Symbiosis between Energy and the Environment

Isogo Thermal Power Station

J-POWER

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Highlights of Isogo Thermal Power Station

Isogo Thermal Power Station was constructed in the late 1960s in line with Japan's national coal policy. The station has concluded an anti-pollution agreement with the Yokohama City Authorities, the first such agreement in Japan. The station has installed flue gas desulfurizers, ahead of other power stations, emphasizing environmental preservation measures while continuing three decades of providing a stable power supply for Yokohama. The Isogo Thermal Power Station was recently reconstructed for the following three purposes.

1. To meet the objectives of the Environmental Improvement Plan of the Yokohama City Authorities under the Yokohama 21st Century Plan (especially in terms of reducing nitrogen oxide (NOx) emissions)
2. Ensuring power supply security mainly for the metropolitan area and enhancing the reliability of power supply
3. Renewal in response to the obsolescence and aging of the old power generating facilities

The reconstructed Isogo Thermal Power Station is a compact, urban coal thermal power station that has achieved both environmental burden reduction and energy efficiency improvement at the world's highest level by introducing the latest environment-friendly facilities and adopting USC(*).

(* For details, see the reverse side.)

Historical Overview of Isogo Thermal Power Station

May 1967	Start of the Old No.1 Unit commercial operation
September 1969	Start of the Old No.2 Unit commercial operation
April 1992	Investigation on environmental conditions implemented (until March 1993)
September 1993	Basic approval by the Yokohama City Municipal
October 1995	Submission of Environmental Impact Survey Report & Environmental Impact Assessment Document to the Ministry of International Trade and Industry and to the Yokohama City Authorities.
July 1996	Approval of the Electric Power Development Adjustment Council
September 1996	Start of construction work of the New No.1 Unit
November 2001	Decommissioning of the Old No.1 and No.2 Units
April 2002	Putting into commercial operation of the New No.1 Unit
March 2004	Old No.1 and No.2 Units removed
October 2005	Construction of New No.2 Unit started
November 2008	Initial firing of New No.2 Unit
July 2009	Scheduled to go into commercial service of the New No.2 Unit

Facility Specifications

Item	Old No. 1 & 2 Units	New No. 1 & 2 Units
Output	No. 1 Unit : 265,000kW No. 2 Unit : 265,000kW - Total : 530,000kW.	No. 1 Unit : 600,000kW No. 2 Unit : 600,000kW - Total : 1,200,000kW.
Fuel	Domestic coal	Overseas Coal
Coal storage	Outdoor coal yard	Indoor coal (silo)
Boiler	Natural circulation drum type boiler	Tower type once-through boiler
Flue gas denitrification system	———	Dry-type flue gas denitrification system (Selective Catalytic Reduction of Nitrogen Oxide with Ammonia) Denitrification efficiency : No.1 Unit: 87.5% / No.2 Unit: 91.9%
Dust precipitator	Electrostatic precipitator Dust collecting efficiency : 99.75%.	Electrostatic precipitator Dust collecting efficiency : No.1 Unit: 99.94% / No.2 Unit: 99.97%
Flue gas desulfurization system	Wet-type flue gas desulfurization system (Lime Gypsum Process) Desulfurization efficiency: 89%	Dry-type flue gas desulfurization system (Active Carbon Absorption Process) Desulfurization efficiency : No.1 Unit: 95.0% / No.2 Unit: 97.8%
Smoke stack	No. 1 Unit : 120 No. 2 Unit : 140m	200m (Centralized type of two stacks)
Proportion of greened to total area	15%	20%
Port facilities	Coal unloading warf - Oil unloading pier x 1	Coal unloading warf x 1 Coal ash loading - Oil unloading pier x 1

Isogo Thermal Power Station Repowering Project

Construction Procedure : Build, Scrap and Build

To maintain the required power supply capacity during the construction of a new generating facility, we built the No.1 Unit (600,000 kW) while operating the old generating facility (530,000 kW). After the New No.1 Unit was commissioned, the old generating facility was decommissioned and demolished. Then, the New No.2 Unit was constructed on the site.

(1) We built the New No.1 Unit while operating the old generating facility.

- The extra space made available by reducing the outdoor coal yard provided room for building an indoor coal silo, water / fuel tanks and other facilities. The old tanks were removed afterwards.
- The space that was made available as a result was used for building the New No.1 Unit.
- In conjunction with the New No.1 Unit, an offshore deck and new water intake / outlet were constructed.

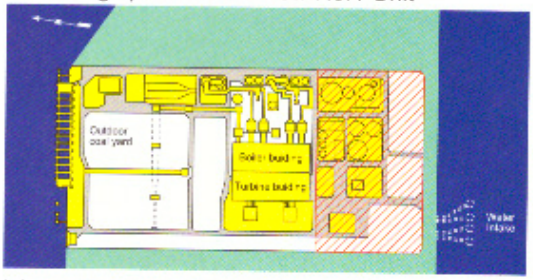
(2) The New No.1 Unit was commissioned and the old generating facility was removed.

- In line with commissioning the New No.1 Unit, the old generating facility was demolished, and the cleared space was secured as the site for the New No.2 Unit. The New No.1 Unit has an output capacity of 600,000 kW and maintains almost the same power supply capacity as the older generating facility (530,000 kW).

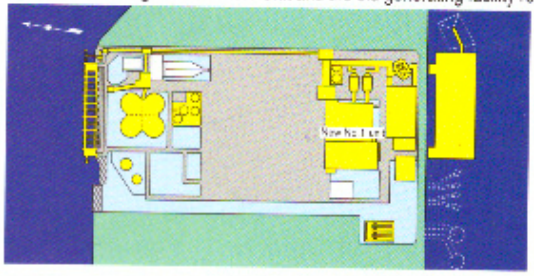
(3) Completing the repowering project with the construction of the New No.2 Unit

- The power generating capacities of the New No.1 and No.2 Units will total 1.2 million kW, more than double the capacity of the old generating facility.
- The New No.2 Unit will be built at the site where the old generating facility used to be located. When tree planting is finished at the site, the project will be completed.

(1) Making space for the New No.1 Unit



(2) Commissioning the New No.1 Unit and the old generating facility removal



From Coal to Power

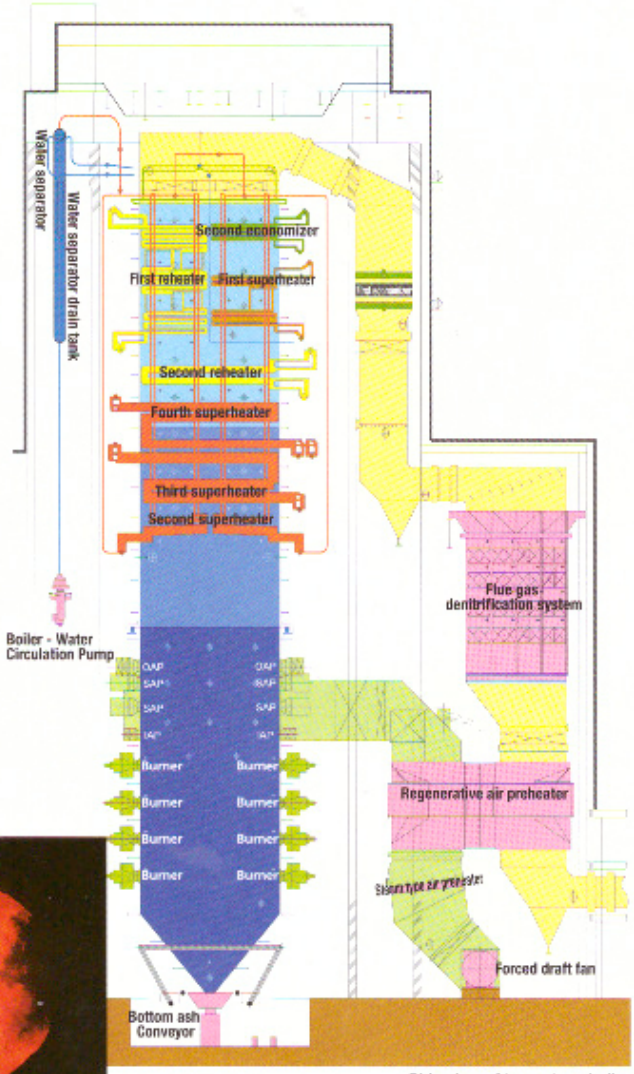
Isogo Thermal Power Station generates electricity by burning coal to produce steam that drives the turbine-generator.

Conveying Coal

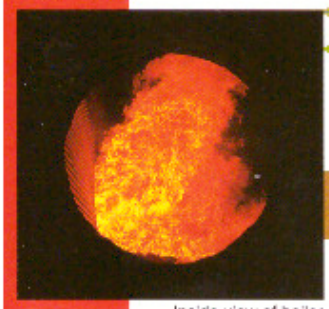
Coal is stored in the coal silo through the conveyors after unloading from coal ships. Then the coal is fetched to the pulverizers through coal feeders after the short time storage in the bunkers. The pulverized coal is transporeted into the boiler by hot air.

Clover-type Coal Silo

Coal, the power station's main fuel, is stored in (the four-leaf) clovers type silo for saving space. The belt conveyors that carried the coal have air floating type belts in sealed pipes. This helps prevent coal dust dispersion and reduces noise and vibration.



Side view of tower type boiler



Inside view of boiler

Generating Steam

The pulverized coal is combusted in the boiler. The combustion heats the water flowing through thousands of small pipes inside the boiler to generate high-temperated, high-pressured steam.

Adoption of USC

We have adopted Ultra Super Critical (USC) for steam, achieving the highest efficiency level in the world.

		Main steam pressure	Main steam temperature	Recycling reheat steam temperature
Steam	Old No.1 & No.2 Units	16.6MPa	566℃	566℃
	New No.1 Unit	25MPa	600℃	610℃
	New No.2 Unit	25MPa	600℃	620℃

Tower type Boiler

To make optimum use of the space available, a tower-type boiler has been installed for the first time ever in Japan. It can make less installation space that would otherwise be required for a conventional boiler on the same scale.

Generating Electricity

The steam is sent to the turbine-generator. The impeller blades of the turbines are caused to rotate at high speed by the jet impact and expansion forces of the steam. This in turn causes the rotor of the generator to generate electricity. The steam that has driven the turbines is sent to a condenser where it is cooled with seawater to condense to water and send back to the boiler.

Turbine and generator

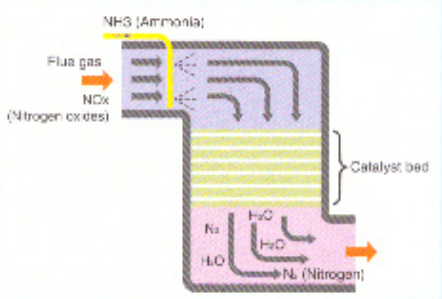
For Better Environment

Measures to Prevent Air Pollution

One of the main objectives of the repowering project was to reduce NOx emission on substantial scale. Although the old plant used low-NOx burners and a two-stage combustion system, the New No.1 and No.2 Unit has a dry-type denitrification system for additional pollution control. SOx and soot are effectively controlled with the use of a high-efficiency dry-type flue gas desulfurization system and electrostatic precipitators.

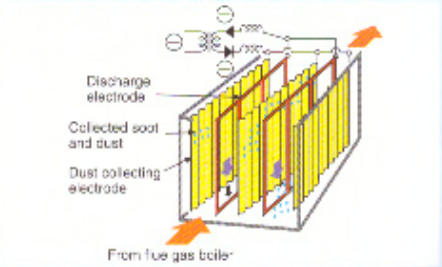
Dry-type flue gas denitrification system

Ammonia is injected to the NOx-containing flue gas and the gas passes through catalyst beds.
The chemical reactions taking place in the presence of the catalyst decomposse the nitrogen oxides contained in the flue gas to harmless nitrogen and water.



Electrostatic Precipitators

When the soot and dust containing flue gas passes among the DC high-voltage electrodes, the soot and dust particles acquire negative charges and are thus attracted to the positive electrodes. The principle is the same as when dust is electrostatically attracted to a plastic cardbord when rubbed. The soot and dust adhering to the electrodes is removed by periodically shaking the electrode to let the particles fall off.



Measures to Preserve Water Quality and Prevent Thermal Discharge Pollution

The Plant effluent and general sewage water from the power station are clarified in the general wastewater treatment plant for discharge.
The intake and outlet temperature difference for the sea water used for cooling the steam in the condenser is 7℃ or less, also the flow speed is considered not to interfere to ship sailing.

General wastewater treatment plant

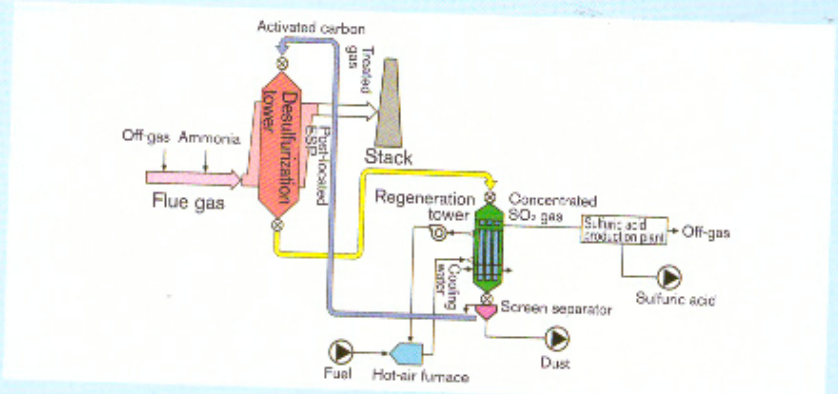
Isogo Thermal Power Station has focused attention on environmental protection measures, with the signing of a pollution prevention agreement with the Yokohama City Authorities, the first time such an agreement has ever been concluded in Japan. For the New No.1 Unit, a new pollution prevention agreement was signed to strengthen our efforts to improve on our anti-pollution measures.

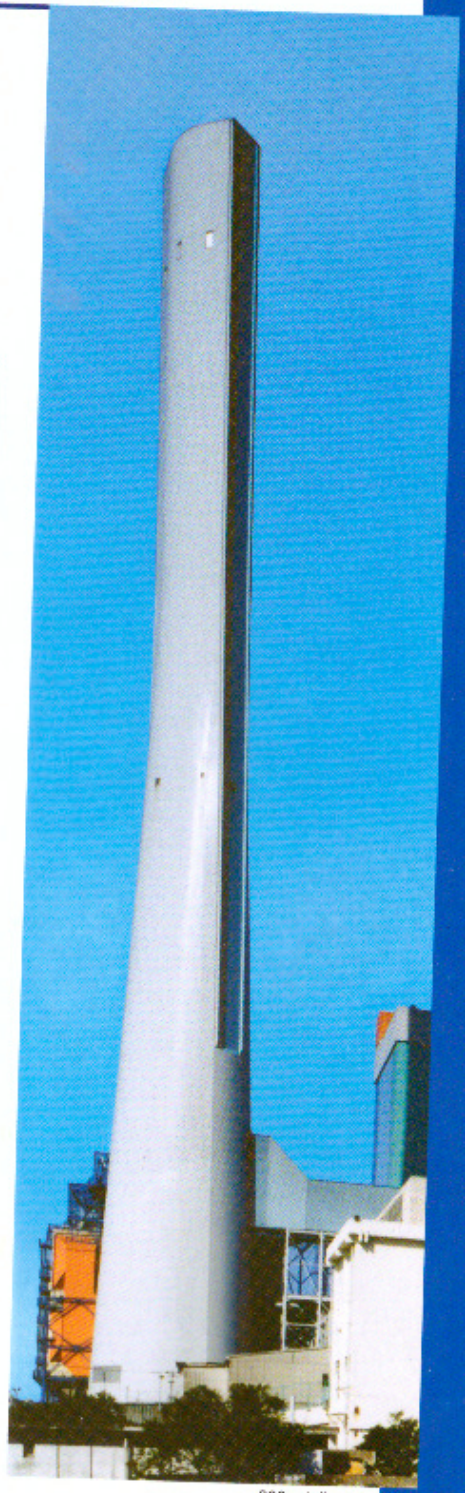
Comparison of flue gas Emission Concentrations of the New and Old Plants

Item		Old No.1 & 2 Units	New No.1 Unit	New No.2 Unit
Gas discharge volume (wet gas)		1,972,000m³N/h	2,000,000m³N/h	1,992,000m³N/h
Smoke and soot emission concentration	Nitrogen oxides	159ppm	20ppm	13ppm
	Soot and dust	50mg/m³N	10mg/m³N	5mg/m³N
	Sulfur oxides	60ppm	20ppm	10ppm

Dry type Desulfurization plant

Flue gas passes through activated carbon filled in the desulfurization tower to adsorb sulfur oxides contained. The activated carbon is then sent to the regeneration tower. In the regeneration tower, sulfur oxides are expelled from the activated carbon and the activated carbon is then again sent to the desulfurization tower for reuse. The sulfur oxides expelled from the activated carbon are recovered as a highly concentrated sulfuric acid which is effectively usable.





200m tall stack

Preventing Soot and Dust Dispersion

Indoor coal/ash silos and air floated belt conveyors are used for storing and handling coal and ash. These systems are of sealed, enclosed to prevent the dispersion of soot and dust.

Utilization of Coal Ash

We make efforts not only on efficient coal combustion but also on utilization of coal ash which can be regarded as byproduct. At the Isogo Station, almost entire amount of coal ash is used to great advantage for fertilizer and for reinforcement of cement.

Landscape Design

Every consideration has been given to the landscaping of the power station to ensure the buildings and stack blending in with the surrounding environment. We have also taken care of the design, arrangement and coloring of the power station to enhance its view from the sea. It gives a harmony on the harbor city.

Noise and Vibration Prevention

All machines are equipment installed indoors or low-noise type to minimize the effect of noise and vibration to the surrounding environment.

Greening

After the repowering work is completed, the greened area will be expanded by planting mainly evergreen broad-leafed tree variation.

Full View of the Power Station

Station Layout after Completion of Repowering