# GLOBAL SOLUTIONS

## —Creating a New World—

In the 2014 edition of *JFE Group TODAY*, we introduced initiatives based on the theme "Revitalizing Japan." The initiatives reflected the fact that Japan had made solid progress toward recovery from the Great East Japan Earthquake in 2011 and was beginning to turn its attention toward initial preparations for the Tokyo 2020 Summer Olympics and Paralympics. Based on priorities at that moment, the 2014 edition of this publication featured the roles that JFE has been playing in helping to restore the country to full strength. In this edition, our focus has shifted to two major issues confronting the world, namely, how to ensure sustainable social and economic development and how to preserve the global environment, or restore it where necessary. Hereafter, we are pleased to introduce our initiatives to address these two challenges.

### Realizing Secure, Affluent Societies Based on Sustainable Economic Development

Develop infrastructure and human resources needed to achieve social and economic development on a sustainable and global scale.

**Concrete Initiatives:**

1. **Infrastructure development centered on emerging nations**
   Develop infrastructure and localize production
2. **Human resource development to foster tomorrow's leaders**
   Nurture local engineers as part of developing a globally capable workforce

### Preserve and Restore the Global Environment

Protect the earth's environment in the face of worldwide industrial development and a burgeoning global population

**Concrete Initiatives:**

1. **Realize a resource-conserving, minimized-impact society**
   Prevent global warming while promoting power generation centered on recyclable energy
2. **Preserve and restore the marine environment**
   Protect marine ecosystems, including through improved water quality.

### JFE Group

JFE Steel Corporation | JFE Engineering Corporation | JFE SHOJI TRADE CORPORATION | Japan Marine United Corporation

JFE, drawing on its comprehensive strengths and world-leading technological capabilities, is developing solutions to ensure sustainable social and economic development and to preserve/restore the global environment in countries worldwide.





# Realizing Secure, Affluent Societies Based on Sustainable Economic Development

**Assisting emerging nations with infrastructure development is an essential part of JFE's effort to realize secure, affluent societies based on sustainable economic development. Although such nations possess abundant potential for economic growth, their needs for infrastructure such as electricity and gas supply, bridges, roads and port facilities is often left unmet. Furthermore, securing and nurturing capable human resources is crucial to developing and invigorating key industries that drive economic growth.**

**JFE supplies high-quality steel products needed to establish almost any kind of infrastructure, and it proposes solutions incorporating cutting-edge technologies developed by its engineering businesses.**

## 1 Infrastructure Development Centered on Emerging Nations

**JFE Engineering**

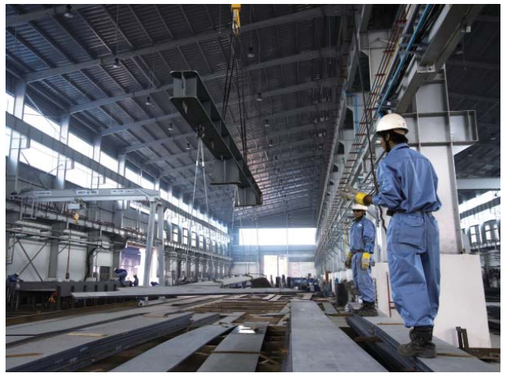
### Economic Growth through Bridge Construction

JFE Engineering has constructed a number of bridges, some quite well known, in overseas locations since the 1980s. In October 2012, for example, the company completed Sun Bridge, an elevated bridge located in the center of the Mongolian capital of Ulan Bator. The bridge provides a useful connection between the city's northern commercial and southern industrial zones, which previously had been separated by railroad tracks. Today, Sun Bridge is playing a significant role by facilitating smoother, more efficient traffic in bustling Ulan Bator, a city that is making rapid economic progress.

JFE Engineering has also secured a foothold in Myanmar, a country in the process of shifting to democracy as "Asia's last frontier." In November 2013, JFE Engineering established the joint venture J&M Steel Solutions with Myanmar's Ministry of Construction. The next month, J&M Steel Solutions initiated the construction of a factory in Yangon, the capital of Myanmar, to manufacture prefabricated steel components for structures such as bridges. In July 2014, the factory made its first shipment of bridge blocks, supplying materials for truss bridge construction in Laos. The factory is currently operating at maximum capacity to meet needs for infrastructure materials in Myanmar and surrounding countries. In response to burgeoning demand, capacity will be doubled to 20,000 tons per year within the current fiscal year. The factory buildings and other facilities will also be expanded in the future.

JFE Engineering looks forward to contributing to global economic progress by steadily supporting infrastructure development in the newly emerging nations of Southeast Asia, as well as the Middle East and Africa.

Sun Bridge, Mongolia's largest steel bridge



Steel structural components produced at J&M Steel Solutions' factory

JFE Steel

## Local Production of High-Performance Automotive Steel Sheets in Asia

Asia is experiencing demand growth in a range of industrial fields. Numerous automakers have established factories in Asia, turning the region into an automotive manufacturing powerhouse with an output that today accounts for half of global production. To accommodate Asia's robust demand for high-performance automotive steel sheets, JFE Steel has been developing local supply bases in Thailand, India and China, in addition to exporting from Japan. Furthermore, efforts are under way to establish a hot-dip galvanizing line for automotive parts in Indonesia, with production scheduled to kick off in March 2016.

In such ways, JFE Steel will continue to deliver high-quality products that satisfy automakers' needs for local procurement and thereby contribute to the further development of Asian automotive industries and economies.

Hot-dip galvanizing line in Thailand

JFE Steel　JFE Shoji Trade

## Development of Energy Infrastructure in North America

The development of energy infrastructure overseas involves having to deal with local conditions and business environments that tend to change over time. The situation is no different in North America, where JFE Steel has had to adapt to diversifying customer needs. Against this backdrop, California Steel Industries, Inc. (CSI), a joint venture in which JFE Steel has a 50% equity interest, brought a new electrical resistance welded pipe mill online in October 2014. The launch of this facility boosted CSI's production capacity 2.6 times and inaugurated the manufacture of pipes offering larger diameters, thicker walls and greater strength.

Meanwhile, JFE Shoji Trade wholly acquired Kelly Pipe Co., LLC, a major steel pipe distributor with a century of experience. Kelly Pipe supplies line pipes that directly connect oil mines and refineries, tubular goods for oil and natural gas drilling, and other standard pipes for water and gas supply systems. Headquartered in California, it has 21 bases in the United States and one base each in Canada, the U.K. and Colombia.

To fulfill the needs of global customers, the JFE Group aims to fully leverage Kelly Pipe's global business network to market high-quality steel pipes produced by CSI, thereby contributing to energy infrastructure in North America and beyond.


CSI

JFE Steel

## Local Steel Pipe Production to Support Development in the Middle and Near East

The demand for pipeline materials is showing strong potential in the Gulf Cooperation Council (GCC) member countries—the UAE, Saudi Arabia and four other countries— that together boast the world's largest combined oil and natural gas reserves.

In line with the projected surge in demand, JFE Steel established a joint venture in the UAE capital of Abu Dhabi for the manufacture and sale of large-diameter welded steel pipes. Co-founders of this joint venture were Marubeni-Itochu Steel Inc. (MISI) and SENAAT, a general holding company wholly owned by the Emirate of Abu Dhabi.

With the production kickoff scheduled for October 2018, the new joint venture will draw on JFE Steel's technological expertise in the manufacture of high-end large-diameter welded steel pipes, MISI's marketing capabilities and SENAAT's significant presence in the local market. Through this undertaking, JFE Steel expects to contribute to the sustainable development of energy industries in the Middle and Near East.



Realizing Secure, Affluent Societies Based on Sustainable Economic Development

# 2 Nurturing Future Pioneers Who Will Lead Global Business

JFE Steel

## Technological Assistance for a New Factory in India

JFE Steel has been assisting its Indian alliance partner, JSW Steel Ltd., with the launch and operation of its new cold-rolling mill since July 2012. In addition to basic planning, JFE Steel has contributed expertise toward the establishment and operation of manufacturing lines at the mill. The company also dispatched 19 supervisors from the trial operation stage to help bring the facility online. Today, technological assistance to JSW Steel encompasses areas such as product certification acquisition, product quality enhancement and operational stability, among the various ways that JFE Steel is contributing to India's steel industry.

Working alongside JSW Steel employees

JFE Engineering

## Training Local Engineers to Nurture Asia's New Industrial Leaders

As JFE Engineering expands its operations overseas, it is building up business networks consisting of local personnel who are involved in the entire gamut of operations, including sales, design and manufacturing. The company views it crucial to secure such personnel because they are so well versed in local conditions.

JFE Techno Manila, Inc., a subsidiary engaged in plant design in the Philippines, hired some 300 local engineers who became the core of the firm's workforce. As shown in this example, JFE Engineering is striving to recruit increasing numbers of outstanding people in local markets, aiming to nurture them as future leaders in Asia's engineering field.

Potential engineering leaders working at a JFE Group subsidiary

## Ensuring Stable Food Supplies to Support the Global Population

JFE Engineering　**Smart Agriculture System Realizes Stable Crops Yields**

The JFE Smart Agriculture System, or "smartagri," combines JFE Engineering's natural gas, biomass, geothermal, etc., utilization technologies and the sophisticated greenhouse climate-control technologies of Priva B.V., a Dutch company that tied up with JFE Engineering in June 2014. The system optimizes both greenhouse climate conditions and energy usage for highly efficient cultivation processes.

In August 2014, the first smartagri facility entered production in Tomakomai, Hokkaido Prefecture, Japan. In April 2015, tomatoes produced at a similar facility in Singapore were served at tasting and sales events and garnered favorable reviews for their rich sugar content of 10 degrees Brix or more. Looking ahead, JFE Engineering will design cultivation facilities tailored to specific local conditions, among its various initiatives to help global farmers ensure more stable supplies of produce.

Harvesting tomatoes at a smartagri greenhouse in Tomakomai

JFE Shoji Trade　**GEISHA Brand Canned Goods Contributing to African Dining Tables**

It is estimated that the global population will grow from 7 billion at present to more than 10 billion by 2100. The rate of increase is particularly notable on the African continent, with Nigeria expected to emerge as the world's third most populous country early in the 22nd century.

Since the 1950s, Kawasho Foods Corporation, a wholly owned subsidiary of JFE Shoji Trade, has been marketing GEISHA brand canned goods in Africa, China and Southeast Asia. Food self-sufficiency has lagged in Africa, particularly with regard to freezing and refrigeration infrastructure, so GEISHA canned fish has been well received by local consumers as a safe source of protein. Today, fish and other GEISHA canned goods are welcomed throughout the continent as highly popular and reliable food products.


GEISHA brand canned goods

# Preserving and Restoring the Global Environment

**To realize a sustainable society, economic growth must progress in tandem with efforts to preserve the global environment. The advance of modern society has negatively impacted the environment, with industrial development and population growth causing air, soil and water pollution that have resulted in the destruction of clean natural resources which were once abundantly available. Unfortunately, international initiatives to reduce $CO_2$ emissions have made little significant progress of late, and all the while ocean ecosystems are being damaged due to the deterioration of water quality.**

**To address such problems, JFE is adapting its much-acclaimed expertise in steelmaking, through which it has achieved world-leading energy efficiency to manufacture eco-friendly steel materials offering superior functionality. Moreover, the Group is promoting recycling-oriented processes that employ renewable energy and waste-to-energy power generation, aiming to simultaneously promote both economic growth and environmental protection.**

## 1 Realizing Resource-saving and Eco-friendly Societies

### JFE Steel

#### Highly Energy-efficient Manufacturing—Super-SINTER® Cuts $CO_2$ Emissions

JFE Steel actively develops technologies that reduce resource consumption in steel manufacturing, aiming to minimize society's burden on the environment.

Super-SINTER® is a novel technology that has won multiple prizes, including the Prize of the Minister of Economy, Trade and Industry under the National Commendation for Invention 2015 award program and the Okochi Memorial Technology Prize. The technology utilizes common hydrocarbon "city" gas to produce sintered ore for use as blast furnace feed, allowing steelmakers to substitute a widely available utility gas for a portion of the powder coke. As the combustion point of hydrocarbon gas is higher than that of powder coke, it enables better control of the combustion temperature and ensures an optimal temperature for the calcining reaction. Super-SINTER® realizes superior energy efficiency and thereby helps to reduce $CO_2$ emissions.

Super-SINTER® facility in the Keihin District

JFE Steel has also developed an advanced Super-SINTER® OXY technology to more than double the duration of the calcining reaction at the optimal temperature. Commercialization of this unprecedented, world's-first technology has enabled JFE Steel to further enhance its manufacturing operations.

Going forward, JFE Steel intends to remain a global forerunner in technology that contributes to more eco-friendly societies.

### JFE Engineering

#### Construction of Waste-to-Energy and Biomass Power Plants in Anticipation of New Energy Policies

In the face of an upcoming shift in energy policies worldwide and the growing need for eco-friendly alternative energy sources for urban settings, waste-to-energy and biomass power plants are attracting growing attention. In particular, they are seen as promising clean energy sources that operate around the clock and regardless of climate, unlike solar power generation.

Having already constructed more than 350 facilities, including a stoker furnace and a high-temperature gasification direct fusion furnace, JFE Engineering has become Japan's top maker of waste-to-energy plants. In regions across Japan, it also handles construction of large biomass power plants with circulating fluidized bed boilers.

In December 2014, JFE Engineering wholly acquired Standardkessel Power Systems Holding GmbH (SPSH), a German plant-engineering company that operates mainly in Europe. SPSH has constructed more than 200 highly efficient waste-to-energy and biomass power plants that incorporate advanced technology for the combustion of various fuels.

As JFE Engineering steps up its global expansion, it will continue striving to realize more resource-saving societies, including by reducing environmental burdens through the provision of cutting-edge technologies.

Waste-to-energy plant built by a subsidiary of SPSH in Spremberg, Germany (daily processing capacity: 960 tons of waste)



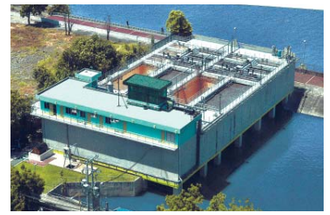
### JFE Engineering

#### Environmental Preservation through Water Treatment Solutions in Tune with Local Needs

The Philippines, with a population of approximately 100 million, is the second most populous ASEAN country next to Indonesia. Currently, water supply and sewerage systems are being developed rapidly in Manila's metropolitan areas, which have been divided since the 1997 privatization of water services.

Among these facilities, JFE Engineering built the Poblacion sewage water treatment facility on a flood control reservoir located in front of Makati's city hall. Thanks to innovative designing that fully utilized the limited space available, JFE Engineering was chosen to receive the Project Innovation Award from the International Water Association.

Drawing on its experience in establishing this and other facilities in 29 locations within Manila, JFE Engineering continues to help preserve Southeast Asian environments with its sewage treatment facilities.



Poblacion sewage water treatment facility in Manila, Philippines (daily processing capacity: 11,000 $m^3$)

## 2 Preserving and Restoring the Marine Environment

### JFE Steel

#### Restoring Coral Reefs with Marine Block® Made of Steelmaking Byproducts

In 1998, JFE Steel introduced its unique Marine Block® construction blocks made with steel slag, a byproduct derived from steel manufacturing. Marine Block® is principally solidified calcium carbonate ($CaO_3$) and has virtually the same composition as seashells. It is made through a process involving the reaction of carbon dioxide ($CO_2$) with calcium oxide (CaO), the main substance of steelmaking slag. Thanks to its sea-life friendliness, Marine Block® is now being used to restore coral reefs near Japan and in other seas.

Coral growing from eggs that colonized a Marine Block®

In 2007, a joint study was conducted by Tokyo University of Marine Science and Technology and Universitas Sam Ratulangi Manado in Indonesia to examine the habitat environment of coral reefs near Indonesia. The study confirmed the settlement and growth of coral larvae on Marine Block®, prompting the universities to launch a full-scale verification of coral growth.

In addition to Marine Block®, JFE Steel produces Marine Stone®, a gravel-type slag product used for coastal engineering aimed at nurturing sea creatures and seagrass beds, and Marine Rock®, an artificial rock boasting strength equivalent to semi-hard stone.

Going forward, JFE Steel will look for other opportunities to effectively utilize steel slag to help preserve and restore marine environments.

### JFE Engineering

#### JFE BallastAce® Manages Ships' Ballast Water to Protect Ocean Ecosystems

Marine vessels are loaded with extra ballast water when they are not carrying cargo to ensure their stability at sea. Later, when the ship is loaded with cargo, the excess ballast water is then released. The water, which sometimes comes from faraway oceans, can have a negative impact if it contains alien organisms that threaten local sea life and ecosystems. This has become a global concern, so the International Maritime Organization adopted the International Convention for the Control and Management of Ships' Ballast Water and Sediments. As a result, it is expected to become mandatory that all long-distance ocean-going ships install ballast water management systems.

In response, JFE Engineering developed Ballast Ace®, a system for effectively managing ballast water. The system removes unwanted organisms, first by filtering the ballast water at the time of loading, after which the water is treated with chemical agents to finish the cleansing process. To date, the system has been installed in more than 700 marine vessels.

JFE Engineering is now developing Ballast Ace® inspection and maintenance facilities worldwide, along with continuing to search for new solutions to help further preserve our global marine environment.

Bulk carrier equipped with JFE BallastAce®



Preserving and Restoring the Global Environment