (a co-product), iron dust from blast furnaces and converters, sludge from water treatment facilities, and other co-products by setting targets to improve recycling rates. Dust and sludge with high iron content are recycled as raw materials for steelmaking. Iron and steelmaking slag is effectively recycled for reuse in cement and other construction materials. The company is also promoting its use as environment recovery material such as Marine Stone™, which works effectively as a base for the adhesion of organisms and for improving the marine environment. As a result of these efforts, it achieved a 99.5% recycling rate for slag, dust, and sludge in FY2024, fulfilling the target of at least 99%, and it remains committed to consistently achieving the target.

For more quantitative data related to co-products, please refer to:
› Environmental Data (P. 255)

### Contribution of Steel Slag Products

Many steel slag products are designated as specified procurement items (products that contribute to the reduction of environmental impact) for public works under the Act on Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities (Act on Promoting Green Procurement), which was enacted in 2001 to protect the natural environment.

To realize a circular economy, JFE Steel has set a target under the Eighth Medium-term Business Plan (FY2025–FY2027) for using a cumulative total of 320,000 tonnes of steel slag products for marine applications (with actual usage of 40,000 tonnes in FY2024), in order to contribute further to the conservation of natural resources (sand and stone). We will further expand this effort.

#### ● Calcia Improvement Material

Calcia improvement material is a slag product that uses converter-type steelmaking slag as raw material and is manufactured by controlling the composition and adjusting particle size. Dredged soil mixed with calcia improvement material is called calcia improved soil, which is stronger than the original weak dredged soil and is therefore able to prevent dredged soil from dissipating into the surrounding area and having a negative environmental impact placed in water. As a construction material for infrastructure development, it can be applied to landfill materials and other uses, enabling the effective use of dredged soil. Calcia improved soil has been used to construct a mid-section submerged breakwater*1 (Shin Honmoku Pier, Port of Yokohama), backfill material for earthquake-resistant quay walls (Fukuyama Port Minoshima District quay wall construction project), and soil for bank protection (Tokyo new landfill site development project).

Calcia-improved soil can also be used for creating shallow waters and tidal flats and backfilling deep excavated holes, as a technology that can restore marine environments*2.

*1 An embankment built under the water surface on the inside of a perimeter wall to divide the land into sections for reclamation

› *2 Biodiversity Conservation and Nature Positive (P. 151)

**Calcia Improvement Material and Calcia Improved Soil**



Example of calcia improvement soil application (landfill material)

### Steel Slag Hydrated Matrix

Steel slag hydrated matrix is a steel slag product that can be used as a substitute for concrete but uses ground granulated blast furnace slag instead of cement, and steel slag instead of natural gravel and sand aggregate, as its ingredients. It effectively uses steel slag and does not rely on natural aggregate, thereby reducing environmental impact, and uses less cement, in turn reducing $CO_2$ emissions.

There are many examples of blocks and artificial stones made from steel slag hydrated matrix being used as a substitute for concrete blocks and natural stones in harbor works, apart from the expected application for scour-prevention at the growing number of offshore wind-power stations to be constructed in the near future. In addition, we are conducting on-site monitoring in the Katsunan Central Zone of Chiba Port with the help of a local fishing association to assess the impact of these blocks on marine biodiversity.

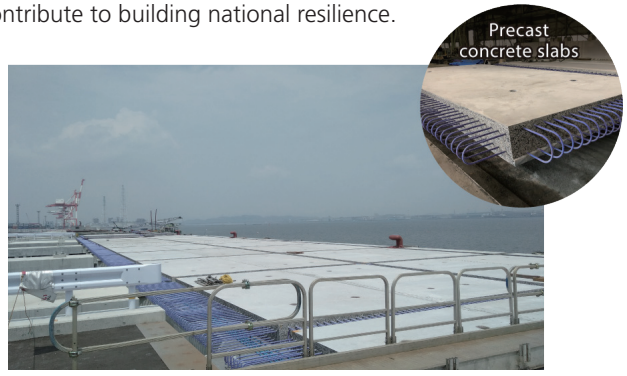
Wave-dissipating and foot protection block

Artificial stones made from steel slag hydrated matrix

### Precast Concrete Products Mixed with Finely Ground Blast Furnace Slag

Finely ground blast furnace slag can be used as a cementing material in concrete. This type of concrete exhibits significantly higher durability under harsh conditions such as applications in sewers and exposure to anti-freeze agents. Its effectiveness in reducing environmental impact is widely understood, although there has recently been growing interest in its practical applications for concrete constructions that require higher durability.

As one of the deliverables for the Japanese government's Strategic Innovation Promotion Program, the Japan Society of Civil Engineers published a draft guideline in March 2019 on the application of finely ground blast furnace slag to precast concrete product, and its application now includes precast concrete slabs installed in highways and piers. With the application of finely ground blast furnace slag in concrete, the durability of precast products is expected to be greater and more consistent, allowing them to contribute to building national resilience.




Precast concrete slabs mixed with finely ground blast furnace slag installed in piers

### Granulated Blast Furnace Slag

Granulated blast furnace slag, when ground to a fine powder and used to replace part of ordinary Portland cement, reduces the amount of limestone, crushed stone, and sand used, saves energy, and can also reduce $CO_2$ generated in cement production. For example, blast furnace cement made by replacing 45% of ordinary Portland cement with granulated blast furnace slag reduces $CO_2$ emissions per tonne of cement produced by 42%. In FY2024, JFE Steel supplied approximately 5.61 million tonnes of granulated blast furnace slag to cement production, equivalent to a reduction of about 3.98 million tonnes of $CO_2$ emissions.

**$CO_2$ Emissions for Producing 1 Tonne of Cement (Unit: kg-$CO_2$/tonne)**

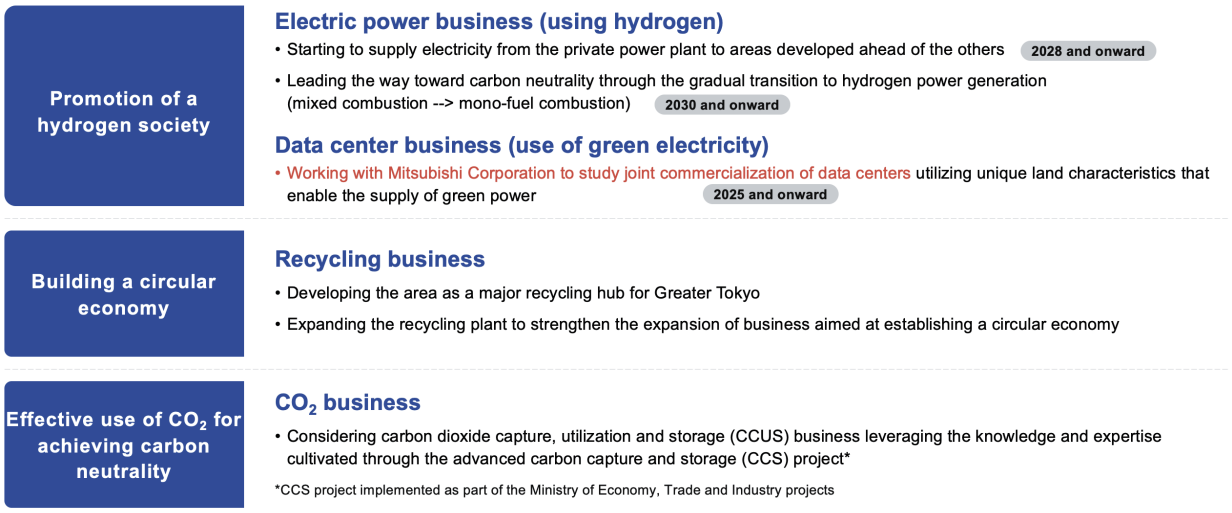
| $CO_2$ Emissions Source | Regular Cement | Blast Furnace Slag Cement |
|---|---|---|
| Limestone | 476 | 270 |
| Electricity/energy | 283 | 170 |
| Total | 759 | 440 |

*Source: Data published by the Japan Cement Association compiled from the actual FY2022 data

## Initiatives for Realizing a Circular Economy in the Keihin Waterfront Area

Taking advantage of its proximity to Tokyo, the Mizue district is collaborating with Kawasaki City in expansion and development to create a major recycling hub for the metropolitan area. J&T Recycling Corporation, a group company of JFE Engineering, partnered with JR East and others to establish J Circular System Corporation in a pioneering project to construct the J Circular Systems Kawasaki Super Sorting Center as one of the largest plastic recycling facilities in the metropolitan area. Full-scale operations commenced in April 2025. Going forward, we will continue to promote businesses toward realizing a circular economy through the expansion and development of the recycling area.

**Keihin District land business utilization (from materials of the Eighth Medium-term Business Plan)**



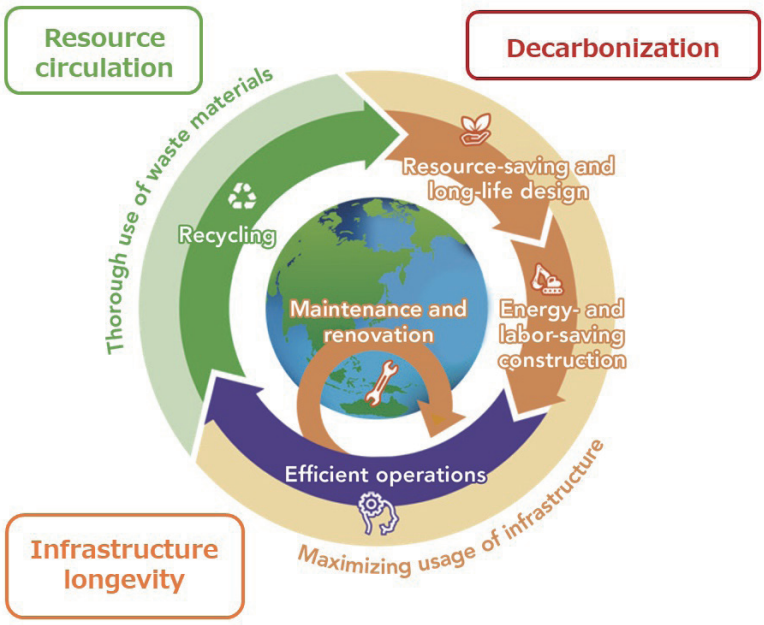

# Development of Resource-Efficient Eco-Products and Eco-Solutions

The JFE Group is developing and providing resource-efficient products and services to support the realization of a circular economy. We are deploying eco-products designed from the perspective of the entire life cycle and eco-solutions that create circular value to reduce environmental impact and effectively use resources.

## EN Infrastructure Reinforcement and Longer Service Life

JFE Engineering is leveraging its diverse business portfolio to promote multifaceted efforts for transitioning to a circular economy. In the infrastructure field, we are helping to realize a sustainable society through projects that maximize the useful life of infrastructure through resource-saving and long-life design, energy- and labor-saving construction, and efficient operation through maintenance and renovation.

**JFE Engineering Circular Economy**




### Toward Realizing Longer Service Life Bridges

Japan's stock of social infrastructure is expected to age rapidly in the coming years. At the same time, declining birth rates, an aging society, and population decline are reducing the available labor force, making it increasingly difficult to secure engineers for infrastructure maintenance. To address this, JFE Engineering is working to lessen the burden of maintenance by using highly durable materials to construct bridges with longer service life.

#### Technology Allowing for Bridges with Longer Service Life

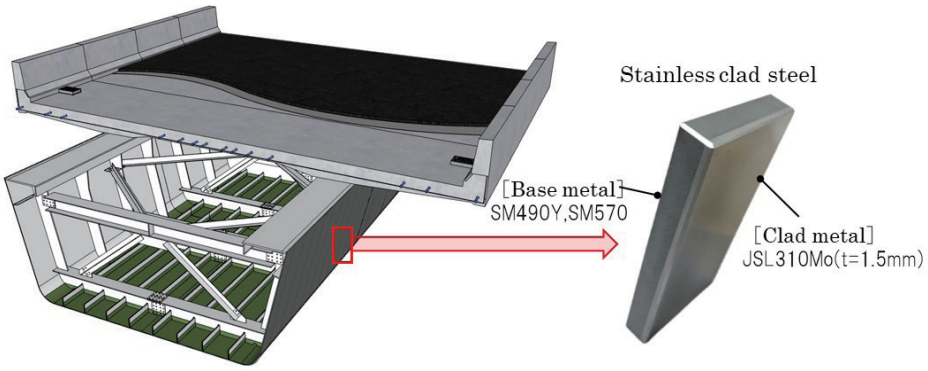
Conventional steel bridges suppress corrosion by using coatings such as paint that must be periodically reapplied. Using highly durable materials that do not need to be coated eliminates the need for reapplications, significantly reducing maintenance tasks associated with ordering, design, construction, and management. Moreover, these bridges demonstrate superior cost savings over a 100-year life cycle compared to painted bridges. We have thus pioneered in adopted stainless clad steel for constructing a road bridge.

Stainless clad steel is a steel plate with a two-layer structure, combining ordinary steel (carbon steel) and stainless steel. Stainless steel is placed on the outer surface, which is susceptible to salt damage, while painted carbon steel (base material) is used on the inner surface, which is less susceptible to corrosion. A stainless clad steel bridge is more economical than bridges made entirely of stainless steel or carbon steel, thereby combining economy and durability.

The clad steel selected for this project uses JSL310Mo, a stainless steel with extremely high corrosion resistance, to extend service life. This seawater-resistant stainless steel was uniquely developed by JFE Steel as a material for clad steel, positioning JFE Steel as a pioneer in fabrication and construction technology for steel structures using clad steel. This one-of-a-kind long-life bridge was possible through the combined strengths of the entire JFE Group.

The bridge is currently under construction as part of the replacement work for the Tedori River Bridge on the Hokuriku Expressway, commissioned by Central Nippon Expressway Company Limited.

**Bridge using stainless clad steel**




## ST Anti-Fatigue-Damage Steel for Increased Bridge Safety (AFD™ Steel)

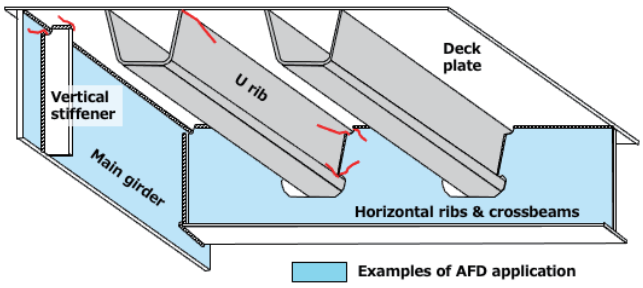
Extending the service life of steel structures conserves resources and reduces waste, although durability remains challenging. In particular, bridges contain many thin components that may develop fatigue cracks due to traffic load from automobiles and other vehicles, and cracks may propagate between inspections or repairs.

JFE Steel has developed a thin version of its anti-fatigue-damage steel (AFD™*1 steel) with improved fatigue resistance. The steel plate, produced by a plate mill at the East Japan Works (Keihin District) using the Super-RQ system with advanced cooling control, has a minimum thickness of 9 mm and retains the mechanical properties of conventional plates while offering improved fatigue resistance. Realization of thin-plate AFD™ steel allows for the application of highly durable materials across a wider range of structural members, such as thin bridge components prone to fatigue cracking. In addition, AFD™ steel suppresses fatigue crack propagation rate*2 to one-half or less compared to the upper limit of ordinary steel, and product life has been extended about twice the useful life of ordinary steel. This reduces life cycle costs accompanying the longer service life of components. The product received the Grand Prize in the Nikkei Superior Products and Services Awards 2023 in recognition of these features.

*1 Anti-fatigue damage

*2 Fatigue damage is caused by small, repeated forces that create cracks that gradually grow until the material fails. Since these cracks propagate incrementally with the repeated application of force, the length over which the cracks propagate per repetition is called the fatigue crack growth rate.

**Examples of Thin AFD Steel Application**




› Developed thin, fatigue-resistant steel for steel structures (https://www.jfe-steel.co.jp/en/release/2023/230330.html)

## ST Electrical steel sheets

Electrical steel sheets* are popularly used as core materials for electrical equipment such as motors and transformers and therefore play a key role in determining their performance. JFE Steel contributes to global energy conservation and consequently to reducing $CO_2$ emissions by supplying high-performance electrical steel sheets.

*Electrical steel sheets are obtained by adding silicon to iron and are widely used as iron core materials in equipment such as motors and transformers.

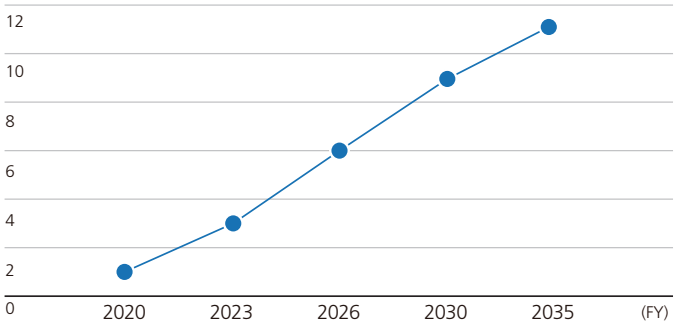
### Non-Oriented Electrical Steel Sheets Completion and Start-up of Phase I Expansion and Strengthened Production Capacity at the West Japan Works (Kurashiki District)

Transitioning to a carbon-neutral society requires a major transformation of the social structure, from fossil-fuel-based energy to primarily carbon-free sources. Highly efficient motors, constructed from high-performance, non-oriented electrical steel sheets, will be essential for transitioning to a society in which mobility depends on electric vehicles (xEVs) and zero-emission electricity is the primary source of energy.

JFE Steel's high-grade non-oriented electrical steel sheets contribute to higher performance xEV drive motors through the improved efficiency of excellent low-iron-loss magnetic properties and reduced size made possible by high magnetic flux density. Recognizing the value of these characteristics has led many automobile manufacturers to incorporate these materials into their products, and demand for high-grade non-oriented electrical steel sheets is projected to expand rapidly. To keep pace with this demand, Phase I expansion work to increase capacity for electrical steel sheet production was completed as planned in July 2024, and line production began in September. The start-up of this facility had doubled JFE Steel's production capacity for high-grade non-oriented electrical steel sheets (NO).

Since an even sharper surge in demand is expected for high-grade non-oriented electrical steel sheets essential for xEV drive motors, Phase II expansion work is now underway. This plan is projected to triple production capacity for top-grade non-oriented electrical steel sheets for main xEV motors by FY2026 compared to pre-Phase I levels.

**Demand for Non-Oriented Electrical Steel Sheets**
**(Calculated by JFE, 2020 results = 1.0)**



## Grain-Oriented Electrical Steel Sheets: Acquisition of Electrical Steel Sheet Manufacturing Company in India

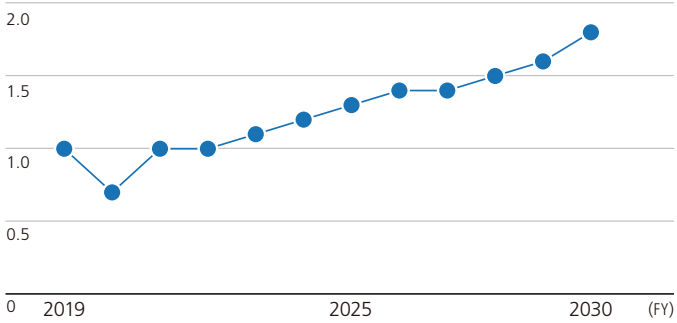
The global demand for grain-oriented electrical steel sheets in transformers is expected to increase due to continuously growing demand for electric power and the expanding adoption of renewable energy. The demand for grain-oriented electrical steel sheets, particularly in India, is expected to increase by 1.8 times in 2030, compared to 2019.

In response, JFE Steel and JSW Steel Limited (JSW) established JSW JFE Electrical Steel Private Limited (hereafter J2ES), a joint venture company in India for grain-oriented electrical steel sheets, in 2023. Preparations, including equipment planning, are currently underway toward starting production in FY2027.

In addition, JFE Steel and JSW jointly acquired, through J2ES, thyssenkrupp Electrical Steel India Private Limited, an Indian manufacturer and distributor of electrical steel sheets in January 2025.

With this acquisition, J2ES will be able to enter the Indian market for grain-oriented electrical steel sheets earlier than planned, ahead of full-scale production in FY2027, thereby capturing medium- to long-term demand for these products. After the acquisition, we will quickly establish an integrated system covering manufacturing through sales to respond effectively to future growth in demand.

**Demand for Grain-Oriented Electrical Steel Sheets in India (Calculated by JFE, 2019 results = 1.0)**




## Resource-Saving Silicon-Gradient Steel Sheets

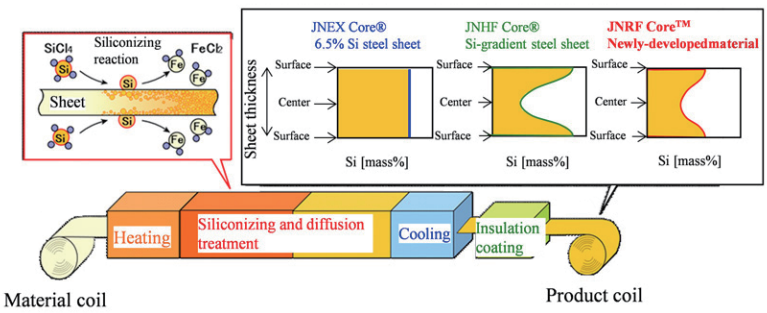
The recent trend toward increasing driving frequency due to the downsizing of electrical equipment has intensified the need to reduce iron loss* in the high-frequency range for electrical steel sheets, widely used as iron core material for electrical equipment such as motors and transformers. Meeting this demand depends upon increasing the concentration of silicon (Si), an element that strengthens electrical resistance. However, increasing concentration also causes magnetic flux density to decrease at the same time.

To overcome this, JFE Steel developed JNHF™, JNSF™, and JNRF™ using its proprietary chemical vapor deposition (CVD) continuous siliconizing process technology for controlling Si concentration distribution. These steel sheets offer low iron loss and high magnetic flux density in the high-frequency range, significantly contributing to higher efficiency and downsizing of electrical equipment. They are used as core materials for solar power reactors and high-speed motors.

In recognition of the positive social impact of this development, we received the 2022 Award for Science and Technology from the Minister of Education, Culture, Sports, Science and Technology under the development category of the science and technology field. JFE Steel will continue to contribute to improving electrical equipment by raising efficiency, reducing size, and saving energy by providing high-performance, high-grade electrical steel sheets.

*The loss of energy, primarily as heat, that occurs when the iron core is excited by an alternating current. The less iron lost, the higher the efficiency of electrical equipment.

**CVD Continuous Siliconizing Process and Si Concentration Distribution Control**



> **Received the 2022 Award for Science and Technology from the Minister of Education, Culture, Sports, Science and Technology for the science and technology field (development category). (Japanese only)**
(https://www.jfe-steel.co.jp/release/2022/04/220408.html)

### SH Further Expanding the Global Supply Chain for the Steel Sheets Business

The key factor in initiatives for countering climate change, including those for reducing $CO_2$ emissions, is minimizing electricity loss and using generated electricity without loss. Motors found in places such as power plants, factories, and homes are responsible for 40–50% of all electricity consumed globally. In Japan, the ratio is approximately 55%. Improving the efficiency of motors by 1% in Japan would contribute to the equivalent of a 500,000 kW-class power generation plant in energy savings. Motors for electric vehicles, which are expected to become increasingly popular as we move toward a decarbonized society, and industrial motors essential for factory automation, need to become even more efficient and lighter through downsizing. In addition, continuous improvement in efficiency is required in transformers, which are essential for distributing electricity from source to factories and homes, in order to minimize energy loss in power transmission and distribution.
JFE Shoji has established a stable global supply chain that includes sourcing high-quality electrical steel sheets, which are essential for improving the efficiency of motors and transformers, from JFE Steel and other manufacturers and processing the products to meet customer needs. Since customers who depend on high-quality electrical steel sheets, such as manufacturers of motors and transformers, typically operate manufacturing facilities across the globe, the company has been expanding its electrical steel sheets supply chain in Japan, the Americas, China, ASEAN, India, and Europe. JFE Shoji will continue to build the world's number-one global distribution and processing system for high-quality electrical steel sheets by further expanding its supply chain, enhancing processing functions, and expanding collaboration with alliance partners, to precisely respond to customer needs.

### ST Verification of the Feasibility of Making Motors 48% Thinner Using Insulated Pure-Iron Powder Denjiro™

In a joint project with JFE Techno-Research Corporation and ARMIS CORPORATION, a venture company launched by Shizuoka University, JFE Steel designed and prototyped a motor using Denjiro™, the company's insulated pure-iron powder, and demonstrated the feasibility of producing motors 48% thinner and 40% lighter than conventional models while maintaining the same output.

Demand continues to rise for smaller but higher-performing electric motors for industrial equipment and vehicles. Axial-gap motors, which are thinner than general radial-gap motors, can deliver high power (Figure 1). Unlike radial-gap motors, however, axial-gap motors pose a significant manufacturing challenge by requiring a three-dimensional magnetic core that cannot be made by laminating electrical steel sheets. In contrast, powder cores formed by pressing insulation-coated magnetic powder possesses uniform three-dimensional magnetic properties, can accommodate complex shapes, and provide flexibility in design. Furthermore, because these cores are easily crushed, copper wire can be readily separated and recovered from motors, improving recyclability. Efforts are underway to remanufacture crushed powder cores by reforming them for reuse.

JFE Steel has developed and launched an insulation-coated pure iron powder Denjirou™ for powder cores. In this project, an axial gap motor incorporating powder cores made with Denjirou™ was designed, prototyped, and evaluated for performance (Figure 2). The results showed a 48% reduction in height and a 40% reduction in weight compared to conventional motors, at equal or greater efficiency (Table, Figure 3). Based on these results, JFE Steel and JFE Techno-Research Corporation have begun supporting customer design of components using powder cores while also supplying large powder compacts for machining and prototype powder cores processed into designed shapes to promote the use of powder cores for motors.

Going forward, JFE Steel will continue to develop products that meet customer needs while also encouraging technical exchanges, such as proposing the application of technologies and supporting prototype evaluation. These efforts will expand the supply of eco-products that contribute to a circular society and help realize a sustainable society.

**Figure 1: Types of motors**

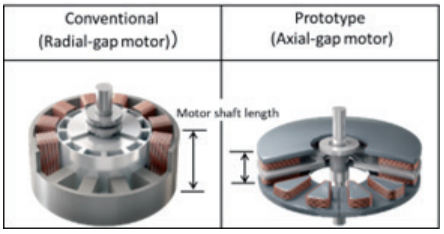
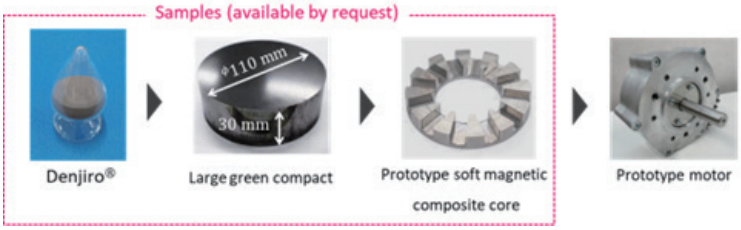



**Figure 2: From powder to prototypes**

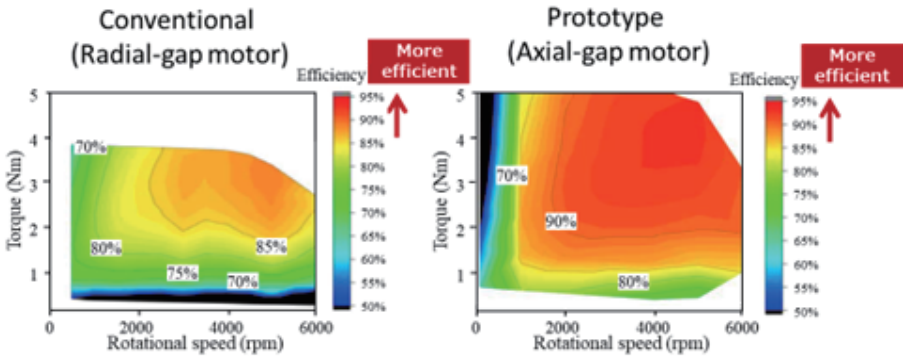



**Conventional vs. prototype motor (test results)**

| | Conventional (Radial-gap motor) | Prototype (Axial-gap motor) |
|---|---|---|
| Motor shaft length (mm) | 90 | 110 |
| Core weight (g) | 1270 | 760 |
| Core diameter (mm) | 62 | 32 |
| Max. efficiency (%) | 89 | 93 |
| Max. torque (Nm) | 3.7 | 5.4 |

Thinner, Lighter

**Figure 3: Efficiency of conventional vs. prototype motor**




› [JFE Steel's New Insulated Pure-iron Powder for Soft Magnetic Composites Enables Prototype Axial-gap Motor to be Slimmed Down by 48%](https://www.jfe-steel.co.jp/en/release/2024/01/240116.html) (https://www.jfe-steel.co.jp/en/release/2024/01/240116.html)

## ST High-Tensile-Strength Steel Sheets (HITEN) for Automobiles

Applying high-tensile-strength steel sheets (HITEN) to automobile components helps reduce weight while maintaining crash safety performance. JFE Steel contributes to improved fuel efficiency and ultimately reducing $CO_2$ emissions by supplying customers with ultra-high-tensile-strength steel sheets that meet needs for lighter car bodies. In addition to developing and producing these steel sheets for automobiles, JFE Steel develops application technologies. These include techniques for applying body design and forming/assembly technologies, which have been systematized to offer comprehensive solutions as JESOLVA™ (JFE Excellent SOLution for Vehicle Application), JFE Steel's unique suite of application technologies for automotive steel sheets. To provide these solutions, JFE Steel is actively promoting early vendor involvement (EVI) activities, in which it collaborates with customers from the early stages of automobile development. By improving car body performance and reducing weight, JFE Steel is contributing to the development of next-generation automobiles and the realization of a sustainable society.

## Construction of a Hot-Dip Galvanizing Line at West Japan Works (Fukuyama District)

The automotive industry is producing lighter and stronger car bodies to meet increasingly stringent environmental regulations and collision safety standards around the world, and demand is expected to grow for ultra-high-tensile sheets* with excellent processability. JFE Steel has therefore decided to construct a new hot-dip galvanizing line (CGL) at the West Japan Works (Fukuyama District), with an annual production capacity of 360,000 tonnes. The investment will total approximately 70 billion yen, with operations scheduled to commence in October 2028. The new line will enable JFE Steel to increase its production capacity for such sheets, including its JEFORMA™ series, to meet growing demand in the foreseeable future and respond to subsequent needs for even higher strength and functionality.

*High-strength steel sheets with tensile strength ≥980 MPa (megapascals)

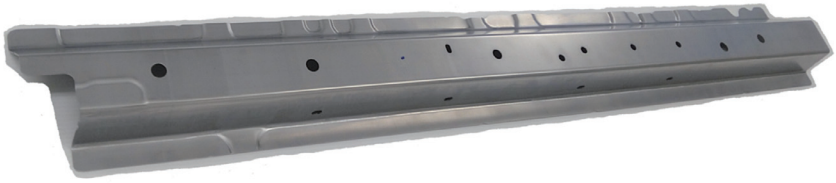
## Wall Bending and Restrike Method to Suppress the Springback of Ultra-High Tensile Steel Sheets

JFE Steel's Wall Bending and Restrike Method has been adopted and used to produce inner rockers, a body frame component, for use in vehicles manufactured and sold by a major Japanese automaker. The Wall Bending and Restrike Method, a press forming method, is applied to suppress the springback of 1,180 MPa class, ultra-high tensile steel sheets.

Since pressed steel sheets are subject to springback—that is, returning to their original shape when removed from a mold—springback conditions must be corrected. Press-formed ultra-high tensile steel sheets generate greater stress than ordinary steel sheets and are therefore more susceptible to higher levels of springback. The resulting challenge of controlling deformation from the intended shape and the increased difficulty of bonding with other components has been a bottleneck to the wider application of ultra-high tensile steel sheets.

The Wall Bending and Restrike Method provides a solution for reducing springback by applying an offsetting force to springback-induced stress, particularly through the optimization of sheet shape prior to press-forming. The inner rockers, a structural component at the bottom of a vehicle door, for which the Wall Bending and Restrike Method is used, are manufactured by Kyoho Machine Works, Ltd., and the application of this method to mass-production molds was achieved through a joint development by this company and JFE Steel.

**Inner rocker made with the Wall Bending and Restrike Method**



## Forming Technologies for Ultra-High Tensile Steel Sheets—Inflow Control Method and Stress Reverse Forming™ Method

JFE Steel's inflow control method and the Stress Reverse Forming™ Method were adopted and have been used for the production of three front bumper components for Suzuki Swift to reduce the formation of wrinkles at pressed areas of 980–1,180MPa class, ultra-high tensile steel sheets and reduce variation in dimensional accuracies.

When press-formed into a curvature shape, press wrinkles form on the steel sheets and the sheets tend to springback to their original shape; both conditions need to be corrected.

While contributing to vehicle weight reduction, ultra-high tensile steel sheets are susceptible to press wrinkles, mold damage, and shape variation, and all these issues are more likely to occur with thicker, stronger steel sheets, a factor that has inhibited the wider application of ultra-high tensile steel sheets. JFE Steel's inflow control method is capable of reducing the formation of press wrinkles, particularly those around the flanges of pressed areas, by optimizing the inflow of materials at multiple press-forming processes.

The Stress Reverse Forming™ Method is designed to reduce variation in the scale of springback (or variation in dimensional accuracies), which increases as ultra-high tensile steel sheets have higher levels of strength. When press-formed, ultra-high tensile steel sheets are more susceptible to springback and to large variation in strength intensities than regular steel sheets. The Stress Reverse Forming™ Method uses the Bauschinger Effect, or the mechanical phenomenon in which

deformation stress in steel sheets decreases immediately after the direction of the deformation is reversed. This method enables customers to stabilize their production of press components even if there are changes in the intensities of steel sheets.

The front bumper components for which these two methods are used are manufactured by Okamoto Press Industry, Co., Ltd. In fact, both the inflow control method and the Stress Reverse Forming™ Method were jointly developed by Okamoto and JFE Steel.

## Ultra-High Tensile Steel Sheet Product Adopted for the First time as a Material for a Hybrid EV Battery Module Component

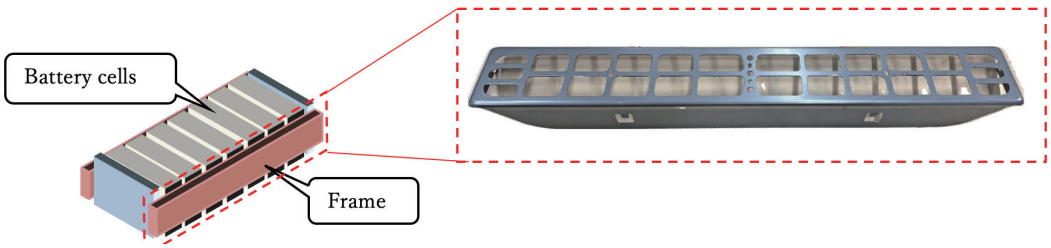
The 980 MPa class galvanized steel sheet was the first of JFE Steel's ultra-high tensile steel sheet products to be selected and used as a material for a lithium-ion battery module frame used in hybrid EVs.

A vehicle battery pack is comprised of multiple battery cells and bound with a steel frame to achieve a high power output. The frame must have a high bonding force to prevent the battery from swelling and from losing performance due to heat during use, and thus there has been demand for a high strength steel sheet. However, high-strength steel sheets are known to be susceptible to fracture when formed by bending. This process is required to minimize the curvature of the folding area of the frame to almost a 90-degree angle and thereby shrink the size of the battery module.

This issue can now be resolved with the use of a press-forming method using CAE* and product specs developed by J-MAX Co., Ltd., both of which have enabled the use of JFE Steel's 980 MPa class, galvanized steel sheet that has the high processability suitable for a battery module frame on hybrid EVs. This galvanized steel sheet is a product of the JEFORMA™ series, a lineup of steel sheets with high strength and high bending formability, properties achieved by optimizing the metallographic structure of the steel sheet through intricate temperature control at the continuous galvanizing facility of the West Japan Works (Fukuyama District).

*Computer-Aided Engineering. A design tool using computer simulation.

**Ultra-High Tensile Steel Sheet Product Adopted for a Hybrid EV Battery Module Component**




## Cold-Press Forming Technology for Integrated Auto-Frame Component

As a component integration solution using ultra-high-tensile-strength steel sheets and cold-press forming, JFE Steel has developed a technology for reducing the number of components in automobile body structures, targeting the rear member*1 Automakers have recently focused on large-scale component integration technologies such as giga casting, which uses aluminum casting technology, and medium-scale integration technologies such as hot stamping, which involves heating steel prior to press forming and simultaneously cooling and quenching in the die to achieve both formability and component strength. This technology falls into the same category of component integration technologies.

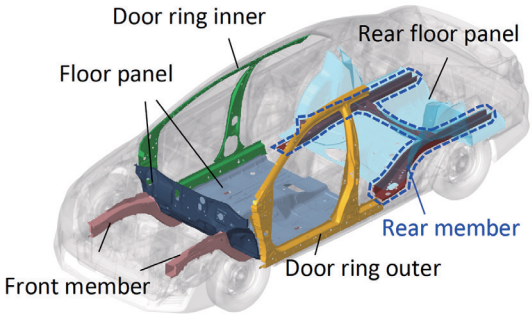
Component integration by cold-pressing presents challenges in formability. However, by utilizing JESOLVA™, JFE Steel's unique systematized solution technology for automotive steel sheets, we have made it possible to form large components using ultra-high-tensile-strength steel sheets of up to 1,470 MPa class. Furthermore, to integrate components with different strengths, we applied Tailor Welded Blank (TWB)*2 and our proprietary Cold Patchwork Method*3, enabling designs with strength variations within a single component. The result is a reduced number of components, even for small-scale integrations, thereby increasing productivity and reducing the cost of auto-frame production.

Challenges arise as integrated components become larger, such as higher logistics costs and greater burdens on end users when damage requires extensive repairs. Limiting integration to appropriate ranges using this technology ensures portability and reduces repair burdens.

The rear member is a large part that protects the body from rear collisions and is composed of 11 spot-welded components. With this technology, the number of components can be reduced to as few as three while maintaining rear collision performance, thereby improving productivity and reducing costs in automobile body manufacturing.

*1 A structural component that supports a vehicle's rear suspension and drivetrain and connects them to the body
*2 A processing technology that uses laser welding to join steel sheets of different thicknesses and strengths into a single sheet
*3 A technology for stacking and spot-welding together steel sheets for simultaneous press forming

**Cold-press integration target and rear member**




**Prototype rear member**

## ST Certification by SuMPO's EcoLeaf Environmental Labeling Program

JFE Steel acquired SuMPO EPD certification for 36 product types under the SuMPO Environmental Label Program operated by the Sustainable Management Promotion Organization (SuMPO). These certifications cover three types of tinplate steel sheets for cans, nine flat steel products, nine construction steel products, three types of steel plates, four steel pipe products, and eight bar and wire rod products.

SuMPO EPD is a Type III EPD program managed by SuMPO for quantitatively disclosing the environmental impact of products and services throughout their life cycle, from raw material procurement to disposal and recycling in accordance with ISO 14025:2006 (environmental labels and declarations, Type III Environmental Declarations, Principles and Procedures). The environmental impact of our products is presented as graphic representations of data to increase transparency. The disclosure of environmental impact data with fairness and reliability assured by third-party review and verification enables customers to quantitatively and objectively evaluate the environmental impact of the products they use.

Going forward, JFE Steel will actively promote the acquisition and publication of SuMPO EPD for its products.

SuMPO EPD JAPAN VERIFIED

> SuMPO Environmental Labeling Program (https://ecoleaf-label.jp/en/)

### ST Extra-Thick, High-Strength Steel Plate for the Materialization of Large Container Ships

The world's thickest crack arrest steel plate*1, developed by JFE Steel, is applicable to large container ships, with its 460 MPa class yield strength and a thickness of 100 mm. The technology is the first in the world to satisfy two different properties in the extra-thick steel plate: weldability and crack arrestability. Ensuring the safety of large container ships improves transport efficiency and fuel savings through lighter ship structures.

Container ships are characterized by large openings in the upper deck. Since their hulls are subjected to large wave loads at sea, extra-thick and high-strength steel must be used in the upper deck and hull sides (hatch side coamings). The trend toward building larger container ships for greater transport efficiency has required that steel plates be thickened from 50 to 100 mm and strengthened to the 460 MPa class in yield strength, while also providing high crack arrest properties to stop the propagation of brittle fractures in the steel. To ensure the safety of rapidly growing hull structures, the International Association of Classification Societies has mandated an arrest toughness value (Kca) of 8,000 N/mm$^{3/2}$ or higher for steel plates of 80 mm and 100 mm thickness used in hatch side coamings. JFE Steel established a proprietary technology using Thermo-Mechanical Control Process (TMCP)*2 technology, which finely controls heating and rolling temperatures, to increase the ratio of crystal orientations in the central thickness of the plate that resist crack propagation. This ensures high crack arrest performance even in 100 mm extra-thick, high-strength steel plates, the world's thickest.

The development of this technology received the 2023 Award for Science and Technology from the Minister of Education, Culture, Sports, Science and Technology under the development category of the science and technology field for significantly contributing to the materialization of ultra-large container ships. It has been awarded many other prizes, including the 2018 Invention Prize of National Commendation for Invention and the 2019 Okochi Memorial Prize. We will continue to improve the economic efficiency, safety, and reliability of vessels by providing high-performance, high-quality steel material while meeting the diverse needs of customers and also addressing global environmental concerns and contributing to the realization of a sustainable society.

*1 A steel plate with outstanding ability to effectively confine hull damage to the minimum should weld cracking occur.
*2 A thermo-mechanical control process technology that improves the strength and toughness of steel material in an online process using controlled rolling and accelerated cooling systems

> Received the Award for Science and Technology from the Minister of Education, Culture, Sports, Science and Technology under the science and technology field (development category) (Japanese only) (https://www.jfe-steel.co.jp/release/2023/04/230407.html)

## Expansion of the Use and Sales of Recycled Resources

The JFE Group is actively promoting the use of recycled resources to help realize a circular economy, and is expanding its market application through products and services that leverage these materials. By combining resource efficiency with waste reduction, we contribute to reducing environmental impact and achieving sustainable growth.

### SH Initiatives to Strengthen the Handling of Environmentally Beneficial Products

Our trading business has strengthened the handling of environmentally beneficial products by setting KPIs for the handling volume of fuels for biomass power plants and steel scrap. Under the Eighth Medium-term Business Plan, JFE Shoji will lead in further expanding the lineup of environmentally beneficial products and promoting efforts toward realizing a circular economy.

### Expanding Business in Biomass Fuels

JFE Shoji imports fuels such as palm kernel shells (PKS) to Japan from Malaysia and Indonesia and wood pellets from Southeast Asian countries as fuel supplies for domestic biomass power plants.

PKS and wood pellets are made from byproducts or waste materials generated during palm oil production and wood processing. Using these as fuel reduces waste and promotes effective resource use. These initiatives also contribute to realizing a circular economy.

Since these biomass fuels absorb $CO_2$ during their growth process, they are regarded as carbon-neutral fuels, offsetting the $CO_2$ emitted when burned. Furthermore, replanting and recultivation of the trees and crops used as raw materials support a more sustainable supply chain.

To encourage the shift away from coal-fired power, JFE Shoji is also developing and supplying alternative biomass fuels to reduce environmental impact and support energy transition through the use of waste as resources.

PKS

Wood pellets

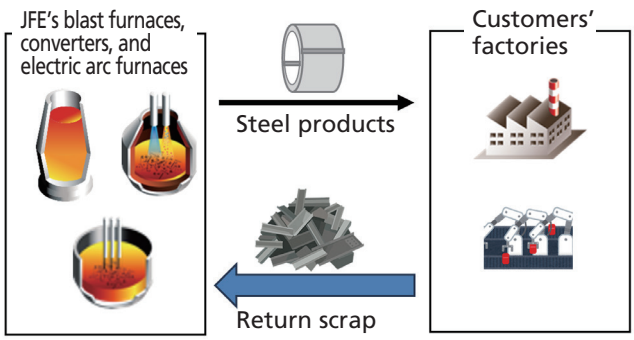
### Expansion of Scrap Trading to Support the Development of a Recycling-Oriented Society

JFE Shoji engages in a recycling business for steel and aluminum scrap. Demand for steel scrap is particularly expected to grow in Japan and overseas as the global community advances toward carbon neutrality. JFE Shoji will contribute to building a recycling-oriented society by increasing scrap recycling across the globe.

## ST Initiatives to Expand Scrap Collection and Use

Steel is highly recyclable because it can be separated and collected using magnetic force. Even after completing its role in society, it remains endlessly reusable as raw material for steel products while retaining its properties. Its recycling rate of 93.7% is extremely high compared to other materials. Steel is recycled through efficient separation and collection into high-quality, high-functionality products, reducing environmental impact across the entire life cycle.

JFE Steel uses steel scrap as raw material in blast furnaces, basic oxygen furnaces, and electric arc furnaces. We have traditionally collected and used "return scrap," a term for scrap generated during production that is sold back by customers and Group factories. Under the Eighth Medium-term Business Plan, we have set a KPI for the expansion of this volume with associated action plans. For FY2025, we expect to achieve our target of doubling the volume of collected and used scrap compared to the average during the Seventh Medium-term Business Plan period. By expanding the collection and use of scrap toward the realization of a circular society, we will also contribute to addressing climate change.



## ST Reducing Plastic Waste by Manufacturing Cups from Highly Recyclable Steel

JFE Steel is proposing recyclable steel cups that take advantage of the properties of steel, featuring light weight, durability, thinness, and a pleasant feel and coolness when drinking. Steel cups can be repeatedly recycled into any type of steel product, taking advantage of steel's high recyclability. Using easily recyclable steel cups also helps to solve the problem of disposable plastic waste. We are encouraging a recycling-based lifestyle by promoting the Steelish™ logo and developing activities that express the message of contributing "stylishly" to the global environment by leveraging the benefits of steel products.

As part of these activities, we have been promoting the BETTER RECYCLE Shonan Project since 2021. This project is a new attempt to approach the issue of disposable plastic cups with consumers and contribute to addressing the issue by proposing new lifestyles through the development of new products. The project team, made up of members from IBLC Co., Ltd. and Shonan Style (a magazine published by EDITORS, Inc.) as well as JFE Steel, sought advice and cooperation from local governments and disposable plastic cup suppliers in the Shonan area and created a prototype for an eco-friendly recyclable disposable steel cup. The prototype and the Steelish™ initiative were presented at Carnival Shonan 2022, an event held at the Kanagawa Municipal Tsujido Kaihin Park in November 2022 to explore turning the Shonan beaches into the first zero-waste beaches in Japan.

In March 2023, steel cups were used at Nakame Challenge Cup 2023, an event hosted by Asahi YOU. US, Ltd. and the Nakame Area Management Association to eliminate disposable plastic bottles discarded by people viewing cherry blossoms in Nakameguro and raise awareness of plastic pollution, food loss, and other sustainability issues.

JFE Steel is committed to playing its part in fostering public awareness about climate change and plastic pollution issues and to achieving the SDGs by developing steel solutions that meet the needs of customers and society as a whole.

The Steelish™ logo


The recyclable steel cup

› **Website on recyclable steel cups (Japanese Only)** (https://www.jfe-steel.co.jp/products/can/use/scene09.html)
› **BETTER RECYCLE Shonan (Japanese Only)** (https://www.jfe-steel.co.jp/products/can/pr/better_recycle_shonan.html)

# Resource Recovery and Recycling Targets and Results

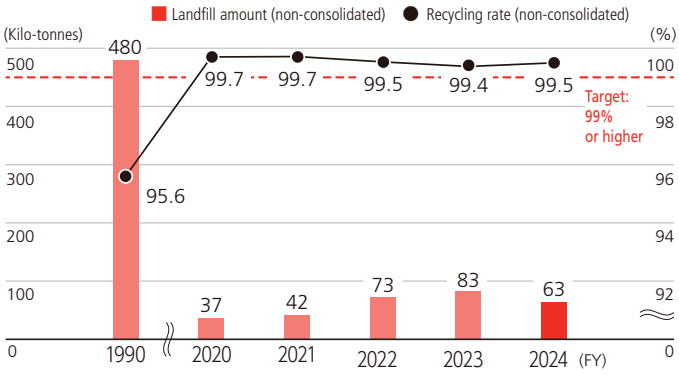
Recognizing that the efficient use of resources is a key environmental issue for the manufacturing industry, the JFE Group sets and manages progress against ambitious targets tailored to the respective business characteristics of Group companies. We will continue to pursue the following targets and advance initiatives that contribute to the transition to a circular economy.

The responsible use of water resources is also an important environmental concern for the manufacturing industry. Since the steel business consumes large volumes of water, we set ambitious targets for water recycling rates, manage progress, and strive to reduce water usage.

**Targets and Results for FY2024 and Targets for FY2025**

| Operating Company | FY2024 Targets | FY2024 Results and Initiatives | FY2025 Targets |
|---|---|---|---|
| JFE Steel | Recycling rate of co-products: 99% or higher | Resource recovery rate: 99.5% | Continue efforts to prevent and reduce the generation of dust and sludge in the recycling of co-products, to maintain the recycling rate of co-products at 99% or higher |
| | Maintain efficient use of water<br>Recirculated water usage rate: 90% or higher | Recirculated usage rate: 92.7% | Continue the water resource recycling effort to maintain the recirculated usage rate at 90% or higher |
| JFE Engineering | Recycling rate at construction sites<br>•Recycling rate of rubble: 99.5% or higher<br>•Recycling rate of sludge: 95.0% or higher<br>•Recycling rate of industrial waste: 85.0% or higher | Recycling rate at construction sites<br>•Recycling rate of rubble: 99.6%<br>•Recycling rate of sludge: 97.1%<br>•Recycling rate of industrial waste: 83.9% | Recycling rate at construction sites<br>•Recycling rate of rubble: 99.5% or higher<br>•Recycling rate of sludge: 95.0% or higher<br>Recycling rate of industrial waste: 85.0% or higher |
| | Recycling rate of office recyclable waste (Yokohama head office): 98.0% or higher | Recycling rate of office recyclable waste (Yokohama head office): 97.7% | Recycling rate of office recyclable waste (Yokohama head office): 98.0% or higher |
| JFE Shoji | Global recycling of steel scrap<br>•Scrap trade volume exceeds FY2020 level by 5% | From FY2020: +5%<br><br>Both domestic and overseas sales increased compared to previous year, achieving the target | Global recycling of steel scrap: +10% from FY2020<br><br>Strengthen domestic and overseas procurement networks and expand sales to JFE Group and domestic and overseas customers |

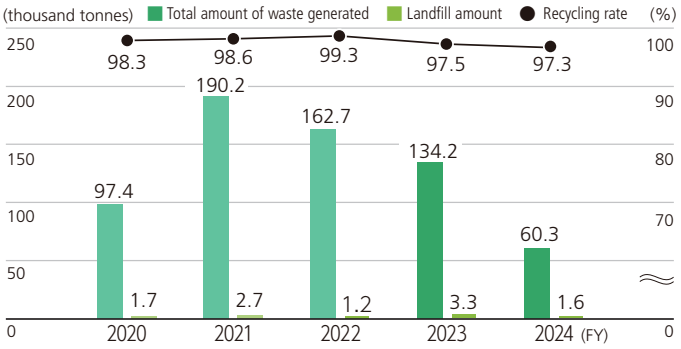
### JFE Steel Landfill of Co-Products and Recycling Rates




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Group companies* | Amount released | — | 513 | 504 | 593 | 583 | 640 (Kilo-tonnes) |
| | Landfill amount | — | 23 | 52 | 94 | 97 | 83 (Kilo-tonnes) |

*Twenty-two JFE Steel consolidated subsidiaries in Japan

### JFE Engineering Waste Generated at Construction Sites




For more on waste generated at the steelworks, please refer to:

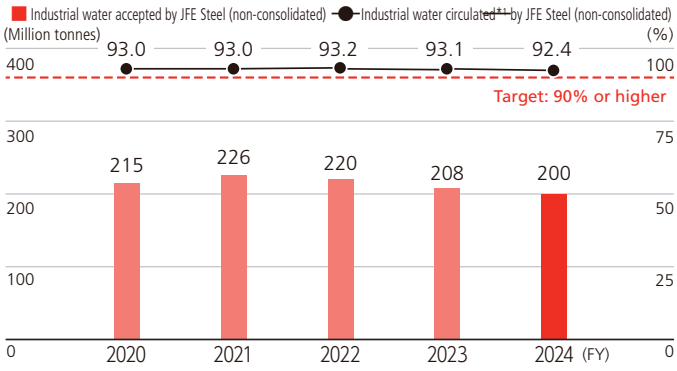
› Environmental Data (P. 255)

# Efficient Use of Water Resources

## ST Setting Targets for Water Recirculation

All of JFE Steel's seven production sites in Japan developed a water management plan and monitored water usage in seeking to increase the recirculation rate of water in order to reduce the volume of water intake and drainage and efficiently use water resources. The target water recycling rate at JFE Steel, which uses a large volume of water for cooling and other processes, is 90% or more, which is extremely high considering the amount evaporated when water is used. We are striving to improve the recycling rate by adopting purification processes such as biological and chemical wastewater treatments, and we have been successfully achieving the target. Our recycling rate of industrial water in FY2024 maintained a high level of 92.4%.

**JFE Steel Industrial Water Accepted and Circulated**




JFE Steel

| | | | | | | |
|---|---|---|---|---|---|---|
| Total amount | 3,066 | 3,207 | 3,242 | 3,053 | 2,731 | (Million tonnes) |
| Industrial water accepted | 215 | 226 | 220 | 208 | 200 | (Million tonnes) |

Group companies*2

| | | | | | | |
|---|---|---|---|---|---|---|
| Total amount | 265 | 235 | 233 | 207 | 226 | (Million tonnes) |
| Industrial water accepted | 21 | 19 | 18 | 16 | 16 | (Million tonnes) |

*1 Industrial water circulated (%) = (Total amount used – industrial water accepted)/ total amount used ×100

*2 Twenty-two JFE Steel consolidated subsidiaries in Japan

## EN Efficient Use of Water Resources

JFE Engineering and each Group company strive to use water efficiently at their business sites.

For more on quantitative data related to water, please refer to:
› Environmental Data (P. 255)

# Biodiversity Conservation and Nature Positive

## Basic Policy

Recognizing that natural capital and biodiversity are foundational for realizing a sustainable society, the JFE Group has endorsed the Declaration of Biodiversity by Keidanren and Action Policy and conducts business in harmony with nature across the world. We particularly recognize biodiversity conservation as a key challenge and conduct assessments to minimize the ecological impact associated with our business activities. We are also engaged in activities that contribute to biodiversity conservation and nature positive at our own production sites, construction sites, and their surrounding areas, and at suppliers. Our initiatives include cooperating with the community to monitor biodiversity and carry out preservation activities around the steelworks, the key facilities for our business, and in surrounding areas. We are also involved in developing iron and steelmaking slag products that can help restore the marine environment. Furthermore, beyond our business operations, we launched a joint research program with a local government and conduct environmental education for local communities.

Our core steelmaking business uses large quantities of fresh water for cooling and cleansing products and facilities. For this reason, the efficient use of water resources with due consideration to the source of the water and stakeholders in the area is a key challenge. While we have always implemented countermeasures against meteorological disasters such as droughts and floods at our manufacturing sites in Japan, we are further reinforcing them in anticipation of the increased frequency and severity of weather events associated with climate change by securing alternative means and raising the height of embankments. We also seek to identify water-related risks throughout our business sites and supply chain in Japan and overseas, such as the risk of drought at the source of water intake and pollution at the point of discharge. In areas under water stress, we will respond appropriately through dialogue with stakeholders.

> **Declaration of Biodiversity by Keidanren and Action Policy (Revised Edition)**
(https://www.keidanren.or.jp/en/policy/2018/084.html)

### Basic Approach

The JFE Group has established a basic policy to promote initiatives for biodiversity conservation and nature positive.

Guided by our corporate philosophy of contributing to society with the world's most innovative technology, the JFE Group recognizes biodiversity conservation and nature positive as essential for realizing a sustainable society, and established the following policies to guide its activities:

- Deepen recognition that our business activities depend on and impact biodiversity and natural capital and promote activities to mitigate risks.
- Promote the development of processes, products, and technologies that contribute to biodiversity conservation and nature positive.
- Collaborate with stakeholders such as local communities and supply chains and promote biodiversity conservation and nature positive efforts through diverse approaches, including integration with carbon neutrality and the circular economy.
- Foster awareness of biodiversity through employees' proactive initiatives and educational activities.
- Disclose initiatives for biodiversity conservation and nature positive and broadly share them with society.

## Endorsing and Participating in External Initiatives

As a member of the Keidanren Committee on Nature Conservation, the JFE Group endorses the Declaration of Biodiversity by Keidanren and Action Policy and actively engages in the conservation of nature and biodiversity.

The Group took part in the Business for GBF Project, launched by the Ministry of the Environment and Keidanren Committee on Nature Conservation. We are now registered as an NPE Partner in developing its Nature Positive Economy Promotion Platform (NPE Platform).

JFE Holdings has also joined the 30 by 30 Alliance for Biodiversity, launched by the Ministry of the Environment, business associations, nature conservation groups, and other organizations. This alliance is committed to effectively protecting at least 30% of Japan's land and sea as healthy ecosystems toward the Nature Positive goal of halting and reversing biodiversity loss by 2030. JFE will contribute to the conservation of biodiversity by carrying out various activities, including the conservation of its biotopes.

For further details on external initiatives, please refer to:

> **Business for GBF Project, Ministry of the Environment** (https://www.biodic.go.jp/biodiversity/private_participation/business/en/
> **Ministry of the Environment's 30 by 30 Alliance** (https://policies.env.go.jp/nature/biodiversity/30by30alliance/)

In addition, JFE Holdings has endorsed the disclosure recommendations published by the Taskforce on Nature-related Financial Disclosures (TNFD), joined the TNFD Forum, and registered as a TNFD Adopter. Going forward, we will appropriately disclose information about the impacts of our business activities on the natural environment and biodiversity in line with the TNFD framework.

> **Taskforce on Nature-related Financial Disclosures (TNFD)** (https://tnfd.global/)

# Governance

The JFE Group's initiatives for biodiversity conservation and nature positive are supervised and guided by the JFE Group Sustainability Council, chaired by the president of JFE Holdings. A cross-group JFE Group Environmental Committee has been established to discuss matters such as targets, progress checks, and improving overall Group performance. Particularly key issues and indicators are supervised through deliberations of the Board of Directors.

> **Framework for Environmental Management** (P. 47)

# Strategy

## Evaluation of the Relationship between Business Activities and Natural Capital (Evaluation in Line with the LEAP Approach)

The JFE Group pilot tested the LEAP approach in line with the recommendations of the Taskforce on Nature-related Financial Decisions (TNFD). In FY2023, we conducted a trial evaluation focusing on the steel business. In FY2024, we expanded the scope within the steel business for more detailed examinations and conducted evaluations for the engineering business.

**Process**

**Locate**

**Locating the interface with nature**
Steel business: identified the location information of major manufacturing sites and mines supplying raw materials such as iron ore and coking coal and assessed the state of natural capital in the surrounding areas.
Engineering business: identified the location information of major manufacturing sites in FY2024 and assessed the state of natural capital in the surrounding areas.
Both evaluations referred to TNFD-recommended tools such as IBAT and Resource Watch.

**Evaluate**

**Evaluating dependencies and impacts**
We applied ENCORE and other TNFD-recommended tools to identify and evaluate the dependencies and impacts of our steel and engineering businesses on important natural capital.

**Assess**

**Assessing nature-related risks and opportunities**
Based on the findings from the evaluation of the dependencies and impacts, we identified and assessed nature-related risks and opportunities for our steel and engineering businesses.

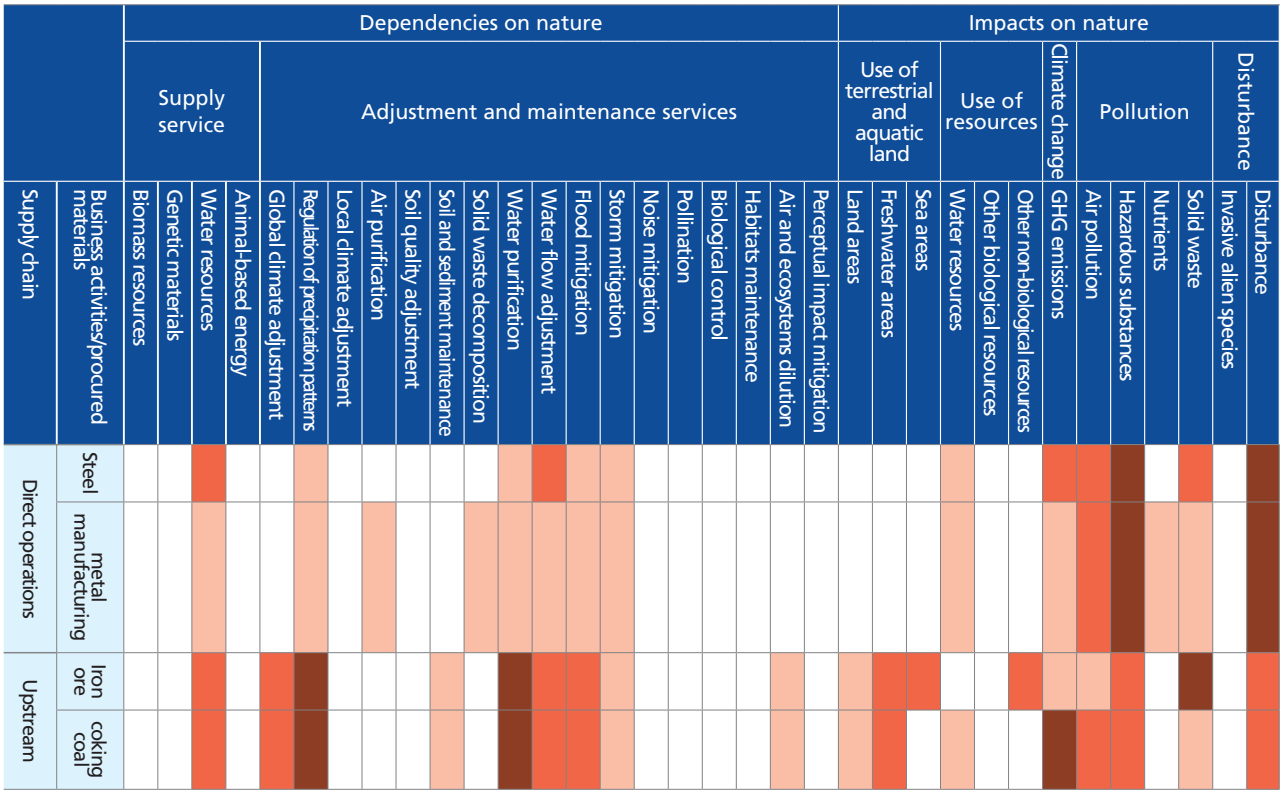
**Prepare**

**Preparing to respond and report**
We have been preparing to respond to the assessed risks and opportunities.

### Steel Business

#### Specific Categories of Findings on the Dependencies and Impacts on Nature (Evaluate)

Regarding the dependencies and impacts of our steel business on nature, we reviewed the findings under the categories of manufacturing at our production sites and procurement from our upstream supply chain at iron ore and coking coal mining sites. Our procurement and manufacturing operations depend on natural resources, particularly related to water supply, the control of water volume, and climate adjustments. Meanwhile, our manufacturing operations impact nature through GHG emissions and pollution. The iron ore and coking coal mining conducted upstream in our supply chain also affect nature through land use, water resource use, GHG emissions, and pollution.




## Assessment of Leading Manufacturing Sites (Locate)

Our assessment of leading major manufacturing sites in line with the five criteria defined by the TNFD for priority areas found that areas of high conservation significance, including key biodiversity areas (KBAs), exist in the surrounding regions. We also conducted similar assessments for production sites of JFE Steel's domestic Group companies, evaluated the surrounding natural environment, and confirmed the results.

| Manufacturing Site | Conservation Significance | | Ecosystem Integrity | Degradation in Ecosystem Integrity | Water-Related Physical Risks | | |
|---|---|---|---|---|---|---|---|
| | Protected Areas/KBA | STARs | Biodiversity Intactness Index | Pressures on Biodiversity | Baseline Water Stress | Riverine Flood Risk | Coastal Flood Risk |
| East Japan Works, Chiba | Located in proximity | 1 | 1 | 5 | 3 | 2 | 3 |
| East Japan Works, Keihin | Not located in proximity | 1 | 1 | 5 | 3 | 2 | 3 |
| West Japan Works, Kurashiki | Located in proximity | 1 | 1 | 5 | 2 | 2 | 3 |
| West Japan Works, Fukuyama | Located in proximity | 1 | 2 | 5 | 2 | 2 | 3 |
| Chita Works | Located in proximity | 1 | 1 | 5 | 3 | 2 | 3 |
| Sendai Works | Located in proximity | 1 | 1 | 5 | 2 | 2 | 3 |

Very high | High | Moderate | Low

In addition, the JFE Shoji Group conducted similar assessments at 48 processing sites operated by 38 companies (24 sites at 18 companies in Japan and 24 sites at 20 companies overseas). In Japan, six sites were found to be adjacent to protected areas or KBAs of high conservation significance. Overseas, sites in eight countries were found to face water risks, and in one country, a site was identified as being adjacent to indigenous peoples or local communities. These sites have been recognized as priorities for future evaluation and responses.

*Assessment based on the five criteria was performed using the following indicators and tools.

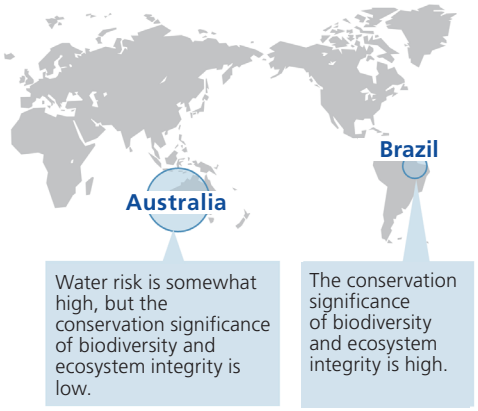
- Conservation significance: Assessed with IBAT, the proximity (within a 5-km radius) to areas of conservation significance, for example, protected areas and KBAs
- Ecosystem integrity: Assessed based on the Biodiversity Intactness Index provided by Natural History Museum
- Rapid degradation in ecosystem integrity: Assessed based on the Pressure on Biodiversity indicator provided by WWF Biodiversity Risk Filter to measure at degree of influence on nature
- Water-related physical risks: Assessed based on the Baseline Water Stress, Riverine Flood Risk, and Coastal Flood Risk indicators through the use of Aqueduct

## Assessment of Raw Material Suppliers (Locate)

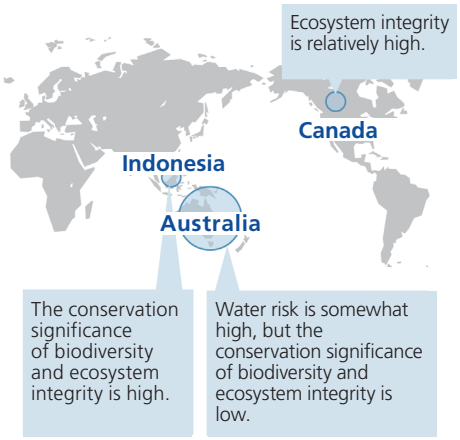
We located the interfaces of our major iron ore and coking coal suppliers in natural settings and assessed the state of nature at those sites (procurement volume of roughly 70%; 8 iron ore mines and 14 coking coal mines). Iron ore is procured from countries including Australia and Brazil. The assessment revealed that procurement mines in Australia are exposed to high water stress, making responses to water-related risks important. Although procurement volumes are relatively small, some mines in Brazil were found to be located near areas of conservation significance.

Our coking coal suppliers are mining in Australia, Canada, and Indonesia. The assessment revealed that procurement mines in Australia face relatively low levels of various risks. On the other hand, some mines in Canada and Indonesia were found to be located in regions with high ecosystem integrity.

**Iron ore (supplier countries and procurement ratios)**




**Coking coal (supplier countries and procurement ratios)**




## Reviewing Nature-Related Risks and Opportunities (Assess/Prepare)

Following the above evaluation of dependencies and impacts, we organized the currently assumed nature-related risks and opportunities. The risks, some of which are recognized in our climate change scenario analysis, include physical risks that could be materialized due to a water shortage or natural disasters and potentially trigger a decrease in production at our manufacturing sites or a lack of procurement from suppliers. Additionally, transition risks may arise if regulations concerning protected areas and pollution are tightened. On the other hand, opportunities were identified in the form of increased demand and development potential for environmentally friendly products, processes, and technologies, as well as environmental materials that contribute to resource circulation.

Meanwhile, we confirmed that JFE Steel's major iron ore and coking coal suppliers have conducted assessments concerning water resources and ecosystem and have publicly disclosed how to respond to their detected risks. We will continue to monitor the status of their response efforts as part of our supply chain management. We will also encourage more of our suppliers to adopt and observe the JFE Steel Procurement Guidelines .

As for our own material risks and opportunities, we will maintain the current measures in place and, while enhancing our assessment, we will keep a close watch on whether additional measures are necessary.

**Nature-Related Risks and Opportunities in Direct Operations**

| | Category | | Item | Impact | Magnitude | Likelihood | Time frame | Response |
|---|---|---|---|---|---|---|---|---|
| Direct operations | Physical risk | Acute | Intensification of extreme weather | Suspension of operations due to infrastructure damage caused by the increased frequency and severity of natural disasters | Large | Low | Medium term | **Reinforcement of drainage facilities at steelworks and plants**<br>•Facilities reinforced to prevent water pollution during heavy rainfall (expansion of treatment, water gates, raised manholes, etc.)<br>•Facilities reinforced to prevent site flooding (forced drainage systems, pump trucks, raised critical equipment, etc.)<br>•Damage mitigation through the use of weather information for torrential rains, typhoons, storm surges, etc. (minimizing damage by preemptively shutting down equipment when risks are anticipated) |
| | | Chronic | Water shortages and ecosystem degradation | Suspension of operations due to ecosystem degradation, such as water depletion | Large | Low | Long term | **Reduced water intake and discharge by recycling water**<br>•Formulate water management plans and monitor and manage water usage (set targets for water usage and recycling rate and track actuals monthly)<br>•Reduce water intake and discharge by increasing recycling rates (install coagulation-sedimentation, filtration, biological treatment to promote recycling)<br>•Conduct water stress assessments (using Aqueduct for objective evaluation) |
| | Transition risk | Policies and regulations | Stricter regulations toward nature positive | Increased compliance costs from tighter regulations on water use and pollution affecting ecosystems around business sites (terrestrial and aquatic) | Medium | Low | Long term | **Implementation of the following measures with the goal of Zero Major Environmental and Disaster Accidents**<br>•Implement thorough purification to reduce environmental impacts when discharging water used in the steelmaking process into public water bodies<br>•Conclude agreements with local governments that enact stricter discharge standards than those mandated by the Water Pollution Prevention Act , and implement water quality improvement initiatives with stricter voluntary management standards to consistently meet those agreements<br>•Conduct environmental audits (annually by the audit department, covering measurement results, responses to incidents, and the handling of complaints)<br>•Install NOx and SOx control equipment (e.g., low-NOx burners, exhaust gas treatment facilities)<br>•Use dust dispersion simulations to design effective countermeasures for neighboring areas (identify sources, strategic placement of windbreak walls and nets)<br>•Continuously monitor major emission sources of soot, dust, NOx, and SOx, and detect and remedy abnormal signs at early stage<br>•Periodically conduct on-site environmental audits of domestic and overseas Group companies (every 3–5 years, depending on environmental impacts and management practices)<br>•Periodically exchange information with local residents (explain environmental measures at steelworks and regularly gather resident feedback) |
| | | Reputation | Impact on surrounding ecosystems | Increased costs from adverse impacts on local ecosystems (terrestrial and aquatic) through water use or pollution, and revenue decline due to loss of trust | Medium | Low | Long term | |
| | Opportunity | Services, markets | Ecosystem restoration and environmental load reduction through steel and slag products | Increased demand for products contributing to nature positivity and reducing environmental load | Medium | High | Short term | **Expansion of supply of products that contribute to biodiversity, nature positivity, and environmental load reduction, and collaboration with municipalities and other companies**<br>•Expand supply of eco-products such as high-tensile steel sheets and electrical steel sheets<br>•Manufacture steel sheets free of environmentally harmful substances such as hexavalent chromium<br>•Contribute to marine environment improvement, tidal flat creation, and coral reef restoration through steel slag products<br>•Joint public-private research project with Yokohama City for "Creating Abundant Seas"<br>•Agreement with Chiba Prefecture on a demonstration project for blue carbon creation at the Hota Fishing Port<br>•Promote biodiversity verification of steel slag products through collaboration with the venture company Innoqua Inc. |

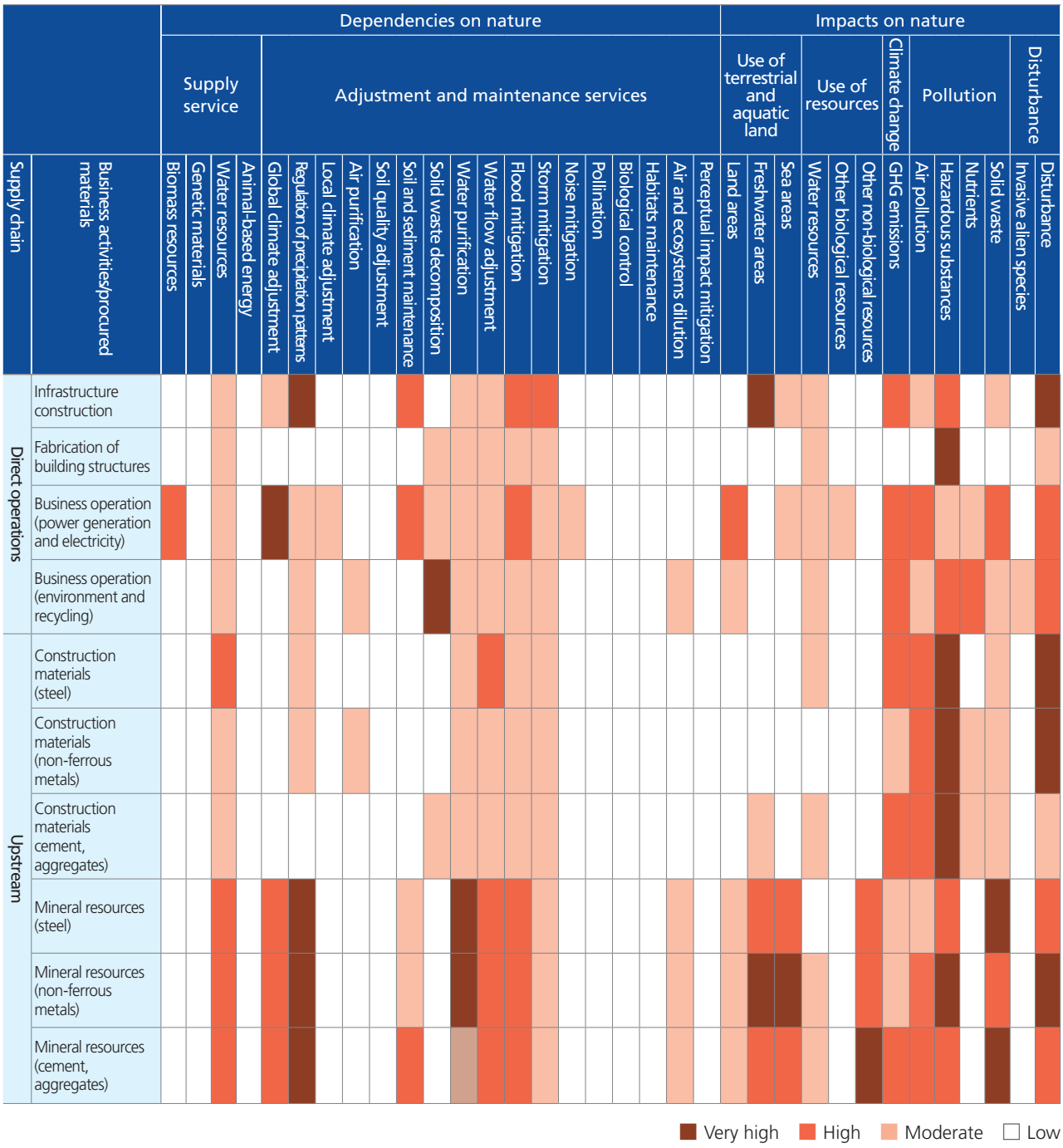
| | Category | | Item | Impact | Magnitude | Likelihood | Timeframe | Response |
|---|---|---|---|---|---|---|---|---|
| Direct operations | Opportunity | Products and services | Growing demand for resource-circulating products | Higher sales by expanding lineup of resource-circulating products | Medium | High | Medium term | **Expand lineup of environmental products supporting resource circulation**<br>•Expand targeted products at JFE Shoji and strengthen distribution and logistics |
| | | Nature preservation and restoration | Biodiversity conservation at factories | Enhanced reputation among stakeholders, including local residents, by promoting initiatives on Company premises in response to growing public interest in nature and biodiversity conservation | Low | Medium | Medium term | **Biodiversity conservation initiatives on Company premises, mainly at the Chita Works**<br>•Reproduction and conservation of the ecosystem of the Chita Peninsula, Aichi Prefecture, at Biotope Chita<br>•Biotope Chita certified as a Nature Symbiosis Site<br>•Chita Works certified as an Aichi Biodiversity Company<br>•Transplanting of rare plants within planned construction areas |
| Upstream | Physical risk | Acute | Intensification of extreme weather | Instability of raw material procurement and increased procurement costs due to increased frequency and severity of natural disasters | Medium | Low | Medium term | **Response policy**<br>•Diversification of procurement sources<br>•Sharing and promoting the JFE Steel Procurement Guidelines<br>•Monitoring suppliers' ESG-related activities<br><br>**Specific measures currently implemented**<br>•Ongoing diversification of procurement sources<br>•Confirming presence or absence of programs addressing proximity to critical ecosystems and water-related risks at each major supplier site |
| | | Chronic | Water shortages and ecosystem degradation | Instability of raw material procurement and increased procurement costs due to ecosystem degradation such as depletion of water resources | Medium | Low | Long term | |
| | Transition risk | Policies and regulations | Strengthening of mining regulations | Increased procurement costs due to decline in new mine development caused by expansion of protected areas | Medium | Low | Long term | |
| | | | | Increased procurement costs due to tighter regulations on environmental impacts such as pollution and water use during mining | Medium | Low | Long term | |
| | | Reputation | Serious impacts at procurement mines | Reputational decline from sourcing at mines that seriously impact critical natural areas or local communities due to deforestation or pollution, and reduced procurement volumes due to mine shutdowns from serious impacts | Medium | Low | Long term | |
| | | Market | Demand for sustainable procurement | Increased compliance costs from demands by customers and investors for sustainability in raw material procurement | Low | Medium | Medium term | |

## Engineering Bussiness

### Specific Categories of Findings on the Dependencies and Impacts on Nature (Evaluate)

Regarding the dependencies and impacts of our engineering business on nature, we reviewed the findings under infrastructure construction and business operation categories at our sites and procurement from our upstream supply chain at iron ore and coking coal mining sites. Our procurement and manufacturing operations depend on natural resources, particularly related to water supply, the control of water volume, and climate adjustments. Meanwhile, our infrastructure construction operations impact nature through GHG emissions and pollution. The iron ore and coking coal mining conducted upstream in our supply chain also affect nature through land use, water resource use, GHG emissions, and pollution.

Following this evaluation, we proceeded with assessments focused on infrastructure construction and upstream procurement, which have significant dependencies and impacts as well as business scale.

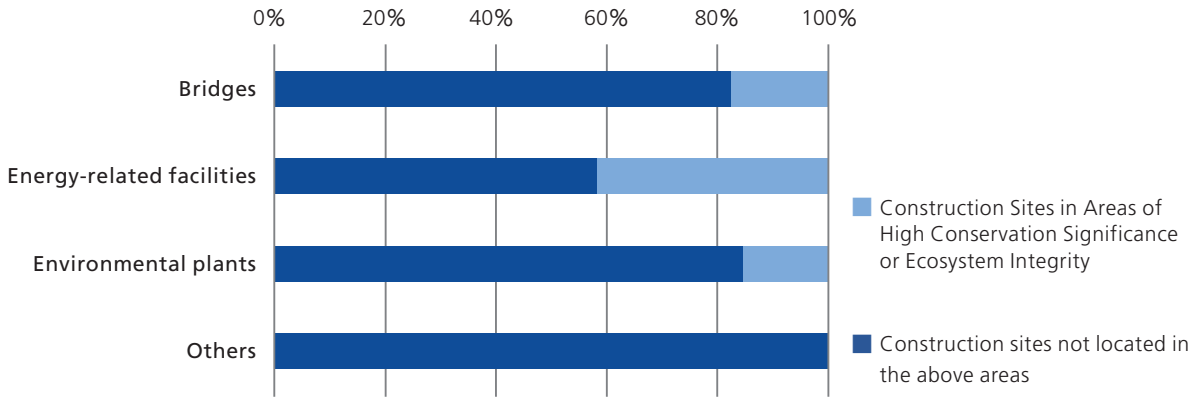


## Assessment of Construction Sites (Locate)

We identified the locations of domestic construction sites at a certain scale in 2024 and evaluated them based on the five criteria defined by the TNFD for priority areas. The evaluation found that some construction sites are in areas of high conservation significance or ecosystem integrity. Other criteria, such as water stress, were generally evaluated as low.

Roughly 20% of the construction sites are in areas of high conservation significance or ecosystem integrity, and when viewed by business type, many are energy-related facilities. At all construction sites, we confirmed that environmental assessments are conducted in advance regarding impacts on surrounding ecosystems and that additional measures are taken during construction to reduce ecosystem impacts.

**Ratio of Construction Sites in Areas of High Conservation Significance or Ecosystem Integrity**




## Reviewing Nature-Related Risks and Opportunities (Assess and Prepare)

Following the above evaluation of dependencies and impacts, we organized the currently assumed nature-related risks and opportunities. The risks, some of which are recognized in our climate change scenario analysis, include physical risks that could materialize due to a water shortage or natural disaster and potentially trigger a decrease in production at our manufacturing sites or insufficient procurement from suppliers, apart from transition risks that might occur if regulations concerning protected areas and pollution are tightened.

**Nature-Related Risks in Direct Operations**

| | Category | | Item | Impact | Magnitude | Likelihood | Timeframe | Response |
|---|---|---|---|---|---|---|---|---|
| Direct operations | Physical risk | Acute | Intensification of extreme weather | Suspension of construction work and increased construction costs due to increased frequency and severity of natural disasters | Medium | Medium | Medium term | •Adoption of construction methods requiring less on-site work and development of new construction technologies<br>•Enhance project management by using weather forecasting systems<br>•Reduce $CO_2$ emissions from fuel consumption by using commercial power instead of generators |
| | | Chronic | Water shortages and ecosystem degradation | Suspension of construction work and increased construction costs due to ecosystem degradation such as depletion of water resources | Medium | Medium | Long term | •Promote water recycling, adopt construction methods with low water use, and develop methods that account for water shortages |
| | Transition risk | Policies and regulations | Stricter regulations toward nature positive | Decline in new construction demand and increased compliance costs due to stricter land use regulations toward 30 by 30 | Medium | High | Medium term | •Properly conduct construction in protected areas based on regulations and in line with the requirements of laws, municipalities, and other customers |
| | | | | Increased compliance costs due to stricter regulations and monitoring requirements on environmental impacts such as pollution and ecosystem disruption during construction | Medium | Medium | Long term | •Optimize environmental assessment compliance costs by leveraging lessons learned from past construction projects<br>•Develop efficient environmental management methods using digital technologies |
| | | Market / Technology | Delay in technologies addressing ecosystem considerations | Increased costs for developing and implementing technologies that contribute to nature positive and resource circulation, and loss of opportunities due to delays in response | Medium | Medium | Medium term | •Develop technologies for sorting and recycling plastics and promote new recycling businesses in collaboration with municipalities and private companies in plastic-related industries |
| | | Reputation | Impact on surrounding ecosystems | Reputational decline due to adverse impacts on terrestrial and marine ecosystems caused by land use change, pollution, and disruption during construction | Medium | Medium | Medium term | •Plan and implement construction in line with environmental assessment results to reduce ecosystem impact risks<br>•Reduce ecosystem impact risks through environmentally conscious initiatives during construction<br>•Plan and implement construction based on engagement with local communities |

**Nature-Related Opportunities in Direct Operations**

| | Category | | Item | Impact | Magnitude | Likelihood | Timeframe | Response |
|---|---|---|---|---|---|---|---|---|
| Direct operations | Opportunity | Services, markets | Efficient use of construction materials | Increased demand for repair work to extend infrastructure lifespans | Large | High | Short term | •Shorten construction periods, adopt methods requiring less on-site work, and develop new construction technologies to reduce impacts on infrastructure users |
| | | | Expansion of orders for environmental facilities | Increased demand and order opportunities for environmental facility construction such as for waste-to-energy plants | Medium | High | Short term | •Design improvements to enhance performance of existing products, develop new customers<br>•Development of new products |
| | | | Development and implementation of ecosystem-conscious technologies | Increased demand and order opportunities through construction technologies with low environmental impact | Medium | Medium | Medium term | •Adoption of construction methods requiring less on-site work and development of new construction technologies |
| | | | Expansion of orders through national resilience measures | Expansion of order opportunities through national resilience measures to address intensifying natural disasters | Large | High | Short term | •Propose designs to customers that anticipate early restoration after disasters<br>•Strengthen orders for seismic reinforcement and vibration control work on existing structures |

**Nature-Related Risks and Opportunities in Upstream and Downstream**

| | Category | | Item | Impact | Magnitude | Likelihood | Timeframe | Response |
|---|---|---|---|---|---|---|---|---|
| Upstream | Physical risk | Acute | Intensification of extreme weather | Instability of raw material procurement and increased procurement costs due to increased frequency and severity of extreme weather events | Medium | Medium | Long term | •Consider the use of green steel depending on construction project requirements<br>•Require suppliers to implement GHG reduction initiatives through procurement guidelines<br>•Develop construction technologies that reduce the use of materials with unstable procurement risks<br>•Reduce procurement instability risks by developing new suppliers |
| | | Chronic | Water shortages and ecosystem degradation | Instability of raw material procurement and increased procurement costs due to ecosystem degradation such as depletion of water resources | Medium | Medium | Long term | •Reduce procurement instability risks by developing new suppliers<br>•Develop construction technologies that reduce the use of materials with unstable procurement risks<br>•Require suppliers to reduce and effectively use resources (water, energy, raw materials, etc.) through procurement guidelines<br>•Require suppliers to implement biodiversity conservation and sustainable use initiatives through procurement guidelines |
| | Transition risk | Policies and regulations | Stricter regulations on raw materials | Increased compliance and procurement costs due to stricter regulations toward nature positive in raw material mining and requirements for sustainability certification | Medium | Medium | Long term | •Reduce procurement instability risks by developing new suppliers<br>•Develop construction technologies that reduce the use of materials with unstable procurement risks<br>•Require suppliers to reduce and effectively use resources (water, energy, raw materials, etc.) through procurement guidelines |
| | Opportunity | Resource efficiency | Efficient use of construction materials | Reduction of natural impacts and cost savings in procurement through efficient use of construction materials, leading to reduced procurement volumes | Medium | Medium | Short term | •Implement environmentally conscious designs that require fewer materials<br>•Further promote the use of recycled materials<br>•Adoption of construction methods requiring less on-site work and development of new construction technologies |
| | Transition risk | Policies and regulations | Expansion of responsibility scope for impacts on nature after construction | Increased monitoring costs and reputational decline due to construction of facilities with significant natural impacts during operation (expansion of responsibility scope) | Medium | Medium | Long term | •Plan and design facilities from a life cycle perspective to reduce environmental impact risks |

### Measures to Address Impacts and Risks in Areas of High Conservation Significance or Ecosystem Integrity

The evaluation of construction sites in FY2024 confirmed the presence of sites in areas of high conservation significance or ecosystem integrity. Actions were taken at construction sites in these areas to avoid and mitigate impacts on ecosystems, as shown below.

**Measures Implemented at Construction Sites in Areas of High Conservation Significance or Ecosystem Integrity**
**Example**
**Example: Bridge repair work in Prefecture A**
The site was confirmed to be adjacent to a protected area and to have high ecosystem integrity, and the following actions were taken during construction.

- In agreement with the client, the following actions were taken:
  ➡ For repainting, existing paint film was removed using the Eco Paint Peeling Method (EPP method)*, which employs a water-based paint stripping agent free of organic solvents.
- The work areas were sealed to prevent paint from dripping during application.

**Example: Construction of an energy-related facility in Prefecture B**
The site was confirmed to be adjacent to a protected area and to have high ecosystem integrity, and the following actions were taken during construction.

- In agreement with the client, the following actions were taken:
  ➡ A sealed conveyor system was adopted, with dust collectors installed at each dust-generating point, in order to reduce dust dispersion into the surrounding environment.
- Oil pans were installed under outdoor gear reducers so that lubricant would not leak even if the gaskets deteriorated.
- Painting was performed at factories insofar as possible, and low-VOC paints were applied in areas requiring on-site application.

› *JFE Group CSR REPORT 2015, Eco Paint Peeling Method (P. 46): (https://www.jfe-holdings.co.jp/en/common/pdf/sustainability/data/2015/csr2015e.pdf)

## Risk and Impact Management

As a holding company, JFE Holdings is responsible for the Group's comprehensive risk management under the Basic Policy for Building Internal Control Systems. Regarding initiatives for biodiversity conservation and nature positive, each operating company identifies priority areas, assesses dependencies and impacts, and evaluates risks and opportunities in line with the LEAP approach recommended by the TNFD, and the results, including priorities for action, are reflected in the JFE Group's strategy.

The JFE Group monitors risks that could affect management at the JFE Group Sustainability Council, Group Management Strategy Committee, and Management Committee. Risks and impacts related to biodiversity conservation and nature positive are also assessed in terms of timeframe, likelihood, and magnitude of impact, and the progress of efforts is reviewed. Quantitative and qualitative targets are set as KPIs for particularly important Group initiatives, and progress and performance are monitored.

For further details, please refer to:

› System for Promoting Sustainability (P. 11)
› Risk Management (P. 251)
› Framework for Environmental Management (P. 47)

# Metrics and Targets

We monitor environmental performance and set targets, and many of these metrics are aligned with the TNFD framework. For the TNFD disclosure metrics that are not yet subject to monitoring and target setting, we will prepare for future data collection.

| Items Monitored | Target Operating Company | Metrics | Correspondence to TNFD Metrics (Global Core and Additional) | Performance |
|---|---|---|---|---|
| Water resources | ST EN SH | Water intake | A3.0 | P. 269 |
| | ST EN | Water discharge | C2.1 | P. 269 |
| | ST | Water recycling volume | A3.2 | P. 269 |
| Pollution | ST EN | Hazardous substance emissions (PRTR) | C2.4 | P. 264 |
| | ST EN | Hazardous substance emissions (COD) | C2.1 | P. 264 |
| | ST | Hazardous substance emissions (SOx/NOx) | C2.4 | P. 263 |
| Resource circulation | ST EN | Resource input volume | — | P. 266 |
| | ST EN | Byproducts/waste emissions | C2.2 | P. 266 |
| Use of resources | ST | Water intake and consumption from water-stressed areas | C3.0 | No intake from water-stressed areas (Japan) |
| Risk | ST EN SH | Fines due to negative impacts on nature | C7.2 | 0 yen (Japan) |
| Opportunity | ST EN | Beautification/greening expenses at production sites | C7.3 | Approx. 0.6 billion yen (Japan) |

| Items with Set Targets | Target Operating Company | Metrics | Correspondence to TNFD Metrics (Global Core and Additional) | Performance |
|---|---|---|---|---|
| Reduction of chemical substance emissions | ST | Reduction of chemical substance emissions | C2.4 | P. 263 |
| Resource use | ST | Recycling of co-products | A2.1 | P. 266 |
| | EN | Recycling rate at construction sites | A2.1 | P. 268 |
| | EN | Recycling rate of office recyclable waste | A2.1 | P. 267 |
| | SH | Expand product lineup, contributing to resource circulation | C7.4 | Initiative starting from FY2025 |
| Effective use of water resources | ST | Efficient use of water resources | A3.0 | P. 269 |

# Target Areas

As part of overall risk management, we identify, analyze, and evaluate water risks based on past incidents of droughts and floods in the JFE Group's businesses, forecast data from the Meteorological Agency and results of our scenario analysis. In particular, we consider as key risks the damages to business sites and disruption of the supply chain caused by restrictions on water intake due to droughts or increasing severity of meteorological disasters. In response, we are further reinforcing measures such as using recycled water, securing alternative means, and strengthening drainage facilities.

## ST Water Risk Assessment and Measures

JFE Steel identifies and evaluates water-related risks based on past incidents of damage caused by droughts and floods, forecast data from the Meteorological Agency and results of scenario analysis. We conduct a further evaluation of water risks around each manufacturing site from different perspectives by also using the World Resource Institute (WRI)'s Aqueduct, a mapping tool for evaluating overall water risks from droughts and floods in each region around the world. According to the WRI's assessment in June 2024, water risks for all of Japan are not designated at a high level or above, but there will be risks of water shortages and flooding due to weather conditions in the future (2030s and 2040s). JFE Steel identifies steelworks under such weather risks and takes measures such as business continuity planning.

## ST Raised Effluent Standards to Reduce Water Resource Pollution Risks in Iron and Steelmaking Processes

JFE Steel strives to reduce its environmental impact on waterways by thoroughly purifying water used in iron and steelmaking processes before releasing it into public waterways or sewers. The company has concluded agreements with the administrative entity in each area that set out more rigorous effluent standards, compared to those stipulated under the Water Pollution Prevention Act. It also established a strict voluntary control standard to improve water quality. For FY2023, COD*, the water quality index for wastewater, was 2.3 tonnes per day.

*COD stands for chemical oxygen demand, an indicator for water pollution in seas, oceans, lakes, and ponds. It represents the amount of oxygen (mg/l) consumed when pollutants present in water, such as organic matter, are oxidized.

## EN Proper Management in Accordance with the Water Pollution Prevention Act and Sewerage Act

Wastewater from the JFE Engineering Yokohama head office, Tsurumi works, Tsu works, and the Kasaoka Monopile Factory is released into public waterways or sewer systems. Nitric oxide, phosphorus, and COD in the wastewater are measured on a regular basis and effectively managed in accordance with the Water Pollution Prevention Act and Sewerage Act.

For more on quantitative data related to water, please refer to:
› Environmental Data (P. 255)

# Main Initiatives for Biodiversity Conservation and Nature Positive

The JFE Group endorses and participates in the Challenge Zero initiative jointly sponsored by Keidanren and the Japanese government. We are also collaborating with Yokohama City on a project that uses steel slag products to improve the marine environment while also undertaking efforts for biodiversity conservation and nature positive.

> **Challenge Zero** (https://www.challenge-zero.jp/en/member/37)

## ST Complete Chromate-Free Hot-Dip Galvanized Steel Sheets

Chromate treatment using hexavalent chromium ($Cr^{6+}$), an environmentally hazardous substance, has been performed employed to improve the corrosion resistance of hot-dip galvanized steel sheets, mainly used in the electrical and building materials sectors. We developed steel sheets that deliver performance equal to or greater than that of chromated steel sheets without using hexavalent chromium, and by having customers evaluate the stable performance of these products, we achieved complete chromate-free hot-dip galvanized steel sheets in 2020.

## ST Contributing to Biodiversity and the Creation of an Attractive Seaside Town by Utilizing Steel Slag Products (Partnership Agreement with Yokohama City)

Silty sediment (sludge containing large amounts of organic matter) piles up at the ocean bed along the seaside frontage of Yamashita Park in Yokohama City, Kanagawa Prefecture, and significantly deteriorates water quality in summer. As a result, the ocean's ability to function as a spawning ground or environment for nurturing organisms has been lost.

In a joint research project with Yokohama City, JFE Steel is restoring the intrinsic ability of the waters to purify seawater with the help of marine organisms by using carbonated steel slag products such as Marine Block™ to form shorelines as a base for the adhesion of organisms and assist in improving the marine environment. Immediately after an experiment, we observed an increase in the presence of marine organisms such as starfish and sea cucumbers around the area, and the populations continuing to grow. Moreover, we estimated that 8,400 kl of seawater (equivalent to seventeen 25-meter swimming pools) is filtered per day by filter-feeding marine creatures such as bivalves and sea squirt. We also estimated their impact on the removal of COD and the reduction of $CO_2$ in comparison to results obtained through water purification at sewage treatment plants.

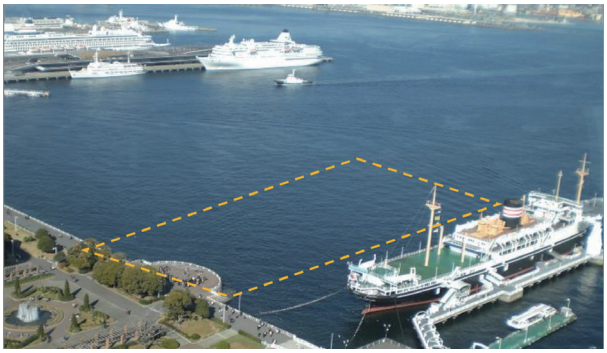
The findings from the research project were presented at many exhibits and other events, helping to raise local awareness of environmental protection. This public-private research project for improving the marine environment has earned public recognition, with Yokohama City and JFE Steel jointly receiving the FY2021 Environmental Award (Group-2) of the Japan Society of Civil Engineering*1. In September 2022, JFE Steel won the Minister of Land, Infrastructure, Transport and Tourism Award of the 5th Eco Pro Awards*2, sponsored by the Sustainable Management Promotion Organization, a general incorporated association. A signboard commemorating these awards was installed next to the sea-facing balcony in Yamashita Koen Park, displaying research findings to visitors.

*1 The Japan Society of Civil Engineering Award is a prestigious award with a history of over 90 years. The Environmental Award (Group-2) is given to an innovative project that has contributed to any combination of environmental preservation, improvement, and creation activities by developing or operating civil engineering technology or systems.

*2 The award is given to goods, services, technology, solutions, or business models with specific and outstanding eco-friendly attributes that are widely recognized by businesses, consumers, investors, and market players in the Japanese market.

> **FY2021 Environmental Award of the Japan Society of Civil Engineering** (https://www.jsce-int.org/node/780)

> **The 5th Eco Pro Award (Japanese only)** (https://sumpo.or.jp/seminar/awards/5th_eco-pro_award_results.html)



The dotted line indicates the area in which slag products are being used at Yokohama Bay (photo taken by Yokohama City)

Colony of sea squirts on Frontier Rock™

Marine Block™ covered by marine bivalves (Yokohama Bay area)

Signboard commemorating the partnership project (installed in September 2023)

## ST Agreement Concluded on the Demonstration Project for Blue Carbon Creation at the Hota Fishing Port

In March 2025, JFE Steel entered into a collaboration agreement with Chiba Prefecture, the Hota Fishery Cooperative Association in Kyonan Town, and Kyonan Town for a demonstration project to restore seaweed beds.

In Chiba Prefecture, shallow coastal areas host many rocky reefs and tidal flats with widespread seaweed and seagrass beds. Recently, however, the destruction of seaweed beds has been spreading in the Uchibo coastal area. Although there are several theories about why this is happening in Chiba coastal waters, the main causes are thought to be rising seawater temperatures and damage caused by herbivorous fish. The demonstration project is scheduled to run from April 1, 2025 to March 31, 2028. Initially, steel slag products (artificial stone) rich in iron, which is essential for seaweed growth, will be wrapped with seed strings containing seaweed seedlings and placed in the sea. To subsequently confirm the effects of seawater temperature and herbivorous fish—considered causes of the destruction of seaweed beds—seaweed growth will be monitored under varying conditions, such as species and water depth.

This demonstration project is intended to create blue carbon* and improve fishery productivity by enhancing the marine environment.

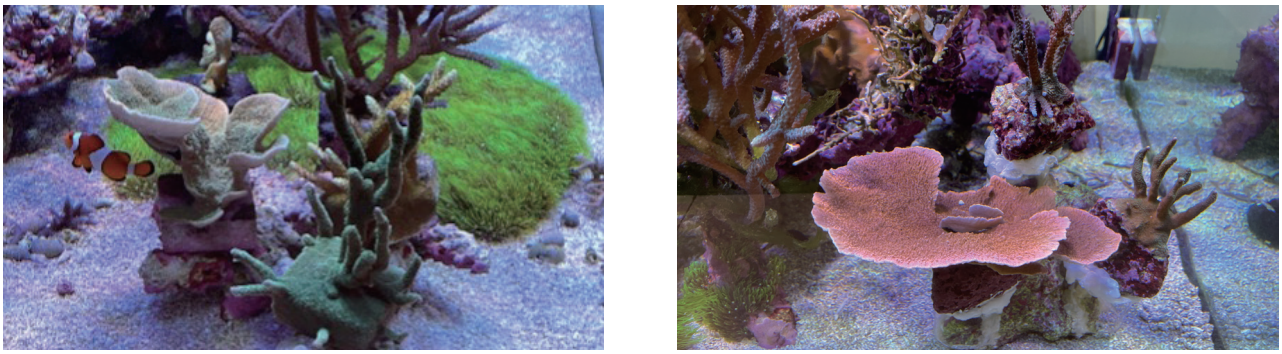
*Blue carbon refers to $CO_2$ sequestered by growing seaweed and other marine vegetation.

April 30, 2025, at the Hota Fishing Port
From left: Ms. Yoko Inoue, Director General, Environmental and Community Affairs Department , Chiba Prefecture
Mr. Eiji Katayama, General Manager, Slag Business Planning Division , JFE Steel Corporation
Mr. Harukazu Shiraishi, Mayor of Kyonan Town
Mr. Shigeo Murai, Representative Director and President, Hota Fishery Cooperative Association

## ST Advancing Biodiversity Verification of Steel Slag Products in Collaboration with Venture Businesses

JFE Steel keeps a water tank containing the coral-covered steel slag products Frontier Rock™ and Marine Block™ at the exhibition area at the reception of the head office, offering visitors the opportunity to enjoy watching coral and tropical fish while learning about our initiative to preserve the ecosystem using steel slag products. We also intend to conduct experiments inside the tank. Innoqua Inc.* is providing technical support for the exhibition, which has been featured by several newspapers and TV programs as an example of business collaboration in the field of the environment.

*A venture company engaged in the development of systems for managing and nurturing corals and fish by combining its aquarist know-how with IoT and AI.



Healthy coral growth on Marine Block™ (left) and Frontier Rock™ (right) inside the water tank

## ST The Biotope Chita Initiative to Reproduce and Conserve the Local Ecosystem

To commemorate the 80th anniversary of its opening in 2023, the JFE Steel Chita Works established and developed Biotope Chita within the plant premises to recreate and conserve the Chita Peninsula's ecosystem. Of the approximately 2 hectares of site area, 1 hectare had already been developed as a green belt in 2013. We are creating habitats at Biotope Chita for living organisms and conducting community-based events in collaboration with the local area.

Biotope Chita overview

Rice planting event

## ST The Chita Works Certified as an Aichi Biodiversity Company

In November 2022, our Chita Works was recognized as a certified enterprise under the Aichi Biodiversity Company Certification Program in its first term launched by Aichi Prefecture based on the Aichi Biodiversity Strategy 2030. The program is intended to encourage more businesses in the prefecture to play a pivotal role in preserving local biodiversity by certifying those that have implemented outstanding initiatives to do so.

We have used Biotope Chita at the Chita Works since FY2022 to create green spaces that attract the chestnut tiger butterfly, a species that migrates more than 2,000 kilometers across Japan, and we have partnered with municipalities in the Chita Peninsula of Aichi Prefecture to exchange information on butterfly arrivals. We are also engaged in conservation activities for native species such as the Japanese rice fish (Oryzias latipes) and Japanese honeybee (Apis cerana japonica). We have further strengthened our initiatives since FY2024 by undertaking ex-situ conservation of wetland plants.

Certified
Aichi Biodiversity Company

Chestnut tiger butterfly

Japanese rice fish

## ST Biotope Chita Certified as a Nature Symbiosis Site

Biotope Chita, the biodiversity conservation base of the Chita Works, was certified as a Nature Symbiosis Site by the Ministry of the Environment in March 2025. The certification was obtained as a result of Chita Works joining in 2024 the previously certified Inochi wo Tsunagu Projec t*2, which operates in the Greenbelt of Chita peninsula*1.

A Nature Symbiosis Site is an area that promotes biodiversity conservation through private initiatives and other efforts, certified by the Government of Japan under a system led by the Ministry of the Environment. It is one of the initiatives for achieving the international 30 by 30 target to effectively conserve more than 30% of land and sea as healthy ecosystems by 2030. This certified area is a portion of Biotope Chita (0.66 ha). Certification was granted following monitoring surveys that confirmed the conservation of biodiversity, having identified 86 plant and 16 bird species. Going forward, JFE Steel Chita Works will also obtain independent certification and further strengthen its initiatives.

*1 The Greenbelt of Chita peninsula (76.33 ha) is a forest belt in the coastal industrial area of the Chita Peninsula. In 2011, efforts began under the Inochi wo Tsunagu Project, a wide-area collaboration focused on biodiversity. Activities include improving the quality of green spaces, creating pathways for species to move freely between green spaces, and creating habitats for living organisms.

*2 The Inochi wo Tsunagu Project was launched in 2011 following COP10 in Nagoya in 2010. The project views green spaces managed by companies along the coastal area of the Chita Peninsula as one large green belt and seeks to promote integrated conservation and management beyond corporate boundaries, including periodic information exchange meetings, collaborative activities to promote biodiversity conservation, and joint awareness-raising events.


## ST Initiatives for Blue Carbon Using Steel Slag Products and Acquisition of J Blue Credit™

In recent years, research on blue carbon (carbon absorbed and stored by living organisms in the ocean) has been advancing. We are also creating seaweed beds using steel slag products and measuring the total carbon absorption of these beds.

JFE Steel has been promoting the research while creating a seaweed bed using steel slag products and measuring the amount of carbon captured by the entire bed. The company has been collaborating with Koujiro Fisheries Cooperative (Iwakuni City, Yamaguchi) and the National Institute of Technology, Ube College (Ube City, Yamaguchi) on a project to create a seaweed bed and ecosystem using recycled materials at areas around Shinto, Iwakuni City, since FY2012. The initiative involves creating a seaweed bed with rich biodiversity using Marine Stone™, a grain-size-adjusted steel slag, and other steel slag products, and measuring $CO_2$ absorption of the created beds. The cumulative amount of $CO_2$ absorbed and stored from 2018 to 2023, which totaled 81.4 tonnes, received J Blue Credit™ certification by the Japan Blue Economy Association. This was the first certification ever given to a three-party joint project by the Fisheries Cooperative, academia, and private business. The seaweed bed created through the project had the co-benefits*1 of offering a gathering place for diverse fish. Additionally, the sea area is used for education and research.

This initiative was highly regarded, and its members and JFE Steel received the Ministry of Agriculture, Forestry and Fisheries Prize for the 32nd Global Environment Award*2 in 2024.

*1 Climate co-benefits are the positive impacts beyond greenhouse gas reduction that result from climate action policies and projects.

*2 The Global Environment Award recognizes environmental preservation and related efforts that will help establish a circular society for a "harmonic coexistence between industrial development and the environment of the Earth."

› The 32nd Global Environment Award (Japanese only) (https://www.sankei-award.jp/eco/jusyou/)

School of rockfish gathered around the steel slag seaweed bed

Excellent place for education and research (photo from the National Institute of Technology, Ube College)

## ST Restoring Marine Ecosystems Using Steel Slag Products

Marine Stone™ is a grain-size-adjusted steel slag that controls the generation of hydrogen sulfide from the silty sediment in enclosed coastal seas and improves the environment in which organisms can live. Its effectiveness in improving marine environments is widely recognized, and the joint project with Hiroshima University has received external commendations.

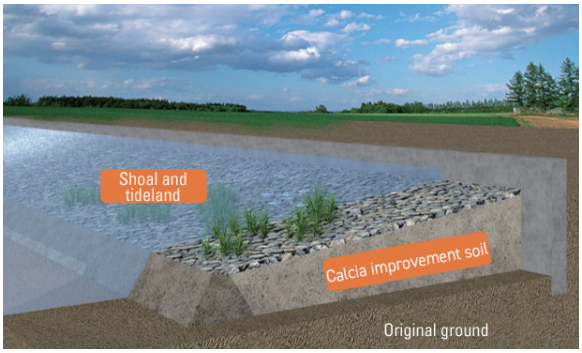
Frontier Rock™ is another steel slag product that consists of artificial stones made from a steel slag hydrated matrix and provides an excellent base for seaweed beds and fishing reefs. A submerged bank built on the seabed off the coast of Minami-Izu Town, Shizuoka Prefecture, has become a gathering place for large perennial seaweeds as well as useful fishery resources such as lobsters and a wide variety of fish.


School of fish attracted to the submerged bank made of Frontier Rock™

## ST Calcia Improvement Material

Calcia improvement material* is a slag product that uses converter-type steelmaking slag as raw material and is manufactured by controlling composition and adjusting particle size. Calcia-improved soil can also be used for creating shallow waters, tidal flats, and embankment material and as backfill material for deep excavation pits left by marine sand extraction. It contributes to improving the marine environment. To date, it has been used as the main embankment material for creating a shallow area (incidental facilities at the sediment disposal site, Tokuyama-Kudamatsu Port).

› *Contribution of Steel Slag Products (P. 165)




Example of calcia improvement soil application
(shoal and tideland construction material)

## EN Initiatives in the Engineering Business for the Preservation of the Natural Environment and Biodiversity

In engineering projects, at waterfronts, in mountainous areas, or in large-scale construction efforts, customers and related organizations often conduct preliminary surveys in advance, depending on the importance of conserving the surrounding environment, and various environmental protection conditions may be imposed on the work, including measures for protecting living organisms.

JFE Engineering respects the proposed conditions and thoughtfully considers biodiversity conservation by keeping the impact of construction works at a minimum. For example, the company may propose a construction method that minimizes the impact of noise or drainage pollution. For its steelworks, the status of biodiversity on its premises and in surrounding areas are checked, and necessary measures are taken to ensure preservation.

Our construction projects adopt methods that comply with customer requirements. For example, reference is made below to Biodiversity Conservation in the Reconstruction of the Tedori River Bridge and Contribution to Japan's First Communication Optical Fiber Cable Installation across Tokyo Bay Using the Curved Pipe Jacking Method.

We also engage in community activities that contribute to the conservation of local natural environments and biodiversity.

## EN JFE Engineering: Biotope for Children's Learning Experience

JFE Engineering has conducted some renovation work at the JFE Dragonfly Path in the Tsurumi Works, and since 2009 it has been inviting children in the community to learn about the ecosystem at a biotope, Dragonfly Pond, located along this path.

The JFE Dragonfly Path Fan Club, a group mainly composed of neighborhood residents, has organized a research event that involved capturing dragonflies in order to learn about their ecology and the local environment.

We are also a founding member of the How Far Do Dragonflies Fly Forum , which aims to improve the quality of green spaces in the Keihin coastal area and contribute to biodiversity. The forum brings together companies, residents, governments, and experts and conducts research activities such as capture, tagging, and release of dragonflies that fly in 15 green spaces and biotopes scattered throughout the Keihin coastal area and inland areas to track their movements. The JFE Dragonfly Path also serves as a research site.

These activities were certified in 2024 by the Ministry of the Environment as a Nature Symbiosis Site under the designation "Yokohama/Keihin Forest."

Dragonfly Pond serving as a biotope

## EN Participation in Kanagawa Prefecture's Reforestation Partner Program

In March 2023, the JFE Engineering Group's J&T Recycling Corporation expressed its support for the Kanagawa Reforestation 50 Year Plan and signed a memorandum of understanding with Kanagawa Prefecture on the Reforestation Partner Program*, an initiative launched by the prefecture.

The company's intent is to use the program as part of its environmental protection and harmony activities while supporting the prefecture's vision. Under the partnership, the company's employees volunteer to help thin trees and take part in other efforts for conserving forests, a valuable source of water for future generations.

The Reforestation Partner Program grants naming rights to participants for parts of the prefecture-owned forests, one of which is now called the J&T Kankyo Miracle Forest (with the word "miracle" expressed in kanji, meaning the "future is coming"). J&T Recycling Corporation is constantly enhancing its ESG initiatives to improve the environment.

*For details about the Reforestation Partner Program, please refer to:

› **Website for Kanagawa Prefecture (Japanese Only)** (https://www.pref.kanagawa.jp/docs/pb5/partner.html)

New employees pruned trees in a volunteer activity

J&T Kankyo Miracle Forest

森林$CO_2$
吸収量算定書

森林再生パートナー
J&T環境株式会社　殿

かながわの森林再生への参加・協力によって貢献した、
森林が吸収する5年間の$CO_2$量は以下のとおりです。

ご支援いただいた寄附額による標準的$CO_2$吸収量
247t $-CO_2$
※覚書存続期間の吸収量　2023.3.1～2028.2.29

令和5年6月13日

神奈川県知事　黒岩　祐治

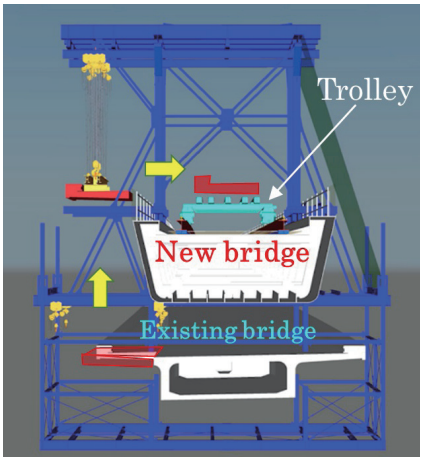
Valuation report on $CO_2$ absorption by the forest

## EN Biodiversity Conservation in the Reconstruction of the Tedori River Bridge

The reconstruction of the Tedori River Bridge* is described under the heading "Toward Realization of Longer Service Life Bridges" in the Initiatives to Transition to a Circular Economy section of this Sustainability Report 2025. The project is characterized not only by the use of stainless clad steel but also by the adoption of a special reconstruction method necessitated by local site constraints. The bridge is located at the mouth of the Tedori River, and the sandy beach beneath the girders is inhabited by the Iso-komori spider (Lycosa ishikariana) and the Little Tern, both listed as endangered species (Category II). We therefore developed a reconstruction method that avoids bringing heavy machinery onto the sandy beach to protect these rare species.

The construction method begins by assembling the new bridge on top of the existing one before its removal and then installing a removal frame on the new bridge. Using this frame, the girders are cut in mid-air, lifted onto the new girders, placed on transport vehicles, and carried out of the bridge area. This reconstruction method was developed by JFE Engineering, combining multiple techniques derived from similar experiences in urban expressway reconstruction and widening projects and applied to the site after full-scale construction trials.

› *Toward Realizing Longer Service Life Bridges (P. 136)




On-site construction status


Removal method image

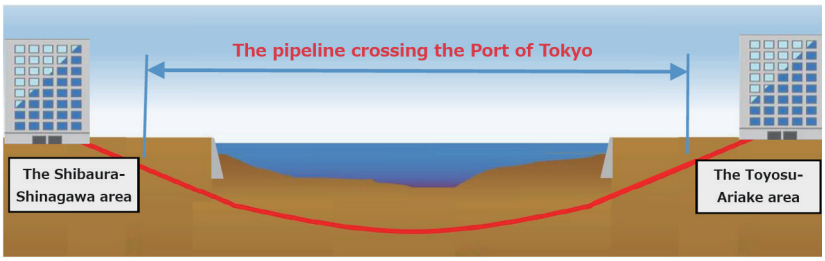
## EN Contributing the Company's Horizontal Directional Drilling Method to Japan's First Installation of Telecommunication Optical Fiber Cables across Tokyo Bay

JFE Engineering has completed the construction of a transmission channel across Tokyo Bay as a project ordered from Nippon COMSYS Corporation. The ongoing advance of information and telecommunication technologies have made telecommunication networks indispensable in daily life, and the growing volume of telecommunication traffic requires an increasing number of optical communications facilities.

Construction involved laying a pipeline for installing telecommunication optical fiber cables between Tokyo's Shibaura and Shinagawa areas, where many tech companies are located, and between the city's Toyosu and Ariake areas, thereby establishing a network with the shortest route. The challenging work required laying the pipeline deep undersea to prevent damaging seawalls and other protection structures around Tokyo Bay as well as handling nearly 2,000 meters of pipeline, one of the longest in Japan. The construction was completed successfully without accident within just two months, thanks to the use of the JFE-RAPID™ method, a pipeline technology developed by JFE Engineering to facilitate quick, low-cost construction.

The JFE-RAPID™ method makes it possible to bring down construction cost and shorten the work period by drilling at the sea bottom and moving the pipeline forward through a circular boring method instead of installing vertical shafts. This is an effective method for installing telecommunication cable and a promising technique for laying power cable pipelines for offshore wind-power stations.

**The pipeline (concept)**



Propulsion machine

> JFE Engineering Completes the Construction of a Pipeline Crossing Tokyo Bay—Contributing with the Company's Horizontal Directional Drilling Method to Japan's First Installation of Telecommunication Optical Fiber Cables across the Bay (Japanese only)
(https://www.jfe-eng.co.jp/news/2024/20240523.html)

## Initiatives for Realizing Nature Positive in the Keihin Waterfront Area

The shared urban space under OHGISHIMA2050 is envisioned as a green, future-oriented venue for demonstration and interaction of advanced technologies supporting DX and GX. In collaboration with Kawasaki City, we are exploring the creation of a nature-positive urban space that fosters biodiversity.

As part of land use initiatives in the Keihin area, we are planning to promote the promotion of CCUS projects by leveraging the expertise and know-how cultivated in advanced CCS projects, contributing to ecosystem conservation through businesses that support carbon neutrality. Land use conversion in the Keihin area involves dismantling large idle facilities such as steelworks and coke plants. Through the recycling of scrap, concrete, and other materials, we are working to reduce environmental impact. At Ogishima, we have continued operations as a steelworks rich in greenery, conducting extensive greening initiatives to create a people- and environment-friendly site. In land use conversion as well, we will aim to realize an urban environment that takes biodiversity and resource circulation into consideration.

Shared urban space (concept)