02 **Engineering Business**

For achieving SDGs, create and *"Ni-na-u"** the foundation for life by promoting digital transformation (DX)

* *"Ni-na-u"* is a Japanese word meaning supporting and remaining responsible.

JFE Engineering has taken up the challenge of achieving SDGs (Sustainable Development Goals) through planning, designing, building, and operating infrastructure supporting people's daily lives and industry.

DX is necessary for our company to continue to be a front-runner in the engineering industry while further accelerating those initiatives.

We will proactively promote digital transformation to enhance corporate value by addressing environmental, social, and governance (ESG) issues. We are seeking fundamental reforms in business processes, additional value in products and services, and new business by using data on top of operational efficiency.

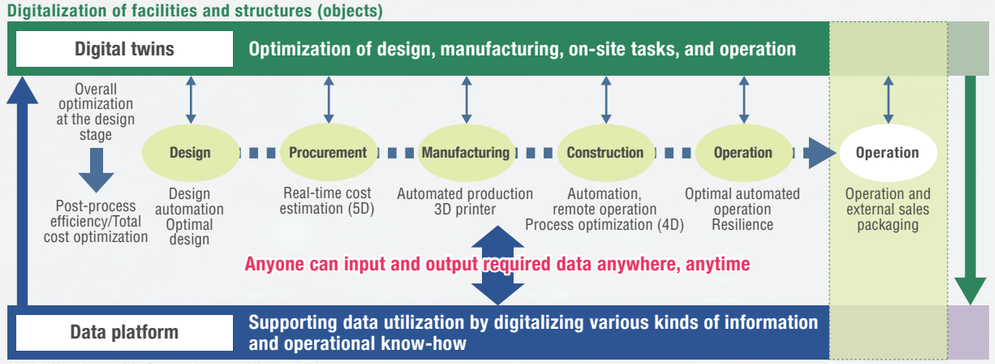
Atsushi Okamoto
Senior Managing Director

Overall optimization of operations by digital twins and data platforms

Looking to the future, JFE Engineering is seeking to enhance corporate value by promoting DX. We will take up the challenge of optimizing overall operations by using both "digital twins*" and "data platforms" in our Seventh Medium-term Business Plan. We are promoting operational innovation in various areas such as optimal design by advanced simulations in virtual spaces, automated on-site operations using 3D data, and optimal automated plant operations.

* Digital twins: Technology that simulates real-world phenomena in cyber space as if they were twins

Digitalization of facilities and structures (objects)



Digitalization of information and knowledge

Received IT Excellence Award in FY2020 for DX promotion activities

IT Excellence Award

We received the IT Excellence Award in FY2020 from the Japan Institute of Information Technology. We received the IT Excellence Award (one of two recipients), following three companies selected for the IT Supreme Excellence Award.

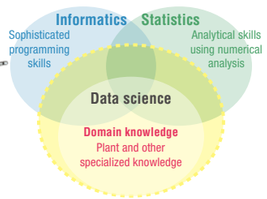
For this award, we were highly evaluated for many achievements such as construction and utilization of data analysis platforms and automatic operation of plants along with promoting DX with a comprehensive and sustainable framework at each level of security/IT infrastructure modernization/digital transformation.

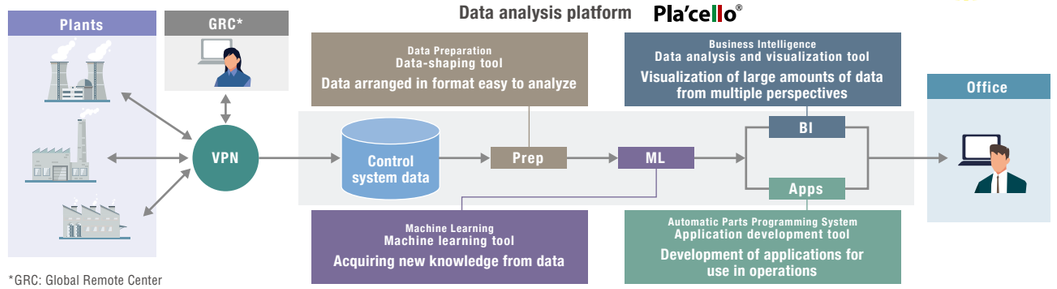
Front row: Executive Vice President Hata, Senior Managing Director Okamoto
Back row: General Manager Kobayashi, General Manager Kasuya, Manager Ueda

Internal data analysis platform "Pla'cello," which does not require specialized IT knowledge
—For more advanced and efficient operation by using accumulated plant data

The Pla'cello data analysis platform, which started operating in November 2018, can intuitively handle data processing, visualization and AI engine development, etc., with a graphical user face (GUI).

Pla'cello makes it possible to analyze data to detect signs of abnormalities, predict demand, and develop applications without advanced knowledge in informatics or statistics. More than 600 people are currently using the platform in a variety of locations. We will continue to enhance its functions and promote its use within our company.





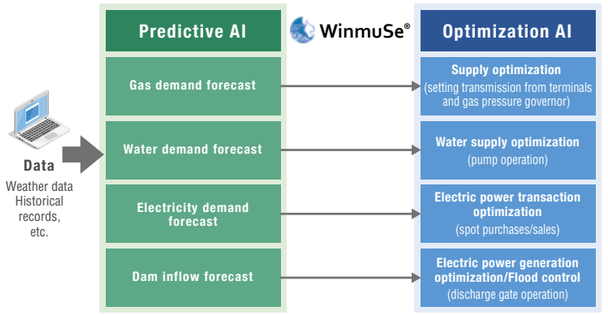
*GRC: Global Remote Center

Solution service "WinmuSe," based on proprietary AI engine developed in-house
—Using internal know-how to resolve issues for social infrastructure businesses

Our proprietary WinmuSe AI engine is an AI solution service that enables optimal operation of facilities, a high priority for social infrastructure companies.

"Predictive AI" to forecast demand using weather data and historical records and "Optimization AI" based on forecast results make it possible to provide the optimal operation plan in a timely manner.

The system already has a successful track record, such as demand forecasting of electric power and gas/supply optimization and water level prediction of a river. Most recently, we are promoting the development of the "Dam Optimal Operation System" with Hokuriku Electric Power Company.



Responding to increasingly advanced cyberattacks
—Developing a comprehensive security program that includes physical countermeasures and training, in addition to system countermeasures

The JFE Group is implementing Groupwide security measures to ensure a safe business environment that prevents virus infections, information leakage, and other problems. These measures include strengthening physical security to prevent unauthorized entry into offices and server rooms, e-learning, training for the detection of targeted cyberattack emails, and other periodic security training.

Our Global Remote Center (GRC) has obtained CSMS certification*1 and operates to counter the risk of cyberattacks targeting plant and infrastructure control systems at locations like factories or power stations. We will continue to provide safe services by implementing appropriate security measures.

Global Remote Center (GRC)

*1 CSMS: Cyber Security Management System for IACS (Industrial Automation and Control System)
*2 ISMS: Information Security Management System

The GRC has obtained CSMS certification.*1

The ICT Center's ICT Solutions Support Department has obtained ISMS certification.*2

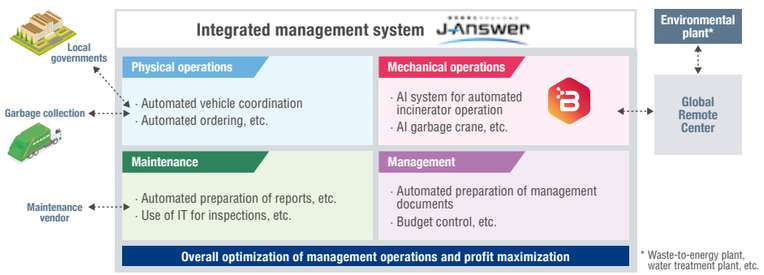
Case 1

For unmanned operation of environmental plants

—Developing world's first AI system for automated incinerator operation (BRA-ING) and integrated management system (J-Answer)

Because the combustion state at waste-to-energy plants changes depending on the type of waste, manual operation by a skilled operator was needed for stable operation. BRA-ING, which uses an AI image analysis of the combustion condition and the systematization of manual operations, is the world's first automated incinerator operating system. The system is already in the implementation stage and we plan to expand its use to 10 facilities in fiscal 2021.

We also started to offer the J-Answer integrated management system in November 2020. We are installing it in stages at waste-to-energy plants commencing operations from March 2021, to make using data more convenient and to optimize overall operations with various types of data linkage and analysis.



On-site comment

Environmental Solutions Sector
Front row: Ito, Shirai, Kojima
Back row: Kawano (ICT Center), Tabe

We started using the IoT (internet of things) to collect data in fiscal 2014, and with the cooperation of many people, we have achieved major successes not seen at other companies. We are accelerating our development toward unmanned operation.

Hiroshi Kojima
PPP Promotion Dept., Environmental Solutions Sector

Case 2

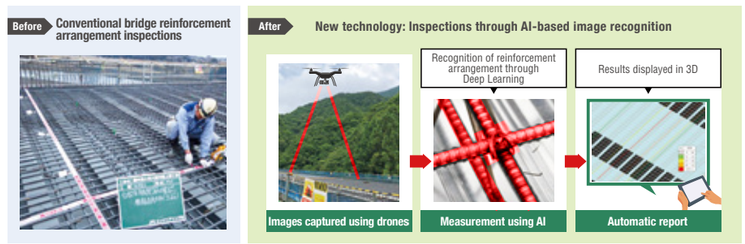
World's first automatic AI-based bridge reinforcement arrangement inspection system

In bridge construction, placement inspection to confirm that the steel bars have been installed as designed is very labor intensive. Working with ACES, Inc., we developed an automated AI inspection system for bridge steel bar placement and began using the system on actual worksites in July 2020.

Using drones, we can capture images of the construction site from above and measure the number of steel bars and their spacing using AI-based image analysis. The results of the measurements are automatically recorded and displayed as a BIM/CIM model.

We expect the system to reduce labor up to 75% as well as improve reliability compared to conventional sampling inspections* that measure the entire construction area.

* Sampling inspections refer to techniques where only certain sections are checked.



On-site comment

Bridge Structure Division, Infrastructure Engineering Sector
Kakiichi, Arai, Nakano, Maeda

We are proactively developing and introducing ICT and AI technologies at construction sites. We are currently using trial installations at selected construction sites for verification testing of increased efficiency and labor saving.

Takumi Kakiichi
Bridge Structure Division, Infrastructure Engineering Sector

JFE VOICE !

Achieve smooth communication even while working remotely during the COVID-19 pandemic by using IT tools

JFE Engineering is proactively promoting the use of cloud services and smart devices. Using a file-sharing system (Box) and a communication tool (Microsoft 365), we have created an environment where required information can be accessed "anytime, anywhere," achieving a remote work ratio above 80%. The use of information technology has enabled us to maintain smooth communication even while working remotely.

On-site comment

April 2020—immediately before the declaration of the state of emergency! Tension was increasing at the Working from Home Promotion Team, COVID-19 Task Force, which was busy every minute installing remote access infrastructure and tools and bringing employees up to speed. Collaborating with members who joined from other departments, the team succeeded in having all our Group companies working from home without any problems.

Masaya Hirotsune, Smart-Work Promotion Sec., Human Resources Dept.

Smart-Work Promotion Sec.
Front row: Furubayashi, Ikeda, Hakamata
Back row: Manager Hirotsune, Uetake, Tanaka

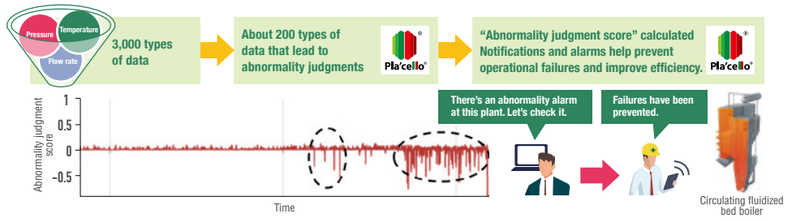
Case 3

Aiming to stabilize operations at biomass energy plants

—Early detection of potential operational failure by using AI

One requirement is to achieve high output with stable, efficient power generation regardless of the quality of the fuel in biomass energy plants. Early detection of potential failures is important to maintain stable operation, which is currently dependent on operators' skill and experience. The AI-based operation support system is able to extract information that might result in operational failures and reduced power generation efficiency from a huge amount of operational data that humans cannot process unaided. The system analyzes data in real time and visualizes it as an "abnormality judgment score," which achieves reduction of monitoring work and abnormality detection in advance.

We aim to establish the AI-based operation support system by continuing to collect more operational data and to expand functions to realize more stable and efficient plant operation than ever before.



On-site comment

Biomass Power Plant Design Dept., Engineering Design Center, Energy Industries Engineering Sector
Nakagawa, Enomoto, Muneoka

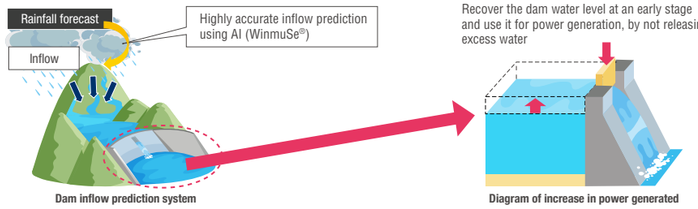
When an abnormality occurs, the operation support system sends a notification, and visualization tools help us check the operational data instantly. It is extremely helpful for understanding the situation and identifying the cause quickly.

Daiki Muneoka
Biomass Power Plant Design Dept., Engineering Design Center, Energy Industries Engineering Sector

Case 4

Aiming for maximized dam power generation by using AI

Aiming to further increase the amount of hydroelectric power generation, JFE Engineering and Hokuriku Electric Power Company have jointly developed the Dam Optimal Operation System. The highly accurate prediction of the amount of water that will flow into the dam, or inflow, was confirmed with an experiment that we did at a dam last year. We were able to confirm that the electric energy of hydroelectric energy generation would further increase (by approximately 5,000 MWh annually) by using and optimizing the prediction data in the dam's operation. In addition to steadily increasing the number of dams where this system is applied, we, along with Hokuriku Electric Power Company, aim to improve and develop this system through a combination of the latest AI technology and dam operation expertise, and promote more effective utilization of CO_2 emission-free hydroelectric power.



On-site comment

ICT Center, Technology Headquarters
Watanabe, Suzuki, Hadama

The development of this system has entered the implementation verification phase. We are speeding up development to contribute to the activities of hydroelectric power facility owners.

Soichiro Yamane
ICT Center, Technology Headquarters

JFE VOICE !

Having various types of training and events to improve and promote the skill level of ICT technology companywide

We hold hands-on training like "ideathon" and "hackathon" events to help employees who are not IT engineers learn how to use Pla'cello for analyzing actual operational data. In fiscal 2020, we also established the companywide AI/IoT Subcommittee for proactively acquiring cutting-edge technologies through education and hands-on training.

Through these activities, we will accelerate our DX promotion such as innovation of on-site operation and operational efficiency improvement using AI and IoT (internet of things).

On-site comment

The activities of the AI/IoT Subcommittee are carefully planned to make participation easy for people with little opportunity to use information technology in their regular work. The members are now very active. I have high hopes that their ICT skills will be improved dramatically over the next few years.

Yoshitaka Kobayashi, ICT Center, Technology Headquarters