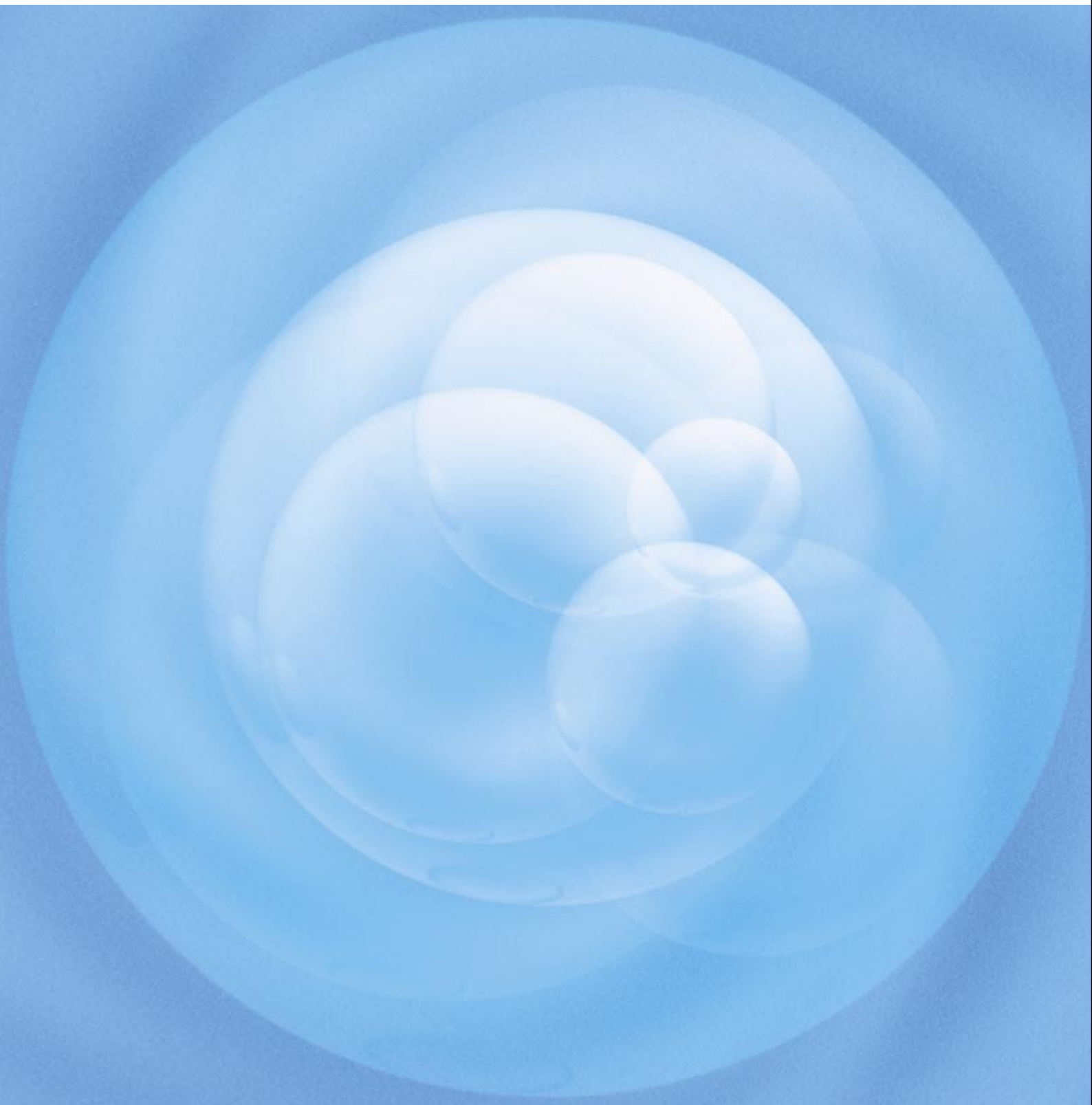


# JFE Environmental Report 2002



## Editorial Policy

The JFE Group was formed on September 27, 2002.

This "JFE Environmental Report 2002" is the first publication of the Group. The performance reporting is based on the environment-related activities of NKK and Kawasaki Steel for the fiscal year ended March 31, 2002.

Descriptions related to future activities are based on the policies of the JFE Group. In future, the report will be published annually, summarizing the activities of the entire JFE Group.

This report has been prepared in accordance with guidelines published by the Ministry of Economy, Trade and Industry (METI) and the Ministry of the Environment (MOE), etc.

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# Towards the Sustainable Growth

The JFE Group was formed on September 27, 2002 to achieve the highest standards of global competitiveness in the areas of steel, engineering, urban development, semiconductors, and in research and development supporting these core businesses.

As one of its primary activities is energy-intensive steel production, JFE is committed to managing environmental influence with the utmost care. It applies the highest international standards in dealing with environmental issues related to air and water quality, as well as in preventing global warming, and in the control of chemical substances. In doing so, JFE is contributing to the creation of better environment with its steel products, engineering operations, and recycling activities.

With the establishment of the JFE Group, environmental activities will remain at the forefront. Key elements of our environmental philosophy are as follows.

- (1) Environmental issues will be a priority for the entire JFE Group.
- (2) Lifecycles of products and services will always be kept in mind.
- (3) The Group will make direct contributions to the resolution of environmental issues through its business operations.

Our advanced environment-related technologies and know-how, developed over the years, will be employed widely in a comprehensive and synergistic manner in dealing with global environmental issues, resource conservation, recycling, and control of chemical substances.

Furthermore, we will promote communication with society through disclosure of environment-related information, and work towards building a future society in harmony with the environment.

The JFE Group will continue to do its utmost full potentials of the Group to achieve these goals.

To demonstrate our these environmental commitment, the JFE Group complied "JFE Environmental Report 2002" in the following pages.

Thank you for your understanding, and for your continued support of the environment-related activities of the JFE Group.

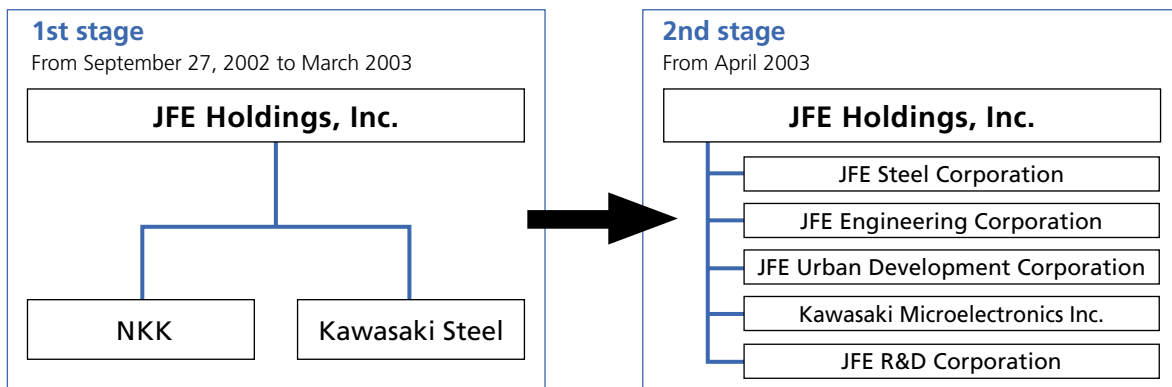


**Kanji Emoto**  
Chairman, JFE Holdings, Inc.

**Yoichi Shimogaichi**  
President, JFE Holdings, Inc.

## JFE Group Outline

The JFE name is composed of the letter "J" for Japan, "F" for steel (as in Fe, the atomic symbol of iron) and "E" for engineering. The acronym can also be thought of as standing for "Japan Future Enterprise," i.e., a future-oriented Japanese business group centered around the core businesses of steel and engineering. The JFE Group was formed through the consolidation of NKK and Kawasaki Steel, and their business operations will be reorganized into five operating companies in April 2003.



# Basic Policy on Environmental Issues

## Corporate Vision

The JFE Group - contributing to society with the world's most innovative technology.

## Environmental Philosophy

The JFE Group considers the improvement of the global environment to be of utmost importance for management, and promotes business operations in harmony with the environment to create a prosperous society.

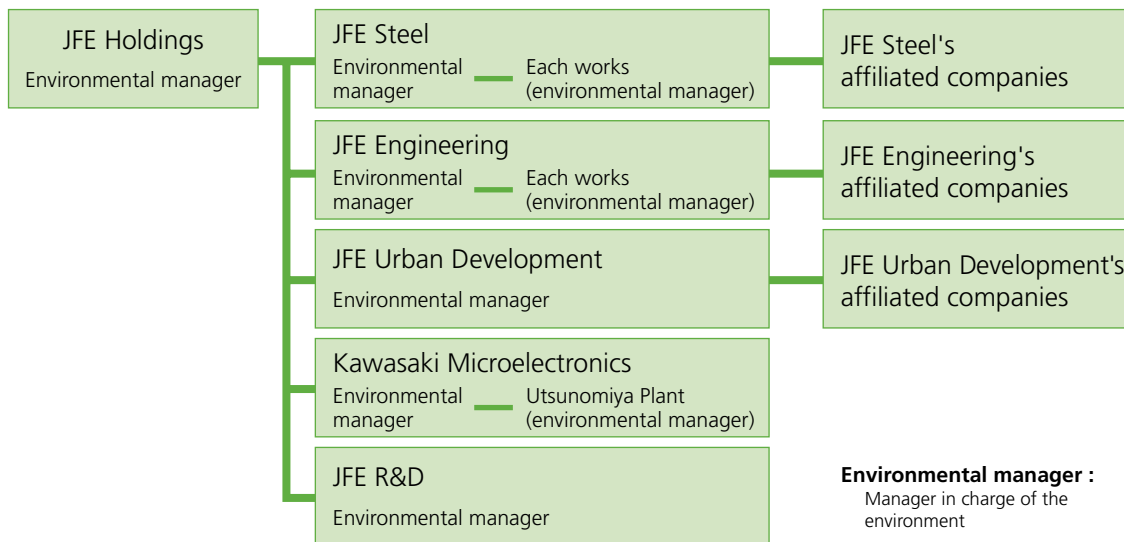
## Environmental Policy

- 1 To reduce environmental influence in all business operations.
- 2 To make contributions through technologies and products.
- 3 To make contributions through conservation of resources and energy.
- 4 To promote communication with society.
- 5 To promote international cooperation.

# System of Environmental Management

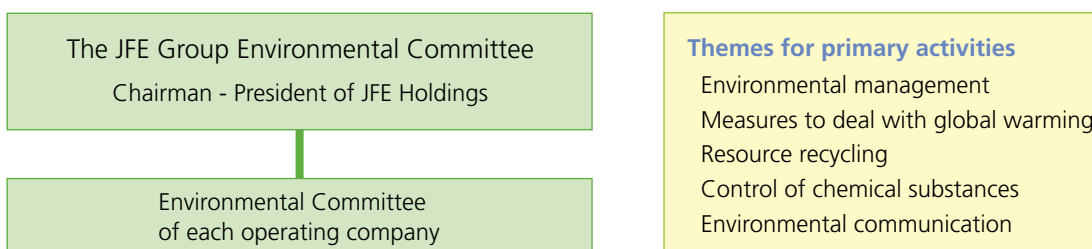
## Environment-related Organization

Environmental issues are principally handled by individual works in JFE on the basis of the Group's environmental philosophy. Departments in charge of the environment and energy in each works deal with these issues in cooperation with those responsible at the operating company level. They cooperate with each other and obtain current information on the trends in society, and share it in the Group so as to incorporate it in technological development and business activities.



## Corporate Environmental Committee

At the start of the Group, JFE has positioned "the Environment" as an utmost important theme for group management. The Environmental Committee is chaired by the President of JFE Holdings, and is tasked with the voluntary and continuous resolution of environmental issues to improve the global environment.



- **Environmental communications network**

Environment-related information is shared among the group companies through the use of electronic bulletin boards and other means.

- **Supporting the group companies**

Support is provided to the group companies for facilitating energy conservation and environmental measures through such means as introduction of national funding and advisory service programs for supporting rational use and conservation of energy.

# 2001 Activities, and Future Objectives

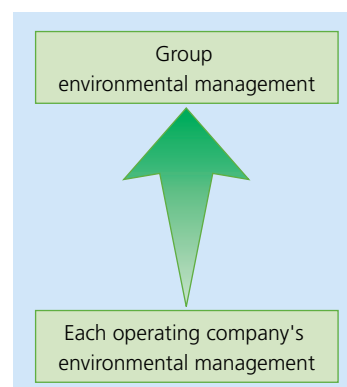
JFE will set new objectives based on past performance to make positive contributions to improvement in the global environment.

Aims of the JFE Group		Future objectives	Activities performed in fiscal 2001
1. Environmental management and communication	(1) Environmental management	<ul style="list-style-type: none"> <li>- Strengthening of systems and raising the level of environmental management</li> <li>- Expansion of green procurement in the entire group</li> </ul>	<ul style="list-style-type: none"> <li>- Acquisition of ISO 14001 certification Nippon Kokan Koji, Kawasaki Steel Civil Engineering &amp; Construction, Kawasaki Steel Container, Philippine Sinter Corp., NKK BARS &amp; SHAPES</li> <li>- Establishment of the JFE Group Guideline</li> </ul>
	(2) Communication with society	<ul style="list-style-type: none"> <li>- Strengthening of communication</li> </ul>	<ul style="list-style-type: none"> <li>- Information disclosure by environmental reports and home pages</li> <li>- Timely information furnishing by in-house magazines</li> <li>- Participation in trade shows for eco products and waste control</li> <li>- Establishment of Environment &amp; Energy Liaison Center in cooperation with public and academic sectors</li> </ul>
	(3) Promoting international cooperation	<ul style="list-style-type: none"> <li>- Contribution to global warming prevention through Kyoto mechanism (joint implementation, CDM, etc.)</li> </ul>	<ul style="list-style-type: none"> <li>- Feasibility studies for energy conservation and environmental protection in China, Thailand, Malaysia, Brazil, etc.</li> </ul>
	(4) Environmental accounting	<ul style="list-style-type: none"> <li>- Qualitative evaluation of environmental activities</li> </ul>	<ul style="list-style-type: none"> <li>- Publication of environmental accounting information</li> </ul>
2. Reduction of environmental influence in all business activities	(1) Preventing global warming	<ul style="list-style-type: none"> <li>- 4.4% reduction of energy consumption per ton of steel by 2010 (base year: 1995) in accordance with the Voluntary Action Plan by Steelmakers</li> </ul>	<ul style="list-style-type: none"> <li>- Progressing as planned</li> </ul>
	(2) Promoting resource recycling	<ul style="list-style-type: none"> <li>- Increase of the recycling rate of by-products generated from production processes</li> <li>- Recycling of wastes generated in society</li> </ul>	<ul style="list-style-type: none"> <li>- Achievement of the recycling rate of 99.5% in 2001</li> <li>- Utilization of waste plastics of 980,000 tons as BF feed</li> <li>- Processing of 520,000 units of waste appliances</li> </ul>
	(3) Protecting the environment	<ul style="list-style-type: none"> <li>- Reduction of the use of PRTR substances and stringent control</li> <li>- 80% reduction of benzene emissions by 2003 (base year: 1999)</li> <li>- More efficient transportation of materials and products</li> </ul>	<ul style="list-style-type: none"> <li>- Strengthening of the PRTR control system and establishment of the data collection system</li> <li>- Achievement of 58% reduction of benzene emissions</li> <li>- Common and joint transportation</li> </ul>
3. Contribution through technologies, products, and services	(1) R&D for the environment	<ul style="list-style-type: none"> <li>- Development of revolutionary technologies for solving global environmental problems</li> <li>- Product development in view of LCA</li> </ul>	<ul style="list-style-type: none"> <li>- Development of steel sheets for ultra-light auto bodies</li> <li>- Development of road-paving technology for mitigating the heat island effect</li> <li>- Development of Marine Blocks</li> <li>- Development of Float Smelters</li> </ul>
	(2) Ecological products	<ul style="list-style-type: none"> <li>- Reduction of social environmental loads by promulgating highly functional steel products</li> </ul>	<ul style="list-style-type: none"> <li>- Highly functional chromium-free coated steel sheet</li> <li>- Weight reduction of automobiles by tailor-welded blanks</li> <li>- Slow-release potassium silicate fertilizer</li> <li>- High-purity silicon for solar cells</li> </ul>
	(3) Proposal of total solutions for creating the better environment	<ul style="list-style-type: none"> <li>- Contribution to the establishment of the Eco-Town and recycling-oriented society</li> <li>- Contribution to society by multi-faceted environmental engineering activities</li> <li>- Development of next-generation clean energy</li> </ul>	<ul style="list-style-type: none"> <li>- Startup of waste PET bottles recycling business</li> <li>- Entry into RDF power generation business by gasifying &amp; melting furnaces</li> <li>- Acquisition of more purchase orders for gasifying &amp; melting furnaces</li> <li>- Entry into waste incinerators dismantling business</li> <li>- Start of public road tests of DME vehicles</li> <li>- Commercialization of the highly efficient fuel cell and development of its market</li> <li>- Achievement of cumulative installed wind power generating capacity of 84,000 kW (as of the end of March 2002)</li> </ul>

# Development of Environmental Management

JFE is developing environmental management for the entire group to make maximum use of the characteristics of each operating company in promoting activities directed towards improvement of the environment.

With JFE Holdings as the nucleus, and based on the environmental management systems (EMS) already developed by each works, the JFE Environmental Committee composed by the operating companies, and each operating company's environmental committee, cooperate with each other to conduct management on the following points.



- (1) To improve the performance of EMS of the group companies, and support their energy conservation activities.
- (2) To share environmental information.
- (3) To perform mutual internal auditing.

## Voluntary and Continuous Activities on Environmental Issues

(examples in steelworks)

Environmental policy	Environmental activity	Remark
Environmental conservation activities	Reduction of air pollutant emissions Reduction of wastewater load Control of chemical substances	Reduction of NOx emissions Reduction of frequency of dust discharge Reduction of COD load Reduction of toxic substance emissions
Conservation of energy and resources, and recycling	Promotion of conservation of energy Promotion of recycling Use as alternative materials Promotion of paperless operations	Identification of energy conserving items and early achievement Energy conserving diagnosis BF feeding of waste plastics Effective use of sludge generated by wastewater treatment BF feeding of waste plastics Reduction of copying volume Increase of waste paper recycling
Improvement of community environment	Promotion of community environment conservation activities Contribution to community's problems on wastes Increase and maintenance of planted areas	Public road cleaning Promotion of no-car day Promotion of automobile idling stop BF feeding of waste plastics Increase of planted areas in each works
Enhancement of environmental awareness	Environmental education	Implementation of education for each level of employees
Deliberation on the global environment	Assistance to developing countries on environmental technologies	Acceptance of overseas trainees

**Environmental Management System (EMS)** : A management mechanism for minimizing the effects of business activities on the environment by establishing environmental policy, making plans based on this policy, implementing the plan, checking the progress, and reviewing such plans, thus voluntarily and continuously make improvements.

# Development of Environmental Management

## Green Purchasing

Guidelines have been established throughout the Group for green purchasing of components and raw materials for production as well as office supplies.

### Outline of the guidelines

- To fully investigate the required amount to minimize volume of purchases.
- To consider environmental influence during the entire life cycle of the final product, in addition to price, quality, and delivery date.
- To request suppliers to give environmental consideration on a daily basis, and cooperate with them.

Examples: Recycled oil, solvent containers, packaging materials, electric vehicles, natural gas vehicles, hybrid vehicles, etc.



Green Purchasing Network (GPN) Databooks

## Environmental Education

JFE conducts environmental education at every level of employees as a means of deepening their understanding of the environment, and to ensure that environmental consideration is a part of the job of individual employee. Environmental education is given to new employees, and is also a part of the training programs required for promotion within the company. This education includes such points as social trends related to environmental problems, the significance of the environment to JFE and measures being taken, responsibility of employees, and the importance of environmental management. In accordance with the annual schedule, each works periodically conducts environmental education as a part of the environmental management system for general employees, and for employees engaged in specific tasks.

## Environment Month Activities

As part of the environmental management system, JFE has established “Environment Month” in June of each year. Activities during the month include conferences with environmental monitors of the community, cleanup of private roads in the works and public roads, group study by personnel in charge of environmental management systems, and practice in preparation for environmental emergency. Top management participates in these activities to raise the level of environmental awareness of all employees. During Environment Month this year, a contest to create environment-related slogans was held, producing 453 responses. The following were selected as winning slogans.

- Let's pursue Eco Life for building a better environment for the future.
- The Earth is a treasure for all human beings - let's protect the environment for pleasant living.
- Reconsider before throwing away. Resources are limited: wisdom unlimited.
- Don't think energy is limitless. Let's recycle and be friendly to the Earth.

## In the Office

Conservation and recycling of energy and resources are being promoted at all of the JFE's offices through such activities as the use of recycled paper, the paperless office operation, and power and water saving as a means of raising the level of environmental awareness among employees. The Global Warming Prevention Plan has been established for NKK's head office building in accordance with the Tokyo metropolitan ordinance, aiming at achieving 1% reduction of CO<sub>2</sub> emissions during the period of 2001 to 2004 by the measures listed to the right.

- Indoor temperature management and dressing light for summer
- Introduction of energy-efficient PCs
- Reduction of the amount of lighting
- Use of motor vehicles with low fuel consumption
- Separate collection of refuse
- Use of recycled paper



## Environmental Auditing

In order to implement a high-quality environmental management system, it is important to understand whether the system is operating appropriately, and whether performance is being continually improved. At JFE, in addition to external inspection by certification authorities, employees experienced in environment-related work such as environmental and energy management participates in internal auditing. Also, the training of in-house environmental inspectors is being promoted. Teams of employees led by external experts carry out internal auditing in JFE in order to ensure transparency in inspection. Issues pointed out by internal or external auditing are used as a basis for revising and continuously improving the system, taking into account the changes in the surrounding conditions.



Periodic auditing based on ISO 14001

## Status of the JFE Environmental Management System

JFE aims at developing a comprehensive environmental management system based on its environmental philosophy. As such, it is promoting voluntary and continuous environmental activities by each company in the JFE Group based on ISO 14001 certification. All the works that are going to be assigned to the operating companies as of April 2003 have already obtained ISO 14001 certification.

### ISO 14001 Certification

#### JFE

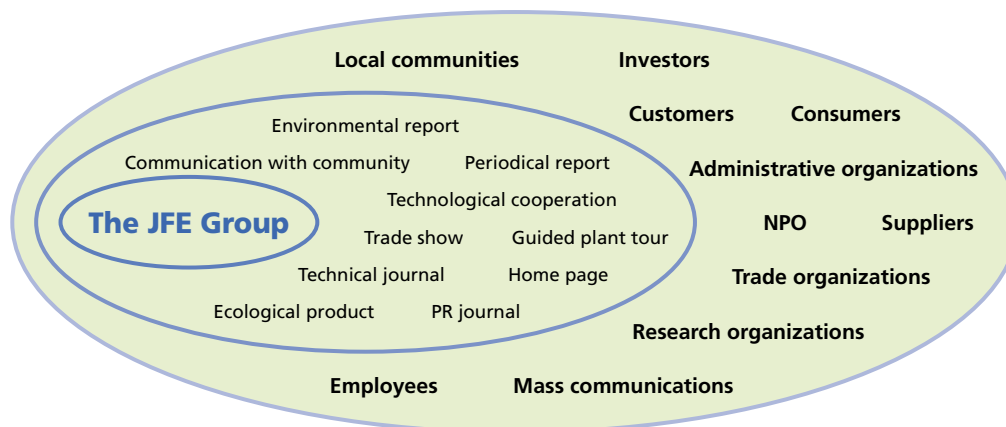
	Certified in:		Certified in:
Keihin Works	May 1997	Chiba Works (including Nishinomiya District)	Jul. 1998
Mizushima Works	Oct. 1997	Chita Works	Jul. 1999
Fukuyama Works	Mar. 1998	Engineering Division	Dec. 1999

#### Affiliated companies

Kawasaki Microelectronics	Oct. 1997	NKK MARINE & LOGISTICS	Mar. 2000
Kawatetsu Mining	Jul. 1998	Kawasaki Steel Metal Products & Engineering	Dec. 2000
Kawatetsu Transportation & Technology	Jul. 1998	Kawasho	Dec. 2000
Kawasaki Refractories	Apr. 1999	NKK Unics	Feb. 2001
ADCHEMCO	Jul. 1999	Nippon Kokan Koji	Jun. 2001
NK KANKYO	Dec. 1999	Kawasaki Steel Civil Engineering & Construction	Oct. 2001
NKK MATERIAL	Jan. 2000	Philippine Sinter Corporation	Nov. 2001
NKK DESIGN & ENGINEERING	Feb. 2000	NKK Environmental Service	Dec. 2001
Korei Kiko	Feb. 2000	Kawasaki Steel Container	Jan. 2002
KOKAN DRUM	Mar. 2000	NKK BARS & SHAPES	Mar. 2002

# Communication with Society

JFE is concerned to raise the level of environmental awareness among the society through communication. Such communication is also aimed at increasing the awareness of managers and employees within the Group, and deepening the mutual understanding between operating divisions.



## Coexistence with Local Communities

JFE has agreements for environmental protection with local authorities (prefectures and cities) in the region in which its works are located on such points as the air and water quality, noise, and wastes discharge. These agreements are sometimes in accordance with strict national legal requirements, however in some cases they focus on regional environmental protection not covered by national requirements. Agreements on forestation with local authorities focus on the establishment of planted areas and their maintenance through the activities of individual works in order to protect regional scenery, absorb CO<sub>2</sub>, and ensure environmental protection in terms of reducing soot, dust, and noise.



Greening in Steelworks

## Opening the Works to the Public

JFE holds open-house events at its works annually for entertaining the general public in each region. Visitor centers have been established at steelworks to have better understanding of the public on steelworks and steel production. Guided plant tours are conducted for school children as well as for interested groups within the surrounding communities. Recycling of empty cans, and voluntary cleanup activities, are carried out by the employees in the areas in which the works are located. Kenaf, a plant with considerable environmental benefits, is being cultivated at some works as a means of furthering the environmental awareness of individual employees.



Mizushima Steelworks Festival



Fukuyama Festival

## Links with the Wider Society

### Environment-related Support and Assistance

The Kawasaki Steel 21st Century Foundation established in 1990 makes social contributions by providing financial assistance to research and development, and works towards establishing harmonious relations of the steel industry with society and culture. The Foundation is also providing assistance to the development of materials for solar cells, which are expected to make a large contribution to the reduction of CO<sub>2</sub> emissions by using natural energy.

Furthermore, it has prepared educational resources on steel materials in Japanese and English, and presented them to a number of universities both within Japan and overseas for introducing Japanese steel technologies that incorporate advanced environmental and energy-conserving measures. These resources are also available through its home page.

URL : <http://www.kawasaki-steel-21st-cf.or.jp/>

### Participation in the Kanagawa Riverhead Forest Partnership

JFE considers the restoration of healthy water circulation and management of forest areas to be of the utmost importance. As a water user, it has become a member of the Kanagawa Riverhead Forest Partnership, which is a part of Kanagawa Forest Conservation Program for Water Resource Regions initiated by the Government of Kanagawa Prefecture.

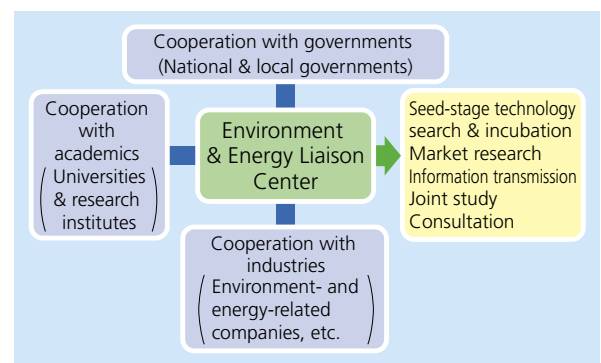


### Cooperation with NPO in Oceanographic Survey

JFE, together with NKK MARINE & LOGISTICS CORPORATION, cooperates with the NPO “VOS Nippon” in voluntary oceanographic survey activities. These activities involve the installation of automatic surface water monitoring equipment aboard the ocean going vessels operated by NKK MARINE & LOGISTICS. Data is collected by VOS Nippon each time a vessel returns to Japan from a voyage in open seas, and made available to interested researchers.

## Cooperative Research Activities for the Environment and Energy by Multiple Sectors

The Environment & Energy Liaison Center was established in 2001. This center contributes towards the creation of new ideas and concepts for environmental business activities, and acts as a core for integrating private sectors, public authorities, academics, and local organizations for promoting research and development on the environment and energy. It also acts as a transmission source of relevant information. It currently sponsors the Environment and Energy Network Research Committee comprised of the businesses operating in the Keihin Coastal Area for promoting resource circulation among different types of industries.



Role of Environment & Energy Liaison Center

## Website for Environmental Information

This website is the first in the industry to be created for the express purpose of providing environmental solutions useful to society. As such, it provides a wide range of information on matters related to the environment and energy, and is designed to be a comprehensive source for information in these fields.

It also provides a forum for bilateral communication between parties concerned with the environment for making a contribution to improvement of the environment.

# Promoting International Cooperation

Environmental issues are a matter of common concern for every country in the world. As such, JFE participates in projects for saving energy and reducing CO<sub>2</sub> emissions in the developing world, as well as providing technological assistance and operational guidance to ensure that technologies and knowledge accumulated in the Group are used for environmental protection on an international scale.

In preparation for activation of the Kyoto Mechanism, JFE actively utilizes financial support programs such as those provided by NEDO to model projects to rationalize energy use, and feasibility study (FS) for joint implementation of projects to reduce greenhouse gas emissions, as well as those provided by JETRO to basic study on a project to protect the global environment or to vitalize industrial plants in overseas countries.

## Russia

- Conversion of the existing coal firing power generating plant in Sakhalin to natural gas firing
- Optimization (including repair and maintenance) of Russian gas pipelines to reduce greenhouse gas emissions
- Autonomous distributed power generation technology based on unused differential gas pressure energy

## Ukraine

- Investigation for optimizing repair and maintenance of gas pipelines
- Energy saving survey at Zaporozhstal Integrated Iron & Steel Works
- Energy saving survey at Ilyich Steel Works in Mariupol City

## Pakistan

- Energy saving survey at steelworks of Pakistan Steel Mill

## Bangladesh

- FS for rehabilitation and optimization of pipelines to reduce greenhouse gas emissions

## India

- Coke oven waste heat recovery facility for SESA GOA Ltd.
- FS for waste heat recovery at sintering cooler at Tata Iron and Steel Company Limited
- Advice on prevention of air pollution from coke ovens at Bokaro Steel Plant of Steel Authority of India Ltd.
- Advice on energy conservation and prevention of air pollution at four steelworks of Steel Authority of India Ltd.
- FS for the model project of BF top pressure recovery turbine power generation at Steel Authority of India Ltd.

**NEDO** : New Energy and Industrial Technology Development Organization

**JETRO** : Japan External Trade Organization

### China

- FS for regenerative burners at Shoudu Iron & Steel Co. and Anshan Iron & Steel (Group) Co.
- Energy conservation measures for lime calcination furnaces
- Sichuan Province natural gas DME project
- Model project of energy conservation at ferroalloy electric furnaces
- Follow-up for the model project of sintering cooler waste heat recovery facility
- Energy conservation project for two steel companies in Fushun City
- FS for the energy conservation model project for sintering plants
- Energy conservation in steel and cement industries in Benxi City
- Environmental and energy saving survey for coke ovens at Nanchang
- FS for blast furnace (BF) top pressure recovery turbine (TRT) for electric power generation at No.1-3BFs, Panzhihua Iron and Steel (Group) Co.
- Construction of TRT at No.4 blast furnace, Panzhihua Iron and Steel
- FS for the model project of coke oven combustion control in Guiyang City and Kunming City
- Advice on air pollution prevention at steelworks in Fushun City
- Advice on air pollution prevention at coke ovens in Huhehaote City
- Advice on air pollution prevention at coke ovens in Guiyang City
- Advice on energy conservation and air pollution prevention at steelworks in Hunan Province
- Advice on energy conservation and air pollution prevention at steelworks in Nangchang City
- Advice on energy conservation and air pollution prevention at steelworks in Kunming City

### Thailand

- Ayutthaya City waste incinerator power generation project
- Waste incinerator heat recovery model project for Industrial Estate Authority of Thailand
- Sumut Prakan Province waste incinerator power generation project
- Tasae-Bansapan water pipeline project
- FS for the water supply system powered by solar cells
- FS for electric furnace dust treatment

### Vietnam

- FS for energy conservation at Vietnam Steel Corp.

### Malaysia

- Energy conservation model project of waste heat recovery from the papermaking sludge incinerator
- Energy saving survey at steelworks of Southern Steel Co.
- FS for environmental improvement at steelworks of Perwaja Steel

### Brazil

- FS for energy conservation by high-performance industrial furnaces

### Indonesia

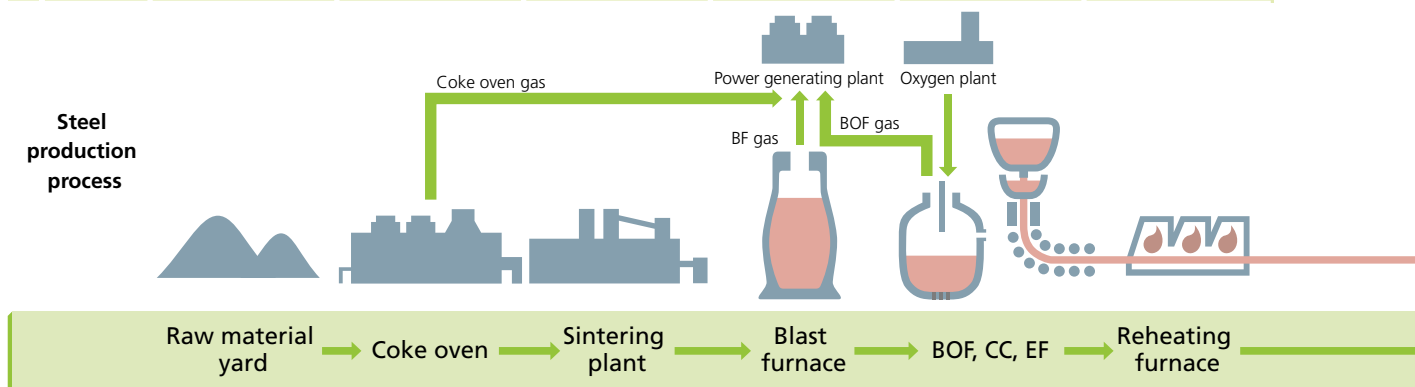
- Biomass (palm refuge) power generation using circulating fluidized bed boiler (CFB)
- FS for direct iron-ore smelting (DIOS) for Krakatoa Steel

# Business Operations and the Environment

## Primary Environmental Influence of Steel Production, and Countermeasures

JFE has been dealing with environmental problems, primarily as related to the steel production sector, since the early 1970's. The Group has developed leading-edge technologies and carried out strict voluntary control in protection of the air and the waters. Representative technologies developed for protecting clean air and water include the desulfurization and denitrification system for flue gas from the sintering process for preventing air pollution and the biological wastewater treatment for preventing water pollution.

Environment	Generated substance	Dust	Waste gas, dust, wastewater (ammonia liquor)	Waste gas, dust, wastewater	Waste gas, slag, dust, wastewater	Waste gas, slag, dust, wastewater	Waste gas, dust
	Environmental influence	Dust	Dust, NOx, SOx, COD	Dust, NOx, SOx	Dust, SS	Dust, SS	NOx
	Counter-measures (facility)	Yard water spraying, belt conveyor dust collection, laser dust monitoring	Coke oven gas desulfurization, waste ammonia liquor COD treatment, chemical by-product recovery	Waste gas desulfurization & denitrification	Gas recovery, dust collection, dust treatment, slag recycling	Gas recovery, dust collection, dust treatment, slag recycling	Low-NOx burner, use of cleaner fuel



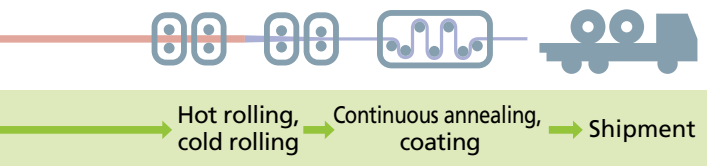
## Primary Energy Conservation Measures for Steel Production

Energy conservation	Coke dry quenching (CDQ), coal moisture control (CMC), combustion control	Sintering cooler waste heat recovery, ignition furnace line burner	Waste plastics feeding, pulverized coal injection, top pressure recovery turbine, hot stove waste heat recovery, fuel gas preheating	Gas recovery, gas sensible heat recovery, nitrogen jet heater, ladle heating	Regenerative burner, direct charging, low-temperature extraction
	Gas turbine combined cycle power plant Power plant fuel preheating device High efficiency air separation equipment				

The steel industry uses large amount of energy, and as such, places great importance on energy conservation. Following the oil crises, considerable effort has been expended to achieve major reductions in energy consumption, resulting in significant contributions to the prevention of global warming. A variety of energy conservation measures have been implemented such as elimination of some of the processes and making them continuous. Conversion to alternative energy has been promoted for reducing dependence on oil. Following the second oil crisis, aggressive investment has been made on large-scale energy-conserving plants such as large-scale waste heat recovery systems. As a result, the energy consumption rate per ton of crude steel production is now about 20% less than in 1973.

	2000	2001
Input amount of resources		
Coal (million tons)	23.0	22.7
Iron ore (million tons)	42.9	40.6
Industrial water (million tons)	290	281
Final disposal amount of wastes (thousand tons)	74	74

Rolling wastewater, pickling wastewater	Coating wastewater	Exhaust gas
SS, waste oil, waste acid, iron salt	Metallic ion, etc.	NOx, SPM (suspended particulate matter)
Waste acid & waste alkali treatment, waste oil recycling, coagulating sedimentation	Wastewater treatment	Conversion to low-emission vehicles



Endless rolling, process coupling	Waste heat boiler, rotary regenerative heat exchanger	Selection of transportation mode, shortening of transportation distance, improvement of load efficiency, modal shift, application of IT
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## Engineering

Primary environmental influence is waste generation, energy consumption, and the use of chemical substances in building ships, steel structures, and machinery, as well as the waste generation in on-site construction.

Since ISO 14001 certification in 1999, the EMS has produced many benefits through a variety of activities for reducing industrial and office wastes, and conserving energy consumption, and through fabrication and construction conducted in consideration of the environment.

Environmental influence		Achievement in 2001
Wastes	Fabrication sector	Reduction of 30% from the 1998 level was achieved through wastes suppression, and separate collection and recycling.
	Construction sector	The final landfill disposal rate of wastes from construction sites was reduced to 30% from 60% in 1999 through separate collection and recycling.
Energy	Fabrication sector	Reduction of 1% from the 1997 level was achieved through energy-saving plant lighting systems power supply cut to unused machinery, energy-saving patrol, and improved operation mode of compressors.

## Urban Development

In planning a condominium, site characteristics are carefully considered, and much importance is placed on harmony with the surroundings in terms of layout, structure, color, and outdoor vegetation. Materials and appliances used are selected in consideration of environmental values.

## Microelectronics

Since ISO 14001 certification in 1997, the EMS at the Utsunomiya Plant has produced many benefits through reduction in substances responsible for environmental influence, conservation of energy and resources, and reduction and recycling of wastes. Of particular note was the waste recycling rate of 98% achieved in 2001.

**COD** : Chemical Oxygen Demand. The amount of oxygen required to chemically oxidize and stabilize pollutants in water. An indicator used to express the degree of water pollution.

**SS** : Suspended Substances in water. Also refers to the amount of suspended substances.

**SPM** : Suspended Particulate Matter. Particulate matter with a diameter of less than 10 $\mu$ m (1 $\mu$ m = 1/1,000mm). Particles of this size remain suspended in the air, and are accumulated in lungs and air tubes when inhaled.

# Preventing Global Warming

Global warming is an important problem that is deeply related with the activities of all in society, including the business sector. Japan has developed measures to deal with global warming, in particular the Guideline of Measures to Prevent Global Warming, and ratified the Kyoto Protocol in June 2002. The Japanese target of 6% for reduction in greenhouse gases as specified in the Kyoto Protocol is of considerable severity in comparison to that of the EU, which is able to look forward to conversion to new energy sources and the benefits of integration with the former Eastern Block nations. In resolving these problems, the role of technology will be of utmost importance.

JFE will deal with the problem of global warming, employing its world-top level expertise and potentiality in technological development.

## Measures Taken by Industry

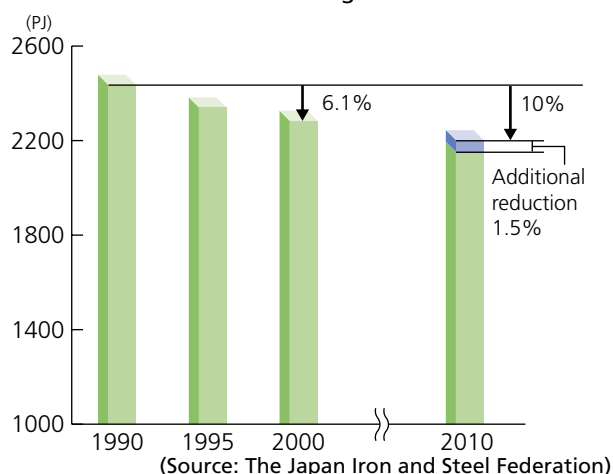
### Voluntary Environmental Action Plan by Japan Business Federation

Japan Business Federation (Nippon Keidanren) established the Voluntary Action Plan in 1997. The plan sets a target to reduce CO<sub>2</sub> emissions in the industrial and energy conversion sectors to the 1990 levels by the year 2010. The Federation's follow-up for the plan reports that progress is on track to achieve the target.

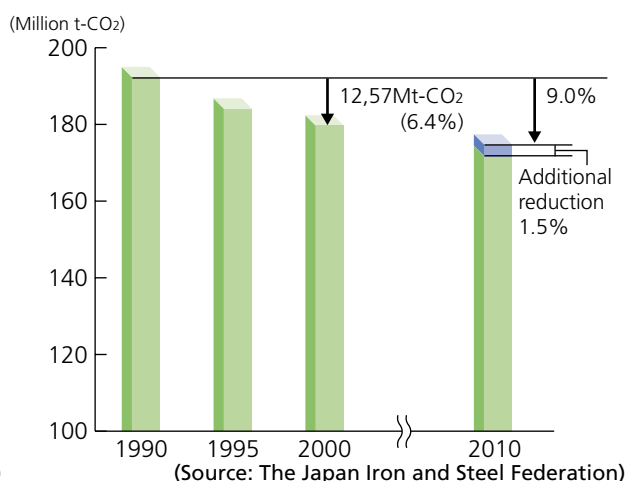
## Voluntary Measures by the Steel Industry

The Japan Iron and Steel Federation established its Voluntary Action Plan Concerning the Steel Industry's Environmental Protection in December 1996. The plan sets a target to reduce energy consumption by 10% in comparison to the 1990 level by the year 2010. Later, a further 1.5% reduction was added to this target by increasing waste plastics injection into blast furnace, subject to improvements in the collection system. In order to reach this target, the achievement is investigated annually and reported to the government council. By 2000, efforts had resulted in a reduction of 6.1% in energy consumption in comparison to the 1990 level, indicating that measures taken by each steelmaker, such as improvements in efficiency in production equipment and improvements in operating techniques, are bearing fruit.

Japanese steel industry's total energy consumption and reduction target for 2010



CO<sub>2</sub> emissions originating from energy consumption



**Guideline of Measures to Prevent Global Warming :** The Japanese government has developed a package of more than 100 measures to provide a general framework for practical measures to implement a 6% reduction in the emissions of greenhouse gases in comparison to the 1990 level. The basic policy is the coexistence of the environment and the economy, step-by-step approach in promoting the countermeasures, unified promotion of the measures both across the sectors and within each sector, and international cooperation in implementing measures against global warming. This guideline will be evaluated and reviewed in 2004 and 2007.

**PJ, GJ :** J (Joules) is a unit of heat. P (Peta) represents 10<sup>15</sup>, and G (Giga) represents 10<sup>9</sup>.

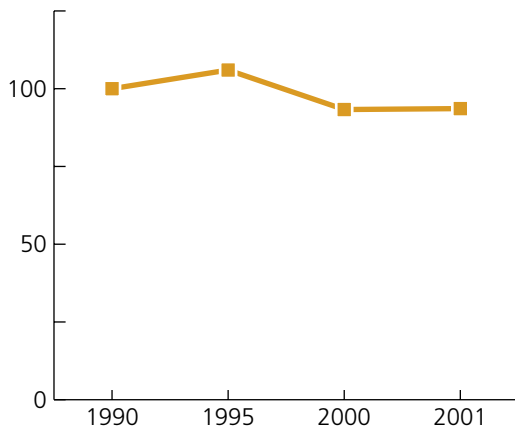


## Achievement of Energy Conservation Measures by JFE

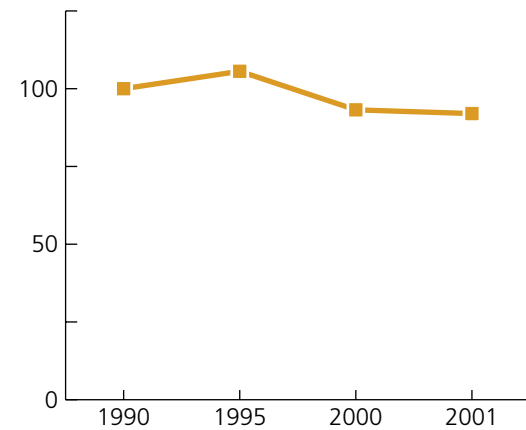
JFE has been aggressive in its pursuit of energy conservation measures since the first oil crisis. Such measures include recovery of waste energy, improvements in efficiency of equipment, introduction of continuous processes, and development of comprehensive energy management systems. These measures have resulted in energy savings of approximately 20%. Measures taken since 1990 to deal with global warming are steadily reducing energy consumption required to produce one ton of crude steel.

Based on the Japan Iron and Steel Federation's Voluntary Action Plan, it is planned to reduce energy consumption per ton of crude steel in 2010 by 4.4% in comparison to the 1995 level. Although energy consumption in 2001 remained nearly at a same level as in 2000, trends are currently proceeding as planned. Continuous introduction of new measures in the future is planned. These measures will include the development of next-generation iron making technology, and more use of waste plastics.

Energy consumption per ton of crude steel production  
(Index) (1990=100)



CO<sub>2</sub> emissions per ton of crude steel production  
(Index) (1990=100)



## Contributions through LCA-based Product Development

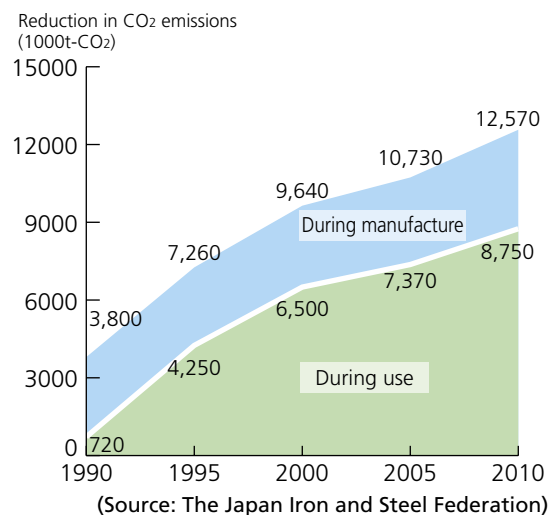
JFE has been giving higher functionality to steel products for reducing the weight of final products made of steel, and reducing the amount of steel used in manufacturing such products, thus contributing to reducing energy consumption.

A survey conducted by the LCA Energy Evaluation Survey Committee (Chairman: Professor Kanji Yoshioka, Keio University) shows that the use of highly-functional steel products in six types of products results in a reduction in CO<sub>2</sub> emissions of 6,500,000 tons during the use of such products in society, and a reduction of 3,100,000 tons during their manufacture in comparison to the case of using conventional steel products (estimated values for the entire Japanese steel industry in 2000).

Product types surveyed are:

- H-beams for buildings.
- Heat-resistant steel tubes for boilers.
- High-strength steel sheet for auto bodies.
- High-tensile steel sheet for shipbuilding.
- Electrical steel sheet for transformers.
- Stainless steel sheet for railway carriages.

Effect of reducing CO<sub>2</sub> emissions in view of LCA through using highly functional steel products

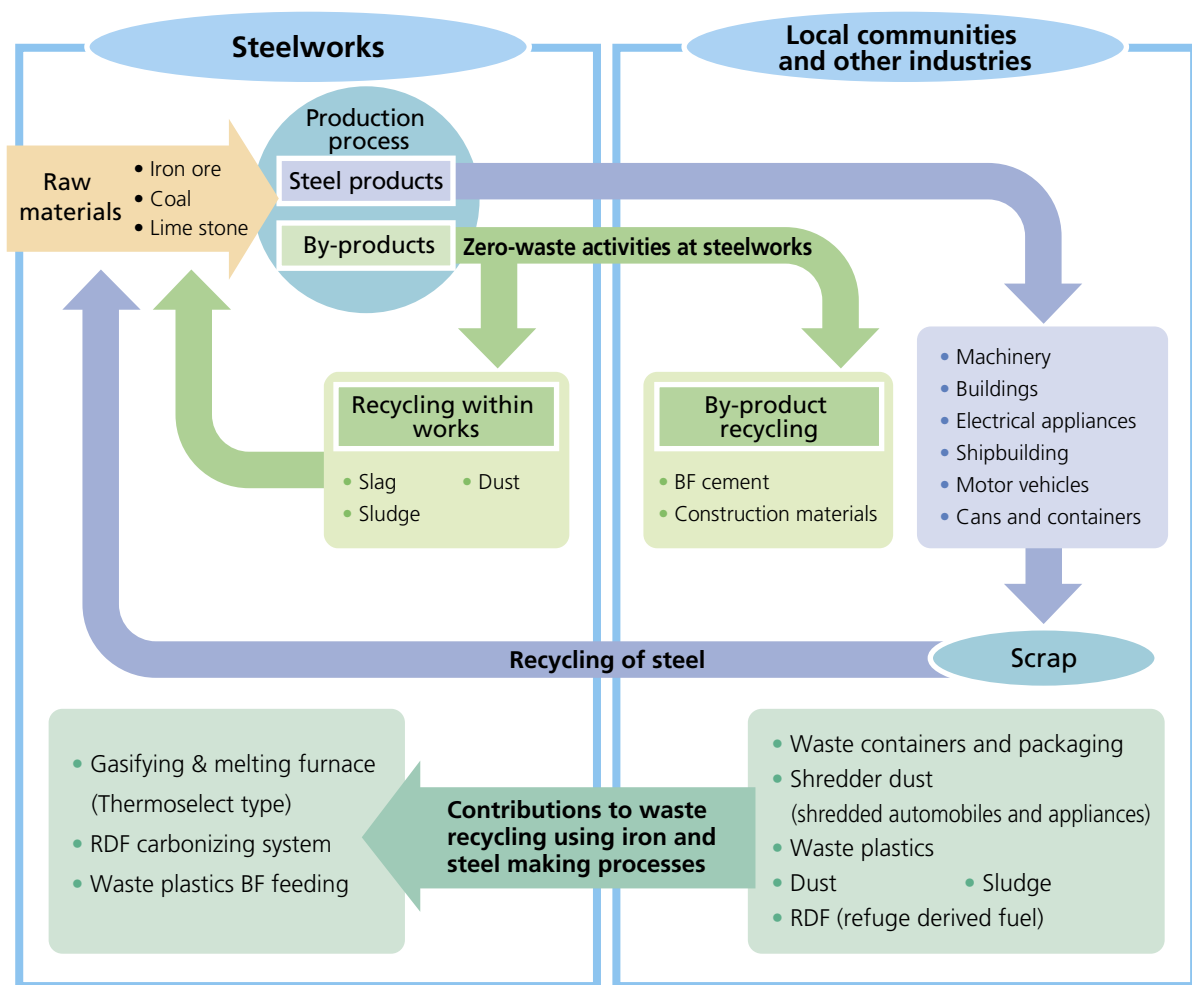


# Promoting Resource Recycling

Strengthening of regulations as a result of shortage of final waste disposal sites and problems caused by illegal dumping, and the necessity of transforming the society from mass production, mass consumption, and mass disposal to a recycling-oriented one, have begun to effect a revolution in the fundamental paradigm of "manufacture." JFE is engaged in an aggressive policy of effective use of resources. It also expects much of the new businesses would be developed in association with this change.

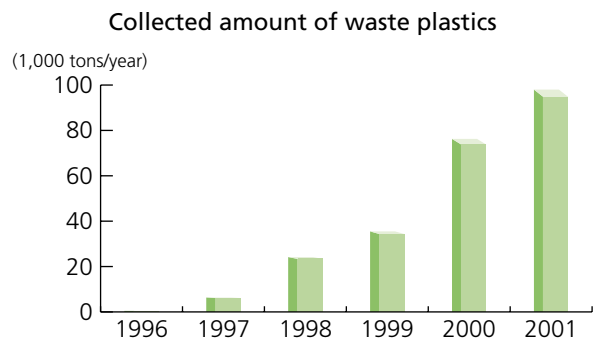
JFE has a variety of infrastructures in its works, most notably steelworks, considerable knowledge and experience in plant operation, and excellent environmental and energy-related technologies, all of which are combined in making contributions to society through reduction, reuse, and recycling of wastes generated from local communities and from other industries.

JFE is working towards achieving zero-waste within its own facilities.



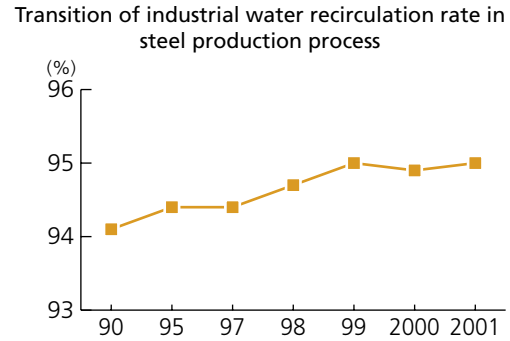
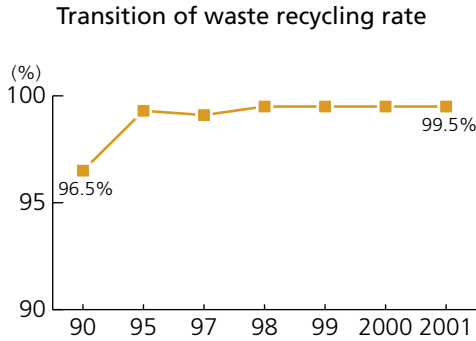
## Collection of Waste Plastics

JFE began recycling waste plastics in October 1996, and has subsequently used a cumulative total of 240,000 tons of waste plastics as a reducing agent in blast furnaces. Current processing capability is 150,000 tons per year.



### Zero-waste Activities and Water Recirculation at Steelworks

The transitions of waste recycling rate and water recirculation rate are shown below.



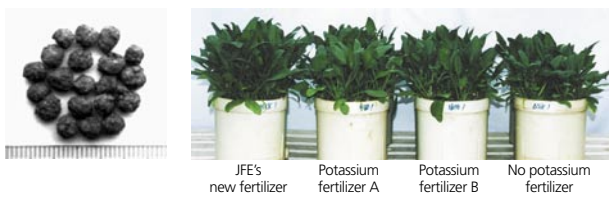
### Reduction, Reuse, and Recycling of Slag

Slag amounts to approximately 90% of all by-products of the iron and steel making process, and is generated by blast furnaces, BOFs, and electric furnaces. JFE employs a preliminary hot metal treatment process, and promotes on-site reuse of steel making slag, thus reducing the volume of slag produced in steel making. Developments of technologies for processing and using of by-products, and making them compatible with JIS standards, have produced benefits in terms of effective use of more than 99% of the slag as roadbed material, concrete aggregate, and raw material for cement.

JFE has developed the following slag recycling techniques.

- (1) Use of the hydration hardening reaction in the manufacture of wave-absorbing blocks for use in marine structures (Ferroform).
- (2) Commercialization of slow-release potassium silicate fertilizer by addition of a potassium material.
- (3) Use of water retaining properties of blast furnace slag in the production of paving materials to mitigate the heat island effect.
- (4) Use of CO<sub>2</sub> absorption technology in the production of carbonated solid blocks of slag to be used for constructing artificial reefs for seaweed and fish farming (Marine Blocks).

JFE is further developing new technologies and applications for iron and steel making slag that will prove useful in improving the global environment.



Slag fertilizer; slowly released over a long period of time to enrich the soil

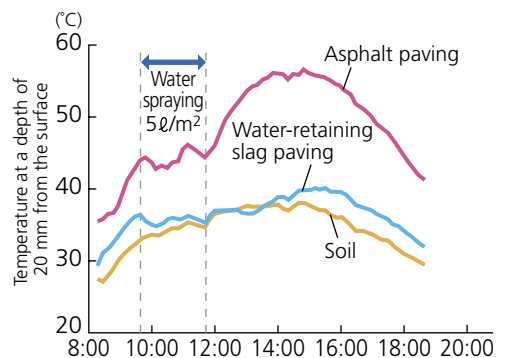


Wave-absorbing blocks made from steel making slag

### Water Retaining Paving Material to Mitigate the Heat Island Effect

JFE employs slag generated in the steel making process in producing paving material that has water-retaining properties. This technology has been developed as a possible means of mitigating the heat island effect and problems associated with local heavy rainfall that are becoming serious in urban areas. When the water-retaining solids primarily composed of blast furnace slag powder are used in asphalt paving, rainwater retained in the pavement during rainfall is released through evaporation once good weather comes, thus lowering the temperature of the paving. At a normal temperature of asphalt paving of between 55 and 60°C, a maximum lowering of 17°C is achieved, with a 10°C lowering after two days, and a 5°C lowering after four days.

Effect of slag paving on heat island effect: temperature after water spraying (Temperature at a depth of 20 mm from the surface)



# Protecting the Environment

Coexistence of business activities and the environment is an imperative element for managing a manufacturing company of any type. JFE has actively dealt with environmental issues, and as such has developed advanced solutions using leading-edge technologies and strict voluntary control. JFE will continue to work towards a more prosperous future for both man and the environment through developing and implementing the technologies to reduce environmental influence.

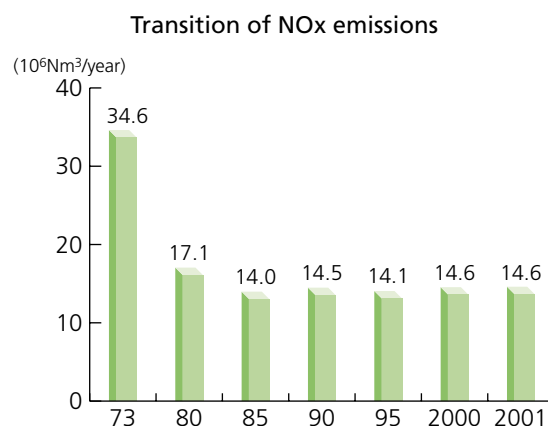
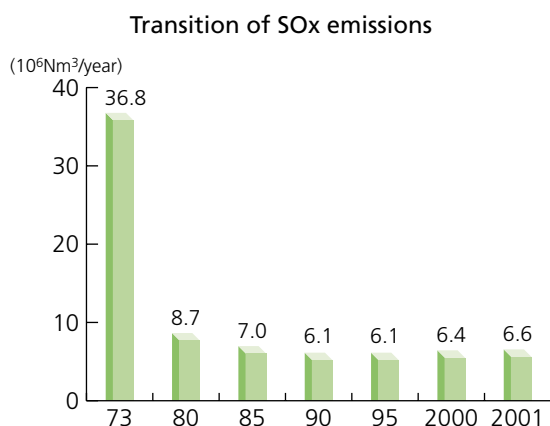
## Air Quality

### SOx

Reduction in the sulfur content of fuels, and the world's first introduction of a highly efficient ammonium-sulfate flue gas desulfurization system, and other measures have resulted in a reduction in SOx emissions to approximately 1/5 from the 1973 level.

### NOx

Installation of the sintering flue gas denitrification equipment to decompose NOx into nitrogen and water has achieved a reduction in NOx emissions of more than 50% relative to 1973.

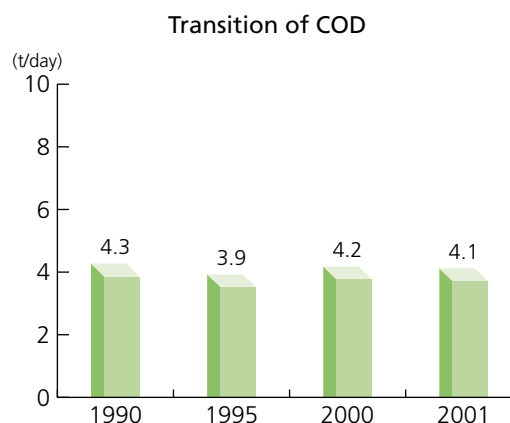


### Dust

Reduction of dust emissions to less than 1/5 from the 1973 level was achieved through such measures as water spraying in storage yards for iron ore, coal, and other raw materials, and the tight sealing of conveyor connections, as well as the installation of highly efficient dust collectors in coke ovens, sintering machines, blast furnaces, and BOFs.

## Water Quality

Approximately 95% of all water used at JFE facilities is recirculated. Whether water is reused or discharged, it is always subjected to appropriate treatment depending on its properties. Wastewater that contains organic matter, for example, is subjected to biological treatment, after which pollutants are removed by passing it through such processes as coagulating sedimentation, filtering, and activated carbon adsorption (ammonia liquor). Thus, original clear water quality is restored.



## Control of Chemical Substances

### PRTR

While the PRTR Law was implemented in March 2000, JFE was already participating in voluntary surveys conducted by the steel industry prior to its implementation in order to grasp the volumes of chemical substances released and transferred, and also engaged in activities aimed at reducing these volumes.

### Benzene and Other Volatile Organic Compounds

In order to reduce emissions of volatile organic compounds into the atmosphere, the steel industry established and implemented its first stage voluntary control plan in 1997 and the expected results have been achieved. The second stage of the plan was established in 2001 and aims at further reductions in emissions.

JFE's objective is an 80% reduction in benzene emissions in comparison to the 1999 level by 2003. Aggressive activities at individual works had reduced emissions by 58% by 2001. In addition to benzene, measures have also been implemented to reduce emissions of tetrachloroethylene and dichloromethane.

In addition to participating in voluntary control on benzene by the steel industry, JFE has also been participating in new voluntary control programs for each region since 2001, and is cooperating with other business enterprises operating in the vicinity, in reducing benzene emissions.

### Dioxins

In steelworks, sintering furnaces, electric furnaces, and incinerators are facilities regulated by the Law Concerning Special Measures against Dioxins implemented in January 2001. JFE is participating fully in voluntary control activities by the steel industry, and is involved in research and development on technologies for reducing emissions of dioxins. The final emission standards to be put into force in December 2002 were already cleared by all facilities subjected to this regulation.

### Polychlorinated Biphenyl (PCB)

In accordance with the Law Concerning Special Measures for the Promotion of Appropriate Treatment of Polychlorinated Biphenyl (PCB) Wastes implemented in July 2001, control on PCB wastes in storage was strengthened. Efforts are underway to dispose of all such wastes within the set time limit (15 years from the date of implementation of the law).

**PRTR** : Pollutant Release and Transfer Register. This is a system that requires release of specified chemical substances into the environment, and transfer of wastes containing such substances, be reported to the national government. Amounts released or transferred in the previous year must be reported as from 2002.

**Polychlorinated Biphenyl (PCB)** : Refers to substances in which hydrogen atoms in the biphenyl molecule is replaced by chlorine. PCBs are extremely stable and do not easily decompose. They are readily dissolved in body fats, thus remaining and accumulating in organisms. Except for the use in closed system, their manufacture, importation, and use were prohibited in 1974.

### Amount of PRTR substances released into the air and water bodies (Fiscal 2001, JFE steel sector)

(Unit: tons/year: for dioxins, g-TEQ/year)

No.	Substance	Emissions
1	Zinc compounds (water-soluble)	5
16	2 - aminoethanol	7
40	Ethylbenzene	11
43	Ethylene glycol	37
44	Ethylene glycol monoethyl ether	16
63	Xylene	549
68	Chromium and chromium(III) compounds	0.3
132	1,1-dichloro-1-fluoroethane; HCFC-141b	2
145	Dichloromethane; methylene dichloride	37
177	Styrene	2
179	Dioxins	26
200	Tetrachloroethylene	18
224	1,3,5-trimethylbenzene	3
227	Toluene	80
232	Nickel compounds	2
283	Hydrogen fluoride and its water-soluble salts	29
299	Benzene	127
304	Boron and its compounds	4
309	Poly (oxyethylene) nonylphenyl ether	5
311	Manganese and its compounds	4
346	Molybdenum and its compounds	2

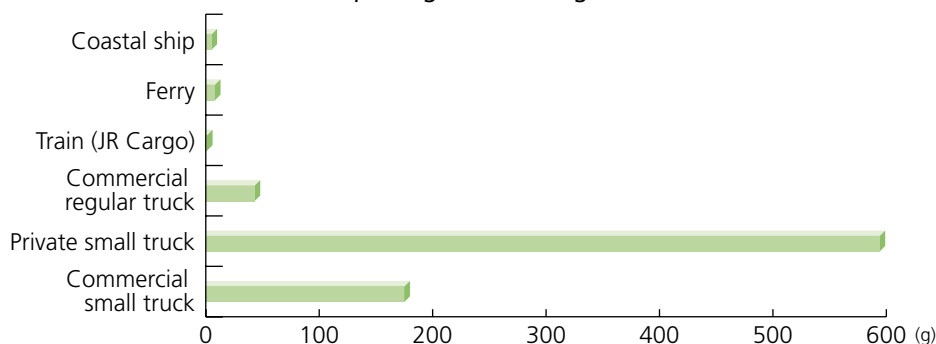
# Improving Transportation

The effects on the environment during the process of distributing steel products in the markets include the release of CO<sub>2</sub>, NO<sub>x</sub>, SPM, etc., due to combustion of fuel. As these factors are causes of global warming and air pollution, JFE places considerable importance on the environmental consideration during the distribution process.

JFE endeavors to reduce environmental influence through well-considered selection of transportation modes, reduction in transportation distances, improvements in load efficiency, and introduction of information technology ahead of the rest of the industry. In anticipation of stricter environmental regulations such as those on SPM, JFE is implementing various countermeasures in advance.

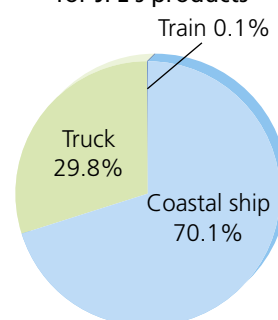
Viewpoint for improvement	Specific measures
(1) Selection of transportation mode	<ul style="list-style-type: none"> <li>Promotion of modal shift by introducing innovative ships (RORO ships, FERO ships, etc.)</li> <li>Avoidance of influence of weather by constructing all weather berths and using RORO ships and U-rack Ships</li> </ul>
(2) Use of larger vehicles, effective use of information, and joint use (more efficient transportation)	<p>(Within works)</p> <ul style="list-style-type: none"> <li>Use of larger transportation vehicles such as U-frame vehicles and carrier vehicles</li> <li>Direct transportation from mill ends to berths for eliminating temporary storage</li> </ul> <p>(Outside of works)</p> <ul style="list-style-type: none"> <li>Making land transportation more efficient by using IT and effective use of return trips</li> <li>Development of a simulation system for optimizing the load efficiency of trucks</li> <li>Reduction of transportation distances to customers by selecting optimum transportation routes</li> </ul>
(3) Effective ship operation	<ul style="list-style-type: none"> <li>Improvement of operating efficiencies of ships by using the coastal ship operation management system (JFE Coastal Ship Control System)</li> <li>Maximization of mixed loading of multiple products</li> <li>Joint transportation with other companies</li> </ul>
(4) Measures for coping with stricter exhaust gas regulations and lowering environmental influence	<ul style="list-style-type: none"> <li>Idling-stop operation</li> <li>Use of vehicles with lower environmental influence</li> <li>Energy-conserving operation of coastal ships in view of loading &amp; unloading schedules</li> <li>Use of ship-bottom paints containing no hazardous substances</li> <li>Selective collection of wastes at unloading sites</li> </ul>
(5) Avoidance of truck transportation through urban central areas	<ul style="list-style-type: none"> <li>Use of dedicated RORO ships in the Inland Sea</li> <li>Use of FERO ships for coastal transportation in Tokyo Bay</li> </ul>
(6) Reduction of materials	<ul style="list-style-type: none"> <li>Use of long-life cushioning materials (conversion from rubber to felt)</li> <li>Reduction of retaining timber (RORO ships, U-rack ships, FERO ships)</li> <li>Reduction of wire and timber (promotion of hoop lashing)</li> <li>Repeated use of retaining materials</li> <li>Simplification of packaging</li> </ul>

CO<sub>2</sub> emissions from transporting 1 ton of cargo over a distance of 1 km



(Source: Ministry of Land, Infrastructure and Transport, Maritime Report 2000)

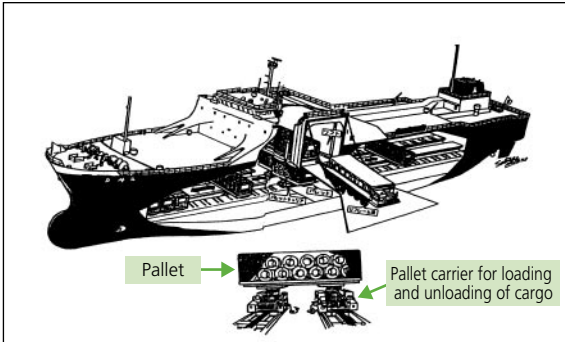
Transportation mode for JFE's products



## Examples of Innovative Ships

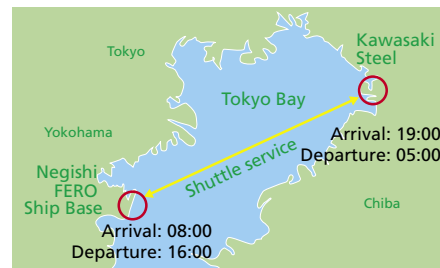
### RORO (Roll-on Roll-off) Ship

Designed for direct loading of cargo vehicles onto a ship. Operates a scheduled service between JFE's steelworks and major cities.



### FERO Ship

Designed for direct loading of trucks carrying steel products onto a vessel, which transports these trucks like a car ferry. Provides a scheduled service between Chiba Works and the Negishi Wharf across Tokyo Bay, thereby reducing truck transportation through the central metropolitan area.



## Examples of Improved Efficiency of Transportation within Works

Introduction of large vehicles (e.g., 100-ton U-frame vehicle, 160-ton carrier vehicle) for transportation within works increases the single-trip load, and allows transportation with fewer CO<sub>2</sub> emissions than is possible with normal trailer transportation.



100-ton U-frame vehicle

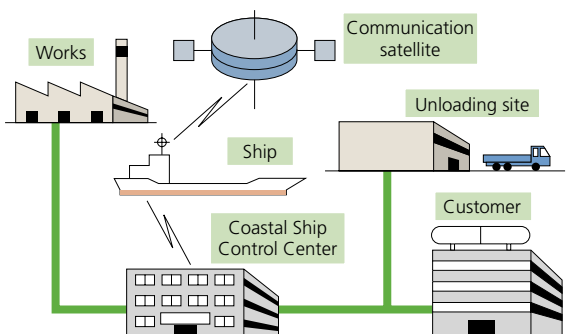


160-ton carrier vehicle

## Examples of IT Applications

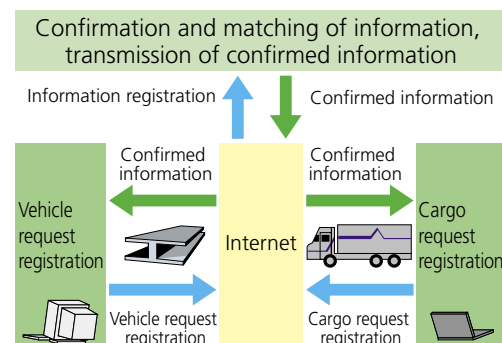
### Optimized Ship Operation Management (JFE Coastal Ship Control System)

All information related to coastal product transportation by ship, such as the current status of ships being operated, product shipment information from works, and unloading site information, is centrally handled for optimizing operation control.



### Development of Optimized Land Transportation Network (Cargo and Vehicle Request System)

The cargo and vehicle request system uses information technology for optimizing land transportation of heavy cargo. It matches information on cargo and vehicles to improve the operating rate of vehicles, thus permitting a reduction in fuel consumption and environmental influence. This is an open system leading the industry.



# Research and Development for the Environment

Carefully watching the trends and requirements of society, JFE develops new technologies and products that are expected to have markets in future. JFE's technological development is carried out with environmental consideration, and is constantly focused on themes necessary for protecting the global environment.

## Examples of Environment-friendly Technological Development that Created New Products

Field	Development theme
Plant	<ul style="list-style-type: none"> <li>• High-temperature waste gasifying &amp; direct melting</li> <li>• Low-temperature waste gasifying &amp; melting reformation</li> <li>• Electric resistance municipal waste incinerator ash melting</li> <li>• Plasma ash melting</li> <li>• Next-generation stoker furnace (*1)</li> <li>• Fly ash dioxin treatment (HICLEAN-DX)</li> <li>• Environment-friendly high-efficiency arc furnace (ECOARC)</li> </ul>
Waste gas treatment	<ul style="list-style-type: none"> <li>• Activated carbon with high thermal conductivity</li> </ul>
Water treatment	<ul style="list-style-type: none"> <li>• Sophisticated sewage treatment by using carriers (BIO-Tube, Pegasus)</li> <li>• Lake &amp; river purification equipment (River-Float)</li> <li>• Accelerated oxidizing treatment system (AOP-more)</li> <li>• Simulation of biological reactions</li> </ul>
Soil remediation	<ul style="list-style-type: none"> <li>• Soil contamination 3-D imaging system</li> </ul>
Recycling	<ul style="list-style-type: none"> <li>• Waste plastics BF feeding system</li> <li>• Waste-to-resource recycling system</li> <li>• Shredder dust treatment system</li> <li>• Slag recycling technologies (paving technology for mitigating the heat island effect, Ferro-Foam, etc.)</li> <li>• Economical activated coke production (*2)</li> <li>• RDF carbonizing system (*3)</li> </ul>
Control	<ul style="list-style-type: none"> <li>• Combustion control system for suppressing dioxin emissions</li> <li>• Waste incinerator operation training simulator</li> </ul>
Analysis	<ul style="list-style-type: none"> <li>• Dioxin precursor analyzer (*4)</li> <li>• New dioxin analyzing method (*4)</li> <li>• Automatic monitoring system for heavy metals</li> </ul>
Energy	<ul style="list-style-type: none"> <li>• High-purity silicon for solar cells</li> <li>• Environment-friendly regenerative burner system</li> <li>• High-density cooling medium</li> <li>• Technologies for improving propulsion efficiency of ships (NOPS, AX-BOW)</li> </ul>
Materials	(See pp. 24-27, Ecological Products)

(\*: See the explanation on the next page)

## Examples of Technological Development in Progress

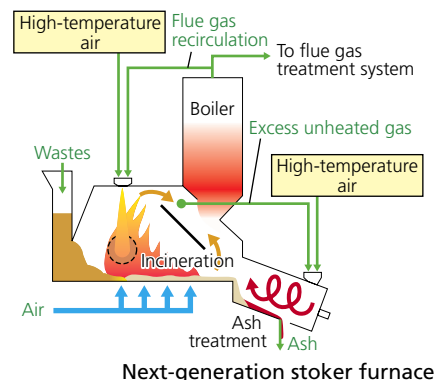
Field	Development theme
CO <sub>2</sub> reduction	<ul style="list-style-type: none"> <li>• Slag recycling technology (Marine Block)</li> <li>• New sintering process for suppressing CO<sub>2</sub> emissions</li> <li>• Revolutionary iron making technology using the Float Smelter</li> </ul>
Energy	<ul style="list-style-type: none"> <li>• Highly efficient hydrogen production technology using sensible heat of coke oven gas (COG)</li> <li>• Mass production technology of clean energy "DME"</li> </ul>
Recycling	<ul style="list-style-type: none"> <li>• Complete recycling technology for stainless steel pickling agent</li> </ul>



### Next-generation Stoker Furnace (\*1)

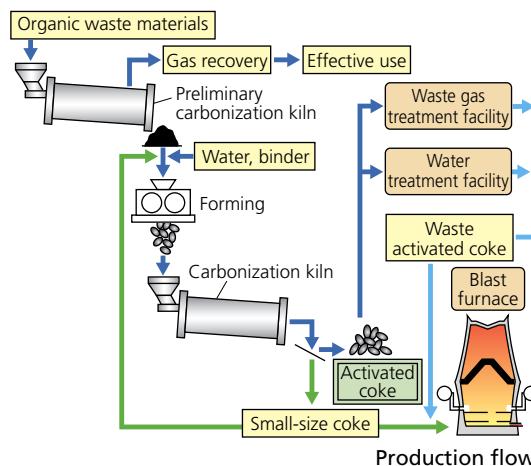
The stoker furnace is the primary means of waste incineration. Many incinerators of this type have been installed, proving their high reliability, however the need for improvements in efficiency and economy has generated an increasing demand for a next-generation stoker furnace. JFE employs a high-temperature air injection to ensure uniform temperature distribution throughout the furnace, and thus achieve a 30% reduction in NOx emissions, and a 50% reduction in dioxin emissions. Combustion at low air ratios, and integration of the incinerator and ash treatment furnace, have greatly reduced operating costs and initial investment.

\* This research has been conducted as part of the NEDO-sponsored R&D project for high-temperature air combustion control technology.



### Economical Activated Coke Production (\*2)

An economical system for producing activated coke from organic waste materials (e.g., waste timber, waste paper, waste plastics) has been developed. In this system, organic waste materials are first subjected to preliminary carbonization. The porous substance thus obtained is then formed into granules by wet forming. The granules are subjected to carbonization for obtaining the final product, activated coke. The high-calorie gas generated during preliminary carbonization is recovered and effectively used as a heat source within this system, or elsewhere in the steelworks.



### RDF Carbonization to Expand RDF Applications (\*3)

A demonstration plant constructed in April 2000 is being employed in the development of RDF(Refuse Derived Fuel) carbonization technology in order to increase the range of applications of RDF. The carbonized RDF called “River Eco-Carbon” may be employed in the iron making process as a substitute for reducing agents in blast furnaces, thermal insulation materials, and powdered coke in sintering furnaces. As it has excellent properties in adsorption, thermal insulation, water retention, and permeability, it may be used as a soil conditioner and river water purification agent.

### Dioxin Analysis (\*4)

Dioxin concentration measurement with the JIS method takes approximately ten days. As dioxin concentrations are normally extremely low, there is no equipment that can automatically and directly measure dioxin concentrations.

(Precursor Analysis Technology)

This technology takes advantage of the high correlation of concentrations of dioxin precursors (chlorobenzenes and chlorophenoles) with those of dioxins. Concentrations of a wide variety of dioxin precursors are measured simultaneously and continuously. Concentrations of dioxins are estimated within a short analysis cycle (approximately 15 minutes). This technology has been commercialized through joint research with Toa DKK.

(New Analytical Method)

This method reduces the time required for the cleanup process for separating and removing the components that hinder dioxin analysis, and reduces the time required for analysis by half to four or five days. Tests have confirmed that the accuracy is equivalent to the JIS method despite the reduced analysis time.

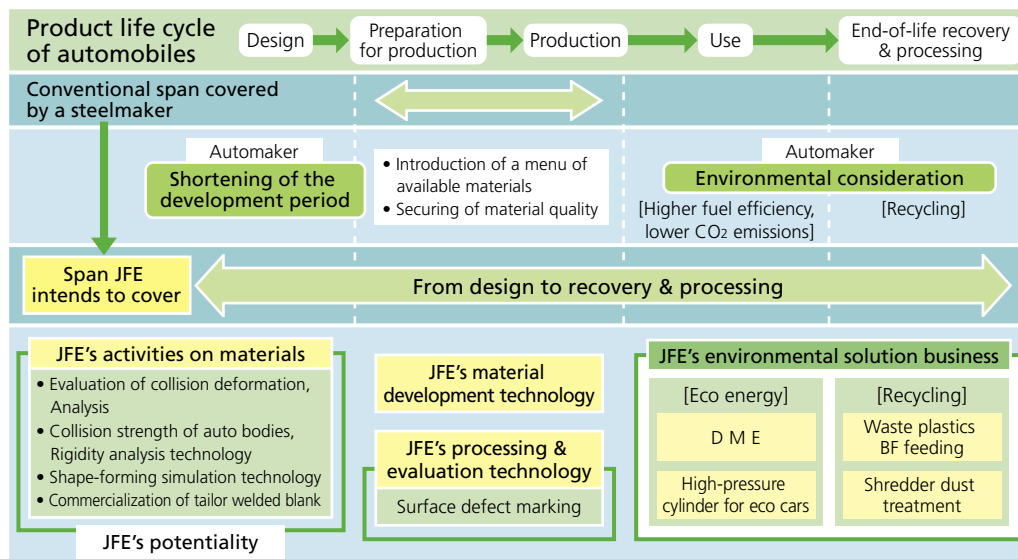
# Ecological Products

As steel scrap is easily recycled back to steel, its recycling rate is higher than other materials. Its environmental influence is small. Steel is therefore a material with characteristics greatly suited to a recycling-oriented society. JFE is engaged not only in the environmental protection during producing steel at its steelworks. It also is engaged in the development and supply of products and services that match the needs of a range of users, while minimizing the overall influence on the environment. This is JFE's DfE (Design for Environment).



## Response to Customer's Green Procurement

In addition to carrying out research and development of ecological products, JFE is also engaged in strengthening marketing of these ecological products and development of a marketing system for such products. It endeavors to respond to customer requirements in relation to ecological products through development of environmental management systems, reductions in toxic substances, submission of environmental influence data, development of criteria for judging green materials, and proposal systems. In terms of practical measures, JFE has developed a green procurement information network to share information on green procurement by customers throughout the company. It is constantly monitoring social trends, including trends in various regulations. It approaches customers and provides product promotion. Its final goal is to establish quantitative LCA-based evaluation methods to be applied to new product development.



Activities related to product life cycle of automobiles

## Steel Product LCA

JFE has participated in LCA studies by the International Iron and Steel Institute (IISI) since 1995, and in the LCA project by MITI (currently METI) since 1998, engaging in the establishment of reliable LCA methodologies and collection of relevant data. LCA data has been processed on twelve types of steel products, and work is proceeding on expanding the data available for steel products. Research is also under way on how to effectively use LCA data.

**Ecological products:** JFE defines ecological products as follows.

Products and services which respond to the needs of customers and society in terms of conservation of resources and energy, ease of recycling, minimal generation of wastes, long life, and low environmental influence.

## JFE's Ecological Steel Products

Customer field	Needs of customers	Ecological product
Automobile	<ul style="list-style-type: none"> <li>Improvement of fuel efficiency and safety by lightweight materials</li> <li>Substitute for cold rolled steel sheets with high dimensional and quality accuracy</li> <li>Resistance to high temperature oxidization</li> <li>Stricter motor vehicle exhaust control</li> <li>Fuel tank that does not contain lead</li> <li>Motor with high efficiency for hybrid vehicles</li> <li>Vehicle life prolongation by increasing corrosion resistance</li> <li>Noise reduction when running</li> </ul>	<ul style="list-style-type: none"> <li>High tensile strength steel with excellent formability (HITEN)</li> <li>High strength steel pipe with high formability (HISTORY PIPE)</li> <li>High accuracy hot rolled steel sheet</li> <li>Stainless steel pipe with excellent formability</li> <li>Stainless steel sheet and pipe for exhaust gas systems</li> <li>Lead-free steel sheet for fuel tanks</li> <li>Highly efficient non-oriented electrical steel sheet</li> <li>GA HITEN with excellent formability</li> <li>Vibration damping steel sheet</li> </ul>
Electrical machinery	<ul style="list-style-type: none"> <li>Corrosion resistant chromium-free steel sheet</li> <li>Press forming without using lubricant</li> <li>Improvement of motor efficiency</li> <li>Smaller transformer with low energy consumption and low noise</li> </ul>	<ul style="list-style-type: none"> <li>Chromate-free coated steel sheet</li> <li>Lubricating corrosion resistant steel sheet</li> <li>Non-oriented electrical steel sheet with high magnetic flux density and low core loss</li> <li>Oriented electrical steel sheet with high magnetic flux density and low core loss</li> </ul>
Container	<ul style="list-style-type: none"> <li>Lower environmental influence in can-making process</li> <li>Elimination of endocrine disrupters</li> <li>Lighter cans</li> </ul>	<ul style="list-style-type: none"> <li>Laminated steel sheet</li> <li>Laminated steel sheet</li> <li>Ultra-thin tinplate</li> </ul>
Construction, piping, shipbuilding, and parts fabrication	<ul style="list-style-type: none"> <li>High strength steel plate for road and bridge construction</li> <li>No spoil discharge during construction</li> <li>Higher efficiency and lighter weight in construction</li> <li>Higher construction efficiency</li> <li>Higher welding efficiency</li> <li>Longer life</li> <li>Lower environmental influence by elimination of painting process</li> <li>Earlier formation of stable rust on weathering steel</li> <li>Longer life with increased corrosion resistance</li> <li>House constructed without using timber for reducing CO<sub>2</sub> emissions and environmental protection</li> <li>House with longer life</li> <li>Pollution-preventive, environment-purifying construction material</li> <li>Improvement of dust generation in sintering</li> <li>Suppression of heat island effect</li> <li>Lower environmental influence by avoiding landfill disposal</li> <li>Harbor construction material compatible with the marine environment</li> <li>Improvement of slag recycling rate</li> <li>Prevention of depletion of beach sand</li> <li>Proper operation of final waste disposal sites</li> </ul>	<ul style="list-style-type: none"> <li>Non-tempered steel plate</li> <li>No-spoil-discharging pipe pile</li> <li>Ultra-thin stainless steel pipe and stainless flexible pipe</li> <li>Constant outer dimension H-beam</li> <li>Ultra-large heat input welding steel plate for shipbuilding</li> <li>Clad steel sheet, oil receiving pipe (1%Cr steel pipe)</li> <li>Weathering steel plate</li> <li>Protective rust layer formation accelerator</li> <li>Highly corrosion resistant stainless steel sheet and pipe</li> <li>Steel-framed house</li> <li>Highly corrosion resistant galvalume steel sheet</li> <li>Construction material with photocatalytic coating</li> <li>Wax-type clean mix iron powder</li> <li>Water-retaining slag paving material</li> <li>Effective use of slag</li> <li>Marine Block produced from steel making slag</li> <li>Potassium silicate fertilizer</li> <li>Sea bottom capping by BF slag</li> <li>Impervious steel wall for final disposal sites</li> </ul>
Energy	<ul style="list-style-type: none"> <li>Low-NOx burner with high thermal efficiency</li> <li>Promulgation of solar cells</li> <li>Oil well drilling pipe with higher corrosion resistance</li> </ul>	<ul style="list-style-type: none"> <li>Regenerative burner</li> <li>High-purity silicon for solar cells</li> <li>Martensite-based stainless steel pipe (13Cr)</li> </ul>

# Ecological Products

## Examples of Ecological Products

### High Tensile Strength Steel Sheet (HITEN)

High tensile strength steel (HITEN) allows making steel sheet thickness thinner while maintaining strength. Used in motor vehicles, this material ensures collision safety while contributing to the improvement in fuel efficiency through reduced vehicle weight. The JFE product lineup includes most grades of galvanized HITEN used in both external and internal panels in auto bodies. They all have excellent properties in press forming, metal coating adhesion, spot welding, and fatigue resistance.



Example of applications of HITEN (door panel experimentally produced by the 1200-ton press)

### Stainless Steel Sheet and Pipe for Motor Vehicle Exhaust Systems

Exhaust manifolds for motor vehicle engines have conventionally been produced by casting. JFE's new hot-rolling technology has been employed in the development of stainless steel that is easily formed, light in weight, and possesses excellent thermal resistance. JFE's high-purity refining and high-speed wide rolling technologies are employed in the production of ultra-thin stainless foil (30  $\mu\text{m} \times 1000 \text{ mm}$ ) for the metal honeycomb structure for use in the catalytic converter mounted ahead of the muffler.



### Steel sheet for Lead-free Fuel Tanks

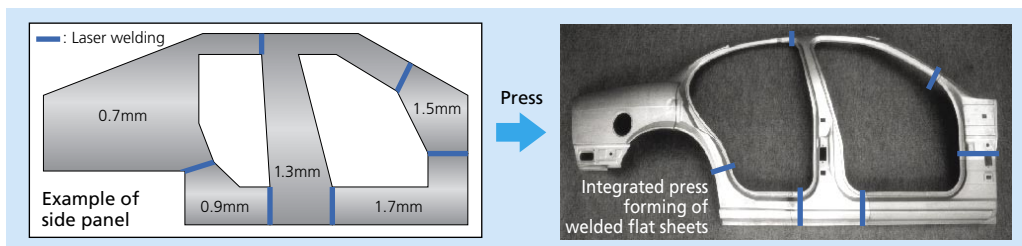
Reduced use of lead requires a replacement for the lead-tin coated steel sheet previously used in motor vehicle fuel tanks. JFE has developed a zinc-coated steel sheet material for this application that is completely lead-free. Both inner and outer surfaces of the material are coated with a special organic film. This material is characterized by its excellent properties in press forming, spot welding, and resistance to corrosion and gasoline-induced deterioration.



Example of application to a fuel tank

### Tailor Welded Blank

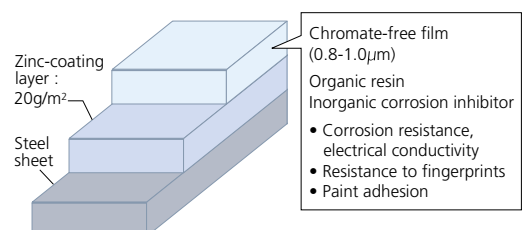
JFE is developing the world's first comprehensive solutions to motor vehicles in view of their full life cycle from designing to end-of-life disposal. One part of the solutions is its tailor welded blank operation in which steel sheets with different thicknesses and properties are welded together prior to press forming. Commercial production commenced in October 2001, and the operation is making significant contributions to weight-reduction in motor vehicles.



Tailor Welded Blank (TWB): Steel sheets with different thicknesses and properties are welded together prior to press forming.

### Chromate-free Coated Steel Sheet

JFE has developed a coated steel sheet that is completely free of hexavalent chromium, while having excellent properties in corrosion resistance, electrical conductivity, paint adhesion, resistance to fingerprints, and lubricity. This product is currently used in interior components of office automation equipment and copiers, and in chassis of TVs, VTRs, and audio equipment. The range of application is expected to increase further.



Chromate-free coated steel sheet

### Weathering Steel

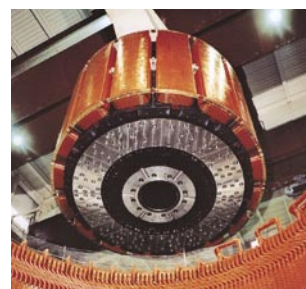
Weathering steel (JIS SMA) employs the concept of “controlling the rust with rust” and is used over a wide range of applications as construction and civil engineering materials. A representative use is in bridges. It protects steel structures from rust, ensuring the life of 50 to 100 years without applying paint. This function is attributable to the formation of strongly protective, stable rust layer on the surface of the steel. This protective rust layer has the same structure as that of the naturally occurring iron ore from which steel is produced. Weathering steel is a material inherently friendly to both man and nature, and has long contributed to environmental protection. JFE has developed new Cr-free weathering steel materials for use in coastal areas. These steel products are used in constructing bridges and other infrastructures.



Oku-Aso Bridge constructed by using weathering steel

### Electrical Steel Sheet (Silicon Steel Sheet)

JFE markets oriented electrical steel sheet that has the world’s highest magnetic flux density. The use of this steel sheet reduces energy consumption, noise levels, and size of electrical transformers, and is employed in a wide variety of applications such as large transformers in power stations, and transformers on the Shinkansen train. JFE’s unique ultra-low core loss non-oriented electrical steel sheet and 6.5% silicon steel sheet are also employed in generators, motors, and reactors, thus contributing to considerable power savings by customers.



Example of applications of electrical steel sheet (large power generator)

### High-purity Silicon for Solar Cells

JFE has developed leading-edge technology for the mass production of solar-grade silicon by metallurgical purification of molten metallic silicon. Conventionally, solar cell substrates have been produced from low-grade silicon materials not conforming to semiconductor standards, and silicon scrap from the semiconductor production process. The newly developed process produces silicon with a purity of six-nine (99.9999%) or more, allowing a solar energy conversion efficiency of between 14 and 16% when processed into solar cells, a level similar to that obtained by solar cells from semiconductor-grade material.



Solar cell module

### Steel-framed House

A steel-framed house is characterized by excellent earthquake-resistance, safety, and durability, and has an extremely long life. It is expected to contribute to protection of forests and thus of the global environment



Steel-framed house

### Marine Blocks

Slag accounts for approximately 90% of the by-products of the iron and steel making process. By applying CO<sub>2</sub> absorption technology, slag is turned into large carbonated solid blocks (Marine Blocks), which are used as artificial reefs, thus contributing to improvements in the environment on a global scale.



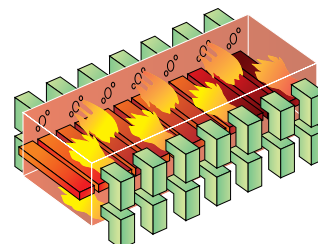
Marine Blocks stacked like a pyramid

Marine plants growing on the blocks

Large carbonated solid blocks made from slag by CO<sub>2</sub> absorption

### Regenerative Burner

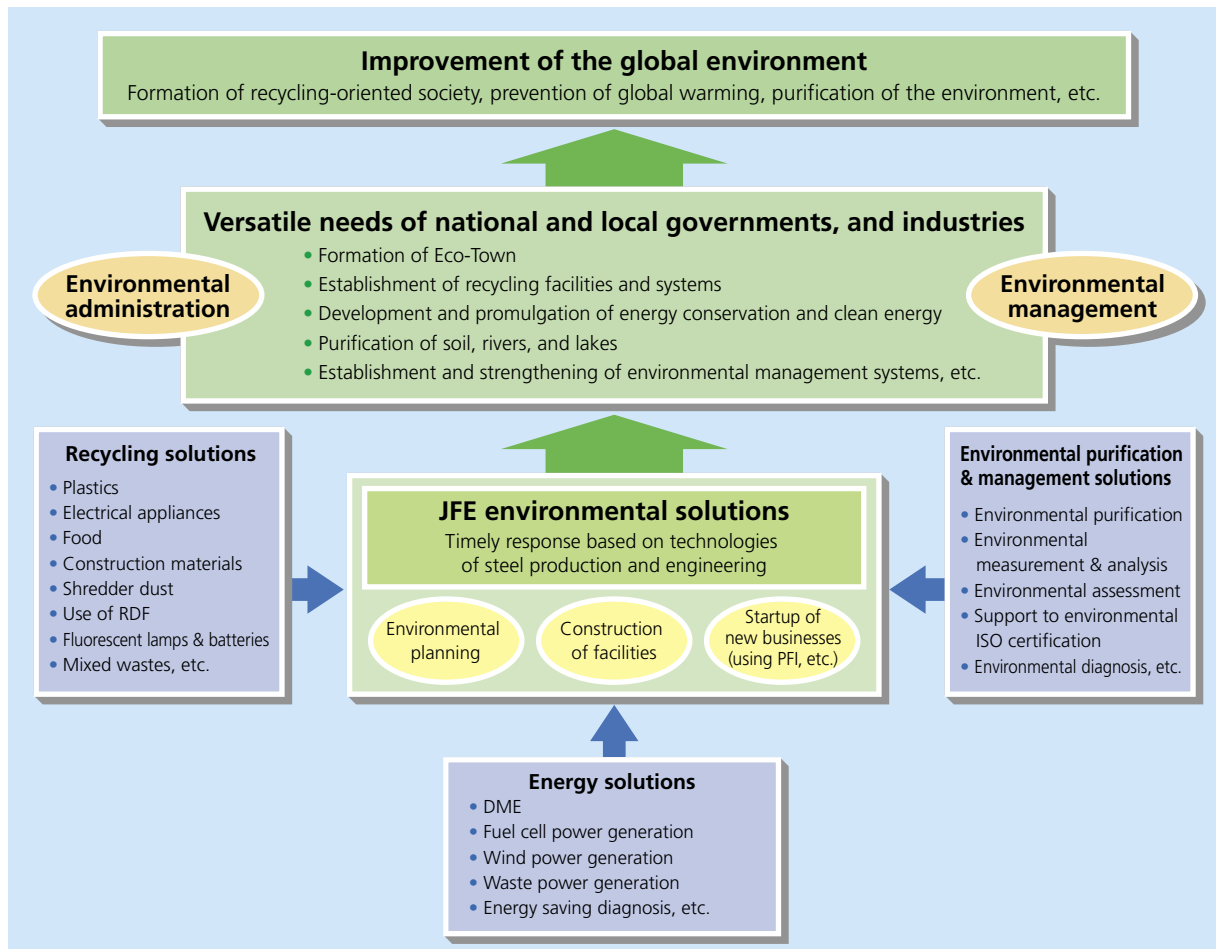
In comparison to the conventional burner heating system, this unique heating system achieves energy conservation of 30% or more, and a reduction in NO<sub>x</sub> of 50% or more. This technology is useful in the prevention of global warming, and is increasingly used in such applications as heating furnaces, heat treatment furnaces, and melting furnaces.



Environment-friendly regenerative burner system

# Total Solutions for Creating the Better Environment

Is it possible to recycle municipal and industrial wastes for use as valuable raw materials? Is it possible to thoroughly reduce the environmental influence of recycling? Is there a way to protect the sea and rivers from pollution and eutrophication? Is it possible to make greater use of clean energy? JFE has developed the technologies and know-how for integrated answers to the various questions encompassing the global and local environments. JFE continues to develop new environmental and energy businesses with new ideas, cooperating with industry, government and academic sectors via networks with the wider society, and mobilizing accumulated technologies and know-how. JFE provides total solutions to protect the environment.



## Eco-Town

### Contributions to Environment-friendly Urban Development

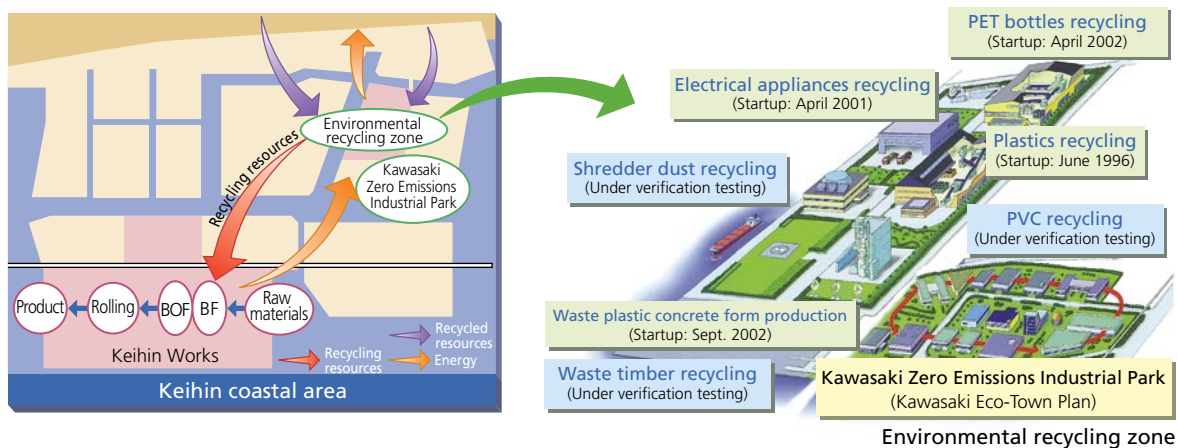
Representative examples of JFE's environmental solutions is its participation in the Eco-Town Plans in the cities as follows.

- Keihin Coastal Area Environmental City Concept and Revitalization (Kawasaki Eco-Town)
- Soga Coastal Ecology Park Concept (Chiba Eco-Town)
- Hiroshima Bingo Eco-Town Concept

**Eco-Town Plan :** The Eco-Town Plan is a project to realize the Zero Emissions Concept by using wastes generated from one industry as raw materials for another aiming at environment-friendly urban planning which goes beyond existing framework. The Plan was started in 1997 by the then Ministry of International Trade and Industry, and the Ministry of Health and Welfare.

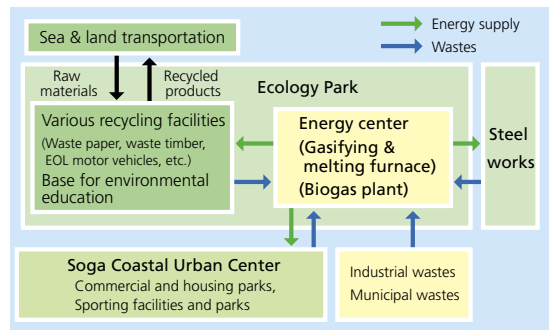
### Keihin Coastal Area Environmental City Concept and Revitalization (Kawasaki Eco-Town)

The Keihin Coastal Area first received the Eco-Town status in 1997. The City of Kawasaki developed the Environmental City Concept aiming at making this area's and its industry more environment-friendly. This concept divides the Keihin Coastal Area into three zones for revitalizing the area. The first zone is in proximity to residential and commercial areas, and is to be utilized as a base for research and development activities. The second zone is to be a field for cultivating new environment-friendly industries based on the environmental network of existing industries. The third zone is to be a base for steel, energy, logistics, and other basic industries. In cooperation with the City, JFE has been participating in this plan since its concept-forming stage, and proposed new ideas based on its expertise in the field of the environment and energy. The waste plastics and electrical appliances recycling businesses JFE has started in this area are part of its endeavors to revitalize the Keihin Coastal Area.



### Soga Coastal Ecology Park Concept (Chiba Eco-Town)

Chiba Prefecture is promoting the zero emissions concept, and has designated the central and western region of the prefecture as Eco-Town. The Soga Coastal Ecology Park is located near the center of the region. This area is scheduled to be a base for facilities for recycling waste paper, waste timber, and end-of-life motor vehicles. It is also used as a base for environmental education. One of the core facilities in the area is a Thermoselect-type waste gasifying & melting system. Gas extracted from wastes with this system is used as an energy source in a steel plant, reducing the amount of fossil fuels required. A highly efficient Bigadan-type biogas plant will also be installed in the park for the conversion of organic wastes into energy.

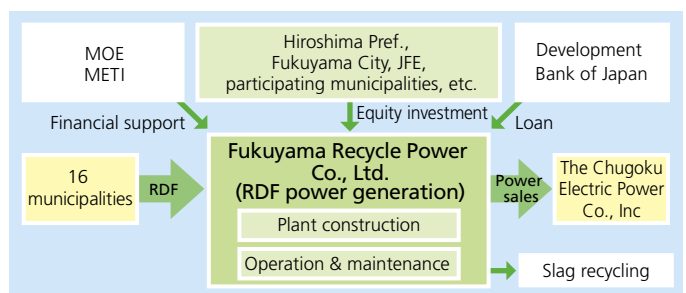


Concept of Soga Coastal Ecology Park

### Hiroshima Bingo Eco-Town Concept

The Bingo Area of Hiroshima Prefecture received the Eco-Town status in 2000, where the Fukuyama Waste Recycling Power Generation Project is expected to begin operation in 2004. This project involves melting the RDF produced from municipal wastes collected from 16 municipalities in Hiroshima Prefecture, and using its heat for power generation. JFE will construct the gasifying & melting furnace that allows high-efficiency power generation. It also will be responsible for operation of the facility. Thus, JFE will be in charge of the core management of this project while playing a major technical role.

As a corporate group that has one of its works in the Bingo Eco-Town, JFE will contribute to the formation of a recycling-oriented society in cooperation with local communities.



Scheme of Fukuyama Waste Recycling Power Generation Project

# Total Solutions for Creating the Better Environment

## Recycling Operations

With increasing awareness of the global environment, comes the legal infrastructure necessary for the development of a recycling-oriented society. Within this framework, comes the need to ensure a smooth process of recycling of resources. JFE has a wide range of unique recycling technologies at hand, and is proceeding with sophisticated recycling operations employing these technologies.

### Use of Waste Plastics as Blast Furnace Feed

JFE is currently recycling more than 100,000 tons/year of waste plastics as blast furnace feed. This technology is the core of waste plastics recycling, and has the following characteristics.

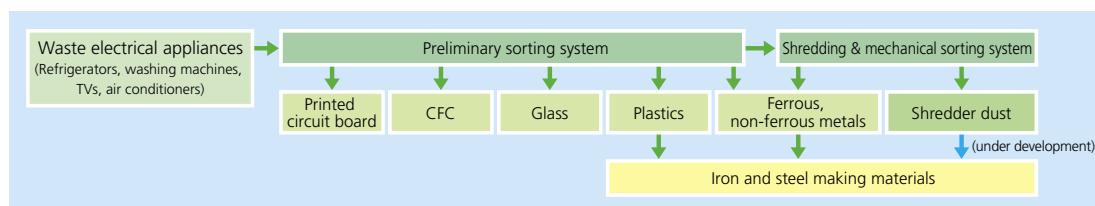
- Up to 600,000 tons/year can be processed by one blast furnace.
- A resource (energy) usage efficiency of 80% is achieved.
- CO<sub>2</sub> emissions are reduced by 30% in comparison with all-coke BF operation.



Waste plastics BF feeding system

### Waste Electrical Appliances Recycling

The Electrical Appliances Recycling Law is now fully implemented, requiring recycling of refrigerators, washing machines, TVs, and air conditioners. JFE has invested in electrical appliance recycling operations at its steelworks, effectively using it as part of the regional infrastructure. These operations involve the efficient dismantling of such appliances and the recovery of metals and plastics. The majority of recovered materials are recycled in its own iron and steel making operations.



Waste electrical appliances recycling system

### Waste Gasifying & Melting Recycling

The Chiba Recycling Center located at the Chiba Steelworks employs a Thermoselect-type waste gasifying & melting system for the complete recycling of industrial wastes transported from the surrounding region. The facility also recycles plastics designated under the Containers and Packaging Recycling Law to produce fuel gas for the steelworks.



Chiba Recycling Center

### Refuse Derived Fuel (RDF) Recycling

The RMJ method developed by Japan Recycling Management is ideal for producing RDF from Japanese refuse with its characteristically high moisture content. This unique technology is used for producing RDF from sorted combustible refuse in recycling programs undertaken at the request of the local municipalities of Haibara Town in Nara Prefecture and Nogi Town in Tochigi Prefecture.



Nogi Recycling Center



## Manufacture of Concrete Form Board (NF Board) from Recycled Plastics

In addition to chemical recycling primarily by using blast furnaces, JFE is also working on materials recycling. The scale of operations was expanded to a commercial level in 2002. The use of waste plastics as a substitute for plywood in producing concrete forms reduces CO<sub>2</sub> emissions and protects tropical forest resources. Used NF boards are recovered and employed as iron making material, thus contributing to zero emissions.

## Recycling of Used PET Bottles

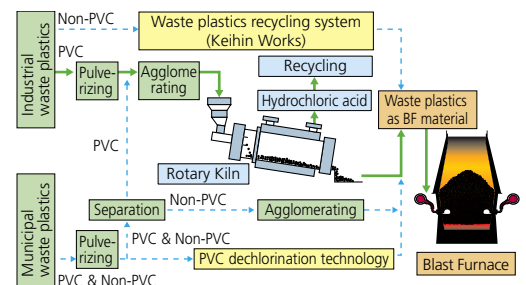
The JFE Group runs a used PET bottles recycling operation in the Keihin district. This operation recycles used PET bottles selectively collected by local municipalities into PET flakes. The flakes are then sold to manufacturers of PET sheet (used in egg packs, etc.), and polyester fiber. Labels and caps are used as iron making material, thus contributing to zero emissions.



Used PET bottles recycling plant

## Vinyl Chloride Dechlorination System

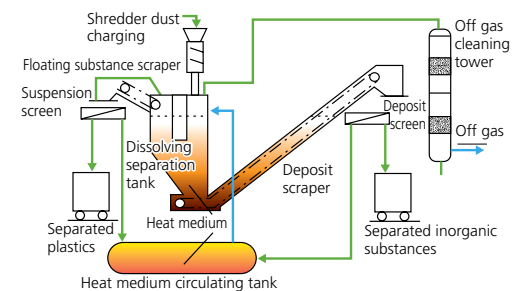
For further promoting the recycling of used plastics, it is important to properly treat vinyl chloride, amounting to approximately 15% of the total. JFE has developed technology for separating vinyl chloride from waste plastics and for separating chlorine from vinyl chloride products, to enable their use as blast furnace feed. The separated chlorine and hydrochloric acid are recovered and recycled.



Recycling waste plastics as BF material using PVC dechlorination system

## Shredder Dust Treatment System

Shredder dust is produced during processing of end-of-life motor vehicles and electrical appliances. It is a complex mixture of metals, plastics, fibers, glass, dirt, and sand. This complexity has conventionally precluded its recycling, so that approximately 1,200,000 tons/year was disposed of by landfilling. JFE has developed a shredder dust treatment system. The method involves placing the shredder dust in the tar bath heated to a specific temperature to allow efficient separation of plastics and metals, and their subsequent use as recycled materials. Use of the system is expected to dramatically improve the recycling rate for motor vehicles and electrical appliances.



Shredder dust treatment system

## Primary Recycling Operations by JFE

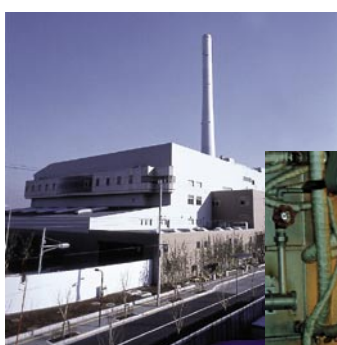
Operation	Started in	Scale
Industrial waste plastics BF feeding	Oct. 1996	50,000 tons/year
Industrial waste gasifying & melting recycling	April 2000	50,000 tons/year
Waste plastic containers and packaging BF feeding	April 2000	120,000 tons/year
Waste plastic containers and packaging sorting and compressing (1) Nagoya City	Aug. 2000	60,000 tons/year
(2) Sendai City	Dec. 2000	20,000 tons/year
RDF recycling (1) Haibara Town, Nara Pref.	Nov. 2000	2,500 tons/year
(2) Nogi Town, Tochigi Pref.	Dec. 2002	5,500 tons/year
End-of-life electrical appliances recycling	April 2001	800,000 units/year
Waste plastic containers and packaging gasifying	April 2001	30,000 tons/year
Waste PET bottles recycling	April 2002	10,000 tons/year
Manufacture of concrete form board from recycled plastics	Sept. 2002	(approx. 200 million bottles) 2 million boards/year

# Environmental Engineering

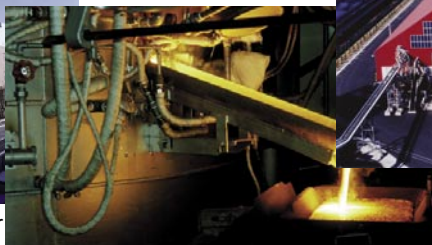
## Waste Treatment

JFE is engaged in the development of next-generation waste treatment technologies such as a stoker incinerator incorporating fuzzy combustion control, fluidized bed incinerator with sophisticated combustion technology, high-temperature gasifying & melting furnace, and Thermostelect-type waste gasifying & melting facility. Electrical resistance type and plasma type ash melting furnaces permit the production of clean slag free of metals from incinerator ash. This slag is used in a variety of applications such as roadbed material, tiles, and acoustic insulation. JFE is also engaged in the development of technologies for producing RDF from combustible materials selected from wastes to provide new and effective methods of using wastes.

Products developed by JFE are subjected to LCA evaluation for establishing systems to reduce the influence on the global environment throughout their life cycle. JFE covers all processes from waste incineration to melting, and meets the sophisticated environmental requirements such as to minimize secondary pollution.



Stoker incinerator



Electrical resistance type ash melting furnace



Thermostelect



High-temperature gasifying & melting furnace

## Recycling

JFE is engaged in the development of technologies for sorting wastes in response to the ever-increasing volume of recycling legislation. The advanced wastes sorting and recycling system is designed for use at facilities such as recycling plazas, and are able to sort steel cans, aluminum cans, glass bottles, and plastic bottles by color and material fully automatically and at high-speed. JFE's other systems such as biogas power generation and rapid composting systems, contribute significantly to the promotion of materials recycling.

## Demolition of Waste Incineration Facilities

Demolition of waste incineration facilities which have reached the end of their useful life, without affecting the local environment, and while maintaining safety of the personnel involved, is becoming an important requirement for industry. JFE has constructed more than 100 incineration facilities, and also has considerable experience in upgrading and expanding these facilities. Some of these operations involved demolition works, which were carried out under strict on-site management with utmost care for maintaining safe working conditions. For undertaking demolition works, dioxin levels are measured and evaluated in advance, pollutants are removed, working areas are sealed, and dust is collected. Demolition wastes are made harmless by heating (On-site Dio-buster, Hi-clean DX). Further, the integrated environmental management system covering all steps to final disposal of wastes has been developed by JFE to reduce environmental influence in total throughout demolition works (APOLLO System). Kawatetsu Machinery, a company in the JFE Group, has developed a completely flameless method of demolition, and is the first to use this technology in Japan for demolition of incinerators.



Wastes sorting and recycling system



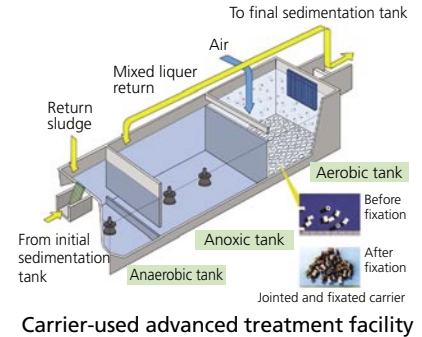
High-pressure water cleaning and removal of deposits



On-site Dio-buster

## Protecting the Water Environment

JFE contributes to the creation of a better water environment through its comprehensive engineering operations. It covers everything from installation of water supply piping to its operation and management, water purification facilities, sewerage treatment facilities, facilities for treatment of night soil and seepage water, facilities for treatment of livestock waste, and plant for fermentation of food product residue to produce methane gas. JFE is engaged in purification of polluted water, and prevention of pollution in rivers, closed water bodies such as lakes, and sea areas through providing water treatment facilities using a variety of methods, both physiochemical and biological, to suit local conditions. The most recent biotechnology using microorganisms and leading-edge membrane separation technology are employed in purification of drinking water and sewerage, both closely related with daily life. Sludge produced through sewerage treatment is fermented to produce methane fuel, phosphates in the sludge are recovered, and melted slag is processed for use as construction materials.



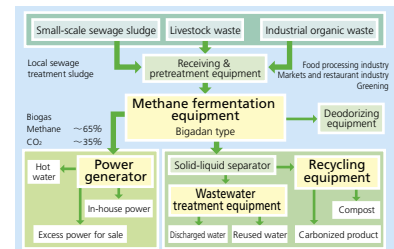
High-load membrane night soil treatment facility



Sewage sludge methane fermentation facility

## Treatment of Organic Waste Products

The Bigadan-type biogas system mixes a livestock waste slurry, organic industrial wastes, and sludge from local sewerage treatment for generating methane gas, electric power, and fertilizer, thus contributing to protection of the environment.



## Protecting the Soil Environment

Contamination of the soil and underground water resources is becoming serious at various locations, and measures to deal with these problems are assuming increasing urgency. JFE is able to provide comprehensive solutions for protection of the soil environment covering everything from surveys, analysis, and evaluation, to proposals of solutions such as water washing & classifying soil remediation and monitoring. JFE is also developing and supplying new and unique steel-based soil remediation agents, for example, iron powder that decomposes volatile organic compounds in the soil.



Water washing & classifying soil remediation system

## Environment-friendly High-efficiency Arc Furnace

JFE has more than 30 years of experience in engineering as related to electric furnaces, and has developed ECOARC technology to allow melting steel scrap at a power consumption half that of conventional furnaces. This innovative energy conservation technology is a significant contribution to steel recycling.



ECOARC

# Energy Engineering

## Next-generation Clean Energy

### Clean Energy for the 21st Century - DME

DME provides for a fuel with the complete absence of sulfur oxides and soot associated with its combustion. The low toxicity and ease of handling of DME are expected to result in widespread use as a practical energy source for the future in such applications as a clean fuel for power generation, as a soot-free fuel for diesel vehicles, and as a substitute for LPG. JFE began the world's first large-scale bench plant (5 tons/day) trial, succeeding in the direct synthesis of DME from coalmine gas in October 1999. This research has established the possibility of large-scale and economical synthesis of DME, thus providing an impetus for practical implementation of the process. Based on these results, DME Development Co., Ltd. has been established and is currently engaged in work on a pilot plant capable of producing 100 tons/day. Activities are currently underway for the purposes of early commercialization of this clean energy source, including the establishment of DME International Corporation for performing commercialization feasibility studies. As part of an effort to increase the use of DME fuel, and to promote the development of DME-fueled motor vehicles, the first DME trial vehicle in Japan was certified in February 2002, and trial operation on public roads commenced. JFE believes that DME will make a significant contribution to resolution of the resource and energy problems of the 21st century.



DME synthesis plant (5 t/d)  
(The project supported by METI)



DME vehicle started public road tests

### High-efficiency Fuel Cell Power Generation - SOFC

In cooperation with Siemens Westinghouse Power Corporation (SWPC), JFE is engaged in commercialization of, and market development for, the Solid Oxide Fuel Cell (SOFC) systems. These systems are able to generate electricity at high efficiencies of 50% or more at an output of 250 kW, and 60% or more at outputs of several MW, and as such is the subject of much attention as a distributed power source able to improve the global environment. JFE is engaged in aggressive programs of development and proliferation of fuel cell power generation. As part of the programs, in 2001 it cooperated with Fuel Cell Technologies Ltd. of Canada in the commercialization of small-scale systems of up to 50 kW output for residential and small business use. SOFCs can perform internal reforming to allow the use of a wide variety of fuels, and research for fuel diversification is currently underway including the use of DME, biogas and digester gas, etc.



5kW SOFC system

### Wind Power Generation

Wind power generation is the focus of attention as clean energy, and has recently begun to be introduced with considerable vigor. JFE handles wind power generation systems developed by Lagerwey Windturbine BV of the Netherlands using variable speed, gear-less systems and synchronous generators, and provides comprehensive engineering services from selection of wind power generator sites to construction and after-sale service. Orders have been received for a total of 116 units to date, most of which are of 750 kW capacity. As of the end of March 2002, these JFE wind power generation systems cumulatively provide 84,000 kW of power, an output second to none in Japan. A technology transfer agreement was signed with Lagerwey in September 2001, and wind power generation systems suited to Japanese conditions will be manufactured. JFE intends to be a clean power producer itself, and has participated in a 21,000 kW wind power generation project in Horonobe Town in northern Hokkaido, and a 14,000 kW project in Aoyama Kogen, a particularly windy plateau west of Tsu City in Mie Prefecture.



Wind power plant

**DME:** DME is safe and clean, and presents no problems related to the greenhouse effect or depletion of the ozone layer. Its combustion produces no SOx or soot, and minimal NOx emissions. It is easily liquefied and may therefore be stored and transported in the same manner as LPG.

## Environment-friendly Energy Use

Progress in the effective use of energy, and use of energy with minimal environmental influence, are important issues in view of the global environment. JFE is contributing to the reduction of CO<sub>2</sub> emissions and the prevention of global warming through technologies for highly efficient energy use and energy conservation.

In addition to wind power generation, JFE is promoting engineering businesses on using other forms of clean and natural energy such as natural gas and geothermal energy.

Technology	Description	
Gas engine co-generation	By using a gas engine and its exhaust heat, energy is used in both forms of heat and electricity.	
District heating and cooling (DHC) by sewage heat	Unused heat contained in sewage is recovered by heat pumps and used for DHC.	
High-density cooling medium (*1)	By using cooling medium that can retain cold heat with high density, the size of a cooling medium storage system is made smaller, and power consumption is reduced. This technology is applicable to air conditioning systems, and district heating and cooling systems.	
Improvement of ship's propulsion efficiency	NOPS	The propeller shaft is slightly off the ship's centerline to improve propulsion performance
	SURF-BULB	A pair of fins and a bulb are fitted to the rudder to improve propulsion performance by utilizing the propeller slipstream.
	AX-BOW	The bow above the waterline is sharpened like an ax to reduce wave added resistance.
Natural gas related technology	LNG carriers, LNG storage tanks, LNG pipelines	
Use of natural energy	Wind power generation, geothermal power generation	



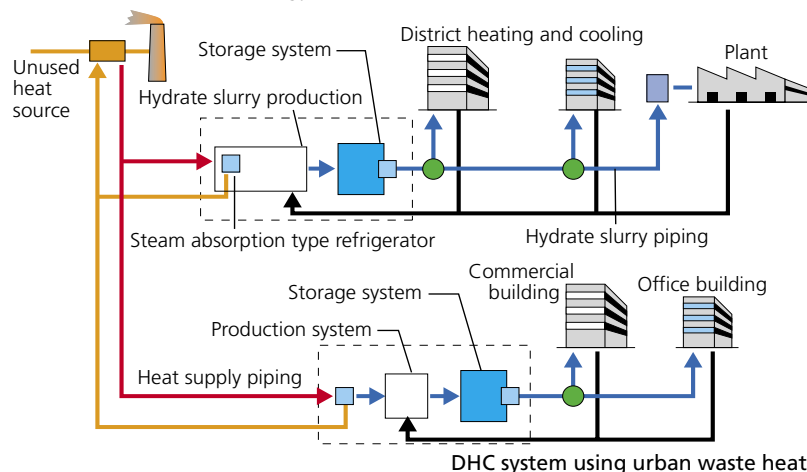
DHC system utilizing waste heat in sewage



Energy efficient off-center propeller system

### Clathrate Hydrate Slurry (CHS) for Air Conditioning System (\*1)

CHS is a new cooling medium first developed by JFE as a substitute for cold water. Trial calculations indicate that the air conditioning system using this new medium can reduce energy consumption by approximately 50% in comparison with conventional ones that use cold water. It is expected that this technology for conserving energy and reducing CO<sub>2</sub> emissions from household appliances will make significant contributions. Hydrate slurry is two-phase fluid comprised of fine particles of clathrate hydrate and its aqueous solution, and holds latent heat over the same temperature range (5 - 12°C) as cold water used for air conditioning. CHS can be transported directly to the terminal air conditioning equipment through pipelines. It has a thermal density of more than double that of cold water, consequently requiring half or less the pumped flow rate, reducing pumping power requirements by up to 80%, and allowing a reduction in the size of cooling medium storage tanks by up to 50%. CHS is produced by refrigerators using unused heat source of industrial waste heat, etc. This research and development work is a joint project between JFE and NEDO for the rational use of energy.



# Environmental Accounting

JFE has been engaged in a variety of innovative, industry-leading environmental measures, including prevention of air pollution, water pollution, and noise, and treatment of wastes, and forestation. JFE has expended considerable efforts in energy-related investment in order to conserve energy, a vital resource of the Earth, and to reach the world's highest level of energy efficiency.

JFE's current environmental activities have been developed in line with its mission to establish high-quality industrial and social infrastructures as a business enterprise. In the background of the current expenses on environmental measures, there is an accumulation of the massive amounts of investment made in the past, and the burden of maintaining this investment is considerable. When evaluating annual costs and performance, it is important to consider these efforts made in the past, and the results obtained.

JFE is trying to quantitatively evaluate its environmental activities in view of corporate management based on environment-related data. This current environmental report incorporates information on investment and expenses in an effort to ensure that these details are understood.

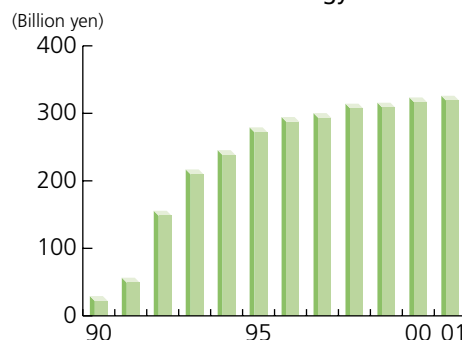
## Investment in Energy Conservation

JFE has been engaged in an aggressive policy of energy conservation since the first oil crisis of 1973.

A variety of large-scale waste heat recovery equipment has been developed and introduced since the second oil crisis, with considerable investment for energy-saving production processes such as continuous annealing and continuous casting. These efforts have resulted in a world's top level of efficiency in energy usage.

Cumulative investment in energy conservation since 1990 amounts to approximately 330 billion yen.

Cumulative investment in energy conservation

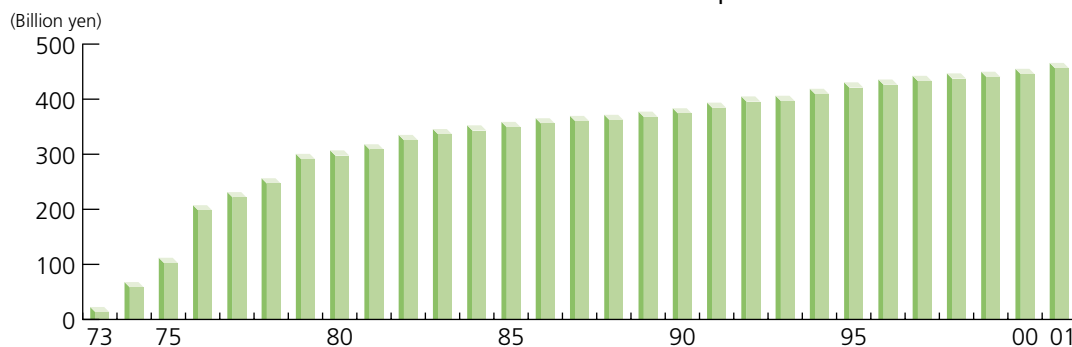


## Investment in Environmental Protection

Due to the location of JFE's steelworks in close proximity to major urban areas, particular efforts have been expended in environmental protection. Various facilities have been installed: e.g., desulfurization and denitrification facilities to deal with atmospheric SOx and NOx, and water treatment facilities to reduce COD and deal with water pollution. A cumulative total of approximately 470 billion yen has been invested throughout the company in environment-related facilities since 1973, resulting in a world's top level of cleanliness in its steelworks.

To further promote the establishment of a recycling-oriented society, JFE has recently began an aggressive program of investment for the effective conversion of by-products from the iron and steel making process for use as resources, and recycling them through the iron and steel making process.

Cumulative investment in environmental protection



## Environmental Accounting at JFE

		Major item	Investment (billion yen)	Expenses (billion yen)
Environmental investment & expenses related to the JFE's own business	Management	Monitoring & measurement of environmental influence, EMS-related activities, environmental education & training, etc.	0.1	0.9
	Prevention of global warming	Energy conservation, effective use of energy, etc.	4.8	14.0
	Effective use of resources	Recirculation of industrial water, Recycling of by-products & wastes generated in-house, waste management, etc.	0.7	17.3
	Environmental protection	Prevention of air pollution, water pollution, soil contamination, noise, vibration, ground subsidence, etc.	11.2	30.2
	Miscellaneous	Fees, charges, etc.		2.2
Environmental investment & expenses related to customers and society	Research & development	Technological development for the environment, energy, prevention of global warming		4.2
	Social activities	Protection of the nature, support to forestation, information disclosure, advertisement, etc.		0.4
Total			16.8	69.2

- \* Scope: Investment and expenses for JFE steelworks, and research and development investment and expenses for the entire company.
- \* Period: April 2001 to March 2002
- \* Prevention of global warming: Investment and expenses the major purposes of which were other than environmental protection and energy conservation were excluded. For example, when the major purpose was renewal of obsolete equipment, such investment and expenses were excluded, even if they resulted in overall energy conservation.
- \* Benefits based on estimates and risk avoidance benefits are not included in calculation.

### 2001 Totals

Investment in environment-related facilities was 16.8 billion yen, which accounted for approximately 16% of the total capital investment of the year. Expenses were 69.2 billion yen. The primary focus of investment was environmental protection and prevention of global warming. Primary expenses were for environmental protection, effective use of resources, and prevention of global warming. The majority of these expenses were for operation and maintenance, and depreciation.

Environment-related research and development expenses amounted to 4.2 billion yen, approximately 13% of total research and development expenses. Activities in 2001 have achieved a recycling rate of 99.5%, and energy conservation benefits amount to 2.5 billion yen.

### Future Challenges


The purpose of environmental accounting is to monitor and evaluate the status of environmental activities in a quantitative manner as much as possible. In accordance with this purpose, continuous review of item classifications and scope of data collection, etc. will be conducted for further refinement in methodologies of environmental accounting, including the following.

- Verification and clarification of the criteria for determining what investment and expenses are to be increased or decreased.
- Investigation of the methodology for LCA, reflecting the progress made in upstream and downstream industries.
- Further investigations of the methodology for quantifying benefits.

# Transition of Environmental Measures

	1967	-	1970	1971	1972	1973	1974	1975	-	1987	1988	1989	1990	1991	1992	1993	1994	1995	
J F E	<p>'70 Pollution Prevention Agreement with Kanagawa Pref., Kawasaki City, and Yokohama City '71 Pollution Prevention Agreement with Hiroshima Pref., and Fukuyama City '71 Pollution Prevention Agreement with Okayama Pref., and Kurashiki City '74 Pollution Prevention Agreement with Chiba Pref., and Chiba City '92 Settlement of suit on Chiba</p> <p>'70 Establishment of the company-wide Environmental Management Committee '71 Establishment of Environmental Management Dept.</p> <p>'91 Establishment of the Coordinating '93 Establishment of Global '93 Establishment of</p> <p>'73-'78 The 1st period of energy conservation (Energy conservation through operational improvement '79-'85 The 2nd period of energy conservation (Introduction of large-scale '86-'94 The 3rd period of energy conservation (Further energy-conserving '95- The 4th</p>																		
Japan	<p>'67 Implementation of Basic Pollution Control Law '70 Revision of Basic Pollution Control Law '70 Implementation of 14 pollution-related laws '71 Establishment of Environment Agency '79 Establishment of Energy Conservation Law '90 Establishment of Action Plan for Preventing Global '91 Establishment of Global Environmental '93 Implementation of Basic '94 Establishment of</p>																		
World	<p>'72 United Nations Conference on the Human Environment: Adoption of Stockholm Declaration '87 Brundtland Commission: Proposal of the concept of Sustainable Development '88 Establishment of IPCC (Intergovernmental Panel on Climate Change) '89 Adoption of Basel Convention '92 Adoption of United Nations '92 Earth Summit in Rio de Janeiro '95 Publication</p>																		



1996	1997	1998	1999	2000	2001	2002
'96 Settlement of suit on Kawasaki pollution '96 Settlement of suit on Kurashiki pollution			'99 Publication of the first environmental report		'01 Establishment of Environment & Energy Liaison Center	
Works No. 6 BF						
	'97 Keihin Steelworks ISO14001 certification '97 Mizushima Steelworks and Utsunomiya LSI Plant ISO14001 certification					
	'98 Fukuyama Steelworks ISO14001 certification '98 Chiba Steelworks ISO14001 certification					
Committee for Global Environmental Issues Environmental Dept.			'99 Engineering Division ISO14001 certification '99 Chita Works ISO14001 certification			
Guideline and Program Principle for Activities for Global Environmental Protection '96 Establishment of Environmental Charter						
such as reduction of fuel consumption by heating furnaces) waste heat recovery equipment, electric power saving) operational improvements, conversion to low-cost fuels) period of energy conservation (Energy conservation to prevent global warming)				'00 Startup of Thermoselect-type gasifying & melting facility		
'96 Startup of waste plastics BF feeding					'01 Completion of waste electrical appliances recycling plant	
Warming Charter by Federation of Economic Organizations Environment Law Basic Environment Plan					'01 Start of Ministry of the Environment '01 Start of PRTR system '01 Implementation of Law Concerning Special Measures against Waste PCB	
'96 Establishment of Voluntary Action Plan by Japan Iron & Steel Federation					'02 Ratification of Kyoto Protocol '02 Implementation of Law Concerning Measures against Soil Pollution	
		'98 Implementation of Law for Promoting Measures against Global Warming '98 Revision of Energy Conservation Law	'99 Implementation of PRTR Law '99 Implementation of Law Concerning Special Measures against Dioxins	'00 Implementation & revision of 6 laws related to the establishment of recycling-oriented society		
of the 2nd IPCC evaluation report '96 Implementation of ISO 14001 '97 COP3 in Kyoto					'01 Adoption of POPs Convention '02 Earth Summit in Johannesburg	
Framework Convention on Climate Change Adoption of Agenda 21						

# Environmental Businesses of Group Companies

The JFE Group encompasses approximately 50 companies covering a range of operations including environmental surveys and measurement, support for ISO 14001 certification, waste management and recycling, environmental plants, and soil remediation. All operations are designed to contribute to the improvement of the environment, and as such provide integrated solutions covering planning and proposals, implementation, and subsequent operation and maintenance.

Field	Company	Business
Environmental surveys, analysis, and consultation	NK NET CORPORATION	Consultation on development of environmental management systems; ISO-based environmental training; seminars for in-house environmental monitoring personnel; internal environmental auditing.
	Kawasaki Steel Techno-Research Corporation	Environmental and energy-related measurement, surveys, and analysis (dioxins, endocrine disrupters, agricultural chemicals, air pollutants, sick-house substances, soil surveys, energy-saving diagnosis); consultation on development of environmental management systems, and environmental technologies; environmental information collection and surveys.
	KOKAN MINING COMPANY, LTD.	Soil and underground water pollution surveys and cleanup work; geothermal water surveys and development; asphalt and concrete recycling; production and sale of environment-friendly products (slag sand, magnesium hydrate, etc.).
	Kokan Keisoku K.K.	Environmental and energy-related measurement, surveys, and analysis (dioxins, endocrine disrupters, agricultural chemicals, air pollutants, sick-house substances, etc.); soil surveys and analysis; energy-saving diagnosis; power peak shaving systems; environmental assessment; consigned development and testing; manufacture and operation of experimental devices; consultation related to these activities.
	NK Techno Service Co., Ltd.	Surveys on environmental technologies; overseas environmental surveys; energy surveys and analysis; consultation on environmental ISO certification; consigned life cycle assessment; consultation on environmental labeling and green procurement.
Waste treatment and recycling	NK KANKYO CORPORATION	Waste treatment and recycling (waste plastics, wastewater and sludge, waste construction materials, fluorescent lamps, batteries, etc.), collection and transportation of wastes, environmental measurement and analysis, environmental measurement certificates, consultation on waste treatment and recycling.
	NKK MARINE & LOGISTICS CORPORATION	Marine transportation of waste plastics, industrial wastes, and waste construction soil; collection of toner cartridges and fluorescent lamps; transportation of industrial wastes; removal and transportation for recycling of business automation devices.
	Kawatetsu Mining Co., Ltd.	Recycling of iron and steel making slag (granulated slag, hard slag, BF slag powder); technological development for effective use of slag; development of high-value-added slag products (SCP method for improving soil quality by slag piling, solid slag blocks for marine construction); recycling business (recycling of waste concrete into concrete aggregate, recycling of molding sand).
	Kawatetsu Life Corporation	Recycling business (production and recycling of asphalt concrete); collection and transportation of industrial wastes; designing, installation, sale, and maintenance of building and industrial air conditioner filter.
	Korei Kiko KK	Cleanup and recovery of dust, sludge, wastewater, etc. in various plants (iron and steel making, electric furnace, petroleum, chemical, paper making, etc.); collection and transportation of industrial wastes.
	Japan Recycling Corporation.	Industrial waste treatment; recycling of waste containers and packaging; sale of by-products from waste treatment; operation and maintenance of municipal and industrial waste treatment facilities.
Environmental plant and equipment	NKK S-Tech K.K.	Manufacture, installation, and maintenance of waste treatment and water treatment equipment, operation and maintenance of waste incinerators.
	NKK PRECISION CO., LTD.	Manufacture, installation, and maintenance of water treatment and waste treatment equipment.
	NKK DESIGN & ENGINEERING CORPORATION	Designing of waste treatment equipment; development of planning and operation management support systems for environmental equipment; designing of environmental protection systems related to combustion exhaust gas; development, designing, and manufacture of VOC treatment systems for responding PRTR; development support for production and use systems related to environment-friendly fuels (DME, hydrogen, palm ester, etc.); energy-saving consultation by equipment diagnosis.
	NK TECHNOS K.K.	Manufacture, installation, and maintenance of water treatment and waste treatment equipment; experimental fabrication and testing related to research and development (DME diesel engine, countermeasures for dioxins, etc.).
	NKK TRADING INC.	Overall sales of environmental plants, equipment, commodities, and services.
	NKK PLANT ENGINEERING CORPORATION	Construction, modification, and maintenance of waste treatment and water treatment equipment.
	Kawasyo Gecoss Corporation	Development of environment-friendly new construction methods; GSS method for recycling soil generated from soil-cement continuous wall construction.
	Kawatetsu Advantech Co., Ltd.	Manufacture and sale of measuring instruments for waste treatment facilities, sewage system, and waterworks (industrial weighing scale, measuring devices of water level, quality, flow rate, etc.).
Kawatetsu Environmental Plant Service Corporation	Operation and maintenance of municipal and industrial waste treatment equipment, and water treatment equipment.	

Field	Company	Business
Environmental plant and equipment	Kawatetsu Electric Engineering Co., Ltd.	Designing, installation, and maintenance of electrical systems and instrumentation of waste treatment facilities; designing and manufacture of photovoltaic power generation systems.
	Kawatetsu Machinery Co., Ltd.	Designing, manufacture, installation, and overall maintenance of environmental equipment; manufacture and sale of small-scale incinerator for suppressing dioxin emissions; dismantling of incinerators.
	KOKAN DENSETSU KOGYO K.K.	Designing and installation of electrical systems and instrumentation of various plants such as water treatment plants and incinerators.
	Tohoku Dock Tekko K.K.	Design, manufacture, installation, and maintenance of waste treatment equipment (incinerators, recycling centers, etc.).
	NKK Environmental Service Co., Ltd.	Contract operation of environment-related plants such as waste treatment and water treatment equipment.
	Nippon Kokan Koji Coporation	Prevention of soil contamination; restoration of contaminated soil; installation of various water treatment equipment; manufacture of raw garbage treatment plants; environment-friendly construction method (no-trenching method).
	NIPPON KOKAN PIPE FITTING MFG. CO., LTD.	Designing, manufacture, and installation of molding sand recycling equipment (energy-saving fluidized calcination furnace, etc.).
	Nippon Chuzo K.K.	Manufacture and sale of heat and wear resistant castings (grate, etc.) for waste incinerators; molding sand recycling equipment.
	Recycling Management Japan, Inc.	Consigned municipal and industrial waste treatment; operation and maintenance of waste treatment facilities; production and sale of RDF and compost; designing, manufacture, and sale of production facilities for RDF and compost fuel.
	Mizushima Green & Clean Service Corporation	Operation and maintenance of industrial waste treatment equipment.
General environmental protection	NK GS Corporation	Collection and transportation of municipal and industrial wastes; operation and maintenance of waste incinerating plants and auxiliary equipment; landscape planting; environmental measurement and measurement certificates; environmental surveys, evaluation, and consultation.
	Kawasho Corporation	Overseas forestation
	Kawatetsu Transportation & Technology Co., Ltd.	Environmental cleanup (high-pressure water washing (cutting, peeling) of machinery and containers; industrial washing and cleanup); collection, transportation, and intermediate treatment of industrial wastes; construction, operation, maintenance, dismantling, and washing of environmental equipment.
	Keiyo City Service Corporation	Designing and construction of gardens and civil works; maintenance of gardens and planted areas; consultation on environmental greening; green plant leasing; washing of waste collection containers; washing and leasing of restaurant kitchen filter.
	Kobekigyo Co., Ltd.	Designing and construction of gardens and civil works; maintenance of gardens and planted areas; consultation on environmental greening; green plant leasing.
	Fukuyama Steel Technology Corporation	Collection and transportation of municipal wastes.
	Fukuyama Techno Research	Recycling of used power cables; landscape planting; environment- and energy-related measurement; energy-saving diagnosis; consultation on environmental ISO and energy saving.
	South Aichi Town Service Co., Ltd.	Designing and construction of gardens and civil works; maintenance of gardens and planted areas; consultation on environmental greening; green plant leasing; recycling of vending machines.
	MENTEC KIKO CORPORATION	Recycling of containers and packaging (glass bottles, PET bottles, plastic and paper containers, etc.); designing, manufacture, installation, and maintenance of waste treatment and water treatment equipment.
Environment -friendly products	ADCHEMCO Corporation	Plastic recycling; gas refining; by-products recovery (ammonium sulfate, liquid ammonia, gypsum); CO <sub>2</sub> recovery and reuse (dry ice, etc.); water treatment chemicals (caustic soda, sulfuric acid, iron sulfide, hydrated lime, etc.)
	Kawasaki Steel Metal Products & Engineering, Inc.	Development of highly functional architectural and civil engineering products with low environmental loads; environment-friendly construction materials (sound barrier and guardrail using photocatalyst).
	Kawatetsu Galvanizing Co., Ltd.	Development of new applications for coated steel sheets with low environmental loads; production of environment-friendly steel products (raindrop-stain resistant prepainted steel sheet for roofing, siding, and sound insulating, heat insulating prepainted steel sheet, acid resistant prepainted steel sheet)
	Kawasaki Steel Civil Engineering & Construction Corporation.	Environment-friendly construction method (steep slope road widening method: Metal Road).
	Kawasaki Steel Roofing Technologies Co., Ltd.	Environment-friendly construction materials (production and installation of metal roofing and walling materials).
	Kawatetsu Rockfiber Corporation	Production of rock wool and its products from BF slag (heat-resistant materials, thermal insulation, and sound-absorbing materials for energy saving and better housing environment).
	KOKAN DRUM CO., LTD.	Manufacture of returnable drums (ECODRUMS), drum recycling, manufacture and sale of compressed natural gas cylinders for natural gas vehicles.
	Chiba Riverment and Cement Corporation	Production of slag powder as mixed cement material, BF cement designated by the Green Procurement Law, and Eco-Mark product (Riverment).
	Mizushima Riverment Corporation	Production of slag powder as mixed cement material, and BF cement designated by the Green Procurement Law.

# External Evaluation of JFE's Activities

## External Awards Received

(since 1998)

### National Invention Award

2002 Invention Award	Invention of high-strength, high-formability titanium alloy with low-temperature super-plasticity
2000 Japan Federation of Economic Organizations Chairman's Invention Award	Environment-friendly regenerative low-NOx combustion technology
1999 Invention Award	Development of high efficiency, multi-size rolling technology for high dimensional accuracy wire rod material and steel bars
1998 Japan Institute of Invention & Innovation Chairman's Award	Industrial production technology for 6.5%-silicon steel sheet by continuous CVD

### Okochi Prize

2001 Memorial Technology Award	3-channel polarized light surface inspection equipment (Delta-Eye)
2000 Memorial Production Award	Development of world's first endless hot strip rolling process and commercialization of new products
Memorial Technology Award	Development of environment-friendly new steelmaking process by zero-slag BOF operation
1998 Memorial Award	Development and commercialization of environment-friendly regenerative burner system
Memorial Technology Award	Development of high-efficiency production process for environment-friendly, high-purity stainless steel

### Iwatani Memorial Prize

1999	Development and world's first commercialization of gradient high-silicon magnetic steel sheet
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### Ichimura Industrial Award

1999 Contribution Award	Development of endless rolling technology in hot rolling
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### Energy Conservation Award

2000 METI Minister's Award	Development and application of technology utilizing waste plastics as BF material
Energy Conservation Center Chairman's Award	Energy conservation through activities to maximize equipment efficiency of oxygen plant
1999 MITI Minister's Award	Minimization of iron and steel making energy through development of new technology for measuring hot metal temperature
Energy Conservation Center Chairman's Award	Activities for reducing oxygen gas dissipation
Energy Conservation Center Excellence Award	Introduction of regenerative burners in Chita small-diameter seamless pipe rotary furnace
1998 MITI Minister's Award	Development of regenerative burner and application to large heating furnaces
MITI Regional Bureau Director General's Award	Application of model control for BF hot blast stove

### Minister's Award for Global Warming Prevention (Environment Agency)

1999 Minister's Award	Recycling of waste plastics as BF material
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### Excellent Energy Conserving Equipment Award

2000 METI Minister's Award	High-speed continuous annealing and heating system applying high-temperature rotary regenerative heat exchanger
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### New Energy Award (award for new energy equipment for the 21st century)

2000 Resources & Energy Agency Director General's Award	Project to produce fuel from wastes by gasifying & reforming method in steelworks
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### Resource Recycling Technology & System Award (Clean Japan Center)

2001 Clean Japan Center Chairman's Award	Technology for cascading & recycling of washing chemical fluorine nitric acid
2000 METI Industrial Technology & Environment Bureau Director General's Award	Technology for recycling stainless steel making dust using smelting reduction method
1999 Clean Japan Center Chairman's Award	Suppression of waste discharge in a casting plant (NIPPON KOKAN PIPE FITTING MFG. CO., LTD.)

### Japan Society of Mechanical Engineers Award

2001 Japan Society of Mechanical Engineers Award (Technology)	Continuous rolling mill of steel bar, section, and wire rod
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### Combustion Society of Japan Award

2000 Technology Award	High-temperature waste gasifying & direct melting technology
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### Recycling Award (NPO Recycle Solutions)

2001 First Planning Award	Marine Blocks (carbonated large solid block of slag for use in artificial reefs for seaweed and fish farming)
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### Surface Finishing Society of Japan

2002 Technology Award	Environment-friendly, highly functional chromium-free coated steel sheet Geo-Frontier Coat
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### Japan Coating Technology Association

2001 Technology Award	Rust stabilization agent for weathering steel Captain-Coat M
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### Japan Society for the Promotion of Machine Industry Award

2001 Japan Society for the Promotion of Machine Industry Chairman's Award	Development of equipment for changing running direction of cold rolled steel sheet by air floatation
2000 Japan Society for the Promotion of Machine Industry Chairman's Award	Development of equipment for ultrasonic detection of electrical discharge

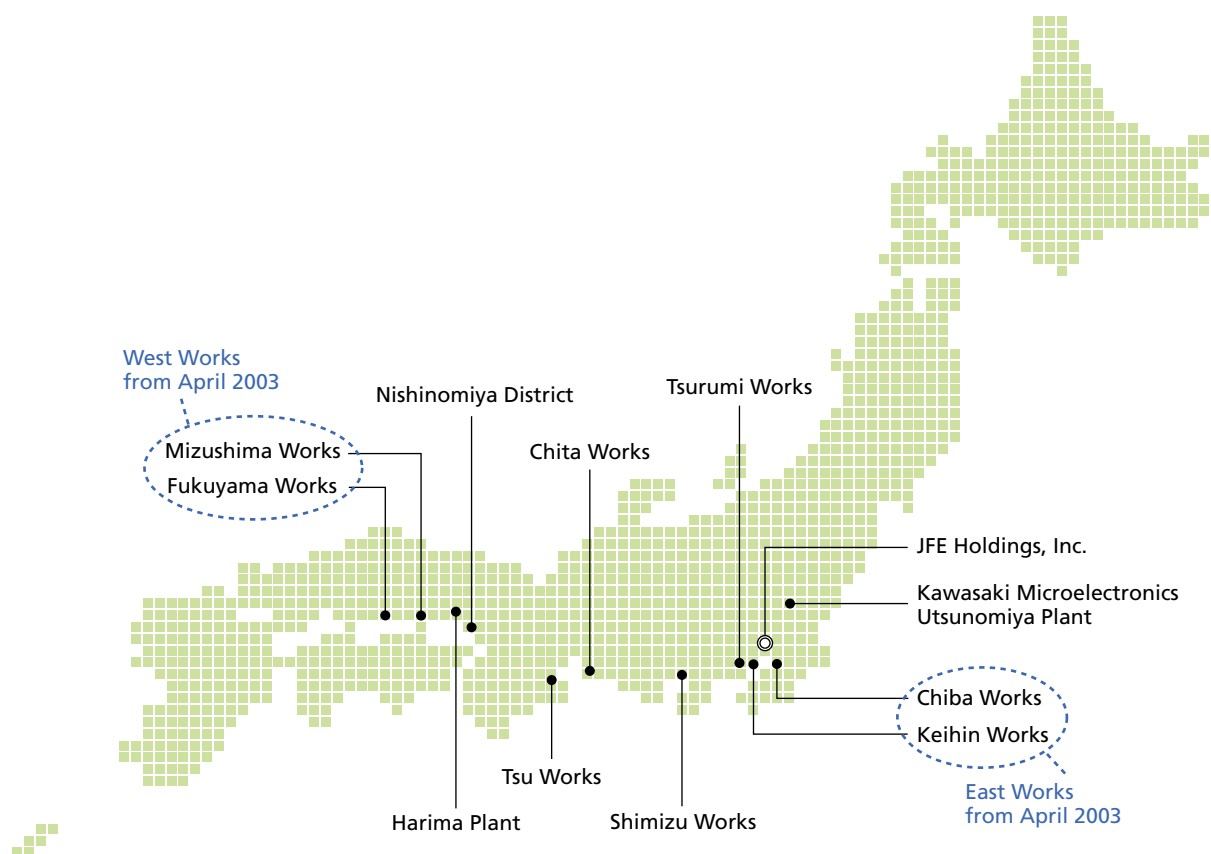
### Excellent Environmental Equipment Award (Japan Society of Industrial Machinery Manufacturers)

2002 METI Industrial Technology & Environment Bureau Director General's Award	Small-scale incinerator using carbonizing & gasifying method (Kawatetsu Machinery Co., Ltd.)
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# Company Outline

## ■ Outline of JFE Holdings

Name	JFE Holdings, Inc.
Headquarters	1-2, Marunouchi 1-chome, Chiyoda-ku, Tokyo 100-0005, Japan
Chairman, Co-CEO and Representative Director	Kanji Emoto
President, Co-CEO and Representative Director	Yoichi Shimogaichi
Established	September 27, 2002
Capital	100 billion Yen (as of October 2002)
Fiscal period	April 1 to March 31
Securities traded	Tokyo Stock Exchange, Osaka Securities Exchange, Nagoya Stock Exchange





**JFE Holdings, Inc.**

<http://www.jfe-holdings.co.jp>

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Published : Dec. 2002