

Preventing Global Warming at JFE Steel

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

Reducing Energy Consumption

In December 1996, the Japan Iron and Steel Federation established a Voluntary Action Program for Environmental Protection^{*1}, which targets a 10% reduction in energy consumption in FY2010 against a FY1990 baseline. Among other positive efforts to prevent global warming, in September 1997, a supplementary goal^{*2} was incorporated in the Voluntary Action Program, calling for an additional 1.5% reduction in energy consumption. In FY2002, energy consumption of Japan's steel industry was 6.6% below the FY1990 baseline, demonstrating the success of voluntary action.

On the other hand, world crude steel demand has continued to grow in recent years, supported by the economic growth of the East Asian region, most notably China (p. 2). Responding to calls for sustainable development, the Japanese steel industry, which boasts the world's highest energy efficiency, is contributing to preventing global warming, while continuing to meet rising

crude steel demand as a long-term supply base for steel materials.

JFE Steel has a long history of positive efforts in energy saving (p. 21) and is continuing its energy saving activities based on the Japan Iron and Steel Federation's Voluntary Action Plan, while responding to rising crude steel demand and the requirements of higher value-added products.

In FY2003, unit energy consumption (energy consumption/ton-crude steel) at JFE Steel and four affiliated electric furnace steelmakers^{*3} was 22.4 GJ/t-s, or a 15% reduction from FY1990 (3% reduction from FY2002). In response to increased demand for high value-added products such as automotive steel sheets and plates for shipbuilding, JFE Steel increased crude steel production to 30.5 million tons, up 17% from FY1990 (2% increase from FY2002), but at the same time, reduced energy consumption to 685 petajoules (PJ)^{*4}, or a 0.3% reduction from FY1990 (0.6% reduction from FY2002) by energy saving activities such as optimizing operating parameters. In a trial calculation, actual CO₂ emissions^{*5} in FY2003 were estimated at approx-

imately 56 million tons (1.3% reduction from FY1990).

JFE Steel fully recognizes the importance of global warming and is committed to solving this urgent problem by developing and introducing new energy saving technologies and developing next-generation steel manufacturing technologies. At the same time, JFE Steel is contributing to preventing global warming in the social/transportation sectors with environment-friendly steel products.

^{*1} Details of the steel industry's Voluntary Action Program for Environmental Protection can be found at the Japan Iron and Steel Federation's website, "Ongoing Commitment of the Steel Industry Against Global Warming" at the following address:
<http://www.jisf.or.jp/energy/index/htm>

^{*2} **Supplementary goal under Voluntary Action Plan**
 The steel industry incorporated in its Voluntary Action Plan a 1.5% reduction in energy consumption by effective use of waste plastic in blast furnaces, coke ovens, etc., assuming creation of an adequate collection system.

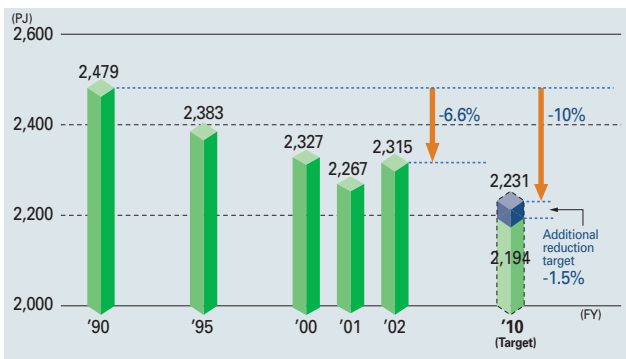
^{*3} **Four affiliated electric furnace steelmakers**
 NKK Bars & Shapes Co., Ltd., Daiwa Steel Corp., Tohoku Steel Corp., and Toyohira Steel Corp.

^{*4} **Petajoule(PJ)**
 Joule (heat unit) x 10¹⁵ (1000 trillion), 1 cal=4.186J

^{*5} **CO₂ emissions**
 CO₂ emissions = CO₂ emissions/unit of energy consumed x unit energy consumption x production

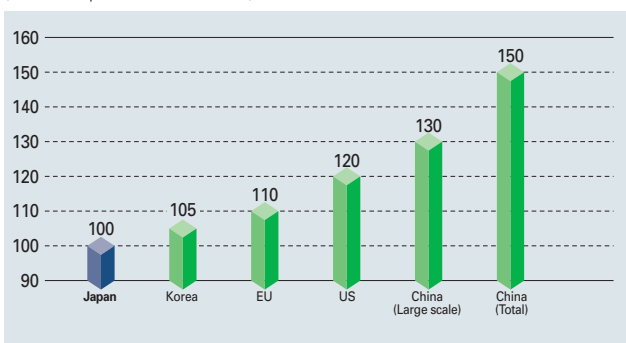
Japanese steel industry's total energy consumption

(Source: The Japan Iron and Steel Federation)



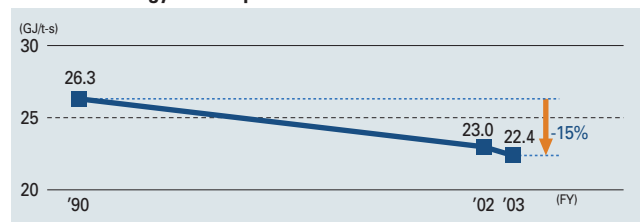
Energy efficiency of steelworks in major countries

(Source: The Japan Iron and Steel Federation)

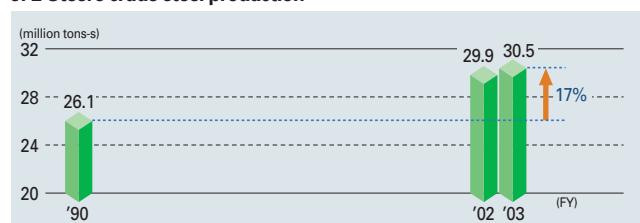


(Source: Korea Iron & Steel Association, China Iron and Steel Association, etc.)

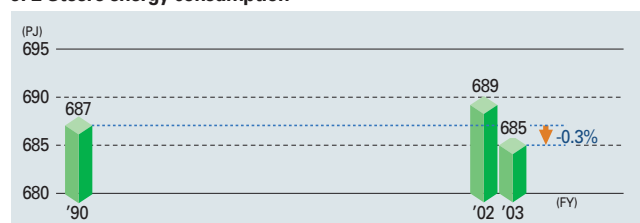
JFE Steel's energy consumption rate^{*6}



JFE Steel's crude steel production^{*6}



JFE Steel's energy consumption^{*6}



^{*6} The sum of data from JFE Steel and four affiliated electric furnace steel makers.

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History of Energy Saving Activities

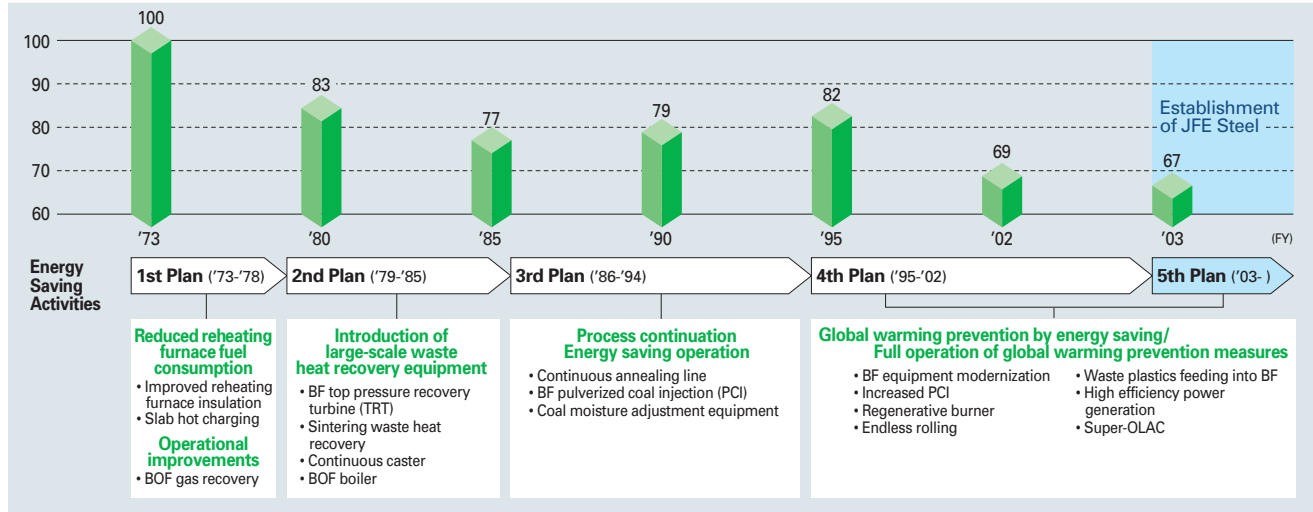
JFE Steel began its 1st Energy Saving Activities Plan in response to the First Oil Crisis in 1973. By 1990, the company had achieved energy savings of

approximately 20% in comparison with FY1973 through measures such as reduced reheating furnace fuel consumption, operational improvements, introduction of large-scale waste heat recovery equipment, and process continuation/energy saving operation of production processes. The compa-

ny also continued its aggressive energy saving activities in the years that followed.

Since the establishment of JFE Steel in April 2003, the company is implementing further measures to prevent global warming under its 5th Energy Saving Activities Plan.

Transition of unit energy consumption index at JFE Steel (1973 = 100)



Examples of Energy Saving Activities (1)

Expanded Application of Regenerative Burners

At the hot strip mill, a reheating furnace is used to heat steel slabs to high temperatures exceeding 1000°C before hot rolling. The reheating furnace burns byproduct gas from the steelworks. Efficient recovery of the sensible heat of the high temperature combustion flue gas discharged from the furnace is essential for reducing energy consumption and CO₂ emissions. Conventionally, this high temperature flue gas was passed through a

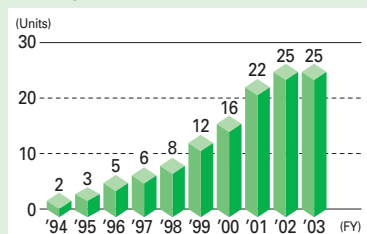
metal heat exchanger to preheat the burner combustion air. However, the heat recovery ratio was limited to 50-60% due to temperature restrictions on the heat exchanger.

Each regenerative burner is equipped with a high heat-resistant ceramic heat exchanger, called a regenerator, making it possible to preheat burner combustion air to virtually the furnace temperature. This dramatically improves the heat recovery ratio, to 70-80%,

realizing a large energy saving.

JFE Steel confirmed the energy saving effect of this technology by applying regenerative burners at the continuous reheating furnace at West Japan Works (Kurashiki) in 1994, and then successively expanded application. The continuous reheating furnaces at West Japan Works (Fukuyama) were completely retrofitted with regenerative burners in 1996, with the epoch-making effect of reducing energy consumption by approximately 25% and NO_x by about 80%. Regenerative burners have now been installed at more than 20 furnaces, including reheating furnaces, heat treatment furnaces, ladle heating burners, and others at JFE Steel and its affiliates, with an energy saving effect of 2PJ/year, achieving a CO₂ reduction of 200,000 tons/year.

Number of reheating furnaces equipped with regenerative burners



Reheating furnace with regenerative burners

Stop Global Warming!

We are reducing CO₂ through voluntary efforts.

Examples of Energy Saving Activities (2)

World's First Continuous Finishing Hot Rolling Process: "Endless Rolling"

JFE Steel's East Japan Works (Chiba) led the world in development and practical application of a new rolling process called continuous finishing hot rolling, or "Endless Rolling."

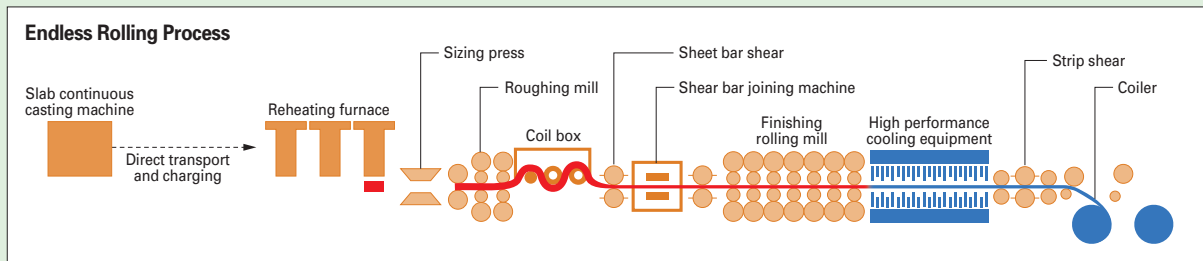
Conventionally, hot rolling was performed in one-slab units, but in Endless Rolling, sheet bars (semi-finished product produced by rolling slabs at roughing mill) are joined before the finishing mill, enabling continuous (endless) rolling.

Sheet bar joining was optimized by adopt-

ing a unique high accuracy on-line material flow control technology and a new joining technology, which are not found in conventional processes. By using rolling technology which prevents joint rupture, rolling conditions can be optimized to match the timing when joints in the strip pass the mill, realizing continuous rolling. This, together with the new high speed shearing and coiling technologies, has realized unprecedented smooth continuous rolling and dramatically improved yield in the hot rolling process.

Productivity in the rolling process has improved by more than 20% in comparison with conventional processes, reducing power and fuel consumption by rolling mills and the reheating furnace by 20%. Endless Rolling also contributes to resource saving because head and tail end crops are greatly reduced.

JFE Steel introduced this technology at No. 3 hot strip mill at East Japan Works (Chiba) and began full scale production in March 1996.



Examples of Energy Saving Activities (3)

Expanded Application of Waste Plastic Recycling System for Blast Furnace Feed

In Japan, industrial and municipal waste plastic reaches 10 million tons/year. About 45% is used effectively in power generation or recycling, but the remainder is either incinerated or buried in landfills. As a result, securing landfills has become serious problem for local governments.

In October 1996, JFE Steel established Japan's first waste plastic recycling system for blast furnace feed for industrial waste plastic at East Japan Works (Keihin). Waste plastic, which consists mainly of carbon and hydro-

gen, is blown into the blast furnace as a raw material and fuel for ironmaking. Approximately 60% serves as a substitute for coke, which is conventionally used as a reductant for ironmaking, and the remaining 40% is consumed as energy, reducing landfill disposal and saving energy. By reducing coke consumption, this system also reduces CO₂ emissions in ironmaking because plastic contains less carbon than coke.

With full implementation in April 2004 of Containers and Packaging Recycling Law,

which applies to municipal wastes, JFE Steel began operation of blast furnace feeding systems for used plastic containers and packaging at both East Japan Works (Keihin) and West Japan Works (Fukuyama). JFE Steel is also active in waste plastic gasification treatment and manufacture of Concrete Form Boards (material recycling). In FY2003, the company received and effectively used a total of approximately 160,000 tons of waste plastic.

