

Providing Total Solutions for a Better Environment

JFE Holdings				
JFE Steel	JFE Engineering	Kawasaki Microelectronics	JFE Urban Development	JFE R&D

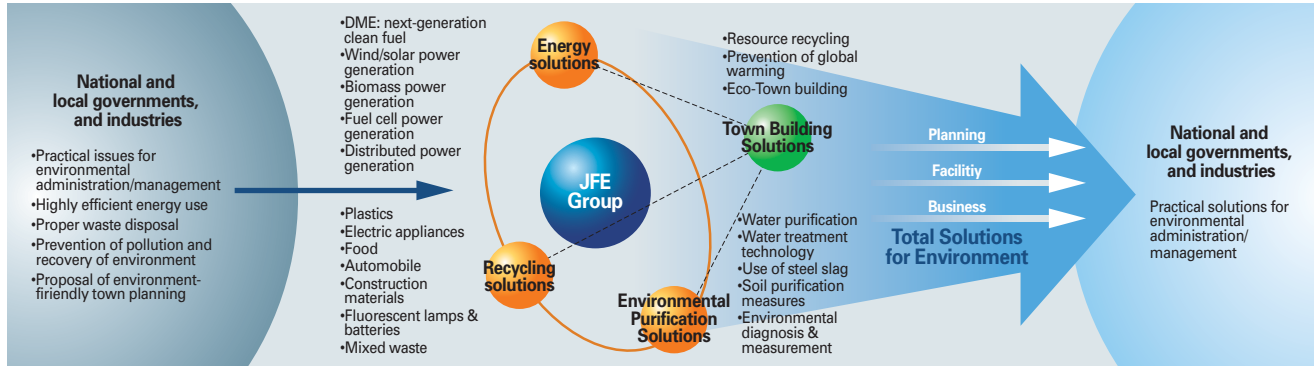
Providing Solutions to Environmental Needs Based on Technologies and Know-how Cultivated in Steel and Engineering

In response to rising environmental and eco-energy needs at the national and local government levels and in business, the JFE Group is expanding its environmental solution business with the total capabilities of the JFE Group, taking advantage of technologies and

know-how cultivated to date. The JFE Group is contributing to the creation of a recycling-oriented society by providing total solutions which offer an integrated response from concept development through business planning and project realization.

Concretely, the JFE Group develops solutions in three areas, "Recycling," "Eco-energy," and "Environmental purification," and provides total solutions for "Town Building" by combining these three elements.

Total Solutions for a Better Environment at JFE Group



Proposal/Implementation of Environment-friendly Town Building Town Building Solutions

Making maximum use of the infrastructure in its steelworks, the JFE Group provides "Town Building Solutions" for environment-friendly urban development in cooperation with local governments and companies in neighboring industrial complexes. The JFE Group is contributing to the creation of a recycling-oriented society by actively participating in environment-friendly urban development from the planning stage, based on technologies and know-how developed in its steel and engineering businesses.

For example, the JFE Group proposes projects under the Eco-Town Concept, which was created

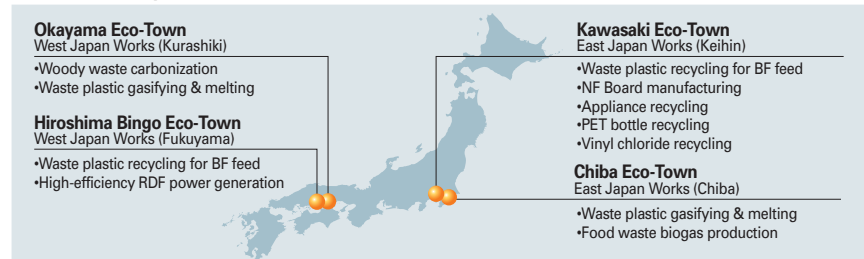
in 1997 and is being promoted by METI/MOE. The Group has also expanded these activities to the Eco-Industrial Complex Concept in cooperation with other industries, and industry, government, and academic circles, and is using the PFI method to create new environmental businesses.

Town Building Solutions: Example 1

Proposal of Environment-friendly Town Building Based on the "Eco-Town Concept"

A representative example of JFE's urban development solutions can be seen in environment-friendly Town Building projects carried out with local governments under the "Eco-Town Concept." The JFE Group has proposed several "Eco-Town Plans" for towns being planned by local governments where steelworks are located. In March 2004, Okayama, where West Japan Works (Kurashiki) is located, was approved as the 20th Eco-Town in Ja-

Eco-Towns in Japan



pan. With this, all four cities where JFE Steel's main works are located have been designated as Eco-Town Areas.

In the future, the JFE Group will promote

"sustainable local society building" through environment-friendly town building suited to the distinctive features of each region in cooperation with industry, government, and universities.

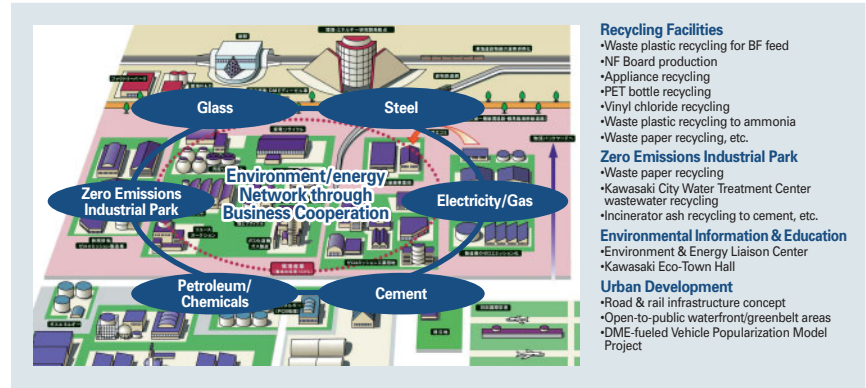
Town Building Solutions: Example 2

Eco-Industrial Complex Concept and Urban Revitalization

There are limits to recycling and CO₂ reduction activities in individual companies and factories. However, a higher level of recycling can be achieved through cooperation between heterogeneous industries such as those in large industrial complexes.

The JFE Group is actively involved in creating “Eco-Industrial Complexes” which promote recycling through this kind of inter-industry cooperation. The Group has already created a cooperative inter-industry network in the Keihin Coastal Area, and intends to contribute to further development of the Keihin Coastal Area as a new core

Eco-industrial complex concept at Kawasaki coastal area (Kawasaki Eco-Town area)



for urban revitalization in the Tokyo Metropolitan area by environment-friendly town building

through a fusion of the Eco-Industrial Complex and Eco-Town Concepts.

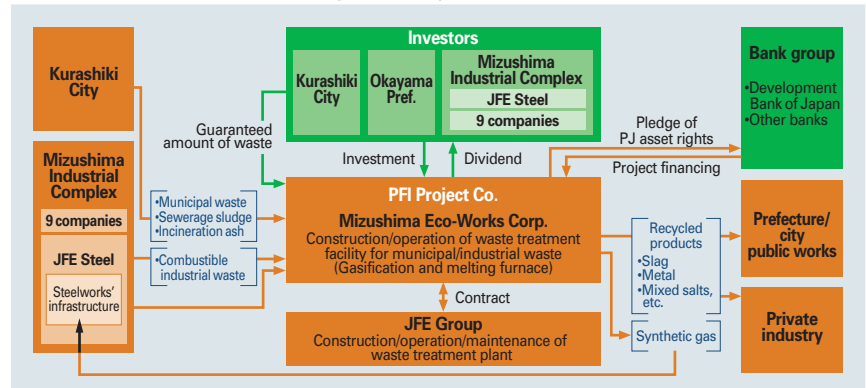
Town Building Solutions: Example 3

PFI Project at Mizushima Industrial Complex

The JFE Group is constructing a gasification and melting furnace at West Japan Works (Kurashiki) to recycle municipal waste from Kurashiki City and industrial waste from businesses located in the Mizushima Industrial Complex.

This project is being carried out as a PFI*¹ project by Okayama Prefecture, Kurashiki City, and the 10 companies which make up the complex, and is attracting attention as a new scheme for recycling local household waste and industrial waste. (Scheduled start of project: April 2005)

Scheme of Mizushima Industrial Complex PFI Project



*1) PFI Private Finance Initiative. Government policy system for improving efficiency, mainly using the private sector, by introducing private-sector capital and management know-how in the creation/operation of social infrastructure which was traditionally in the public sector.

Purification/Restoration/Protection of the Natural Environment

Environmental Purification Solutions

The JFE Group has provided numerous environmental solutions, including water and soil purification and environmental diagnosis and monitoring.

Recently, the Group proposed projects utilizing the features of recycled slag products, which were developed as an advanced use for iron and steel slag (p. 25), in marine environment restoration and has carried out model marine purification projects throughout Japan.

The JFE Group is developing “Environmental Purification Solutions” which purify, restore, and protect the natural environment while respecting the ecosystem.

Environmental Purification Solutions: Example 1

Marine Purification/Sand-Capping Work in Nakaumi Lake Shimane Pref.

A “Marine Purification/Sand-Capping Project” under the auspices of the Ministry of Infrastructure, Land and Transport (MLIT) is being carried out using “Marine Base,” a blast furnace granulated slag sand-capping material developed by the JFE Group. As of August 2004, more than 200,000 tons had been placed, contributing to improved water quality.



Environmental Purification Solutions: Example 2

Shallows Creation Model Project at Innoshima Island, Hiroshima Pref.

A model shallows was created at Innoshima Island, with support from the prefecture. Approximately 1,000 tons of “Marine Base” and 20 “Marine Blocks” were used.

Studies show that a variety of fish have gathered around the shallows, and shellfish, shrimp, and fish are inhabiting the Marine Base, while profuse growth of large seaweeds have been observed in the Marine Blocks, indicating satisfactory results.

Resource recycling solutions: Example 1

Waste Plastic Recycling for BF Feed

The JFE Group currently recycles more than 100,000 tons/year of waste plastics by converting industrial waste plastic and plastic packaging into raw material (substitute for coke) for its ironmaking. Because waste plastic recycling for BF feed makes an important contribution to reducing CO₂ emissions and saving coal in steel production process, it is a key technology for recycling waste plastic.



Waste plastic recycling for BF feed

Resource recycling solutions: Example 2

NF Board for Concrete Forms Manufactured from Recycled Plastic

In addition to chemical recycling of plastics, primarily as blast furnace feed, JFE Steel also established a commercial material recycling business in 2002. Use of recycled plastic as a substitute for plywood in NF Board for concrete forms reduces CO₂ emissions and helps preserve rain forests. The JFE Group has a system that recycles used NF Board as a raw material for ironmaking, realizing a “Zero Emission product.”



NF Board production line

Resource recycling solutions: Example 3

Vinyl Chloride Recycling

Because vinyl chloride comprises 15% of all plastics, a treatment process for this material is an essential requirement for plastic recycling. The JFE Group has developed a technology for separating chlorine (Cl) from vinyl chloride itself, for example, in pipes and gutters. The separated Cl is also recycled as hydrochloric acid (HCl), which are used in pickling process of steel sheets. The rest hydrocarbon is also used as an ironmaking material.



Vinyl chloride de-Cl process

Resource recycling solutions: Example 4

PET Bottle Recycling

JFE KANKYO, an affiliate of the JFE Group, operates a PET bottle recycling business at East Japan Works (Keihin). Using PET bottles collected by local municipalities, PET resin flakes are recovered by a process of crushing, classification, washing, etc. and sold to polyester manufacturers and makers of PET sheets for egg cartons and similar packaging. Labels and caps are recycled as material for ironmaking in this distinctive Zero Emission process.



PET bottle recycling plant

Resource recycling solutions: Example 5

Home Electric Appliance Recycling

Home Appliance Recycling Law requires recycling of refrigerators, washing machines, televisions, and air conditioners. To meet this need, JFE invested in JFE Urban Recycle, an appliance recycling company located in its steelworks, where it efficiently dismantles appliances and recycles most steel and non-ferrous metals and waste plastics to iron and steel production processes.



Waste appliance recycling plant

Resource recycling solutions: Example 6

Recycling by Waste Gasifying & Melting

Using the JFE THERMOSELECT waste gasifying & melting furnace, the Chiba Recycling Center at East Japan Works (Chiba) completely recycles industrial waste from Chiba Prefecture and the surrounding region, as well as waste plastic collected under the Containers and Packaging Recycling Law, as gas for the steelworks.



Chiba Recycling Center

JFE Engineering has joined Fukuyama Recycling Power Generation Project. Electric power generated by RDF is sold to an electric power company. Slag is also recycled as construction materials.

Resource recycling solutions: Example 7

Food Waste Recycling

Chiba Biogas Center at East Japan Works (Chiba) uses the BIGADAN process Biogas System (see p.41) to produce gas for the works from food waste by methane fermentation. Residue from the process is recycled to the JFE THERMOSELECT plant at the Chiba Recycling Center, achieving zero-emission 100% recycling.



Chiba Biogas Center

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Recycling Businesses Supporting a Recycling-oriented Society

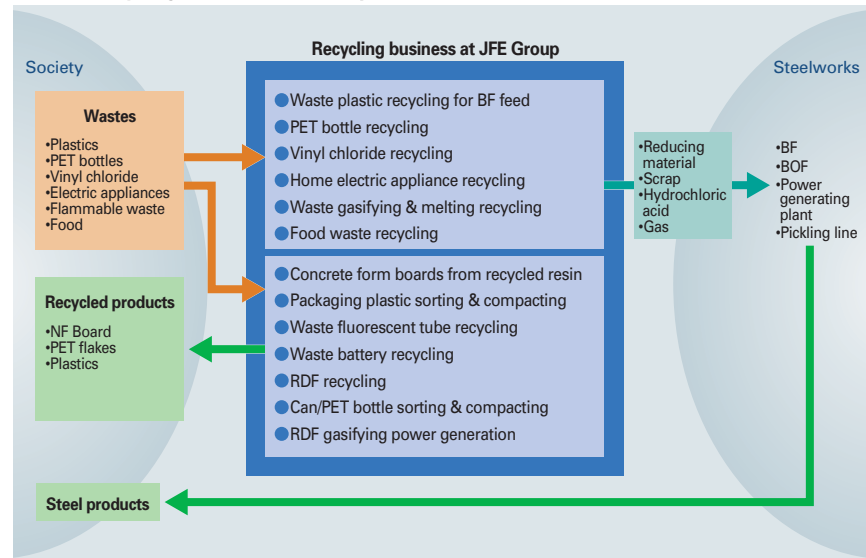
Recycling Solutions

Through advanced use of steelworks' infrastructure, the JFE Group has created a system for efficient mass recycling of waste, and has developed a wide range of recycling businesses, including use of waste plastic as blast furnace feeding material.

Among recycling businesses which are closely related to local society, JFE Group companies are involved in sorting/collection of waste plastic, recycling of waste as solid fuel, and recycling of used dry-cell batteries.

JFE Group companies receive a wide range of waste materials and perform the most appropriate treatment (material recycling, chemical recycling, thermal recycling), contributing to a recycling-oriented society by providing recycling solutions which minimize landfill disposal.

Resource recycling solution at JFE Group



Primary Recycling Business at JFE

Operation		Started in	Capacity
Waste fluorescent tube recycling		April 1995	6,000 t/yr
Waste plastic recycling for BF feed		October 1996	50,000 t/yr
Waste gasifying & melting recycling	1. Chiba	April 2000	50,000 t/yr
	2. Kurashiki	April 2005 (scheduled)	160,000 t/yr
RDF gasifying power generation	Fukuyama	April 2004	96,000 t/yr
Plastic containers & packaging for BF feed		April 2000	120,000 t/yr
Plastic containers & packaging gasifyin		April 2001	30,000 t/yr
PET bottle recycling		April 2002	10,000 t/yr
Concrete form boards from recycled resin		Sep. 2002	2 million/yr (approx. 200 million bottles)
Packaging plastic sorting & compacting	1. Nagoya	Aug. 2000	60,000 t/yr
	2. Sendai	Dec. 2000	20,000 t/yr
	3. Hiroshima	April 2004 (scheduled)	40,000 t/yr
	4. Yokohama	April 2005	31,000 t/yr
Can/PET bottle sorting & compacting	Kawasaki	Sep. 2003	5,500 t/yr
RDF recycling	1. Haibara Town, Nara Pref.	Nov. 2000	2,500 t/yr
	2. Nogi Town, Tochigi Pref.	Dec. 2002	5,500 t/yr
Home electric appliance recycling		April 2001	800,000 units/yr
Dry cell battery recycling by non-ferrous metal melting furnace		March 2002	1,500 t/yr
Dry cell battery recycling by electric furnace		March 2003	1,000 t/yr
Food waste recycling		Aug. 2003	8,000 t/yr

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Creating a Next-generation Clean Energy Society

Eco-Energy Solutions

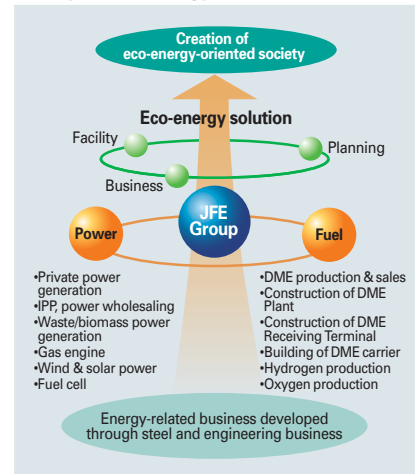
JFE Group is providing various eco-energy solutions based on highly efficient and advanced energy technology developed through its steel and engineering business, thus to contribute to the society.

Concretely, this includes power wholesaling/retailing businesses on an annual scale of 1.5 billion kWh using high efficiency private power plants, a recycling power business using general waste as fuel (RDF), a wind power engineering business which now has a record of 124 units with an output of 92,000 kW (end of March 2004), and participa-

tion in wind power generation businesses.

In addition to these solutions, the JFE Group is developing a next-generation clean fuel, "DME" (dimethyl ether), and high efficiency DME-fueled generating systems, and is also developing solid oxide fuel cells (SOFC: see p. 53). In the longer term, the JFE Group intends to realize the optimum eco-energy environment demanded by local communities and society by developing customer-oriented businesses utilizing the power- and energy-related know-how and technologies gained through these efforts.

Concept of eco-energy solution



Eco-energy solutions: Example

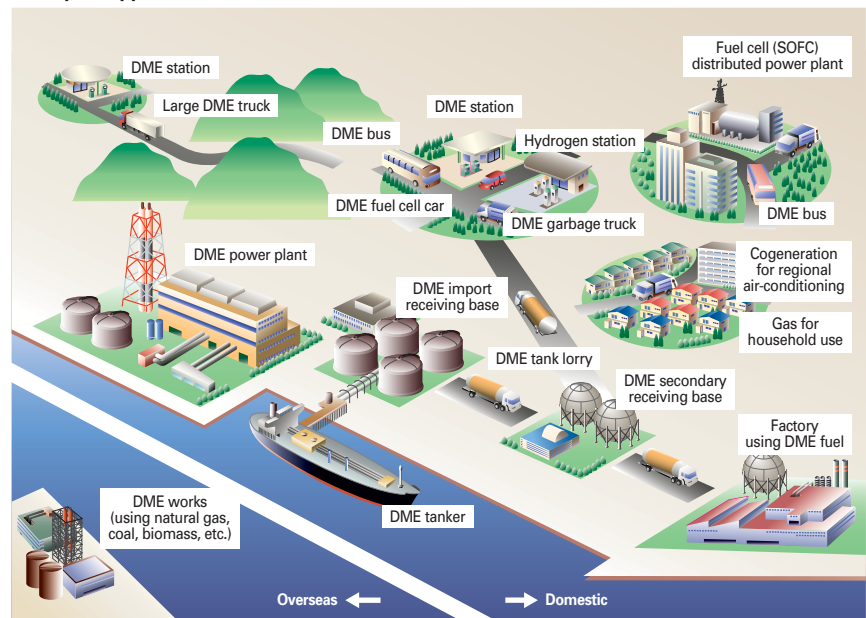
DME Project

DME can be produced from a variety of hydrocarbon materials such as natural gas, coal, biomass, etc. and generates no sulfur oxides (SOx) or particulate matter (PM) during combustion. Considering these environmental advantages, it has attracted much attention as a form of next-generation clean energy.

Because DME is non-toxic and easy to handle, a wide range of applications is expected, including use as fuel for power generation at thermal power plants, substitute for LPG and other fuels in social use, fuel for transportation, for example, as diesel automobile fuel, and hydrogen energy source for fuel cells, making DME the "leading contender" for practical application as a form of next-generation clean energy.

In 2001, the JFE Group established DME International Corporation jointly with 9 other companies and is studying commercialization, centering on marketing activities. Also in 2001, an R&D company called DME Development Co., Ltd. was established jointly by 10 companies with the aim of commercializing a DME direct synthesis technology, and is carrying out R&D on production/application technologies with a 100 tons/day DME direct synthesis pilot plant (p. 53). To popularize DME, in 2004, the JFE Group established the DME Promotion Center jointly with 6 other

Concept of applications of DME



companies to carry out technical development of applications, surveys, and popularization and education activities.

Activities supporting introduction of DME are also underway at the national government level. The Agency for Natural Resources and Energy of the Ministry of Economy, Trade and Industry has created the Fuel Policy Planning Office to handle DME and is establishing concrete directions for DME in national energy policies. At the same

time, the High Pressure Gas Safety Institute of Japan and the Japan Oil, Gas and Metals National Corporation (JOGMEC) are engaged in research on the safety of DME and technical development of applications.

The JFE Group is devoting great energy to marketing, development of production technology, and studies of commercialization, including overseas production, aimed at early practical application of DME.