NKK Fukuyama Iron & Steel Works intends to be an iron & steel works in harmony with the community environment based on the following principle and policy.

Principle

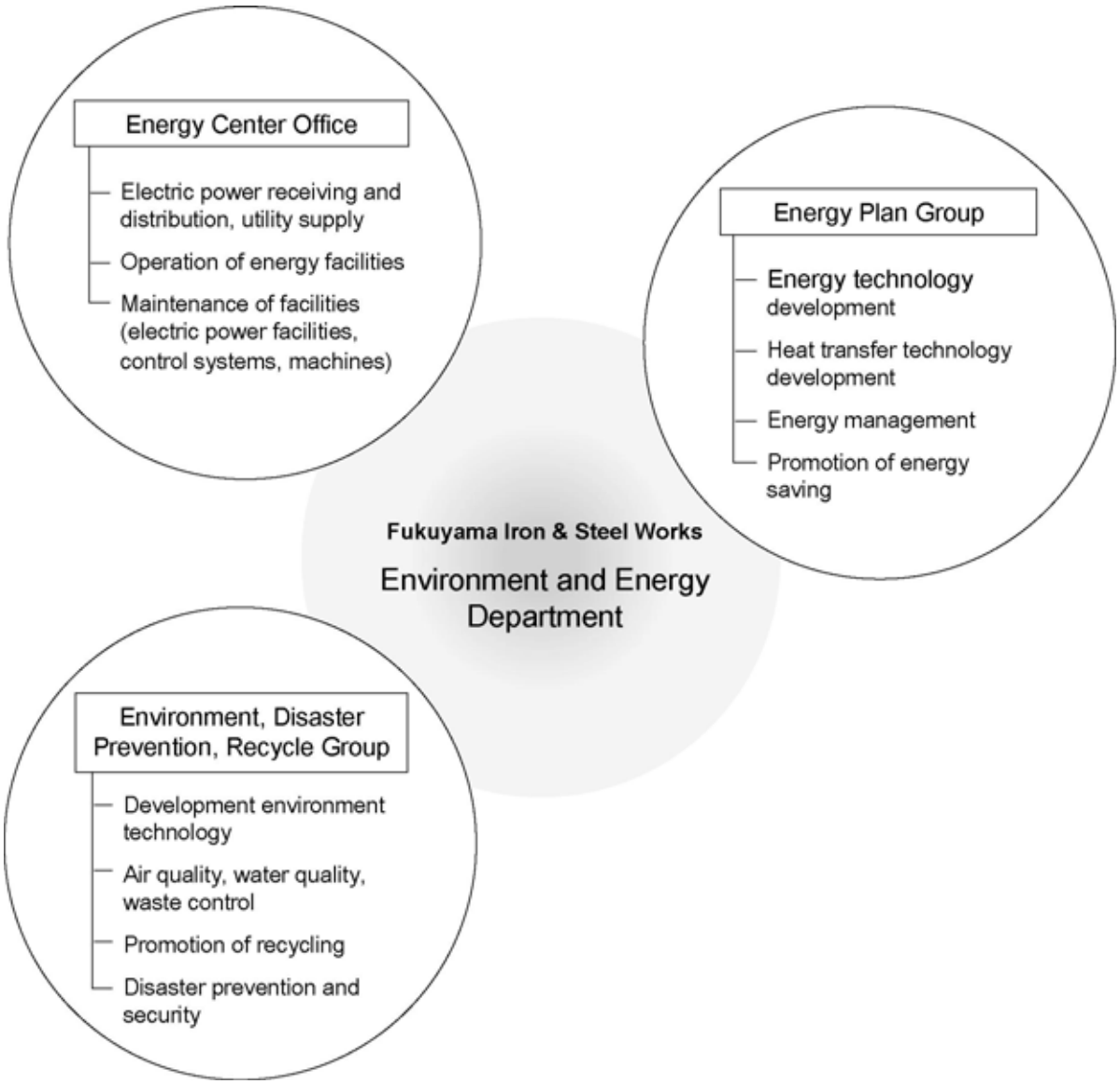
NKK has a corporate principle that NKK contributes to creation of rich human environment through development of industrial base and life-supporting infrastructure. Under this corporate principle, NKK fulfills its social responsibility through promotion of business activities that contribute to development of societies that coexist with good environment.

Policy

Fukuyama Iron & Steel Works promotes business activities compatible with the natural environment and acceptable to the local communities, in view of its location in the Seto Inland Sea National Park.

1. Fukuyama Works endeavors to have a right understanding of the impacts the works may have on the environment, and establishes proper environmental objectives and targets, and executes them. Also, Fukuyama Works examines the adequacy of its activities by internal environmental audits, thereby continually improving its environmental conservation activities.
2. Fukuyama Works abides by laws, ordinances, environmental agreements and other agreements on the environment. Also, Fukuyama Works implements measures to prevent environmental contamination, including those for promoting energy saving, resource saving, resource recycling, and thus promotes iron making by technologies that are compatible with the environment.
3. Fukuyama Works promotes enlightenment and education on environmental conservation to its all employees and staff members, and thus enhances their environmental awareness.
4. Fukuyama Works promotes its environmental conservation activities that consider coexistence with the local communities and conformity with the global environmental conservation.

Organization of the Environment and Energy Department



Major companies that cooperates with the works

Fukuyama Kyodo Thermal Power Co. Ltd.	Byproduct gas power generation
Kokan Oxygen Center K. K.	Manufacturing of industrial gases
Fukuyama Techno-Research Corporation	Water management, disaster prevention and security, environmental measurement
CHUSEI OIL CO., LTD.	Waste treatment

Chronology

Year	Fukuyama Iron & Steel Works		Japan	World
1965	65 Commissioning of Fukuyama Iron & Steel Works 66 Startup of No. 1 Blast Furnace 100% coke use for blast furnace	**Industrial Pollution Countermeasures**	67 Basic Law for Environmental Pollution Control	
1970	73 Startup of No. 5 Blast Furnace **1st phase energy saving activities** **Energy saving by means of operation improvement**	71 Sealing of the Agreement on Environmental Pollution Control among the Hiroshima Pref. Gov't, Fukuyama City Gov't and NKK. Commissioning of the desulfurization facility of the coke oven gas Treatment of aqueous ammonia from coke production (activated sludge process) Installation of yard sprinklers Installation of various dust collectors	71 Establishment of the Environment Agency	72 United Nations Conference on Human Settlements 73 1st Energy Crisis
1980	79 Commissioning of the top-pressure recovery turbine (TRT) 81 Realization of oil-less iron & steel works **2nd phase energy saving activities** **Installation of large-scale waste heat recovery units** 84 Commissioning of the hot direct rolling (HDR) 86 Commissioning of the coke dry quenching (CDQ) 87 Realization of full continuous casting (CC) **3rd phase energy saving activities** **Energy saving by realization of continuous manufacturing processes**	**Measures for Improvement of Living Environment** Recovery of basic oxygen furnace gas Measures to prevent generation of dust, strengthening and renewal of dust collection facilities Measures to prevent generation of graphite dust		79 2nd Energy Crisis
1990	95 Starting of pulverized coal injection (PCI) to the blast furnace 96 Adoption of environment-compatible regenerative burners **4th phase energy saving activities** **Measures against the global warming issue** 98 Acquisition of the ISO14001 certification 98 Pulverized coal injection (PCI) to all blast furnaces	**Global Environment, environment and society** Modernization of the coke oven cover Introduction of the continuous unloader Renewal of air conditioning machines using the chlorofluorocarbon	91 Law for the Promotion of Utilization of Recyclable Resources 92 Waste Management and Public Cleansing Law 93 Basic Environment Law 95 Law for Promotion of Sorted Collection and Recycling of Containers and Packaging 97 Voluntary Action Plan of the Japan Federation of Economic Organizations (Keidanren) 97 Formulation of target for reduction of greenhouse effect gases 98 Amendment of the Law on Rational Use of Energy 98 Law Concerning the Promotion of Measures to Cope with Global Warming 99 Law Concerning Reporting, etc. of Releases of Specific Chemical Substances to the Environment and Promotion of the Improvement of Their Management 99 Law Concerning Special Measures against Dioxins	90 Gulf War 92 Earth Summit 95 COP1 96 COP2 97 COP3 (Kyoto Conference)
2000	00 Start of waste plastic injection to the blast furnace 01 Approval of the renewal of the ISO14001 certification		01 Law for Recycling of Specified Kinds of Home Appliances	

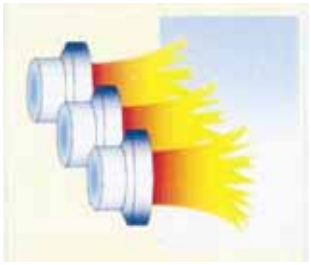
Fukuyama Works' Measure for Energy Conservation

Development of Thermal Hydrodynamic Technology

Combustion technology

Fukuyama Works is developing burner heating systems that can efficiently heat the materials suited to the purpose of heating.

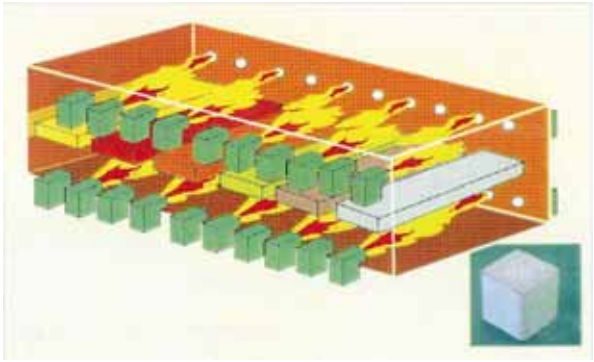
- NKK toroidal burner
  This burner has been developed to effectively heat the steel plate surface in reducing atmosphere by blowing hot burning flames at it, and has been applied to the heating facilities of the NKK-CAL and NKK-CGL. This burner was awarded the Naoji Iwatani Memorial Prize in 1991.



Toroidal burner

Inside the furnace

- Environment-compatible regenerative burner
  This burner combines a honeycomb regenerator and high-temperature air combustion to realize high-efficient recovery of heat from the combustion exhaust gas and reduction of NOx emission. This burner of unique technology is applied to the hot-rolling furnace and steel plate heating furnace, and has achieved 30 percent energy saving and more than 60 percent reduction of NOx emission. This technology was awarded the Ohkochi Memorial Prize and Minister of International Trade and Industry Prize for Excellent Energy Saving Case in 1999.

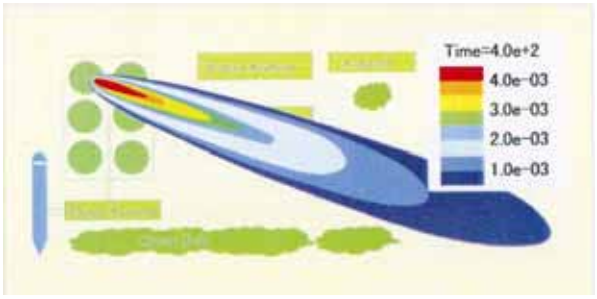


Regenerative burner furnace Regenerator

Thermal hydrodynamic technology

The works analyzes heat transfer, fluid behavior, combustion, etc., and reflects the results of analyses in the optimization of process design. The works also supports analyses of the effect on the environment and disaster prevention.

- Gas diffusion analysis



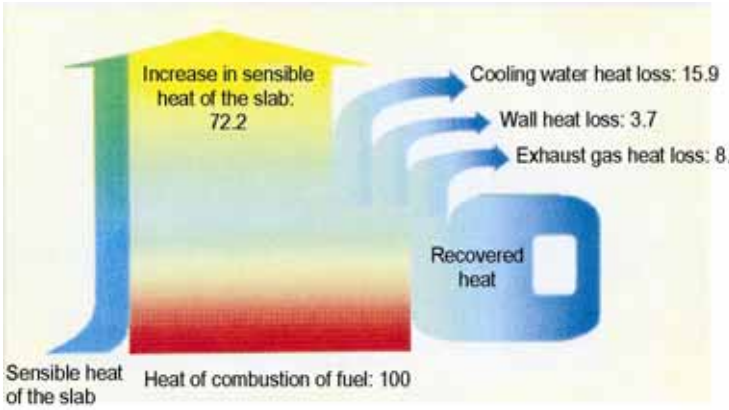
Gas diffusion analysis (example)

Technology for energy saving diagnosis

The works periodically inspects heating facilities to efficiently utilize gases generated at the iron works; namely, the blast furnace gas, basic oxygen furnace gas, coke oven gas.

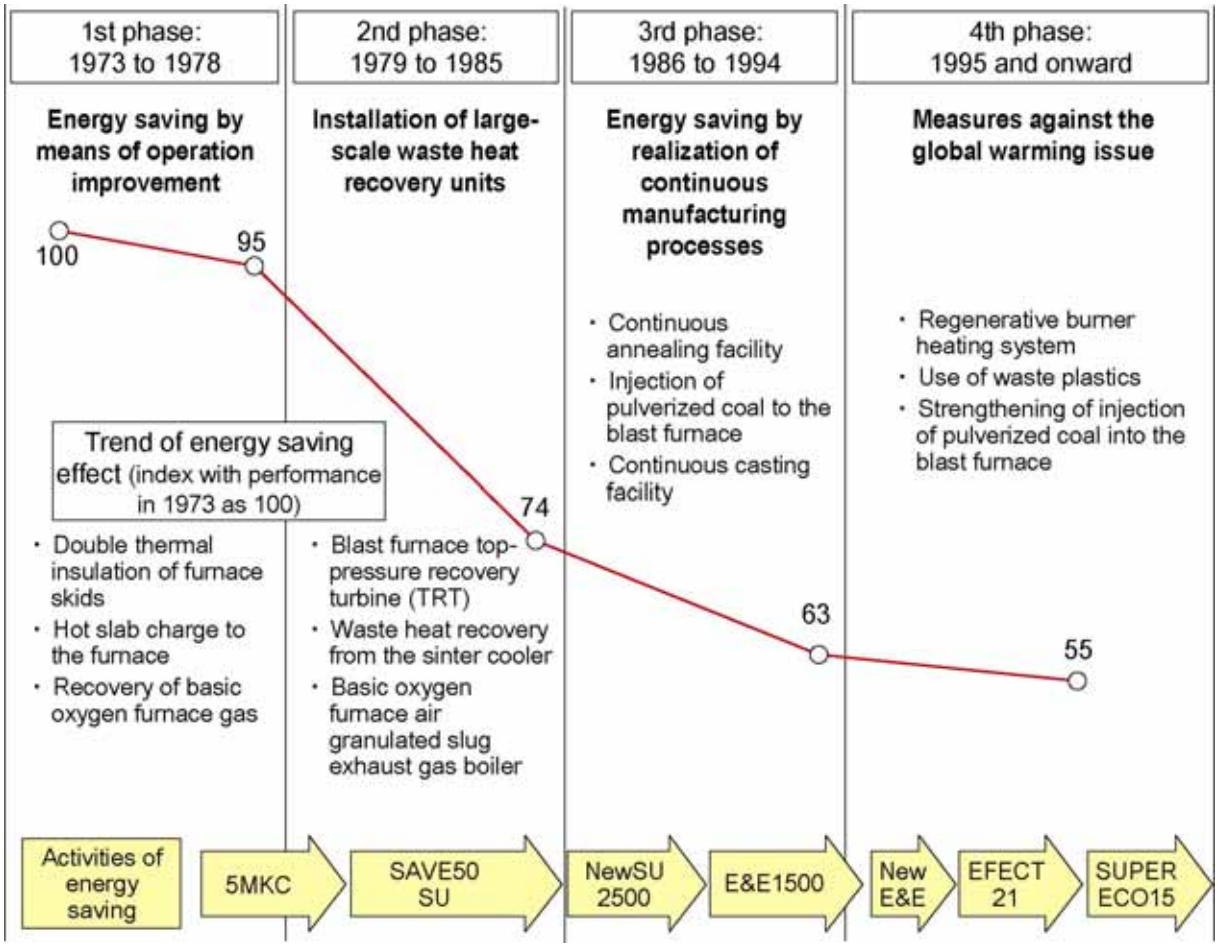
- Heat balance

  The heat balance is developed to measure data and diagnose the plants to see whether the combustion facilities are properly operated according to the Law concerning the Rational Use of Energy. The results of the measurements and diagnoses are informed to each concerned plant and reflected in their facility maintenance.



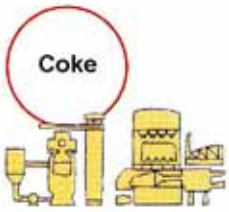
Result of a heat balance (example)

Chronology of Energy Saving

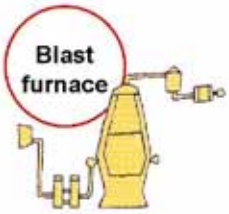


Cases of Energy Saving Measures

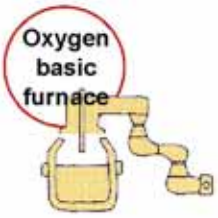
Action
- o Rotation control of the main draft blower
- o Waste heat recovery from the sinter cooler
- o Waste heat recovery from the discharge zone



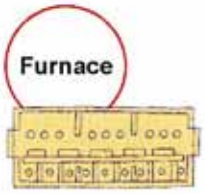
Action
- o Coke dry quenching (CDQ)
- o Rotation control of duct collecting fans
- o Coke automatic combustion system



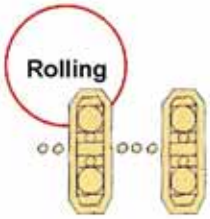
Action
- o Top-pressure recovery turbine (TRT)
- o Dry dust collector
- o Thermal insulation of the air duct



Action
- o Recovery of sensible heat of the basic oxygen furnace gas
- o Rotation control of blowers
- o Rotation control of pumps



Action
- o Regenerative burner
- o Strengthening of thermal insulation of furnace walls
- o Optimum control of furnace pressure
- o Control of O_2 content in the stack gas
- o Optimum control of furnace temperature
- o Improvement of sealing of the discharge doors

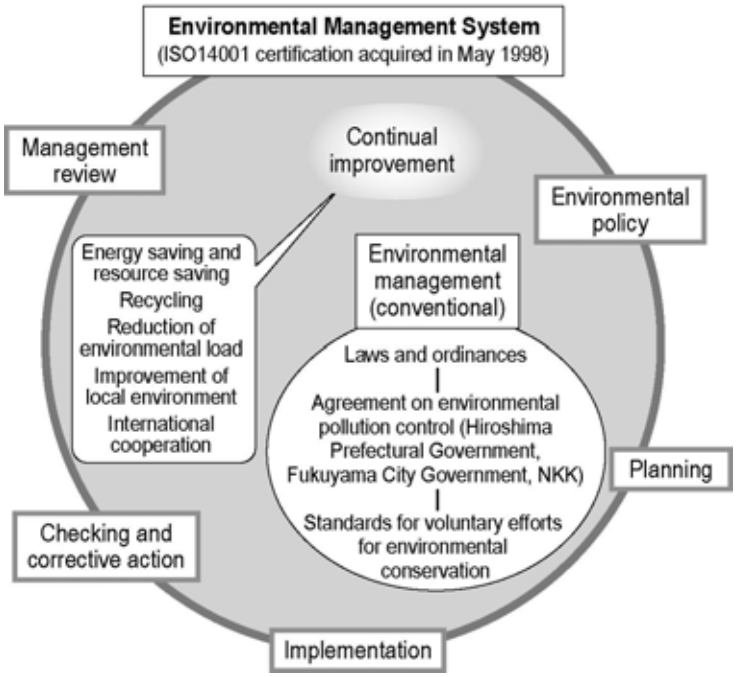


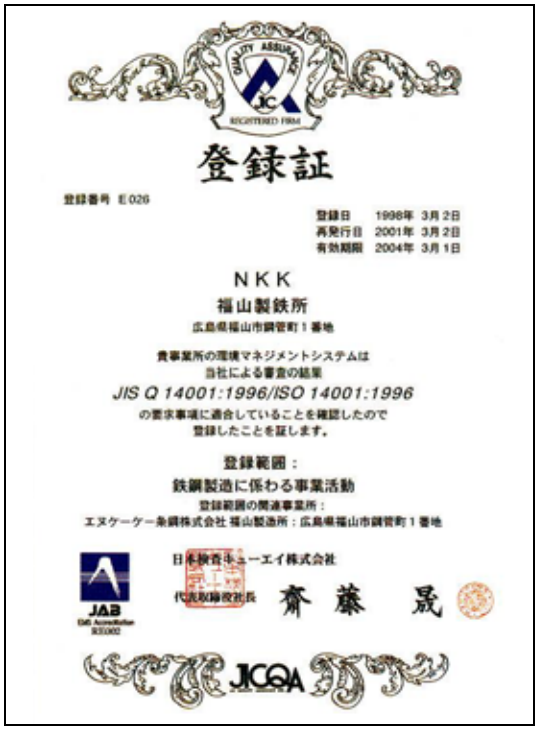
Action
- o Hot direct rolling (HDR)
- o Continuous annealing line (CAL)
- o Pre-printed coated metal (PPCM) (acid washing + tandem)

Environmental Conservation Activities

Environmental Management

Fukuyama Works have considered its environmental conservation activities as one of important management themes. In this context, Fukuyama Works have established its environmental management system. In March 1998, Fukuyama Works acquired the third-party certification, and have been working on the continual improvement.





登録証

登録番号 E026

登録日 1998年 3月2日
再発行日 2001年 3月2日
有効期限 2004年 3月1日

NKK
福山製鉄所
広島県福山市鋼管町1番地

貴事業所の環境マネジメントシステムは
当社による審査の結果
JIS Q 14001:1996/ISO 14001:1996
の要求事項に適合していることを確認したので
登録したことを証します。

登録範囲：
鉄鋼製造に係わる事業活動
登録範囲の関連事業所：
エヌケーケー条鋼株式会社 福山製造所：広島県福山市鋼管町1番地

日本検査キューエイ株式会社
代表取締役社長 齋藤 晟

JAB
JCQA

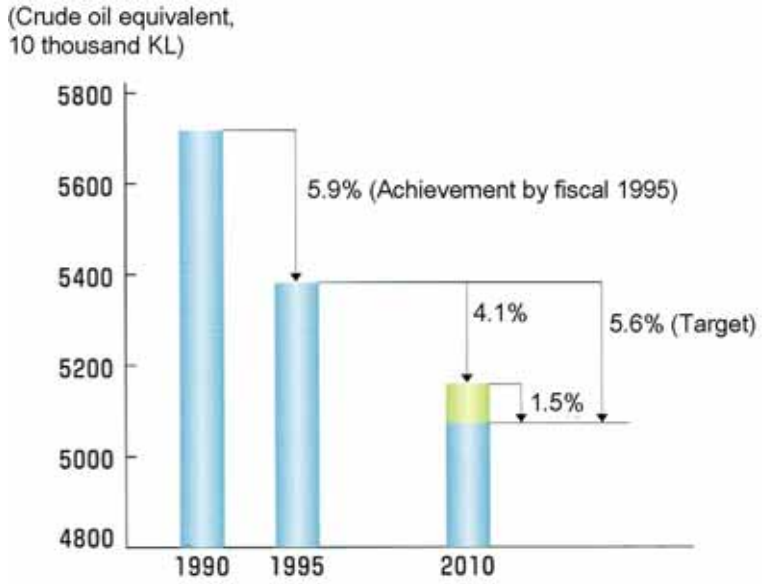
Toward Prevention of the Global Warming

The iron and steel industry of Japan established a target for reduction of energy consumption in the manufacturing processes; that is, a 10 percent reduction in 2010 from the energy consumption in 1990, the base year, in its effort for prevention of the global warming. The industry thereafter added another 1.5 percent reduction of energy consumption to the target by feeding waste plastics to blast furnaces and other facilities, on condition that the system of collection and other necessary conditions are fulfilled.

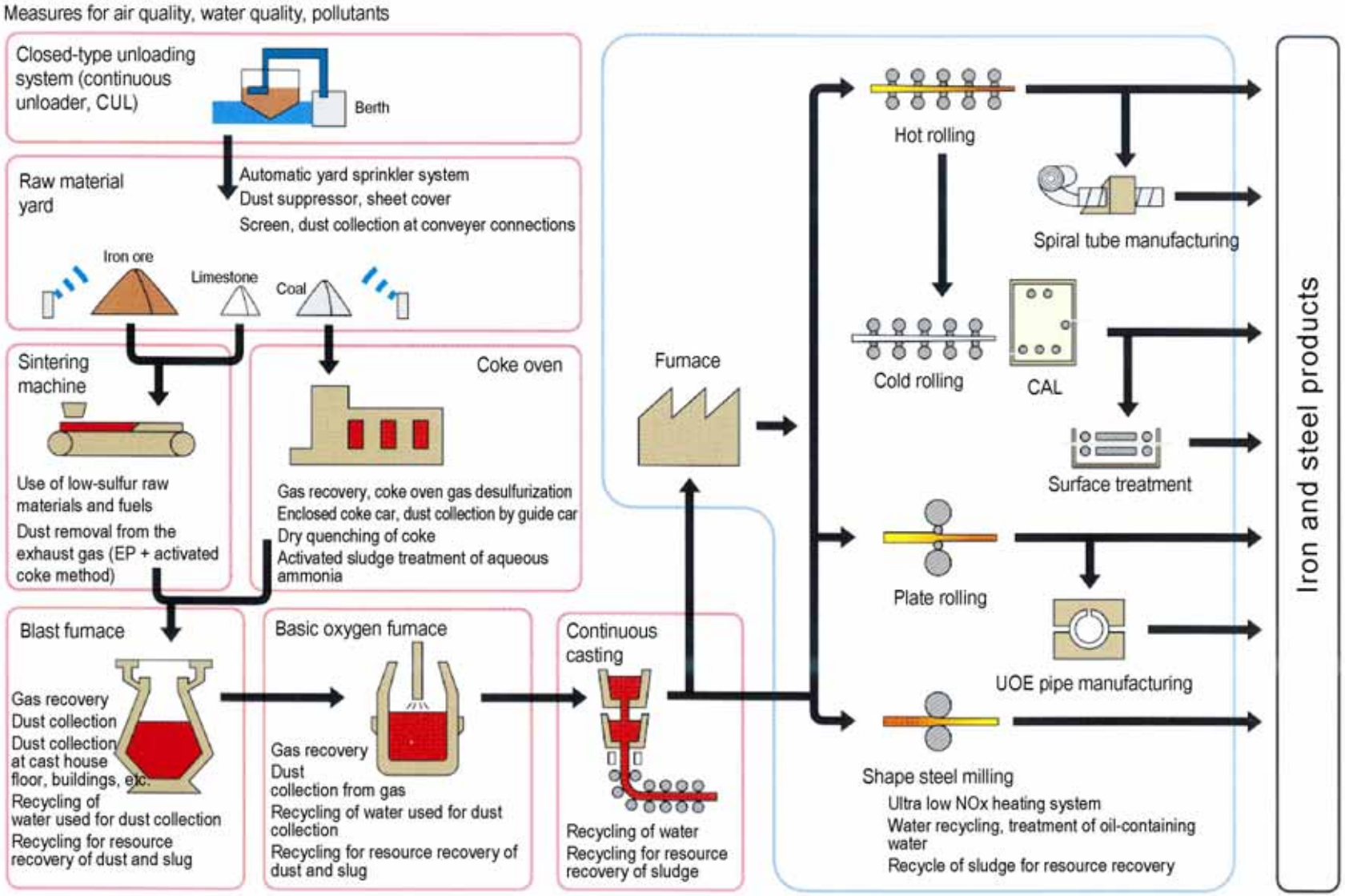
The Japanese iron & steel industry achieved 5.9 percent energy saving during the period from 1990 to 1995.

Against such a background, NKK intends to achieve 5.6 percent reduction of energy consumption in 2010 compared with the consumption in 1995. For this purpose, NKK promotes development of next generation iron making technologies, in addition to extensive adoption of such existing technologies as regenerative burners and continuous manufacturing technologies.

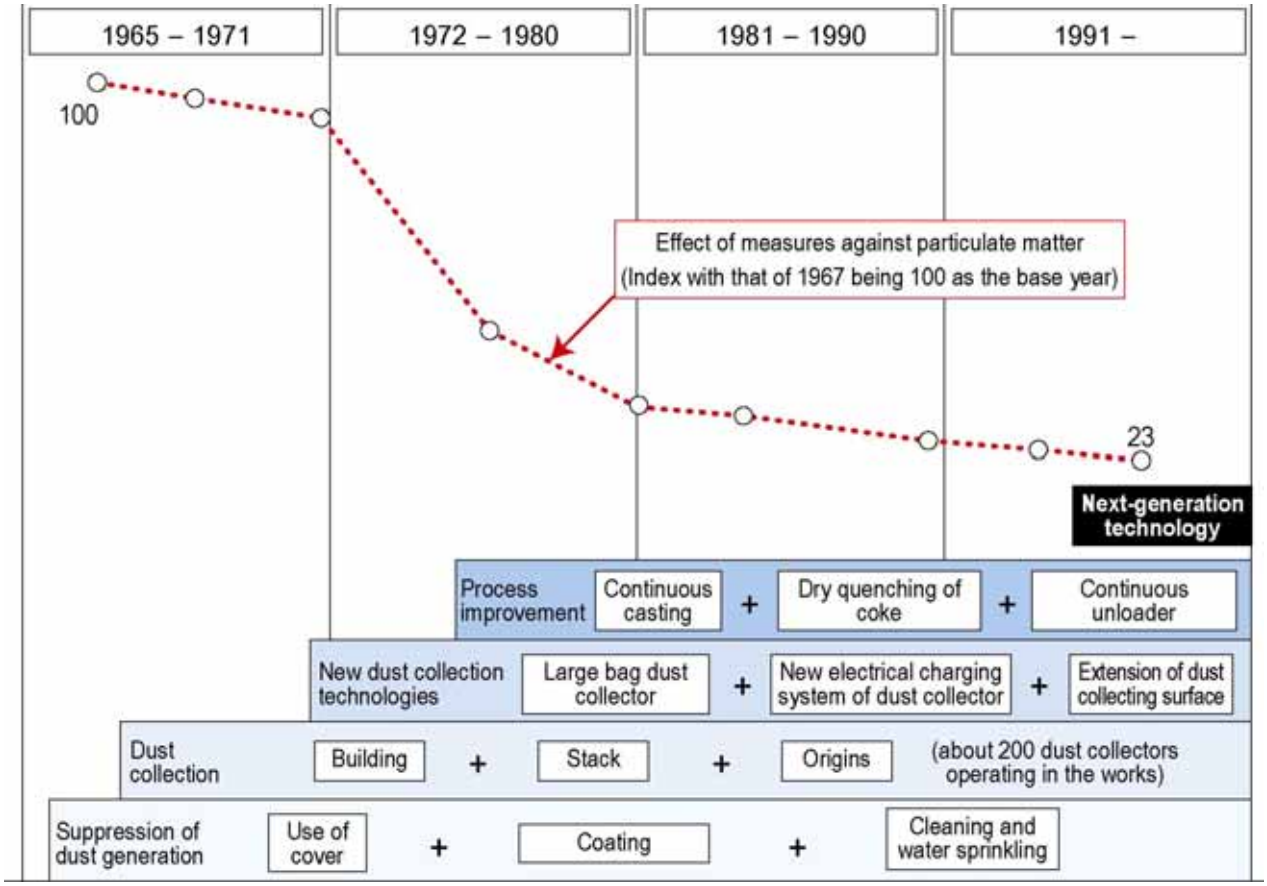
Achievement and Target of Iron & Steel Industry in Energy Saving



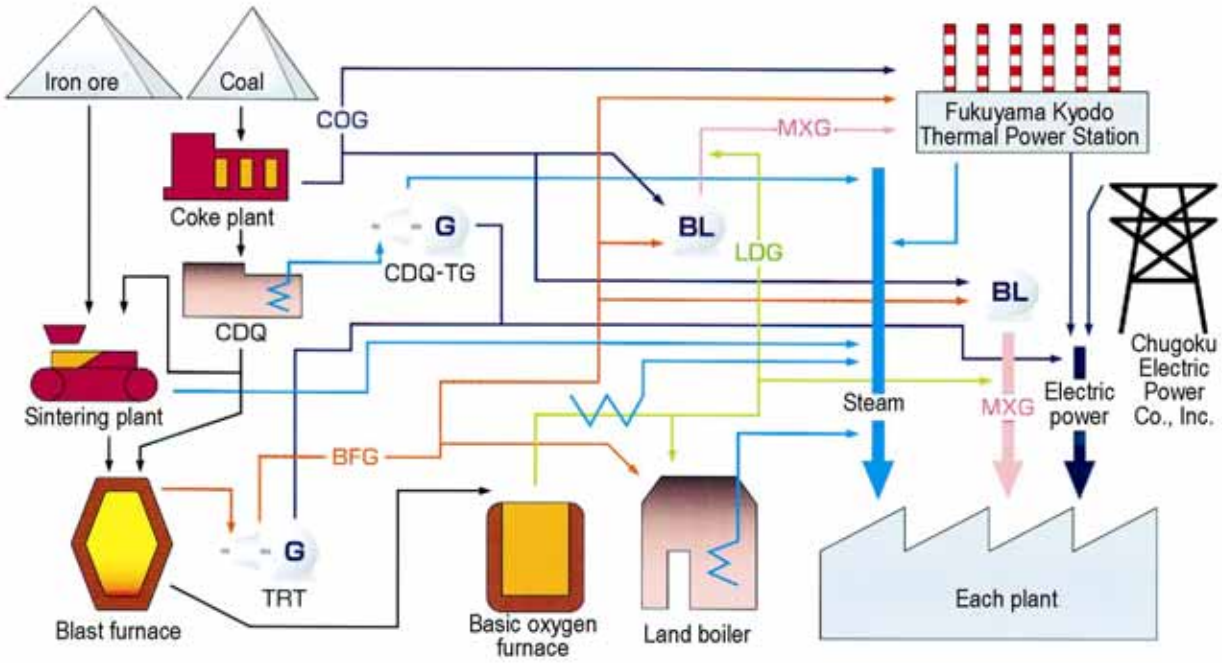
Manufacturing Process of Iron and Steel Products and Major Environmental Conservation Measures



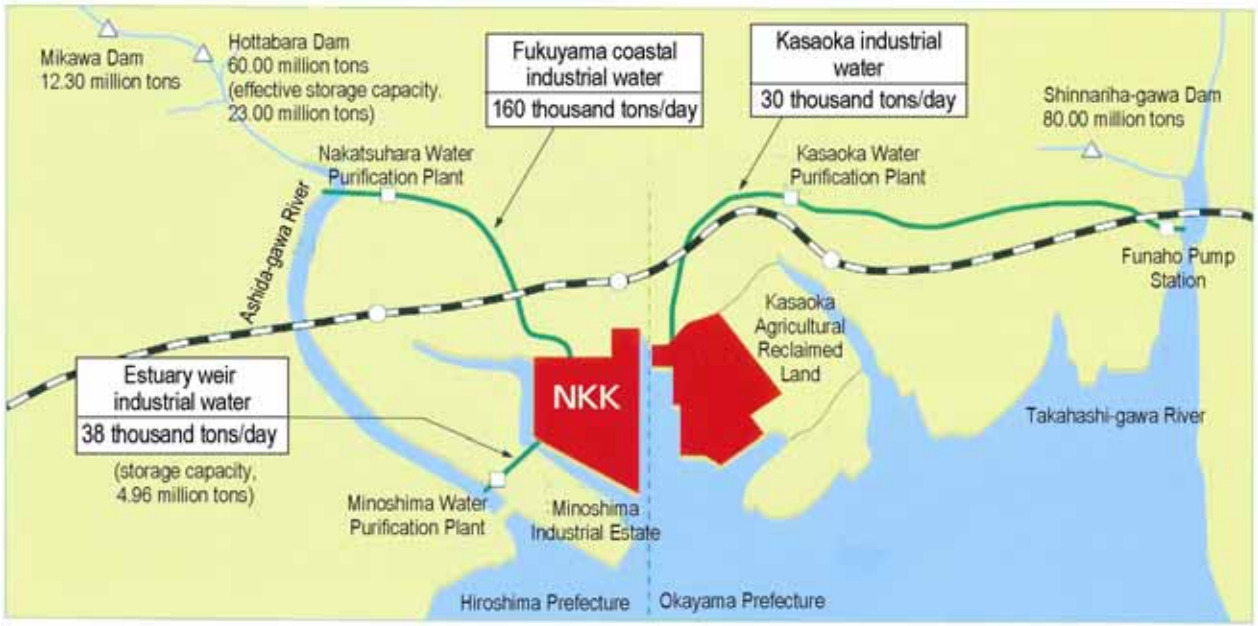
Trend for Measures against Particulate Matter, Dust and Soot



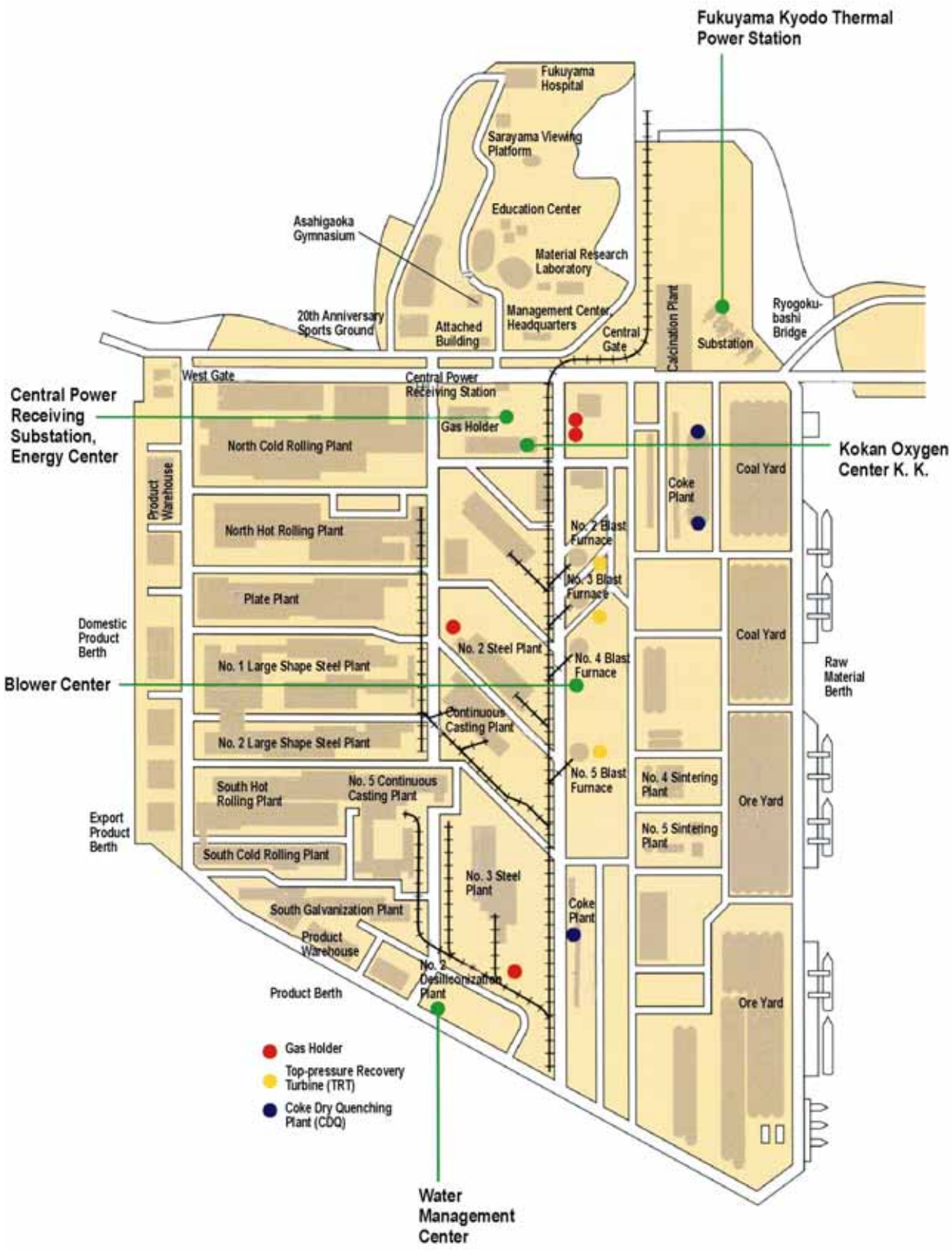
Energy Flow



Industrial Water



Hattabara Dam: 60.00 million tons	Ashida-gawa River	→	Minoshima Water Purification Plant	→ Estuary weir industrial water: 38 thousand tons/day
Mikawa Dam: 12.30 million tons			Nakatsuhara Water Purification Plant	→ Fukuyama coastal industrial water: 160 thousand tons/day
Shinnariha-gawa Dam: 80.00 million tons	Takahashi-gawa River	→	Kasaoka Water Purification Plant	→ Kasaoka industrial water: 30 thousand tons/day


Fukuyama Kyodo Thermal Power Station
Fukuyama Hospital
Sarayama Viewing Platform
Education Center
Asahigaoka Gymnasium
Material Research Laboratory
20th Anniversary Sports Ground
Attached Building
Management Center, Headquarters
Central Gate
Calcination Plant
Substation
Ryogoku-bashi Bridge
West Gate
Central Power Receiving Station
Central Power Receiving Substation, Energy Center
Gas Holder
Kokan Oxygen Center K. K.
North Cold Rolling Plant
Product Warehouse
Coke Plant
Coal Yard
North Hot Rolling Plant
No. 2 Blast Furnace
No. 3 Blast Furnace
Plate Plant
Domestic Product Berth
No. 2 Steel Plant
No. 4 Blast Furnace
Blower Center
No. 1 Large Shape Steel Plant
Raw Material Berth
Continuous Casting Plant
No. 2 Large Shape Steel Plant
No. 5 Blast Furnace
No. 4 Sintering Plant
South Hot Rolling Plant
No. 5 Continuous Casting Plant
Ore Yard
Export Product Berth
No. 5 Sintering Plant
South Cold Rolling Plant
No. 3 Steel Plant
Coke Plant
South Galvanization Plant
Product Warehouse
No. 2 Desiliconization Plant
Product Berth
Ore Yard
Gas Holder
Top-pressure Recovery Turbine (TRT)
Coke Dry Quenching Plant (CDQ)
Water Management Center

Central Power Receiving Substation, Energy Center

Gas holder facility

Blast furnace gas (BFG):..... 100 thousand m^3

Coke oven gas (COG): ..... 50 thousand m^3

Lindz-Donawitz Gas (LDG): ..... 80 thousand m^3
+ 70 thousand m^3

Gas holder facility

COG blower and compressor:.....14 units

LDG blower:.....5 units

MXG blower:.....7 units

Air compressor:.....14 units

Nitrogen blower and compressor:..19 units

Electric power facility

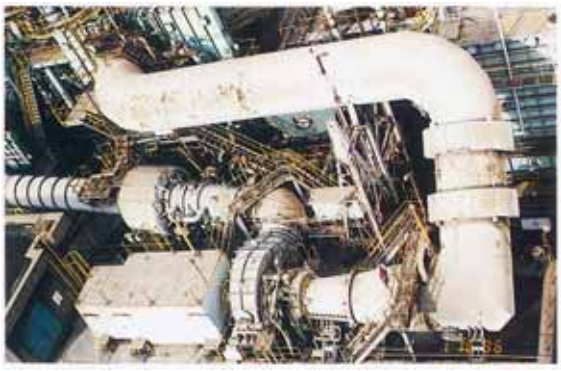
Transformer (extra high tension and high tension): .....about 150 units

Breaker (extra high tension and high tension): .....about 1,000

Blower Center

Blast furnace blower	Maximum discharge volume [Nm^3/min]	Maximum discharge pressure [kPa]	Power output [kW]
No. 2 blower	4,400	397	22,000
No. 3 blower	5,550	441	28,000
No. 4 blower	5,800	422	38,000
No. 5 blower	8,250	510	52,000
No. 6 blower	8,200	515	52,000
No. 7 blower	8,900	471	60,000

Energy Recovery Facility



● **Electric power recovery facility**

	Approved capacity [kW]	Type
2BF TRT	12,500	Dry-type axial-flow reaction turbine
3BF TRT	14,000	Wet-type axial-flow reaction turbine
4BF TRT	18,000	Wet-type axial-flow reaction turbine
5BF TRT	24,000	Dry-type axial-flow reaction turbine
3 CDQ power generating facilities	32,200	Condensing impulse turbine
4 CDQ power generating facilities	28,600	Condensing mixed pressure impulse turbine
5 CDQ power generating facilities	33,800	Condensing extraction turbine
Total	163,100	—

*TRT: top-pressure recovery turbine, CDQ: coke dry quenching power generation

● **Electric power recovery facility**

	Steam generated [tons/hour]	Pressure [MPa]	Temperature [°C]
3 CDQ boilers	111.7	8.4	523
4 CDQ boilers	69.0	10.3	540
5 CDQ boilers	116.5	8.3	520
4 sintering plant heat recovery boilers	40.2	1.3	230
5 sintering plant heat recovery boilers	55.6	1.3	230
2 steel plant heat recovery boilers	145.5	3.1	Saturated
3 steel plant heat recovery boilers	173.0	3.9	Saturated

Fukuyama Kyodo Thermal Power Station

	Approved capacity [MW]	Commis-sioning (year)	Note
No. 2 Power Plant	75	1967	
No. 3 Power Plant	156	1968	
No. 4 Power Plant	156	1970	Gas single fuel firing
No. 5 Power Plant	156	1971	
No. 6 Power Plant	156	1972	Gas single fuel firing
New No. 1 Power Plant	149	1995	Gas mixed fuel firing

Kokan Oxygen Center K. K.

● **Air Separation Plant**

	O_2 [Nm^3/h]	N_2 [Nm^3/h]	RAr [Nm^3/h]
No. 7 Plant	12,100	4,000	200
No. 8 Plant	12,100	4,000	200
No. 9 Plant	35,000	15,000	—
No. 10 Plant	35,000	15,000	1,000
No. 11 Plant	35,000	15,00	600
No. 12 Plant	4,300	22,000	270
No. 13 Plant	35,000	95,000	1,430
No. 14 Plant	50,000	130,000	1,750

● **Gas Manufacturing Plant**

CO_2/H_2 Plant	1 unit
H_2-PSA Plant	2 units

Water Management Center

Recirculating water

Water pump: about 400 units

Cooling tower: about 150 units

Water purification plant: at about 15 locations

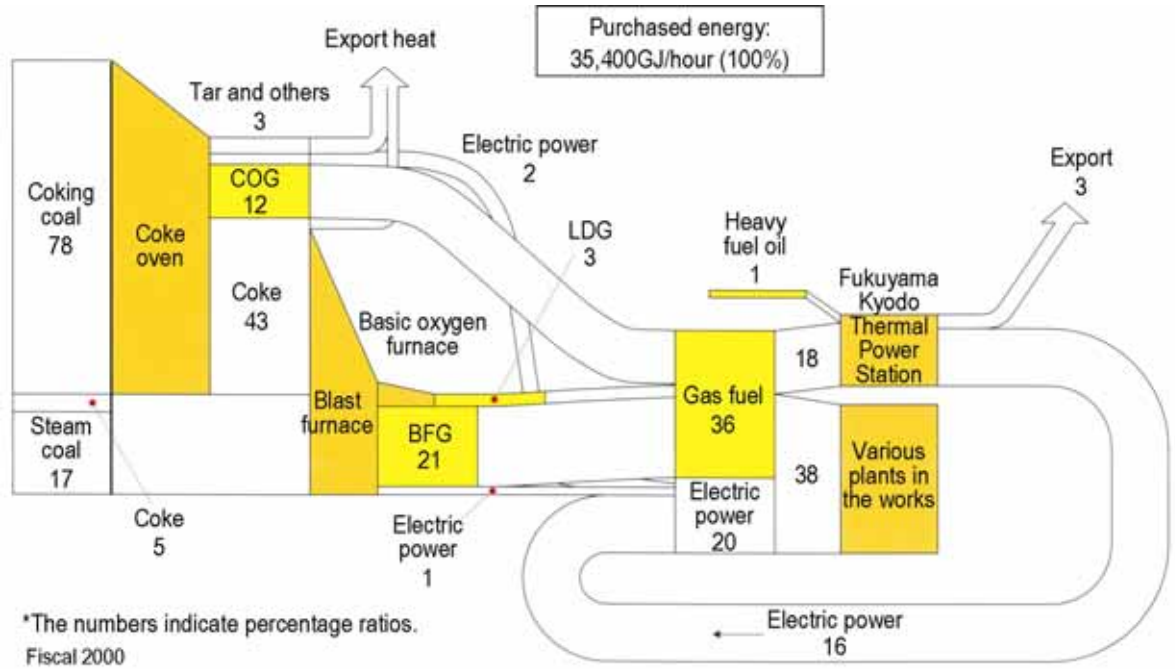
Wastewater treatment facility: at 2 locations

Land boiler

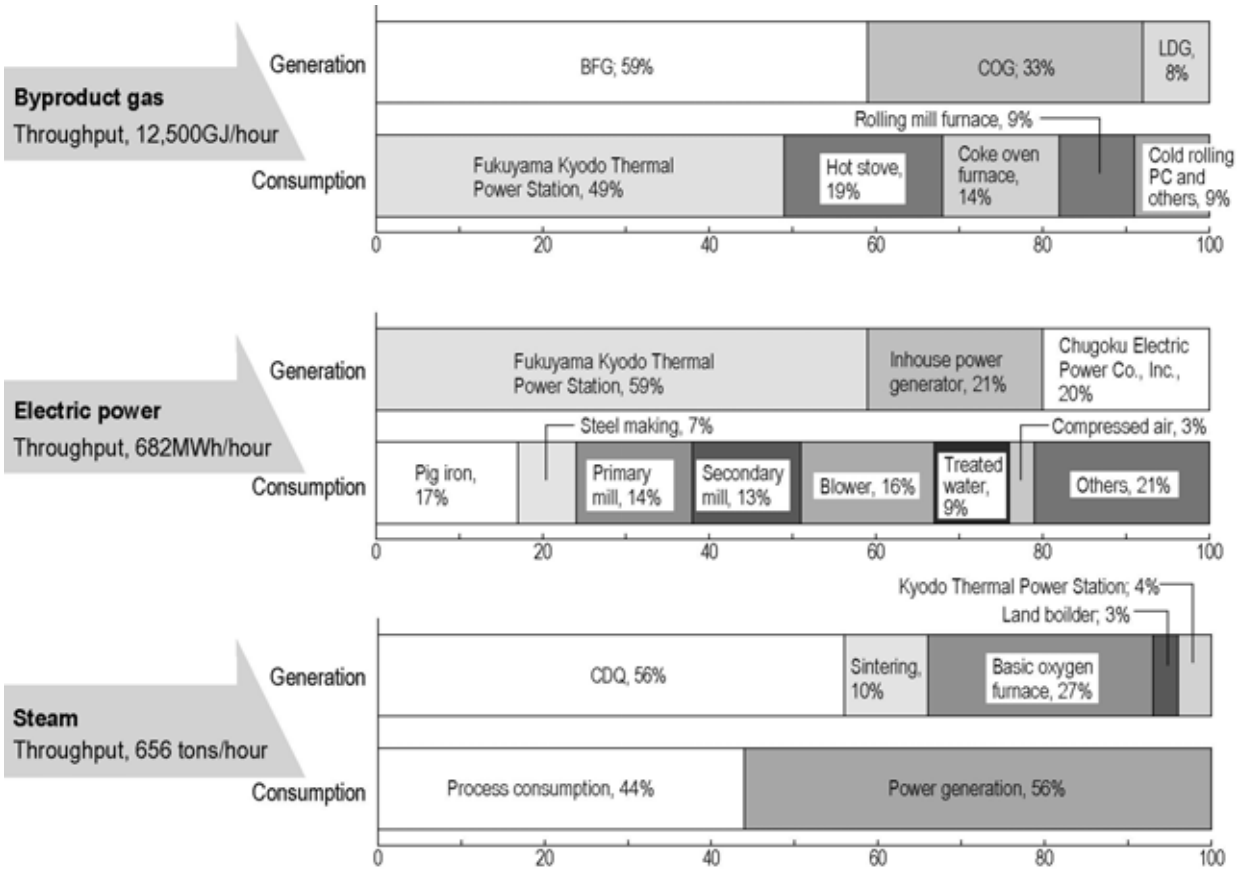
Steam generation, 100 tons/hour (process steam)

Energy

Energy Balance Sheet



Energy, Generation and Consumption



Outline of Major Energy Facility

Boiler	Manufacturer	JFE Engineering Corporation
	Model	Single drum natural circulation boiler
	Maximum steam generation	275 T/H
	Maximum working pressure	12.2 MPa
	Maximum working temperature	543°C
Turbine	Manufacturer	JFE Engineering Corporation, Alstom
	Model	Single drum impulse extraction condenser type
	Output	74,000 kW
	Inlet steam pressure	9.8 MPa
	Inlet steam temperature	538°C
	Maximum steam extraction	80 T/H
	Rotation	3,600 rpm
Generator	Manufacturer	TOSHIBA CORPORATION
	Model	3-phase AC synchronous generator
	Capacity	82,223 kVA
	Voltage	13.8 kV

Schematic Flow of Boiler - Power Generation System