Feature

Replacement Activities Completed at Isogo Thermal

Under construction since 2005, the Isogo New No. 2 Thermal Power Plant commenced commercial operations on July 15, 2009. Together with the New No. 1 Plant, the city of Yokohama is now home to a cutting-edge coal-fired thermal power plant boasting a total power output of 1,200 MW.

Power Plant

1 Brief History of the Isogo Thermal Power Plant

The Isogo Thermal Power Plant (former No. 1 and No. 2 plants; 265 MW each) was built in the late 1960s in line with Japan's national coal policy. Given the power plant's location in a major city, J-POWER entered into Japan's first pollution prevention agreement with Yokohama, installed flue gas desulfurization equipment at an early stage, and implemented other environmental preservation measures. J-POWER has contributed in this way to the stable supply of electric power for the Tokyo metropolitan area, primarily Yokohama, over three decades.

Since 1996, J-POWER has been conducting a project designed to replace the plant's old facilities with cutting-edge coal-fired thermal power technologies in response to Yokohama's environmental improvement plans, enhance power supply stability and reliability particularly for the Tokyo metropolitan area and deal with the aging of plant facilities.

In order to maintain the supply of electric power, the former power plant facility (530 MW) remained in operation while the New No. 1 Plant (600 MW) was under construction. The old plant facility was then scrapped and dismantled once operation of the New No. 1 Plant commenced. Adopting an unprecedented "build, scrap and build" approach, the New No. 2 Plant was then built on the site of the old plant. In conjunction with the power plant replacement activities, J-POWER again signed a pollution prevention agreement with Yokohama, this time as an environmental preservation agreement. As part of this change, the Company has adopted even stricter SOx, NOx, and other emissions limits than in the earlier agreement.

Construction of the New No. 1 Thermal Power Plant began in 1998, and commercial operations commenced in 2002. With the start of commercial operations at the New No. 2 Thermal Power Plant, replacement activities for the Isogo Thermal Power Plant are now complete.

		Isogo Thermal Power Plant: operations launched in 1967	New No. 1 Plant: operations launched in 2002 New No. 2 Plant: operations launched in July 2009
			
Three objectives			
1. Boost output	**Capacity**	**530** MW (265 MW x 2 units)	**1,200** MW (600 MW x 2 units)
2. Enhance environmental performance	**SOx**	**60** ppm	New No. 1 Plant: **20** ppm / New No. 2 Plant: **10** ppm
	NOx	**159** ppm	New No. 1 Plant: **20** ppm / New No. 2 Plant: **13** ppm
	Soot and dust	**50** mg/m³N	New No. 1 Plant: **10** mg/m³N / New No. 2 Plant: **5** mg/m³N
3. Improve efficiency	**Steam condition**	**Sub-Critical**	**Ultra Super Critical**
	CO_2 emissions*	**100**	**83**

* Comparison based on pre-replacement gross CO_2 emissions per kWh of 100.

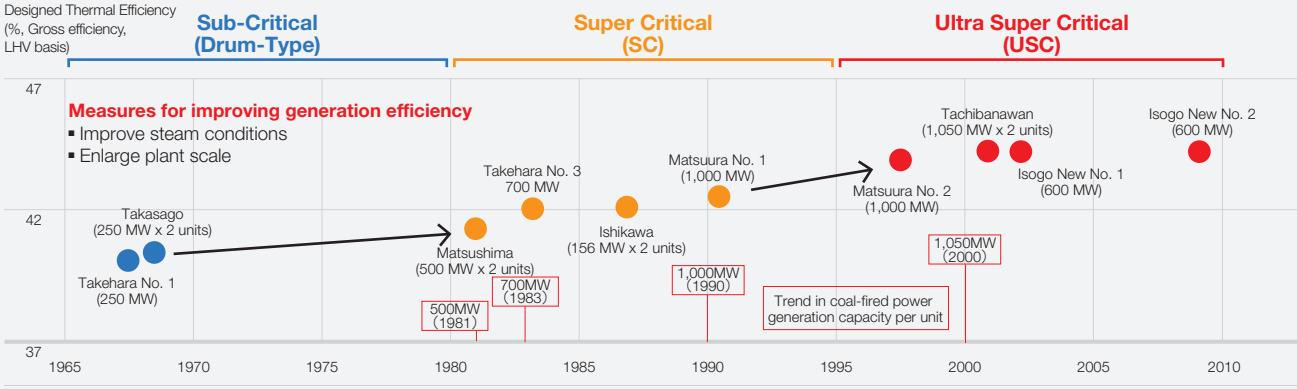
2 Cutting-Edge Power Plant:

Striving for High Power Generation Efficiency and Lower CO_2 Emissions

In Japan, steady strides have been made in technology development aimed at improving coal-fired thermal power generation efficiency, both to comply with tougher environmental regulations and achieve better economic performance. Ever since the days of the former Isogo Thermal Power Plant, J-POWER has taken the initiative to develop state-of-the-art technologies, proactively adopting the cutting-edge technologies of the day. Furthermore, the Company's dedication to plant maintenance and improvement over the years through proper operations, maintenance and control after operations commence, have resulted in high power generation efficiency for its coal-fired thermal power versus that in Europe and Asia.

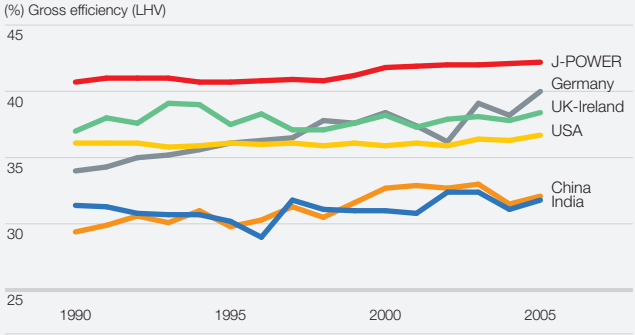
For J-POWER, the New Isogo Thermal Power Plant is the epitome of coal-fired thermal power built on an assortment of clean coal technologies. Using a method that raises the steam pressure and temperature of steam turbines to the Ultra Super Critical (USC) level, J-POWER has realized one of the highest levels of power generation efficiency for coal-fired thermal power in Japan. With the New No. 2 Plant, J-POWER has raised the efficiency bar further by boosting the reheat steam temperature 10°C higher than the New No. 1 Plant, to 620°C.

Power Generation Efficiency at J-POWER



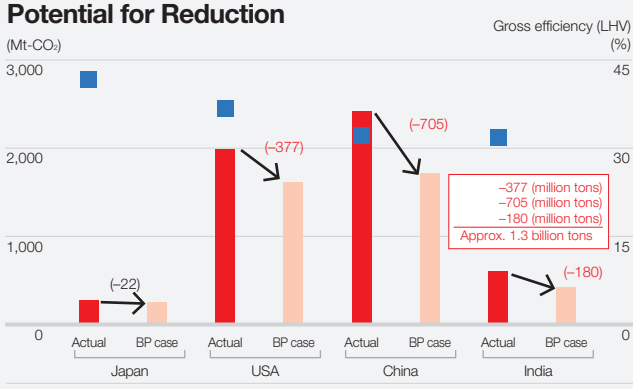
(Notes)
Sub-Critical, Drum-Type Boiler: Steam pressure is under 22.1 MPa.
Super Critical (SC): Steam pressure is 22.1 MPa or greater, with steam temperature 566°C or less.
Ultra Super Critical (USC): Refers specifically to SC-range steam pressure at temperatures exceeding 566°C.

Trends of Thermal Efficiency in World's Coal-Fired Thermal Power Generation



Source: Ecofys Comparison of Power Efficiency on Grid Level 2008

CO_2 Emissions from Coal-Fired Thermal Power and Potential for Reduction



BP case: Calculation assuming application of best practice (highest efficiency from commercial power plant) from Japan
LHV: Lower Heating Value standard
Source: IEA World Energy Outlook 2007, Ecofys Comparison of Power Efficiency on Grid Level 2008

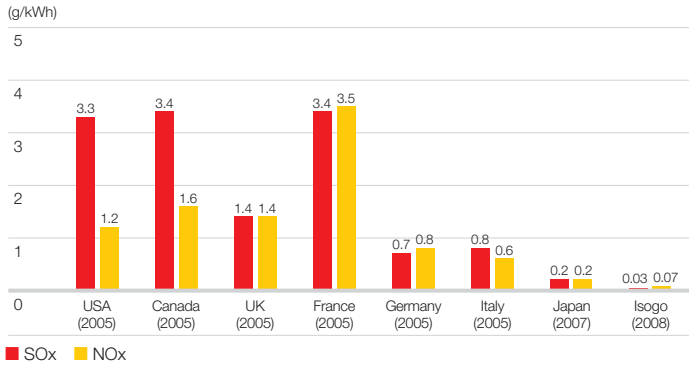
High-efficiency power generation is itself a means of curbing CO_2 emissions. J-POWER sees improved energy-use efficiency as a key element in its efforts to reduce CO_2 emissions. From this standpoint, the replacement of the Isogo Thermal Power Plant facilities is highly significant.

To illustrate, if major CO_2-emitting countries like the United States, China and India were to apply the highest level of environmental performance found at thermal power plants in Japan, including that of the Isogo Thermal Power Plant, to all of their coal-fired thermal power plants, it is estimated that they could cut CO_2 emissions by a combined total of roughly 1.3 billion tons per year. This figure is equivalent to about 5% of the world's total CO_2 emissions, or around the same as Japan produces annually. Encouraging the transfer and diffusion of this technology will thus enable the Company to contribute substantially to preventing global warming, and represents an important business opportunity for J-POWER.

Addressing Environmental Problems

The introduction of cutting-edge environmental technology at the Isogo New No. 1 Thermal Power Plant has greatly reduced the plant's environmental load, bringing SOx and NOx emission levels on a par with those of gas-fired thermal power plants. J-POWER is pushing forward with business development in this area, recognizing regional environmental measures of this kind as a field for leveraging its technology.

INTERNATIONAL COMPARISON OF SOx AND NOx EMISSIONS PER VOLUME OF THERMAL POWER GENERATION



Source: The Federation of Electric Power Companies
* Figures for Japan include combined data from 10 EPCOs and J-POWER.
* Figures for Isogo are actual results for fiscal 2008.

Developing Operations Using the ReACT Dry-Type Flue Gas Desulfurization-Denitrification System

The regenerative activated coke technology (ReACT) dry-type desulfurization-denitrification system continuously regenerates and recycles activated coke and removes such pollutants as SOx, NOx, and soot and dust from flue gas. In addition to using almost no water, another distinctive feature of the process is its high NOx removal capability even at low temperatures. The system is in operation at J-POWER's Takehara Thermal Power Plant Unit 2 and at its Isogo New No. 1 and New No. 2 Thermal Power Plants.

J-POWER subsidiary J-POWER EnTech Inc. provides ReACT engineering services. It has delivered ReACT systems to J-POWER's Isogo New No. 2 Thermal Power Plant and to the Wakayama Steel Works of Sumitomo Metal Industries, Ltd. Going forward, J-POWER EnTech aims to continue efforts to capture opportunities to deliver ReACT systems to power plants, steel plants and other entities both in Japan and abroad.

The activated coke used in the system is sourced from JM Activated Coke, Inc., a joint venture between J-POWER and NIPPON COKE & ENGINEERING CO., LTD. that supplies coke to J-POWER and other consumers in and outside of Japan.

Dry-type desulfurization system at Isogo New No. 2 Thermal Power Plant

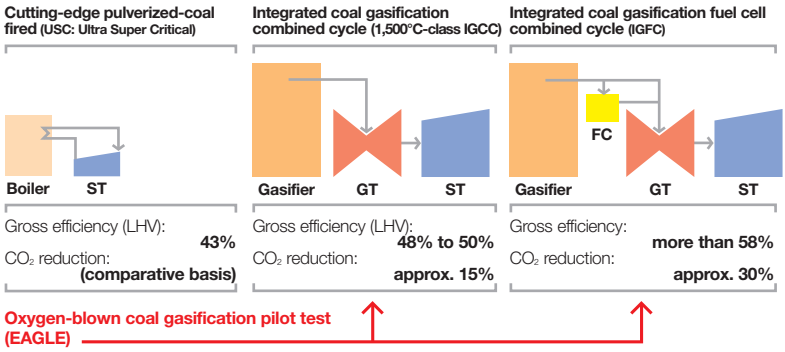
Research and Development

Realizing Next-Generation Coal-Fired Thermal Power

Aiming to raise power generation efficiency and develop low carbon operations in coal-fired thermal power generation, J-POWER is pressing ahead with activities specified along different timeframes. As a long-term initiative for the future, we are working to achieve the practical application of oxygen-blown coal gasification technology, which is anticipated to become vital to next-generation coal-fired thermal power generation. By establishing the technology and applying it to integrated coal gasification combined cycle (IGCC) and integrated coal gasification fuel cell combined (IGFC) systems, we will be able to dramatically boost power generation efficiency while sharply reducing CO_2 emissions.

Ultimately, we intend to combine these systems with carbon dioxide capture and storage (CCS) technology to realize groundbreaking, zero-emissions coal-fired power generation.

Coal-Fired Power Technology for the Next Generation



ST: Steam turbine; GT: Gas turbine; FC: Fuel cell

Ultra Super Critical (USC)
USC technology raises the steam pressure and temperature of steam turbines above that of conventional supercritical steam turbines (pressure: 246 kg/cm²; temperature: 566ºC) in order to enhance the efficiency of thermal power plants.

Integrated Coal Gasification Combined Cycle (IGCC) and Integrated Coal Gasification Fuel Cell Combined Cycle (IGFC)
Both technologies are built on coal gasification and offer substantially improved power generating efficiency relative to pulverized-coal fired thermal power. Whereas pulverized-coal fired thermal power utilizes steam turbines only, IGCC power generation employs both gas and steam turbines. IGFC power generation adds another element, fuel cells, for a triply integrated power generation configuration.

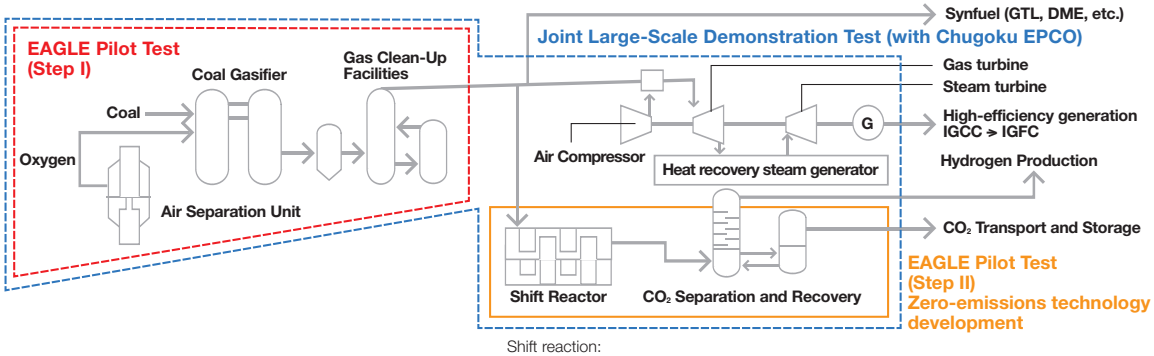
Joint Large-Scale Demonstration Test of Oxygen-Blown Coal Gasification Technology (With Chugoku EPCO)

Towards the Commercial Use of IGCC

J-POWER has conducted pilot tests of oxygen-blown coal gasification at its Wakamatsu Research Institute since 2002, with the aim of developing both a gasifier based on this technology and gas clean-up technology (EAGLE—Step I 2002–2006). In addition, we currently continue to implement testing with the dual aims of developing CO_2 separation and capture technology, and expanding the number of coal types suitable for gasification (EAGLE—Step II 2007–2009).

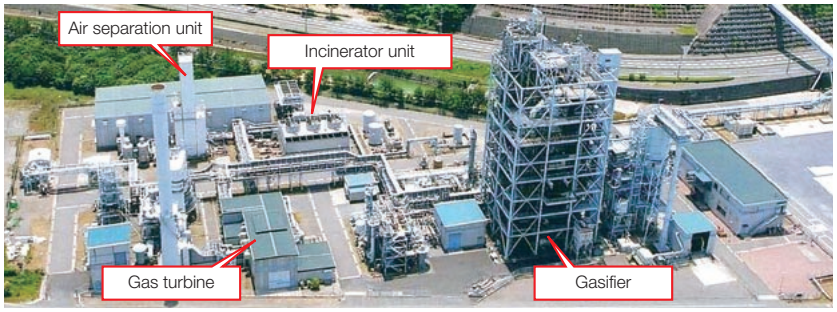
Based on the success of these pilot tests, namely our accomplishment in terms of developing oxygen-blown coal gasification technology and CO_2 separation and recovery technology, we are now preparing for a large-scale demonstration test on the premises of the Osaki Power Plant (Osakikamijima-cho, Toyota-gun, Hiroshima Prefecture) of The Chugoku Electric Power Co., Inc. in collaboration with Chugoku Electric Power.

Overview of R&D in Clean Coal Technologies at J-POWER



Shift reaction:
The shift reaction is the conversion of CO and added steam to CO_2 and H_2 with a catalyst

Projects Through Innovative Technology



EAGLE pilot-scale testing facilities

CO_2 separation and recovery facility

In July 2009, J-POWER and Chugoku Electric Power established a new company, Osaki CoolGen Corporation, as a joint investment to efficiently carry out the demonstration test.

This test will involve the construction of a demonstration plant with an output on a scale of 170 MW-class (coal processing volume of approx. 1,100 tons/day), and will investigate the reliability, economic efficiency, operability and other features of power generation based on oxygen-blown integrated coal gasification combined cycle (IGCC) technology. In parallel, we intend to perform trials for the application of cutting-edge CO_2 capture and storage (CCS) technology, with the view to conducting a large-scale demonstration project concerning CCS, as stipulated in Japan's national Cool Gen Project.

We aim to commence environmental assessments from August 2009, with plans to start construction in 2013 and demonstration testing in 2017.

Cool Gen Project

The Cool Gen Project is a plan proposed by the Clean Coal Subcommittee, Mining Committee of the Advisory Committee for Natural Resources and Energy of Japan's Ministry of Economy Trade and Industry (METI). The plan calls for promoting experimental research projects aimed at realizing "zero-emissions coal-fired thermal power generation" through a combination of IGCC, IGCF (aimed at ultimate coal-fired thermal power generation), and carbon dioxide capture and storage (CCS) technologies.

Carbon Dioxide Capture and Storage (CCS) Technology

Working to Achieve Zero Emissions of CO_2

At present, surveys and plans to conduct trials around CCS, whereby CO_2 from large-scale emission sources is separated and recovered for capture and permanent storage underground or in the ocean, are moving forward most notably in Japan and Europe. Of the three distinct elements comprising CCS—separation and capture, transport and storage—J-POWER has focused most intently on the development of CO_2 separation and capture technologies. This decision reflects our view that aligning "separation and capture" functions with power plant design is a critical path, as well as our recognition that CO_2 separation and capture is the most cost-intensive component of the entire CCS process.

As part of EAGLE—Step II, J-POWER is conducting pilot testing of CO_2 separation and capture technology for gases derived from oxygen-blown coal gasification, considered the most promising future technology in this area particularly in terms of efficiency. In parallel, we are actively working to develop similar technologies for combustion exhaust from pulverized-coal fired (PCF) thermal power, currently the most common method of power generation from coal.

CO_2 Separation and Capture at PCF Plants

PCF is currently the most widely used method of power generation in systems fueled by coal, and the separation and capture of CO_2 from combustion exhaust is likely to become common in the future.

At J-POWER's Matsushima Thermal Power Plant, J-POWER conducted pilot trials (from 2007 to 2008) in collaboration with Mitsubishi Heavy Industries, Ltd. regarding the chemical absorption method.

Additionally, J-POWER is a participant in the Callide OxyFuel Project using the OxyFuel method, a project planned to be held at the Callide A Power Station in Queensland, Australia. This joint demonstration project between Japan and Australia, planned to run from 2010 to 2014, will carry out the world's first demonstration test of an integrated CCS and underground storage system at an existing power plant.

(From left)
Equipment for demonstrating CO_2 separation and recovery at the Matsushima Thermal Power Plant, Unit 2
Callide A Power Station (Australia)