



JFE

JFE Group



DX注目企業2023  
Digital Transformation

# DX REPORT

2023

Contributing to society with the world's most innovative technology

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## Disclaimer

Current plans, strategies, beliefs, and other content described in this report that are not historical facts are forward-looking statements that may involve risks and uncertainties. Actual results, performance, or achievements could differ significantly from the anticipated outcomes presented in this report due to various factors, including changes in the global or domestic economy, as well as unanticipated trends in the industries to which JFE Group companies belong. Readers should understand that JFE Holdings cannot guarantee the certainty of such forward-looking statements.



## JFE Holdings named Noteworthy DX Company 2023

JFE Holdings was named a Noteworthy DX Company 2023 as a firm that merits attention for proactively promoting digital transformation (DX), selected by the Ministry of Economy, Trade and Industry, the Tokyo Stock Exchange, and the Information-technology Promotion Agency, Japan, as part of the Digital Transformation Stock Selection (DX Stock) 2023 program.

# Pursuing DX strategy to create new value and contribute to society's sustainable development

The JFE Group has developed a diverse range of businesses over many years, with a focus on a steel business, an engineering business, and a trading business. The huge amounts of operational data, expertise, and technologies built up through these businesses are valuable assets that other companies cannot easily replicate, and our leading world-class technologies are the source of our value creation, which supports society. By combining these intangible assets with cutting-edge technologies including artificial intelligence (AI), the Internet of Things (IoT), and data science, we are creating new value through a range of initiatives that lead to the resolution of social issues.

Countermeasures against increasingly sophisticated cyberattacks and risks from information leakage are also very important issues that we cannot ignore as we develop our businesses around the world. Security countermeasures and enhanced security governance go hand in hand with the pursuit of our DX strategy, and these are steadily being carried out Groupwide, primarily through JFE-SIRT.<sup>\*1</sup>

This is the third year under the Seventh Medium-term Business Plan, which was formulated in fiscal 2021. We view our DX strategy as an important management strategy and have been pursuing DX Groupwide. The various initiatives we have been carrying out are steadily producing concrete results like the use of CPS<sup>\*2</sup> to create intelligent steelworks (please refer to the Steel Business on page 7) and product development that uses GRC<sup>\*3</sup> as a core technology (please refer to the Engineering Business on page 11). We are increasingly pursuing DX with even greater strength to achieve the Medium-term Business Plan's targets. This approach is leading to enhanced corporate value.

This report introduces specific DX strategy initiatives being carried out at our operating companies. We hope that readers will find this information useful for better understanding the JFE Group's DX program.



**Seiya Kitajima**

Vice President

JFE Holdings, Inc.

\*1 JFE-SIRT: JFE Security Integration and Response Team (please refer to page 17)

\*2 CPS: Cyber Physical System

\*3 GRC: Global Remote Center

**JFE Group's DX Strategy**

**Initiatives under the Seventh Medium-term Business Plan (FY2021–24)**

- ▶ Aggressive DX to lead to improving earnings power, realizing growth strategy, and advancing business model
- ▶ DX investments: ¥120 billion over four years  
→ FY2021–22 results  
48% of investments selected

**Strategy for Each Business**

**JFE Steel**

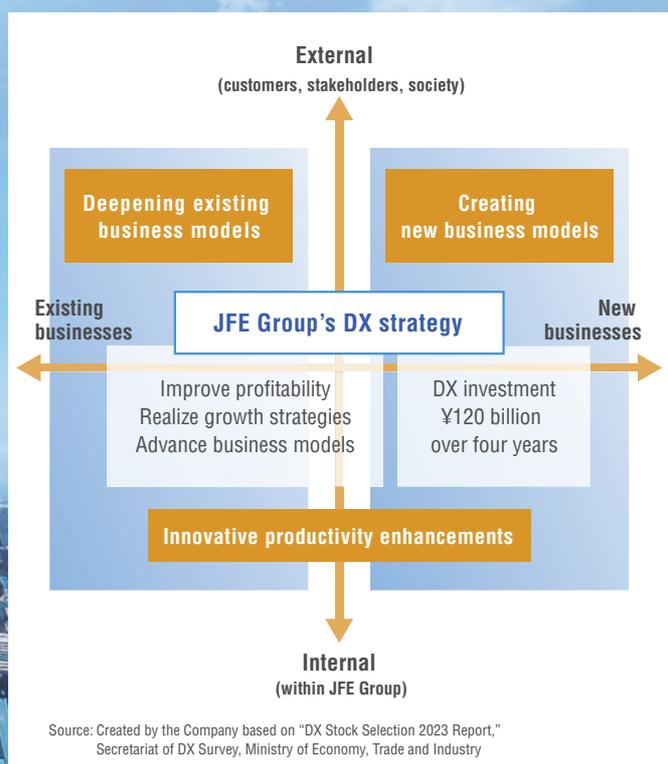
Establish competitive advantage through advanced use of data

**JFE Engineering**

Implement sweeping business reforms with further data utilization and provide digital services

**JFE Shoji**

Create businesses through external sales and intra-Group utilization of DX solutions



Source: Created by the Company based on "DX Stock Selection 2023 Report," Secretariat of DX Survey, Ministry of Economy, Trade and Industry

# JFE Group's Initiatives to Resolve Social Issues

The JFE Group is using DX to resolve social issues in various ways by maximizing the Group's technological capabilities. The following section introduces some of those initiatives being carried out internally, including DX human resource development, which has become a social issue.

## Initiative 01 | Offshore Wind Power Generation Business

### Engineering Business, etc.

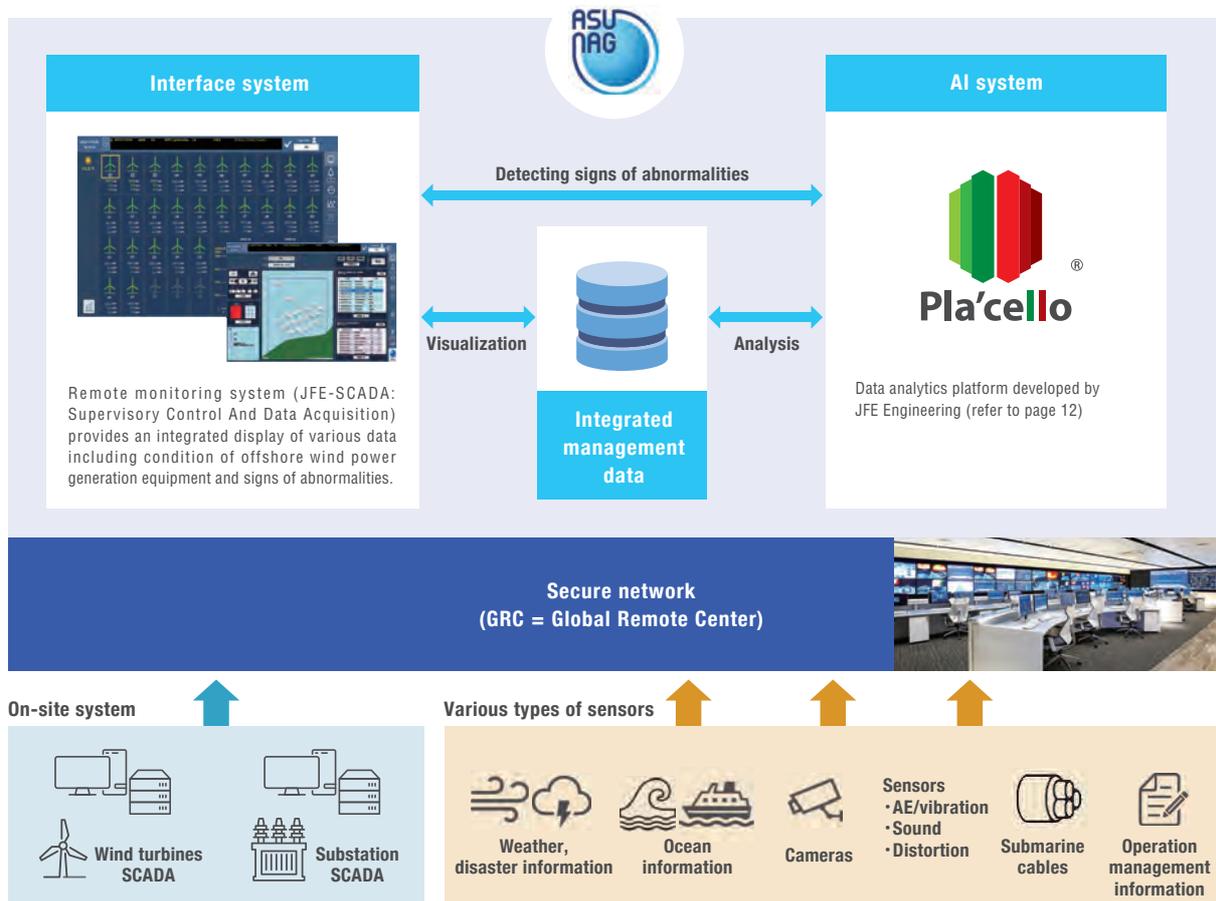
The JFE Group is using the Group's comprehensive strength, which includes JFE Steel's material production, JFE Shoji's supply chain capabilities, and JFE Engineering's monopile production and plant operation expertise, to expand its business in the field of offshore wind power generation. In the area of operation and maintenance (O&M), JFE Engineering is using its technologies and expertise gained through the operation of a Global Remote Center that monitors 88 sites in Japan and overseas (as of the end of March 2024), big data analysis technologies to detect signs of abnormalities, and operation and maintenance technologies and expertise that allow steelworks to continue 24 hours without interruption, to achieve labor savings and improved efficiency.

JFE Engineering has developed the ASUNAG integrated management system, which flexibly manages various kinds of information, including the substation, weather, and ship information required for the stable operation of an offshore wind power business. In November 2023, the company delivered its first unit to Nyuzen Marine Wind LLC's Nyuzen Offshore Wind Farm.



Nyuzen Offshore Wind Farm

#### Overview of ASUNAG integrated management system



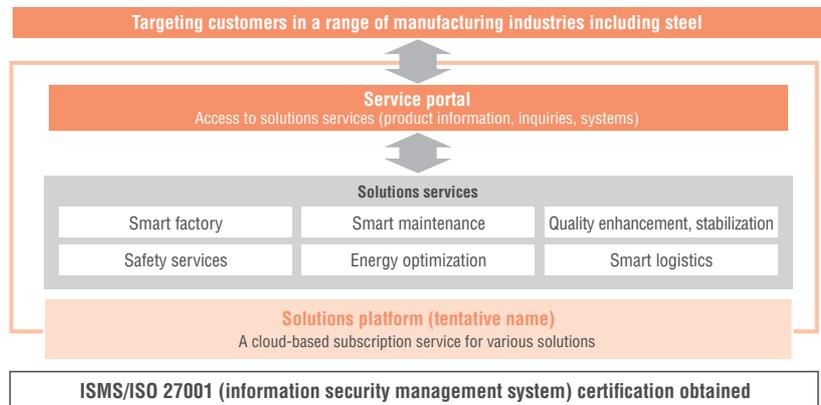


**Steel Business**

JFE Steel Corporation is pursuing a solutions business that uses its expertise related to areas including improved quality and productivity, equipment maintenance, and the reduction of the environment impact cultivated through steelworks operations and management, to provide external customers with “solutions technologies.”

During fiscal 2023, the company built a system platform and an operation structure that allow solutions products to be cloud based.

In addition, various technologies developed in-house are being commercialized, and sales are gradually beginning to customers in a range of manufacturing industries including steel.



### Products

#### Fault recovery support solution (J-mAlster®)

Uses AI search technologies to rapidly display desired file data from huge volume of internal data

**Customer's chosen system environment**

- Customer data
- Fault/response history
- Manuals
- Spare parts inventories, etc.

IBM Watson

- Instant search for data required for recovery
- Helps staff identify cause
- Searches performed within or across business locations

#### Equipment anomaly detection system (J-dscom®)

Detects signs of system anomalies using multiple data including electric current, temperature, and vibration, and triggers alert

**Monitoring level**

- Overall level monitoring**: Monitor overall process variables and extract their correlations automatically
- Equipment-level monitoring**: Multiple variables in specific piece of equipment (human-designated variables)
- Meter-level monitoring**: Confirm maximum readings on individual meter

System using correlation of multiple data sets to detect signs of anomalies

For information regarding other solutions products, please visit: <https://www.jfe-steel.co.jp/en/products/solution/index.html>



**Trading Business**

JFE Shoji Electronics Corporation is launching a logistics-tracking solutions service business using the GPS terminal in spring 2024. The GPS terminal will “visualize” information on location, temperature, and jolt impact to help improve efficiency in trailer operations and reduce working hours required for various operations, thus contributing to the elimination of the “2024 problem” in the logistics field (when new rules are introduced to limit overtime for long-haul truck and delivery drivers).

#### System features

- Efficient management of trailer arrival and delivery using GPS location information
- Reduction of labor and time for drivers searching for a trailer by grasping location information
- Contribution to reduction of CO<sub>2</sub> emission by visualizing emission caused by users in transit
- Confirmation of collected data on personal computers or smartphones via a web-based application

#### GPS terminal (Made in Japan)

- Equipped with high-accuracy GPS (position-measurement error: several meters), temperature sensor, and accelerometer
- Advantage of high-volume, stable telecommunications
- Long-life battery (approximately 10 years)
- Maintenance-free

#### System overview

Information transmission using high-volume, stable telecommunications method (Cat. M1)

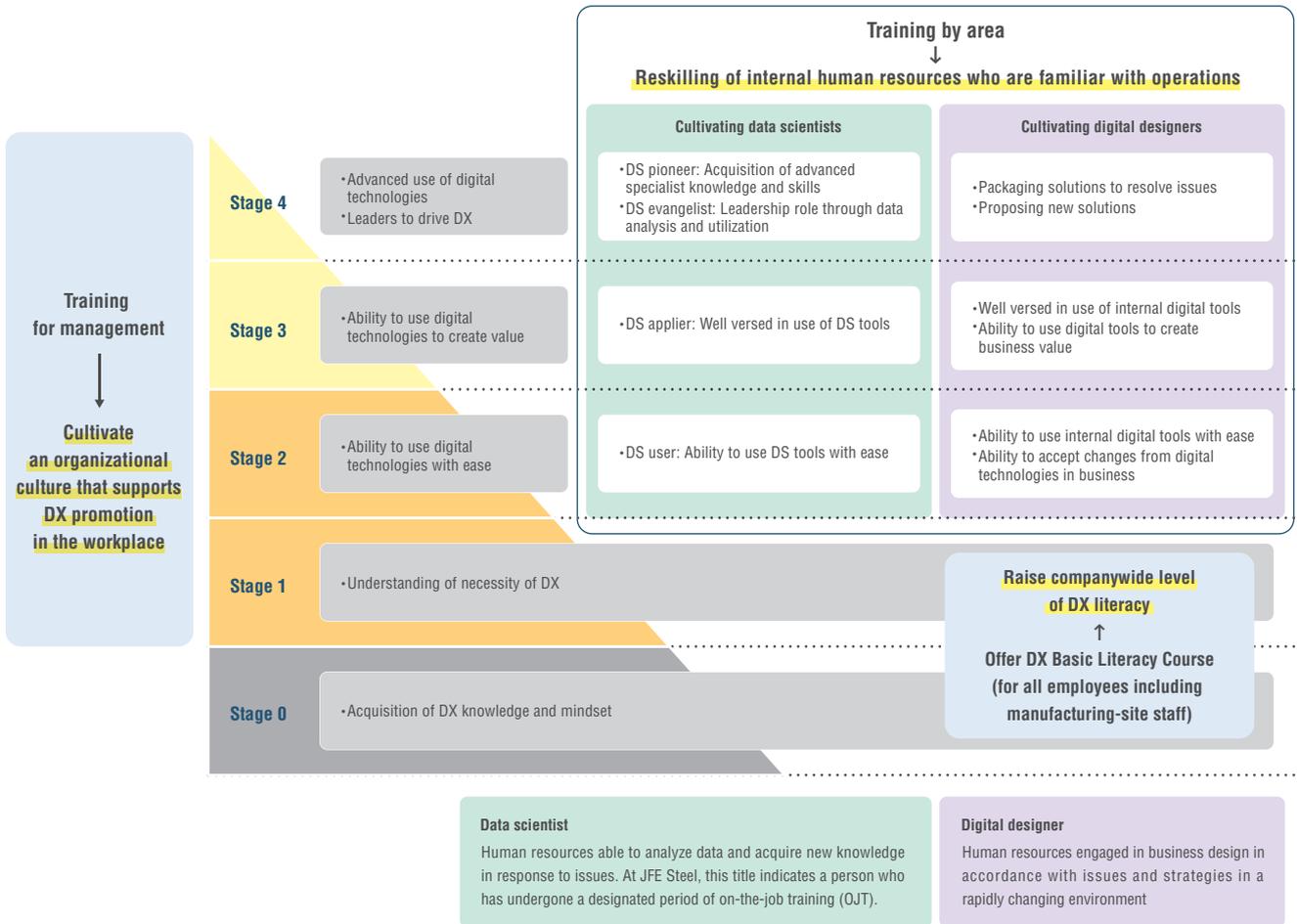
Location information acquisition using high-accuracy GPS

Continuously available to acquire information for management of trailer operations

## Steel Business

JFE Steel provides educational curricula to encourage all employees to take ownership of DX and actively participate. The **DX Basic Literacy Course** raises the level of DX literacy among all employees, and **training for management including officers** aims to cultivate an organizational atmosphere that facilitates the pursuit of new challenges.

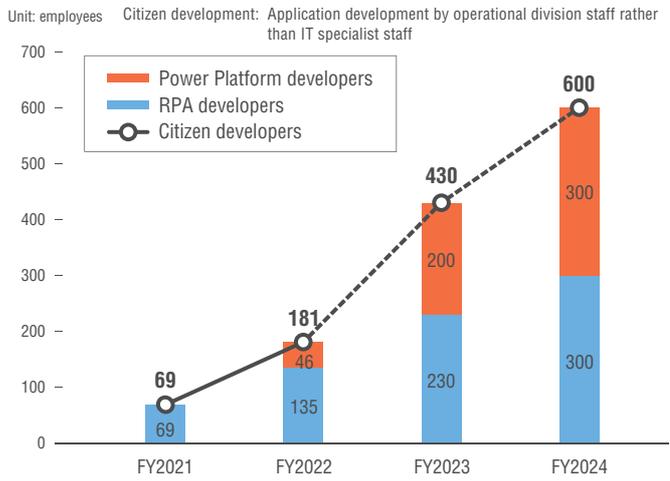
In addition, the company is providing training and internal tools to core DX human resources to allow them to gain the skills of a **data scientist** or **digital designer**, creating an environment in which people leading businesses can use digital technologies themselves to pursue innovation.



**Number of data scientists trained**



**Number of citizen developers**





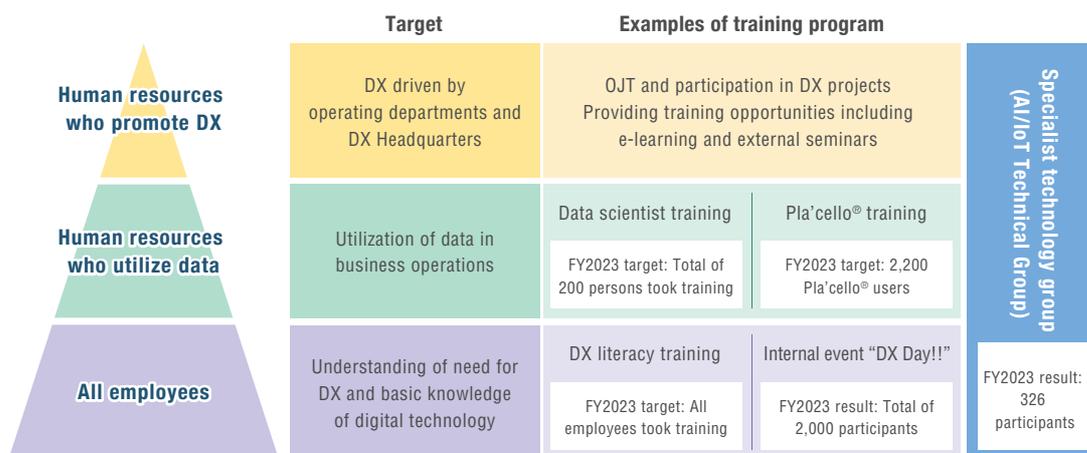
## Engineering Business

As part of its companywide DX program, JFE Engineering offers various training courses to raise the level of employees' digital knowledge. During fiscal 2023, DX literacy training was provided to all employees to help them understand the need for DX and supplement their basic knowledge related to digital technologies. In addition, the internal event "DX Day!!" is held once a year to cultivate a DX mindset. The company has also established an internal AI/IoT Technical Group to raise the companywide level of ICT (information and communications technology) skills under specific themes such as strengthening ICT skills and utilizing AI (artificial intelligence).

The company is also actively engaged in training human resources in the utilization of data. It provides introductory training in the use of its Pla'cello® data analytics platform in business operations, and the number of Pla'cello® users has surpassed 2,000. The company has also put in place the entire 17-class, 120-hour data scientist training program to help employees acquire more specialized data science knowledge, with the aim of having a total of 200 employees take the course by the end of fiscal 2023.

DX Day!! → Refer to Engineering Business on page 12

Pla'cello® → Refer to Engineering Business on page 12



## Trading Business

### ■ Increasing motivation for transformation

As part of its DX promotion activities, in addition to the DX workshop and DX executive seminars for officers held during fiscal 2022, JFE Shoji has been continuing to offer DX literacy training as part of its position-specific training in fiscal 2023 to instill an awareness that the leaders of DX are employees themselves.

Purpose	Content	Targeted employees
<ul style="list-style-type: none"> <li>Cultivate a DX promotion mindset (ownership)</li> <li>Instill awareness of significance and effects of using data efficiently</li> </ul>	<ul style="list-style-type: none"> <li>Examples of DX in the steel industry</li> <li>Features of companies successful in DX</li> <li>Examples of effective use of data</li> </ul>	(1) Newly appointed general managers: 15 (July 2023) (2) Newly appointed managers: 22 (May 2023) (3) Persons promoted to managerial positions: 36 (May 2023)

#### Training excerpt

#### Need to "take ownership" for successful DX promotion

- Must take ownership for transformation and carry out work as one's own responsibility
- Must enhance one's own knowledge and ability for further evolution because of progressing digital technologies

#### Three elements of "take ownership"



Instill "take ownership" of DX (transformation) while having participants recognize roles at each managerial level

Level	Roles
Senior management	<ul style="list-style-type: none"> <li>Taking the initiative to disseminate necessity of transformation and management issues internally and externally</li> <li>Decision-making on difficult transformation themes (taking responsibility)</li> </ul>
Middle management	<ul style="list-style-type: none"> <li>Taking the initiative for penetration of digitalization and backup support</li> <li>Planning and proposing of original transformation themes to his/her organization and management</li> </ul>
Other managerial staff	<ul style="list-style-type: none"> <li>Strong awareness of issues and transformation in one's own work and workplace</li> <li>Willingness to set up opportunities to disseminate one's own recognized issues and to propose improvements</li> </ul>

# Steel Business (JFE Steel Corporation)

JFE Steel is proactively implementing various measures to transform existing businesses, make innovative improvements in productivity, and create new businesses, to establish a competitive advantage that maximizes the wealth of data we have collected over many years.

We have integrated our IT platforms, including steelworks' system upgrades, and have created an environment that makes it possible to make comprehensive use of operational data including our accumulation of mission-critical operational data, images, and sensor data. This enables us to do things like make operations more sophisticated, introduce cyber-physical systems (CPS) for manufacturing processes, and implement remote and automated operations, achieving further improvements in productivity, labor productivity, quality, and safety.

Under the Seventh Medium-term Business Plan, we plan to invest 115.0 billion yen in DX with the aim of a 30.0 billion yen improvement in earnings annually. The approval of investments is on track relative to the plan, and the company will continue to invest in fiscal 2024 to improve earnings through DX.



**Akira Nitta**  
Senior Vice President

## DX Strategy

The main pillars of JFE Steel's DX are the introduction of technologies like the Internet of things (IoT), artificial intelligence (AI), and data science (DS) for gaining a competitive advantage by proactively utilizing data (= data-driven). Our accumulated expertise in high-grade steel manufacturing, responses to aging equipment, and data related to predictive management are the sources of our competitiveness, as we make advanced use of data—one of JFE Steel's important strategies. We are pursuing DX with three main areas of emphasis—"raise our level of data use" mentioned above, "execute IT structural reforms," and "reinforce our IT risk management."

### JFE Steel's major initiatives under the Seventh Medium-term Business Plan

Use "digital" technologies to strengthen the manufacturing base and execute new growth strategies

### JFE Steel's vision for DX promotion

#### Gain competitive advantage through the proactive utilization of data (= data-driven)

With a long history of manufacturing, JFE is a storehouse of data. Our accumulated expertise in high-grade steel manufacturing, responses to aging equipment, and data related to predictive management are the sources of our competitiveness. Advanced use of data is JFE Steel's strategic theme.

#### Three pillars of DX promotion

**1 Execute IT structural reforms**

Upgrade systems at steelworks

Realize a flexible, change-tolerant IT structure

#### Maximize value

Synergistic effects

**2 Raise our level of data use**

Promote business reforms and the latest advancements in IT

Actively utilize data science and AI

**3 Reinforce our IT risk management**

Enhance security and standardized controls

Enhance the security environment for IT

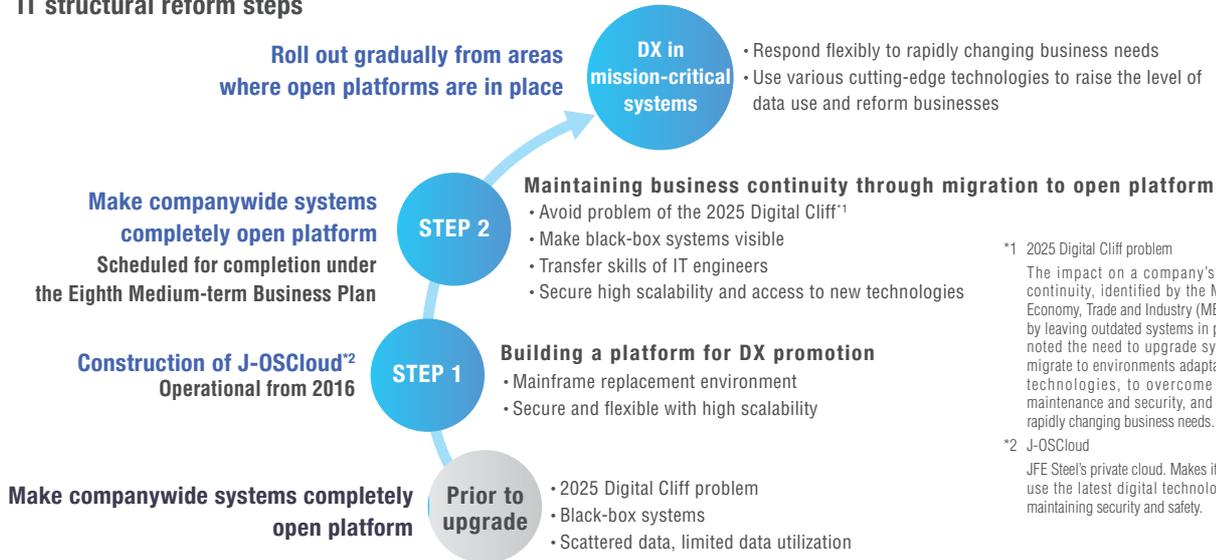
Operational and R&D data assets



# Pillars Supporting DX Promotion

## Execute IT structural reforms

### IT structural reform steps



In May 2023, the Kurashiki district (Kurashiki City, Okayama Prefecture) of the West Japan Works, our core steelworks, migrated to an open platform environment for the shaped steel area of its mission-critical system. This is JFE Steel's first system upgrade to its mainframe system, which is made in Japan by Fujitsu, at its major steelworks, which has three blast furnaces continuously operating 24 hours a day.

Head office	Steelworks					
	Kurashiki	Fukuyama	Chiba	Keihin	Sendai	Chita
Open platform project Sales, manufacturing, logistics	System updates at steelworks Manufacturing management, operational management					
Marketing : Logistics						
Upgrade completed in FY2021	Upgrades scheduled for completion during period covered by Eighth Medium-term Business Plan					
Open platform project Business management	Open platform project General administration				Upgrade completed in 2022	
Upgrade completed in FY2021	Upgrades scheduled for completion during period covered by Eighth Medium-term Business Plan					

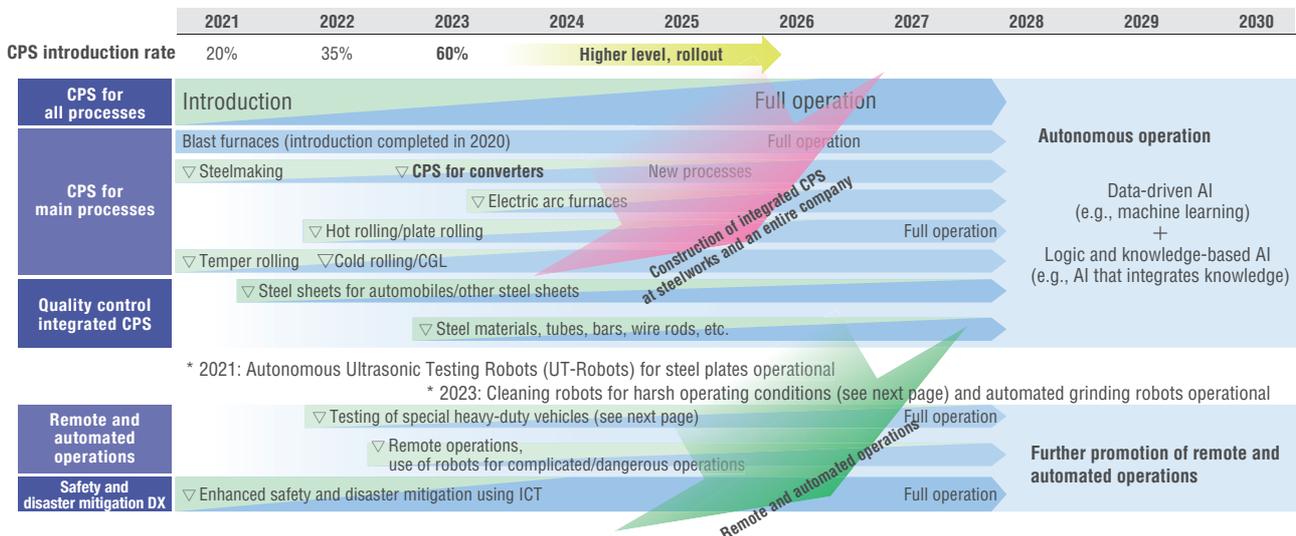
Shaped steel area upgrade (more than 5 million steps) completed

Open structure process : Restructuring and migration : ERP installation

## Raising our level of data use

Technological development roadmap and current status (as of the end of FY2023)

- ▶ **CPS introduced for all processes:** Automated operations for some blast furnaces, introduction of CPS for converters, etc. (FY2023 forecast: 86% for development, 60% for district rollout)
- ▶ **Remote and automated operations:** In-house development and use of testing robots and cleaning robots for harsh operating conditions under way



Initiative | 01 **Coke furnace digital twin**

As part of its DX strategy, JFE Steel aims to use a cyber physical system (CPS) for an entire steelworks to become an intelligent steelworks. Digital twins are a core CPS technology that reproduces physical systems and processes from the real world with equivalent properties in a digital model (a twin) in a virtual space to perform accurate simulations of the real world. Even with a small amount of data, conditions within a piece of equipment that are inaccessible in the real world can be visualized, which enables the efficient development and operation of manufacturing processes in equipment for which internal conditions have conventionally been difficult to confirm via sensors or direct observation. This also makes it possible to predict the effects of large-scale changes in operations or equipment.

JFE Steel has recently used this digital twin technology to improve operations at the No. 5, D Group coke furnace (the 5D furnace) in the Fukuyama district of the West Japan Works (Figure 1). An analysis confirmed that a mechanism for partially controlling air supply achieves greater operational efficiency than controlling the entire amount, as had been done in the past, and also made it possible to calculate the amount of supplemental air needed to optimize combustion. Utilizing this partial combustion optimization, the new 5D furnace uses 5% less fuel than in the past and has reduced 6,600 tons of CO<sub>2</sub> emission a year.

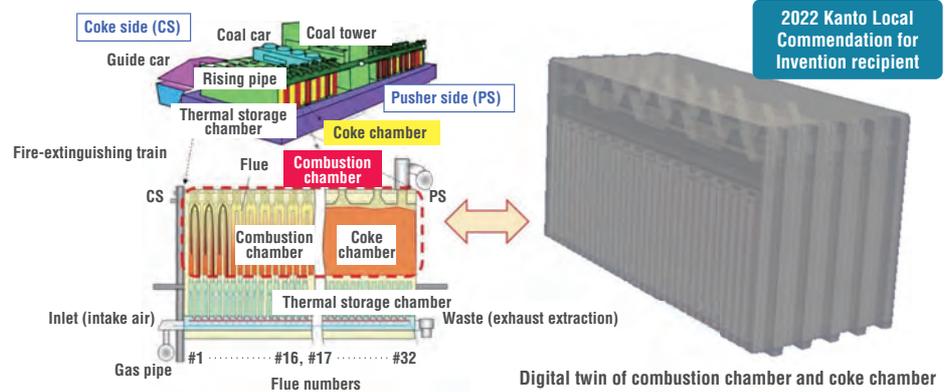


Figure 1. Digital twin model of coke furnace and its architecture

Initiative | 02 **Developments in robotics**

JFE Steel is emphasizing the use of remote operations and automation robots to increase labor productivity at least 20%, as called for in the Medium-term Business Plan. Autonomous Ultrasonic Testing Robots (UT-Robots) were introduced at a steel plate plant, and the company has developed the GAZMASTAR™ (Figure 1) autonomous cleaning robot to operate in harsh conditions involving high temperatures, dust particles, and rough roads.

Some equipment used in steelmaking processes uses materials such as iron ore and coal that create dust particles, and environmental measures including the installation of dust collectors and regular cleaning of dust particles near equipment have been introduced to prevent the dust from being scattered by the wind.

JFE Steel has developed a proprietary internally cooled valve mechanism for robots that can operate in environments with high temperatures, in order to reduce manual cleaning operations, and incorporated this in the GAZMASTAR™.

A LiDAR<sup>\*1</sup> sensor functions as the “eye” of the GAZMASTAR™ measuring the distances of surroundings and obstacles, and SLAM<sup>\*2</sup> is used as the location recognition system (Figure 2). This arrangement enables GAZMASTAR™ to clean while automatically moving along a targeted route within a cleaning area. Verification and durability testing have already been carried out in ironmaking processes. Going forward, the company will develop models for all equipment within steelworks in all the districts, to reduce the operational burden and improve safety and productivity.

\*1 Light Detection and Ranging. Near-infrared light and other types are beamed, and the time until the reflection from objects is captured by sensors is used to measure the distance.

\*2 Simultaneous Localization and Mapping. LiDAR sensor information is used to “map” the robot’s location relative to its surroundings and obstacles, while simultaneously “locating” to determine where the robot is and where it should go based on the map.



Figure 1. GAZMASTAR™ autonomous cleaning robot for harsh operating conditions

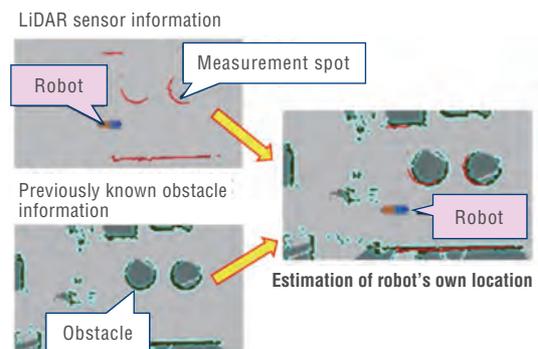


Figure 2. Use of SLAM for robot to determine its own position



Demonstration video  
<https://www.youtube.com/watch?v=soN1djRN3Ew>

JFE Steel, JFE Logistics, and NICHIGO CORPORATION completed development of the basic functions for automated transport of steel materials within the Kurashiki district of the West Japan Works using special heavy-duty vehicles (Figure 1) equipped with positioning sensors, and began verification testing in 2023.

To address future shortages of drivers and improve working conditions, in 2018, JFE Steel began research and development of technologies to automate the transport of steel materials. Steel materials are transported within a steelworks using trolleys called pallets. Large numbers of steel materials such as rolled steel coils can be loaded onto a pallet, and carrier pallet trucks are special heavy-duty vehicles that can transport these pallets. While a trailer can transport roughly 20 tons of cargo in one load, carrier pallet trucks can efficiently transport up to 160 tons and play an important role within a steelworks for transporting materials between processes and for shipment.

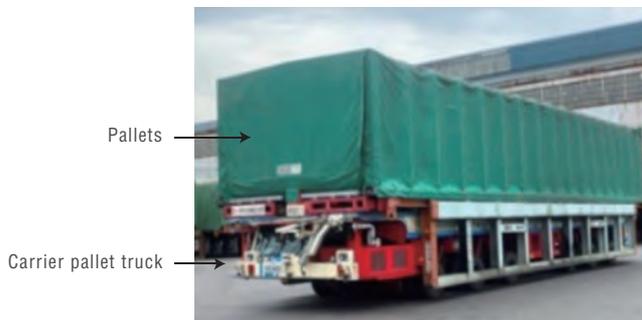


Figure 1. Carrier pallet truck



Figure 2. Rolled steel coils loaded onto pallets



Figure 3. Pallet storage

## Cultivating an internal culture for DX



In addition to human resource development (page 5), JFE Steel considers “a culture in which every employee takes ownership of DX and can pursue challenges” important for achieving companywide DX and is working to cultivate that internal culture.

### Companywide presentations of dissertations related to data science

Presentations of dissertations have been held since fiscal 2019 to provide successful examples companywide and create a culture that makes greater use of data science, as part of a companywide effort to promote the introduction of data science (DS), the Internet of Things (IoT), and artificial intelligence (AI) in equipment, steelmaking processes, and operations. The eighth presentation event was held in December 2023 at the head office and was also streamed to nine locations including steelworks and manufacturing centers, with more than 700 people including the president and officers participating. Dissertations were presented by various departments at the head office and steelworks, and all employees were able to watch the presentations via Teams, an internal network. Awards were given to recognize particularly excellent dissertations based on criteria including logic, creativity, novelty, immediate effectiveness, and versatility.



The president giving a presentation to show all employees in addition to engineers the importance of personally acquiring DX literacy and cultivating a companywide DX culture



President Yoshihisa Kitano and presenters after the awards ceremony

# Engineering Business (JFE Engineering Corporation)

Maximizing use of DX to realize a green society with the mission of supporting the foundation of life

**Just For the Earth**

For JFE Engineering, digital transformation (DX) is an important growth engine to promote an evolution of its business domain related to “creation (EPC: engineering, procurement, and construction),” “responsibility (O&M: operation and maintenance),” and “connection” to the future as the foundation of life.

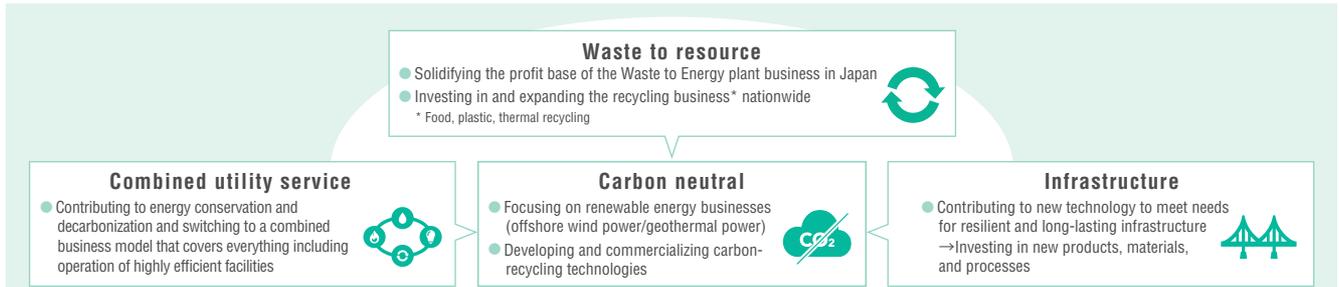
By proactively introducing digital technologies, we are raising business productivity and transforming the engineering business model using data collected through infrastructure construction and operations for a higher level of decision-making. At the same time, we are pursuing the realization of a green society (GX) as a leading company in the engineering industry for the sustainable enhancement of corporate value (SX).



**Tateki Koyama**  
Managing Executive Officer

## DX Strategy and Policy

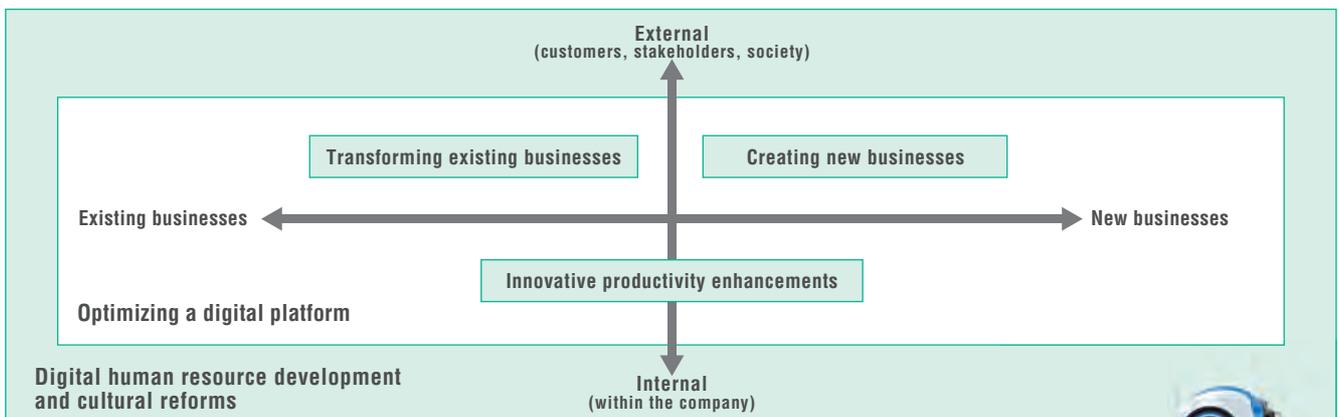
The Seventh Medium-term Business Plan designates four priority areas: Waste to resource; Combined utility service; Infrastructure; and Carbon neutral, and a policy for business expansion. We believe that digital transformation is essential for the achievement of this policy, and have positioned DX as an important initiative to support all business areas.



### DX Accelerating achievement of SDGs with DX

To accelerate these initiatives, we established a DX Headquarters in fiscal 2022. The DX Headquarters comprises IT engineers who build and maintain the internal IT environment and provide cloud platforms, data scientists who analyze data, control system engineers who implement a data-collecting function and a new function using AI in our products at plants, and DX promoters who work together with business divisions to resolve various issues internally and for our customers, to work for the “transformation of existing businesses,” “creation of new businesses,” and “innovative productivity enhancements.”

“Digital human resource development and cultural reforms” and “optimizing a digital platform” to allow everyone to use digital tools and data are very important for efficient DX promotion. The following pages introduce specific initiatives and examples in each area.



For more information on JFE Engineering's DX initiatives, please visit the following:  
<https://www.jfe-eng.co.jp/dx/en/index.html>



In addition to implementing digital projects, we consider “digital human resource development” to enable employees to personally acquire technologies and expertise to promote DX and “cultural reforms” to create a corporate culture in which employees take ownership of DX and pursue challenges important for realizing DX. We are implementing various programs in these areas.

Please refer to page 6 for more information on digital human resource development.

	Objectives	Programs
<b>Cultural reforms</b>	<ul style="list-style-type: none"> <li>Take ownership of DX</li> <li>Cultivate a DX mindset</li> <li>Share information across divisions</li> </ul>	<ul style="list-style-type: none"> <li>Internal DX event “DX Day!!”</li> <li>DX award (annually)</li> <li>DX Information Portal</li> </ul>
<b>Human resource development</b>	<ul style="list-style-type: none"> <li>Raise level of DX-related knowledge</li> <li>Raise level of general ICT capabilities</li> </ul>	<ul style="list-style-type: none"> <li>DX literacy training</li> <li>Data scientist training</li> <li>Specialist technology group (AI/IoT Technical Group)</li> </ul>

### Internal DX event “DX Day!!”

“DX Day!!” is held once a year to promote DX companywide by cultivating a DX mindset in employees, sharing information across divisions, and raising the level of digital knowledge. The fiscal 2023 event took place over two days with roughly 2,000 participants in a program that included shared cases of DX initiatives by internal divisions, hands-on digital technology and solutions experiences, presentations by experts, and an ideathon. The event was intended to spark interest in DX among employees and increase motivation to work toward its promotion, while providing an opportunity for active communication across divisions.



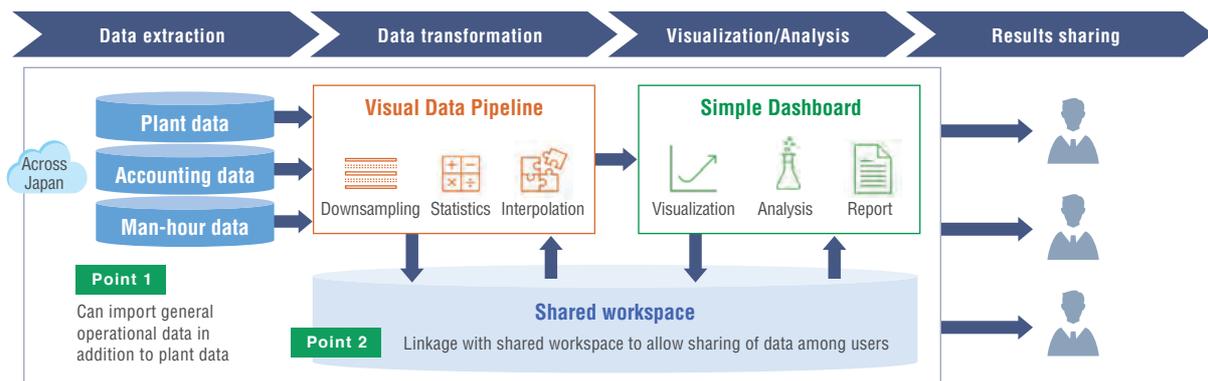
### DX Information Portal

One project JFE Engineering is accelerating is the companywide launch in fiscal 2022 of the DX Information Portal as a portal site for collecting internal DX information. This portal site makes it possible to share cases of internal DX initiatives, disseminate DX-related information, and hold DX-related consultations and make inquiries.



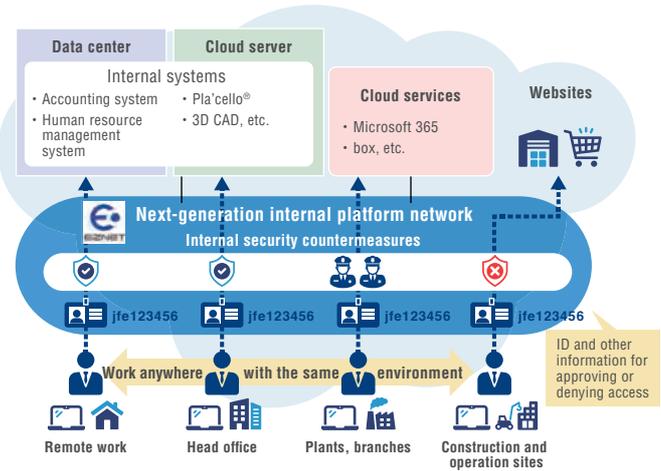
### Pla'cello® Data Analytics Platform

Released in November 2018, Pla'cello® is a data analytics platform that enables employees without advanced knowledge of informatics or statistics to use data. The platform was developed in-house to respond flexibly to users' requests and has already been used by more than 2,000 employees. Besides reducing the time required to compile a plant's operational status report from roughly one day to 10 minutes, the platform has a wide range of applications including anomaly detection in a plant and visualization/analysis of plant data for stable operations. In fiscal 2023, the platform was extended to include accounting and other data. Going forward, we will promote the use of data in various other business tasks.



### Zero trust security initiatives

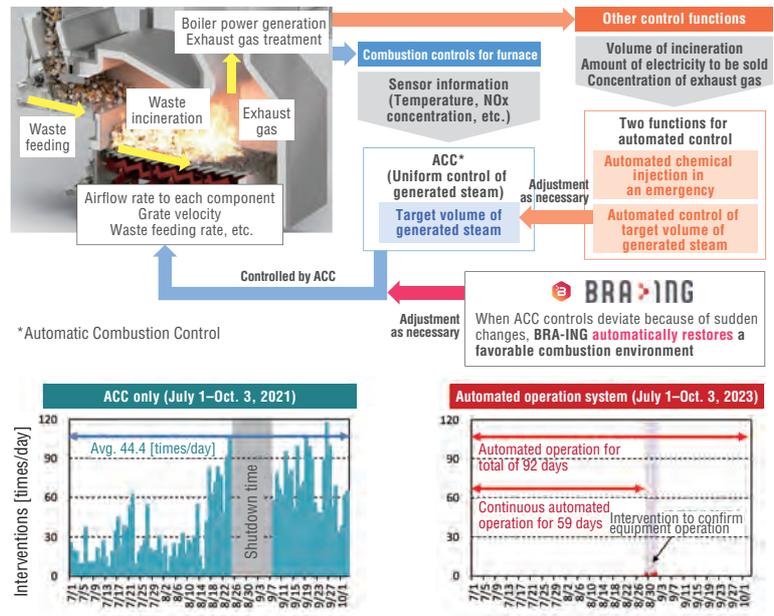
In response to increasingly diversified work styles and work environments including remote work and globalization, JFE Engineering is striving to create an information and communications technology (ICT) infrastructure that allows employees to work securely anytime and anywhere. As part of this effort, in fiscal 2023, we became the first JFE Group company to begin migrating to a “zero trust” internal ICT infrastructure platform. Zero trust is a security approach that assumes no access from within or outside the network is necessarily safe. This change has increased security and also enhanced employee convenience. We plan to complete the introduction at all major domestic locations during fiscal 2024 and to roll it out across the Group and overseas going forward.



## Initiative | 03 Transformation of existing businesses

### Efforts to fully automate waste-to-energy plants

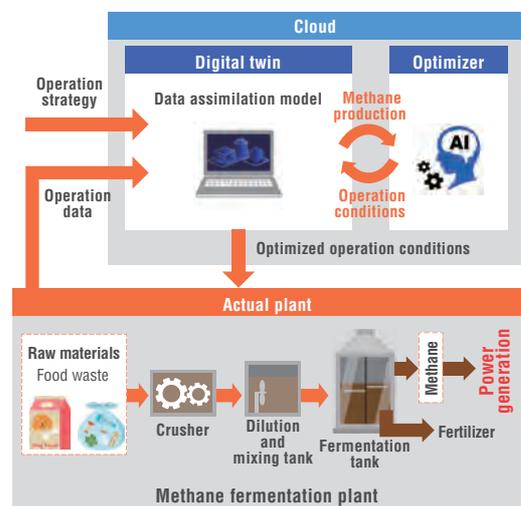
Plant work sites are facing shortages of human resources due to the aging of operators and a contraction of the working-age population, making it difficult to rely on human labor as in the past. To address this, JFE Engineering is continuously pursuing cutting-edge development and initiatives to automate all plant operations. Automated operations at waste-to-energy plants are one such initiative. Along with enhancing the existing automatic combustion control (ACC) function, we have developed and are introducing the BRA-ING automated operation AI system for incinerators. We are also developing fully automated operating systems that expand the scope of automation to include manual intervention work by operators other than the incinerator. In verification testing conducted during fiscal 2023, fully automated operations were achieved for 92 days over 95 days of testing, with continuous fully automated operations for 59 days. We are improving these technologies with the aim of unmanned plant operations.



### Digital twin (data synchronization) for optimal operations

Methane fermentation plants, which use methane gas generated by the fermentation of food waste and other substances for power generation, are easily subject to changes in the fermentation state depending on the composition of the raw materials used. Thus, maintaining a stable amount of generated methane is difficult. JFE Engineering has developed data synchronization technology that synchronizes a theoretical model showing the chemical processes of methane fermentation with plant operation data to make adjustments as necessary to predict the methane biomass emission with a high degree of accuracy. Utilizing this technology, we have built a digital twin able to grasp plant operations in stages from the introduction of raw materials to the generation of electricity. This digital twin contains algorithms that depict raw material introduction plans and operating conditions that achieve optimal power generation output while performing the required treatment of waste material, contributing to stable and efficient plant operations.

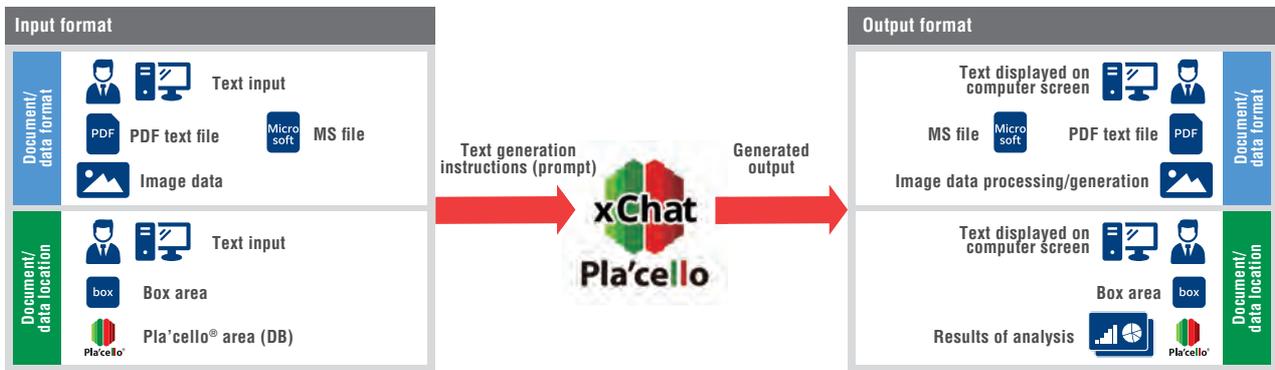
J Bio Food Recycle, the Group company that operates methane fermentation plants, is also working to convert the portion that remains after methane fermentation to fertilizer. In recognition of this concept of a double recycling loop that supplies “electricity” and “agricultural products made using fertilizer” to businesses that create food waste, the company received the Minister of Agriculture, Forestry and Fisheries Award at the sixth EcoPro Awards in 2023.



Due to a labor shortage caused by the contraction of the working-age population and aging population, the use of digital technologies to improve productivity is becoming an important management issue. JFE Engineering is using DX, including Robotics Process Automation (RPA), artificial intelligence (AI), and the Internet of Things (IoT), to improve productivity and is currently engaged in more than 100 DX projects. We began the initiative to utilize generative AI in fiscal 2023, are creating an internal environment for its use, and are considering its application to design operations.

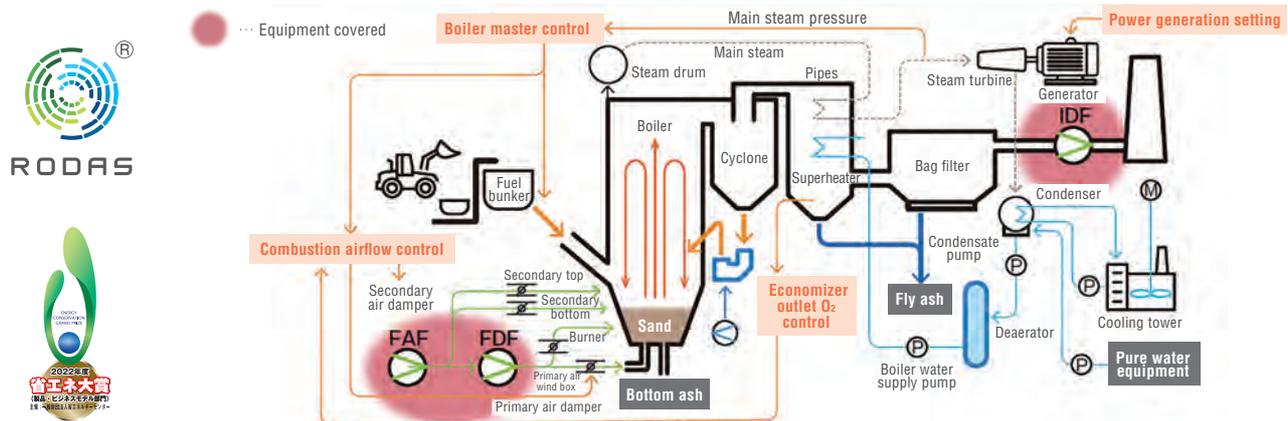
## ■ Pla'cello xChat text generative AI service for internal use

JFE Engineering internally released a text generative AI service called Pla'cello xChat in September 2023. The service, which employs proprietary security measures and user guidelines for generative AI, has been prepared to provide a secure user environment with a minimal risk of information leakage. It currently has more than 1,000 users. An internal working group has also been established to consider how to use the service in operations, information is being spread via the internal portal site, and study groups have been organized to promote its use and create examples. We will promote further use of Pla'cello xChat and work to develop a system that utilizes internal data to perform tasks like documents search and make design operations more efficient.



## ■ Achievement of energy-efficient operations with RODAS® new combustion control system

JFE Engineering's RODAS® DX service package is a solution for issues at boiler power plants. The system manages and analyzes huge amounts of plant operation data to contribute to optimal, stable power plant operations. In verification testing at a 20MW-class biomass power plant, the "new combustion control system," an AI-driven solution, achieved highly efficient operations and reduced energy consumption in the plant (a 4% reduction in electricity used to power things like combustion exhaust fans). Initiatives including preventive plant maintenance and improved operating rates through remote support by the company's engineers have also received recognition, with the system winning the Minister of Economy, Trade and Industry Grand Prize, the highest award under the Energy Conservation Business Models category of the Energy Conservation Grand Prize 2022. We will promote the introduction of RODAS® to contribute to the optimal operations of biomass power plants and the increased use of renewable energy.



# Trading Business (JFE Shoji Corporation)

Under the Seventh Medium-term Business Plan (Fiscal 2021–24), the JFE Shoji Group is currently promoting its DX strategy through the ongoing initiatives of “building a framework for the creation of DX projects,” “raising productivity through DX,” and “developing and offering DX-related products and services.” We are also focusing on human resource development and the cultivation of an organizational mind for DX promotion, to encourage employees to autonomously think about DX and to establish the foundation for execution of DX. The JFE Shoji Group will expand and accelerate these initiatives to continuously create and enhance our corporate value, while strengthening our competitiveness by providing new value to customers.



**Takanori Adachi**  
Managing Executive Officer

## DX Strategy

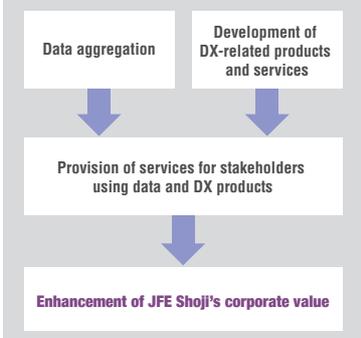
### Seventh Medium-term Business Plan (Status of DX initiatives)

Theme	Digitalization of existing operations	Preparations toward creating new value
Initiatives	<b>RPA promotion</b> <ul style="list-style-type: none"> <li>• Initiatives launched from FY2018</li> <li>• Identified operations in all departments and sections</li> <li>• Estimated labor savings at end of FY2023: Approx. 57,000 hours/year (580 robots)</li> </ul>	<b>Basic DX training (e-learning, surveys)</b> <ul style="list-style-type: none"> <li>• Increase of DX-related knowledge and assessment of internal needs</li> </ul> <b>DX workshop</b> <ul style="list-style-type: none"> <li>• Identification of issues and consideration of measures to address them by representatives of various departments</li> </ul> <b>DX executive seminars, position-specific training</b>
	<b>OCR* implementation</b> <ul style="list-style-type: none"> <li>• Greater efficiency through linkage with RPA</li> <li>• Reduction of operational workload by receiving electronic data through Excel, etc.</li> <li>• Estimated labor savings at end of FY2023: Approx. 12,000 hours/year (120 documents)</li> </ul>	<b>Consideration of use of AI technologies in operations</b> <ul style="list-style-type: none"> <li>• Implementation of proof of concept (PoC) of numerical AI using machine learning</li> <li>• Consideration of use of generative AI (ChatGPT)</li> </ul>

\*Optical Character Recognition/Reader

### From FY2025

#### Enhancement of customer service and value provided



## Initiative | 01 Effective use of data

The effective use of internal collected data (customer information, financial and accounting information, budget management information, etc.) is the key to the success of DX promotion.

JFE Shoji will transform operations that relied on personal intuition, experience, and judgment to objective decision-making based on data analysis rather than the previous subjective decisions, by reviewing how to collect and use data at various work sites through position-specific training, etc.

Many Japanese companies have already begun to transform operations that relied on the personal intuition, experience, or judgment of experts to ones that use prediction and optimization that are reproduced from know-how accumulated by artificial intelligence (AI).

<p><b>1 Digitalization and visualization of operational data</b></p> <ul style="list-style-type: none"> <li>• Convert operational know-how and information gathered from customers and operations to digital data</li> <li>• Make it possible to use BI tools* and other digital technology to better understand the current status of data</li> </ul> <p>Intuition, experience, judgment Paper documents Possible to collect, digitalize, and visualize data</p>	<p><b>2 Use of data for statistical analysis</b></p> <ul style="list-style-type: none"> <li>• Perform statistical analysis based on collected data</li> <li>• Make it possible to use results of analysis to identify causes of current business issues and solutions for them</li> </ul> <p>Possible to conduct diverse analyses</p>	<p><b>3 Forecasting demand and operational optimization with AI (use of big data)</b></p> <ul style="list-style-type: none"> <li>• Conduct future prediction (prices, demand, trends, etc.) by using data and AI (machine learning, deep learning, etc.)</li> <li>• Improve and optimize operations based on AI prediction</li> </ul> <p>Numerical prediction   Trend prediction   Improved operational efficiency (xx hours/person)</p>
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\* Business intelligence tools: Tools that aggregate and make it possible to visualize and analyze data to support decision-making and to provide resolutions based on data

As part of our approach to effective use of data, JFE Shoji has started to execute PoC to apply the results of prediction and analysis in the use of machine learning (AI) in future operations.

We are considering standard operational flows to develop AI models and activation methods to meet operational situations.

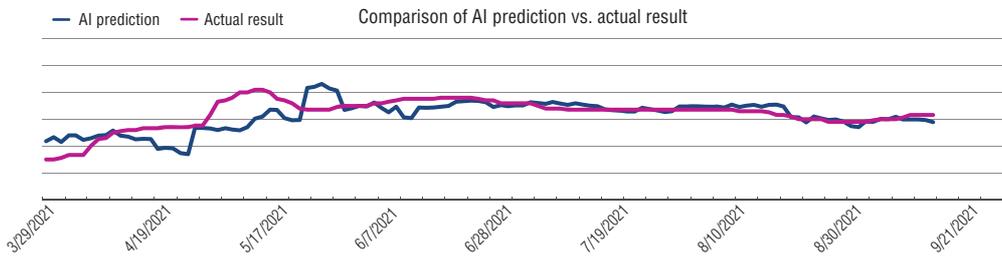
■ Objectives of AI PoC implementation

- Consider standardization of individual operational expertise
- Verify contribution to improved operational efficiency
- Consider possibilities for providing new customer services
- Accumulate skills and expertise in construction of AI models

■ Examples of major PoC implementation

Theme	Objectives	Implementation results
Commodities market prediction	Predict future prices and verify whether the prediction is effective for the judgment of current trading activity	Reached similar level of prediction by sales specialists
Credit ratings for overseas customers	Verify whether AI judgments are reliable for replacing individual skills in credit department	Reached similar level of judgments to ones by specialists in credit department

[Example] A commodity market price – AI prediction and actual result



In preparation for the advent of an ultra-aging society, JFE Shoji Electronics and Osaka University have jointly developed millimeter-wave radar technology that can inspect air gaps and cracks within the outer walls of buildings without making contact or destroying the walls, to address the issues of transferring skills and shortage of inspectors.

JFE Shoji Electronics will contribute to labor savings, safe and efficient operations, and the acceleration of regular inspections by building owners by offering this solution by using wall-surface robots and drones installed with millimeter-wave radar. The application of this radar solution will also result in extending the life of buildings and preventing disasters for building owners.

**Features of the nondestructive inspection system using a drone equipped with ultrawide band (1G~1,000 GHz) radar**

**Announced success of second verification test with achievement of lighter weight, higher sensitivity, and greater speed for commercialization**

1. Dramatic reduction in weight of radar portion (435 g)
2. Miniaturization enabling closer, more sensitive inspection of objects
3. Time reduction to less than one millisecond (1/1,000 second) required to measure one object

➔ Possible for drone to operate with greater stability for more precise measurement

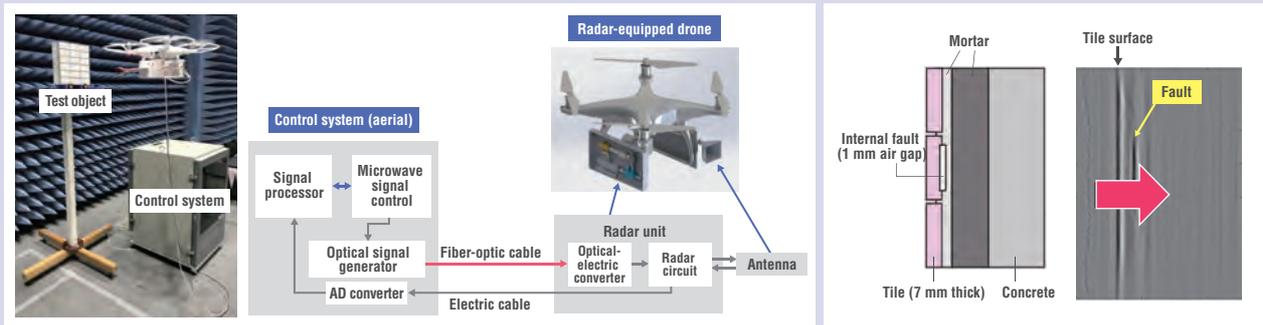
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1. Visualization of risks invisible to the naked eye
2. Cost reduction and improvement of efficiency and safety for inspection operations
3. Elimination of issues caused by lack of personnel to conduct inspections and repairs

**This is a new inspection technology that addresses issues with previous methods!**

**Great success of verification test in use of test object that replicates faults within the outer wall of a building**

- Succeeded in taking photographic cross-section images and visualizing air gaps
- Detected air gaps as small as 0.5 mm, gaps between tiles and layers of mortar, and gaps between concrete and layers of mortar





# Security Management

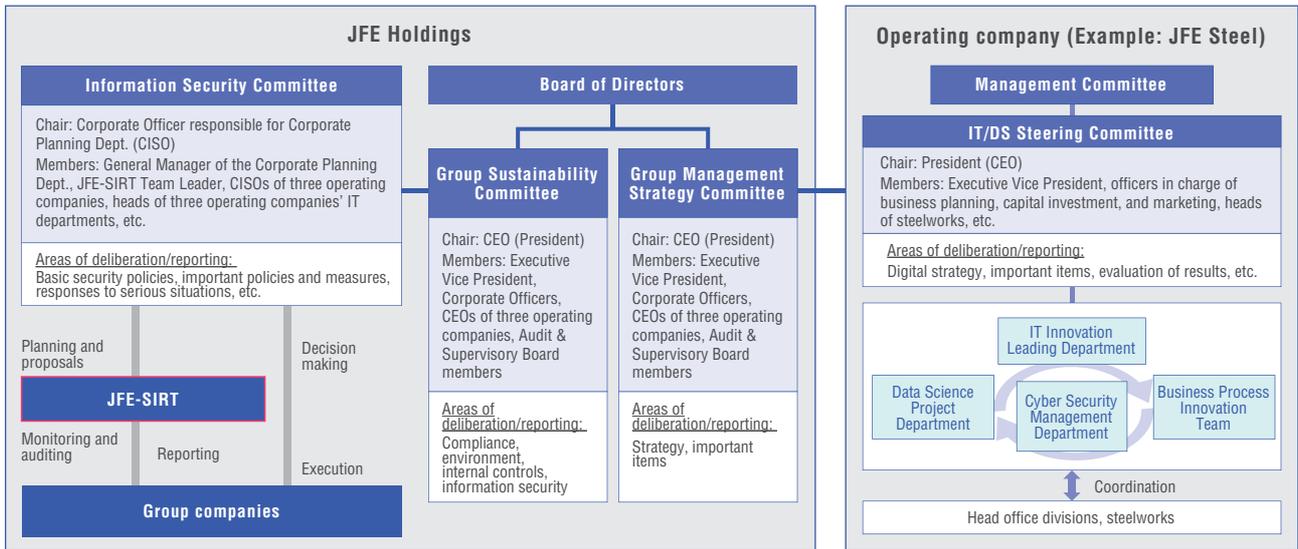
The JFE Group, which views security as an important activity that goes hand in hand with DX promotion, is working to strengthen security Groupwide in the face of increasingly serious and sophisticated threats.

With regulations for security management shared across the Group, we are strengthening our security under a uniform policy. Employees engage in drills and training at the Group level to respond to cyberattacks, and we are working to instill a thorough understanding of rules and raise the level of security-related knowledge. In addition to all Group companies implementing shared IT measures, we are working to raise the level of security management Groupwide through regular information security audits and other measures.

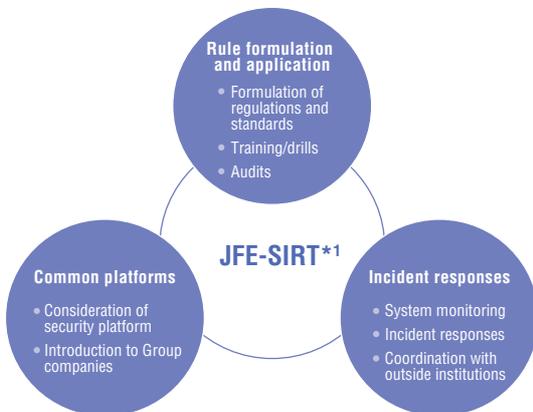
## Security management

### JFE Group's digital governance and cybersecurity framework

A Group **digital governance structure and security structure** are part of our corporate governance framework.

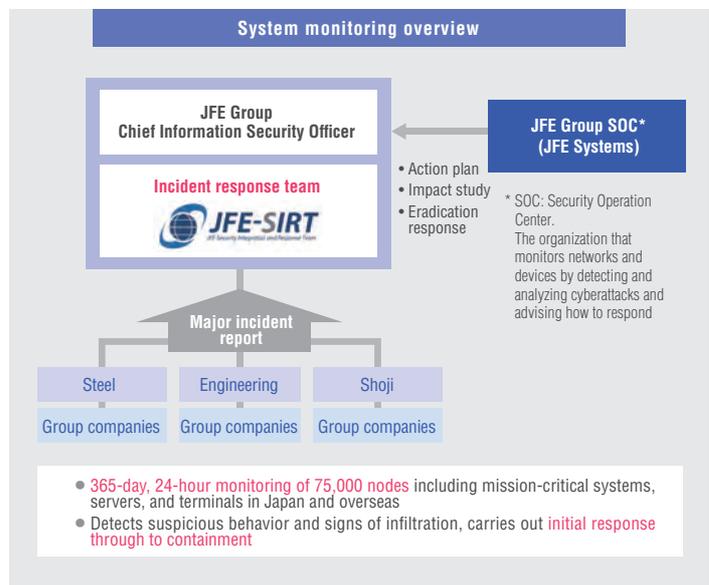


### Cybersecurity monitoring initiatives



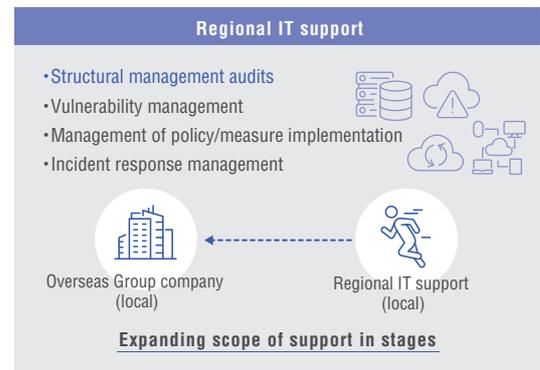
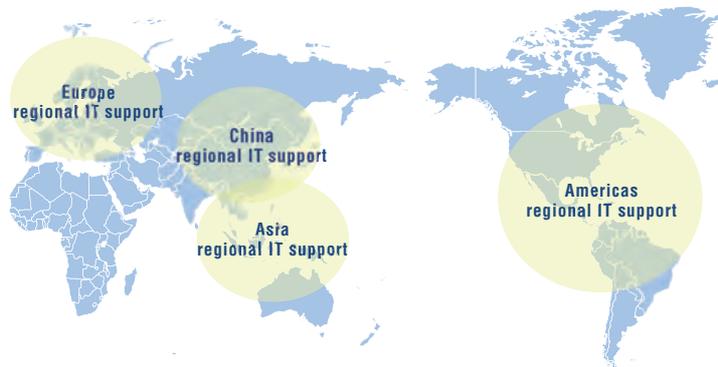
\*1 JFE-SIRT: A CSIRT\*2 responsible for responding to incidents of information security, as well as planning, proposing, and promoting Groupwide measures, auditing Group companies, and reviewing security policy

\*2 CSIRT: Computer Security Incident Response Team. A general term for a group that responds to internal computer security-related incidents



## Strengthening the global structure

To strengthen security at overseas Group companies, Asia regional IT support began operating in fiscal 2023.



## JFE Group Declaration of Cybersecurity Management

### 1 Recognize cybersecurity as a management issue

The JFE Group recognizes cyber-related risk as a key management priority. We shall enhance our own understanding of the latest cybersecurity developments and actively engage in management by positioning cybersecurity spending as an investment that is critical to DX promotion.

In facing the risks associated with digitalization, management recognizes the importance of strengthening cybersecurity across the entire supply chain, and will exercise leadership as it implements measures under its responsibility. Members of management shall chair cybersecurity-related committees at JFE Holdings and its three operating companies, promote constructive discussions, validate various measures, and allocate appropriate resources to whatever measures deemed necessary.

### 2 Determine management policies and declare intentions

The JFE Group shall determine management policies and draft a business continuity plan (BCP) aimed at quick recovery in the event of a cybersecurity incident, emphasizing not only identification and defense, but also detection, response, and recovery.

Every year, the JFE Group shall lay out a cybersecurity action plan for the Group, reflecting a review of risk identification, defense mechanisms, and guidelines for responding to an information security incident. Also, the JFE Group shall strengthen incident response capabilities through regular drills and prepare the BCP. Furthermore, the JFE Group shall periodically conduct cybersecurity audits on JFE Group companies. Through these efforts, the JFE Group aims to steadily raise the level of the overall Group.

Management shall take the lead in declaring companies' intentions to internal and external stakeholders, and make every effort to voluntarily disclose recognized risks and measures to deal with them, in corporate reporting.

### 3 Build internal and external systems and implement security measures

The JFE Group shall establish internal systems mainly through JFE-SIRT, ensure sufficient resources including budgets and personnel, and take necessary human, technical, and physical measures.

Using various internal and external human resources development programs, the JFE Group shall cultivate the skills of high-level, professional staff with detailed knowledge of cybersecurity and shall work with external specialists to leverage the benefits of sharing know-how. The JFE Group shall strive to educate and motivate employees at every level in all divisions at each company under the JFE Group umbrella through in-house training and drills, as well as participation in cross-industry exercises.

The JFE Group shall strive to address the entire supply chain, including overseas, using cybersecurity guidelines and frameworks, cooperating with government activities to support cybersecurity measures, and monitoring cybersecurity measures at subcontractors and other parties.

### 4 Encourage widespread use of cybersafe products, systems, and services

The JFE Group shall manage cybersecurity across the full spectrum of corporate activity, including development, design, production, and supply of products, systems, and services.

### 5 Help build safe and secure ecosystems

The JFE Group shall collaborate with relevant government agencies, organizations, industry associations, and other bodies to actively share information, engage in dialogue, and build human networks, both in Japan and internationally. The JFE Group shall contribute to reinforcement of cybersecurity throughout global society by raising awareness of measures taken on the basis of such information.

Revised January 2023



**JFE**

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