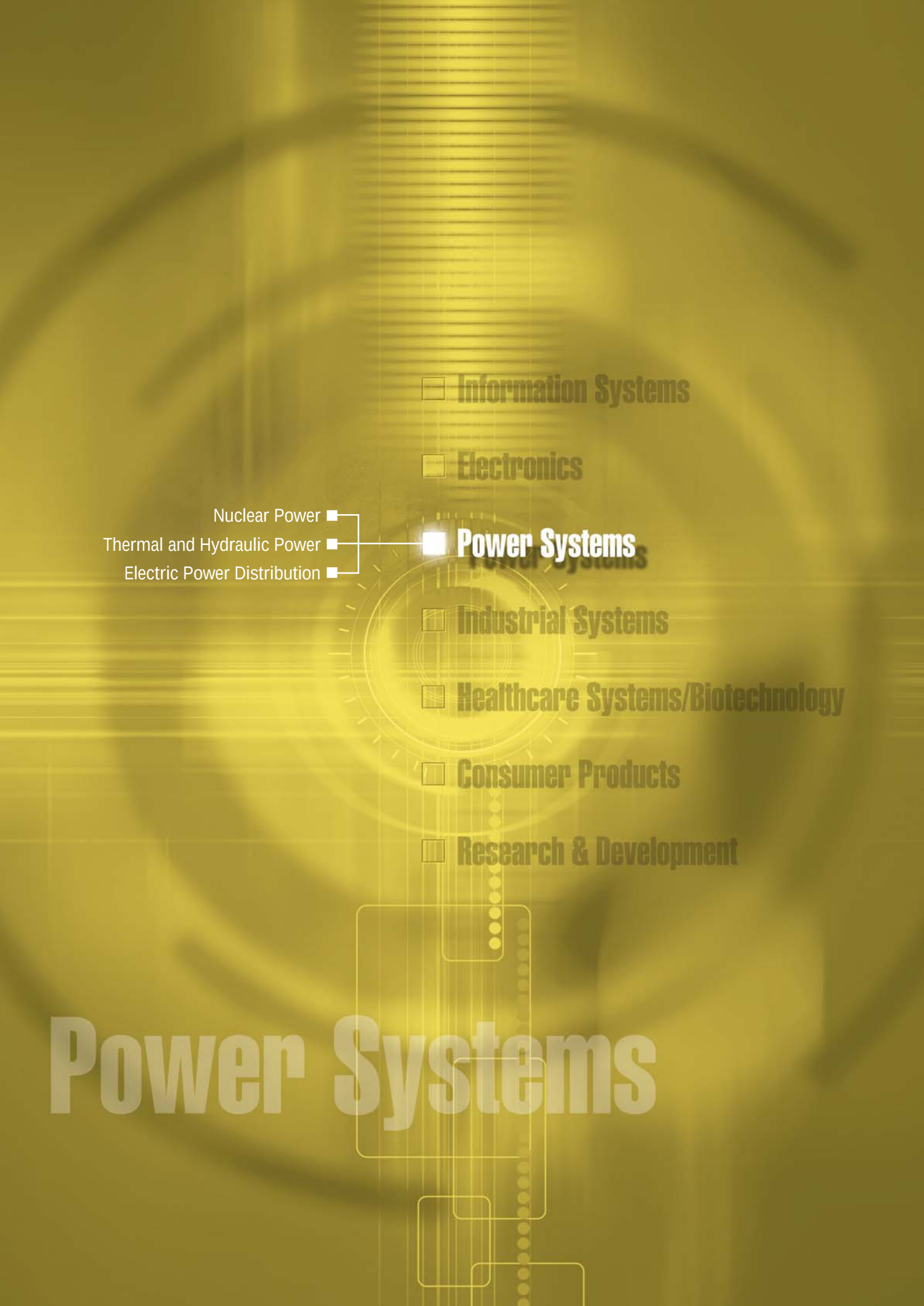

Information Systems
Electronics
Nuclear Power
Thermal and Hydraulic Power
Electric Power Distribution
Power Systems
Industrial Systems
Healthcare Systems/Biotechnology
Consumer Products
Research & Development
Power Systems

Commercial Operation of Hamaoka Nuclear Power Plant Unit No. 5 (1,380-MW Output) of Chubu Electric Power Co., Inc.

Commercial operation of Unit No. 5 at Hamaoka Nuclear Power Plant (an advanced boiling-water reactor with power output of 1,380 MW) of Chubu Electric Power Co., Inc. started in January 2005.

Since starting in March 1999, the construction of Unit No. 5 continued smoothly, and from February 2004, it has been running under actual test operation. And a short time ago, test operation of the Unit was completed and commercial operation started.

The Unit No. 5 is composed of nuclear-power generation equipment incorporating the latest technologies, thereby attaining the maximum power output of any plant in Japan. Hitachi, Ltd. was in charge of supplying the turbine and generator equipment as a complete set.

[Main technologies utilized for high efficiency]

(1) Improvement of turbine blades

High-efficiency turbine blades with an improved shape are utilized to reduce disturbance in the steam for driving the turbine and to generate a smoother steam flow.

(2) Application of large-capacity turbine

Large-size—52-inch-long (132 cm)—turbine blades suitable for the main steam throughput of an ABWR are utilized.

(3) High-pressure heater drain pump-up system

By directly collecting the high-temperature drainage of turbine extracted steam produced from the water supply in condenser pipes, the volume of steam bled from the turbine is reduced, thus increasing the volume of steam that drives the turbine.

(4) MSH (moisture separator heater)

By removing moisture in the steam discharged from the turbine and by reheating the main steam and the extracted steam, the steam condition at the low-pressure turbine entrance is improved.

Combining these technologies for high efficiency and a generator with the highest domestic capacity (rated output: 1,570 MVA) has contributed to attaining the highest power output in Japan.

External views of the completed Unit No. 5 facility of Hamaoka Nuclear Power Plant (above right) and turbine generator (below)

Development of an Innovative, Small and Medium Sized Reactor Utilizing a Natural Circulation System

Aimed at accommodating the reductions in capital expenditure due to deregulation of utilities and the slowdown in growth of power demand, an innovative, small and medium sized reactor (DMS-400; output power: approximately 400 MW) that provides outstanding economic efficiency at medium-scale power output was developed. The Japan Atomic Power Company has been taking intiative in developing this plant concept.

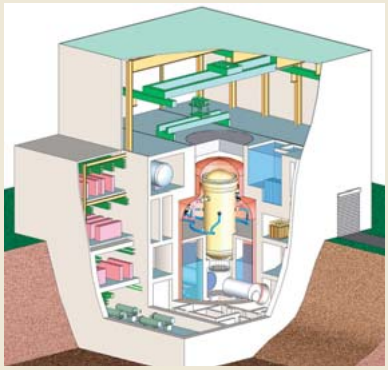
[Main features]

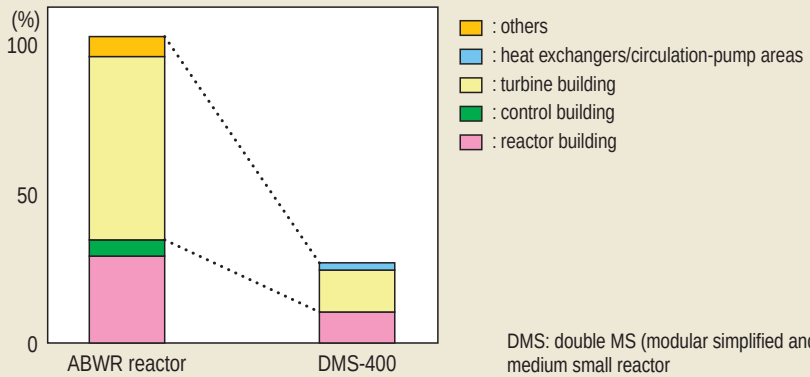
(1) Simplification of installation due to use of natural circulation system for reactor core cooling

(2) Simplifying of safety system with combined active and passive component

(3) Reduction of amount of construction material by reducing the size of the primary containment vessel

It is expected that the DMS-400 will meet the needs of various electric power companies, as well as carrying part of the burden on nuclear power generation by advanced boiling-water reactors (ABWR, output power: 1,350-MW class; ABWR 600, output: 600 MW; and ABWR 900: output: 960 MW).





The compact reactor building housing the DMS-400 (left) and the size of its associated buildings compared to those for an ABWR reactor (right)

700-MW IPP Power-generation Unit for Kobe Steel, Ltd. Installed at No. 2 Power Plant of the Shinko Kobe Power Station

Commercial operation of the No. 2 700-MW generating set at the power plant of Shinko Kobe Power Station — one of Japan's biggest IPPs (independent power producers) —started on April 1, 2004.

Hitachi, Ltd. was contracted to manufacture, install, and test the turbine generator unit—the main component of the No. 2 generating unit.

Applying the latest technologies, this turbine generator unit attains high efficiency and high reliability. As for turbine efficiency, it has achieved the design value of 47%.

[Main features of turbine]

(1) Main steam pressure: 24.1 MPa; temperature: 538/566˚C

(2) 40-inch-long (102-cm-long) blades utilized in low-pressure-turbine final stage

(3) High/medium pressure one-body cylinder construction

(4) Heat supply to local brewing companies by extracting steam from medium-pressure turbine

Internal view of the power-generation unit (above left) and No. 2 power plant building at the Shinko Kobe Power Station (below right)

A 100-MW-class Combined-cycle Power Generation Set at No. 1 Series Goi Power Plant of Goi Coast Energy, Ltd.

Delivered to Goi Coast Energy, Ltd., a 100-MW-class combined-cycle power generation set started commercial operation on June 1, 2004.
As well as supplying the steam and electricity it generates to the Goi Plant of Chisso Petrochemical Corporation, this generator set also sells surplus power to eREX Co., Ltd.
Composed of a gas turbine, a steam turbine, a generator, and an exhaust heat-recovery boiler, these three generator sets attain high operability and saves energy due to its outstanding energy efficiency.
[General description]
(1) Generation system: combined-cycle type
(2) Plant output: 112,200 kW
(3) Shaft output: 42,560 kW
(4) Number of shafts: 3
(5) Fuel used: natural gas

External view of the Goi Power Plant of Goi Coast Energy, Ltd.

Installation of Steam Turbine for Combined-cycle Generator Unit at Spalding Energy Co., Ltd., UK

Following installation of a steam turbine for a combined-cycle generator unit at a power plant of Spalding Energy Co., Ltd. in the UK was completed, it was handed over for commercial operation in September 2004.
Hitachi, Ltd. received an order of a complete steam turbine and generator set from Bechtel Overseas Corp., the EPC (engineering, procurement, construction) contractor of this project. This Hitachi-made steam turbine is the first of its kind aimed at export to Europe.
[Main specifications of the steam turbine]
(1) Power output: 362.7 MW
(2) Type: tandem-compound-type reheated-condensate turbine
(3) Main steam pressure: 12.45 MPa
(4) Steam temperature: 565.5/565.5˚C
(5) Exhaust pressure: 10.57 kPa
(6) Revolution speed: 3,000 r/min

Steam turbine for a combined-cycle generator unit at Spalding Energy Co., Ltd. in the UK

H-25 Gas Turbine Generator Sets for Egypt Damietta LNG Project

Hitachi has supplied five H-25 gas turbine sets for the power generation facility in the SEGAS Egypt Damietta LNG Project.
This contract was awarded by a joint venture of KBR, JGC, and Técnicas Reunidas, three major international engineering contractors, and it was designed strictly in accordance with API standards and project specifications and delivered in a short manufacturing period in June, 2003.
All of the gas turbines were commissioned in September, 2004 and turned over to SEGAS (affiliate of Union Fenosa Gas, a Spanish utility company) in November, 2004.
The client appreciated Hitachi's professional performance on this project.
[Main specifications of facility]
(1) Gas turbine
Type : H-25 (heavy duty gas turbine)
Power output : 24,970 kW
Fuel gas : natural gas
(2) Generator
Type : FCAC
Capacity : 31,250 kVA
Excitation type : brushless exciter

H-25 gas turbine generator sets for Egypt Damietta LNG Project

Completion of an Air-cooled Generator-motor with the World's Largest Capacity

At the Kannagawa Power Station (Ueno village, Gunma Prefecture, Japan) of the Tokyo Electric Power Co., Inc., installation of a generator-motor (started in June 2003) was completed in August 2004, and test operation was started in September 2004.
During the daytime, this generator-motor supplies power as a 525-MVA generator. During the night, however, when the required electric power supply is low, operating as a 464-MW electric motor, it pumps water up from below the dam to above the dam in order to store energy for the daytime power generation.
As a pumped-storage generator, this generator-motor attains the world's largest capacity, namely, 525 MVA. Moreover, it applies the large-capacity, high-speed technology developed during the design of a similar machine (i.e. a 475-MVA/438-MW generator-motor) installed at the Kazunogawa Power Station of the Tokyo Electric Power Co., Inc.
From now onwards, the operation tests of the generator-motor will continue until its commercial operation starts in December 2005 (planned).

Rotor of the 525-MVA/464-MW generator-motor installed at the Kannagawa Power Station of the Tokyo Electric Power Co., Inc.

Development of a 250-MVA Air-cooled Turbine Generator

Performance-evaluation tests on a 250-MVA 60-Hz air-cooled turbine generator (inner-cooler type) have been completed.
An air-cooling type can be operated and maintained at low cost, and it has the advantage that an explosion-protection area is not needed. However, compared with a hydrogen-cooled generator, it is difficult to make a large-capacity air-cooled type with good efficiency. Accordingly, performance improvement of the air-cooled type, particularly at 60 Hz, has become necessary.
To satisfy this need, various new techniques—beginning with reduction in cooling-air flow and mechanical loss by optimizing the ventilation structure as well as equalization of temperature and lowering of electrical loss by optimizing the winding structure of the stator coil—were applied. As a result of these techniques, under operating conditions of 250 MVA, 60 Hz, and a power factor of 0.85, a high efficiency approaching that of a hydrogen-cooling unit, i.e. 98.8%, was achieved.
This development has given birth to a power generator—combining the advantages of operation at high capacity combined with ease of maintenance—with the same high efficiency as possible with a conventional hydrogen-cooled generator.

Performance tests of the generator at the test shop

Splitter Blade Runner Improves Efficiency by 5%

Introduced as the first in Japan, a Francis-turbine runner with splitter blades started commercial operation at the Ontake Power Station of the Kansai Electric Power Co., Inc., on No. 1 turbine in April 2003 and on No. 2 turbine in May 2004. These hydraulic turbines—with the latest hydro-power characteristics meeting current power demands—are replacements for those that started operation in 1945.
In contrast to a normal runner, in the case of a Francis-turbine runner with splitter blades, long blades (referred to as the main ones) are arranged alternatively with shorter splitter blades around the circumference of the runner. Collaborating in research taking advantage of computational fluid dynamics and model tests, Kansai Electric Power Co., Inc. and Hitachi, Ltd. have achieved the first practical application of a Francis-turbine runner in Japan.
Compared to that of a conventional turbine, efficiency under partial load of a hydro-turbine applying this runner is improved by 5%. Moreover, yearly carbon-dioxide emission is reduced by 3,200 tons by installing the splitter blade runner. From now onwards, we plan to continue to develop and fabricate a high-efficiency hydro-turbine runner that will further contribute to reduction in carbon-dioxide emission.


Splitter blade runner installed at Ontake Power Station of the Kansai Electric Power Co., Inc.

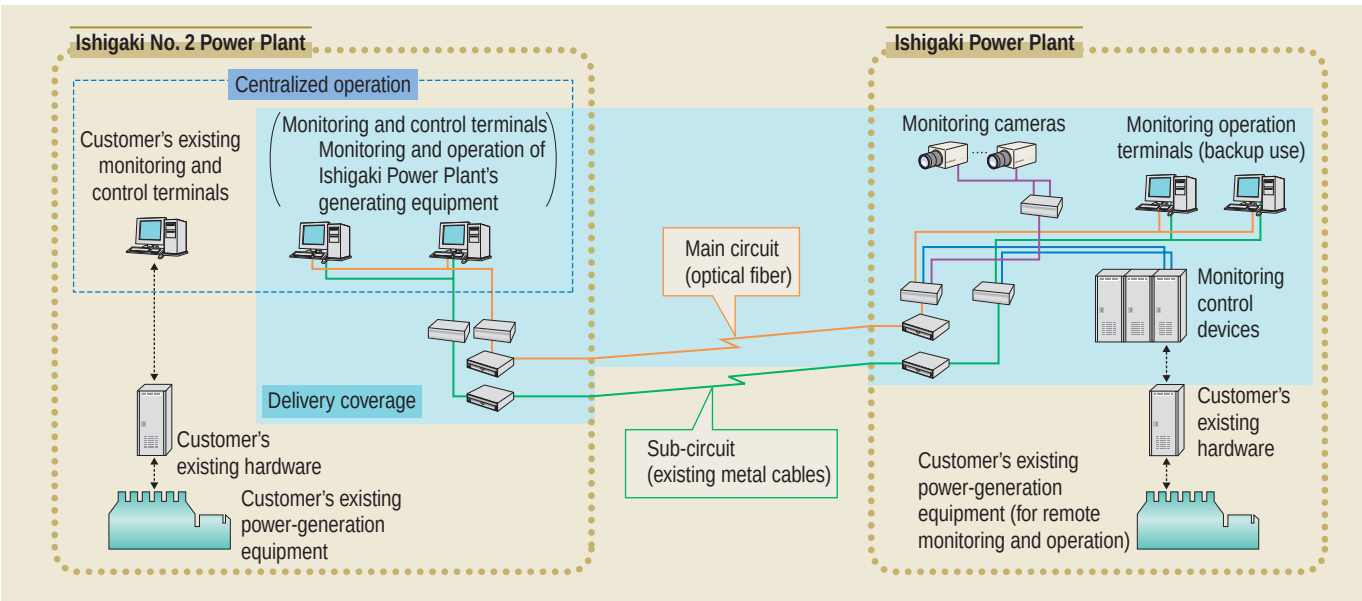
New-generation Integrated Monitoring and Control System for 900-MW Maximum Capacity Coal-fired Power Station in China

With the rapid growth in the demand for power in China, the construction of power plants is advancing at a rapid pace. The power plants being constructed must have advanced operability; accordingly, it is demanded that on top of utilizing the latest control technologies, these plants must be fitted with new-generation integrated monitoring and control systems for supporting, for example, power-plant management and high-efficiency operation.
In response to these needs, Hitachi has installed a new-generation integrated monitoring and control system at Shanghai Municipal Electric Power Company, Waigaoqiao Power Station in China—a coal-fired supercritical-pressure plant with a 900-MW maximum single-turbine capacity. From now on, demand for this system is forecast to increase.

Inside of the central monitoring and control room set up for new-generation integrated monitoring and control

Remote Monitoring and Operation System Delivered to the Okinawa Electric Power Co., Inc.

A remote monitoring and operation system has been delivered to the Ishigaki Power Station of Okinawa Electric Power Co., Inc. Under this system set up, the two power stations on Ishigaki Island are connected by optical fiber, thereby allowing the generating equipment at one plant to be remotely monitored and operated from the other plant. In other words, this system aims to centralize the operation of the power plants.
Owing to this centralization of operation, full-scale application of CRT operation systems and addition of camera-monitoring functions has resulted in improved monitorability and operability.
The same system has also been installed at the Miyako Island Power Plant of Okinawa Electric Power Co., Inc., and in the future, it is planned to implement the system at power stations on Japan's other isolated islands.
(Start-up of operation: July 2004)



Overview of the configuration of the remote monitoring and operation system delivered to the Okinawa Electric Power Co., Inc.

Digital Thyristor Start-up Control and Protection System for Pumped Storage Hydroelectric Power Plant

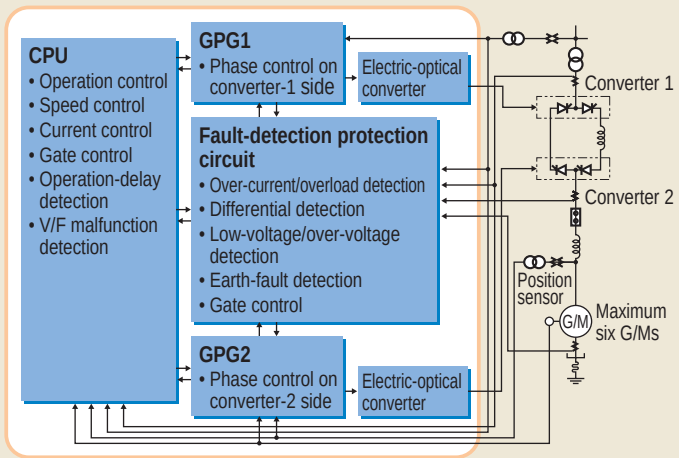
A thyristor start-up control and protection system for a pumped storage hydroelectric power plant was conventionally composed of analog circuitry. However, there have been growing needs to improve the reliability and maintainability of these devices. Responding to these needs, Hitachi has introduced a new type of digitalized thyristor start-up control and protection system.

[Main features]

(1) Space saving as a result of three-panel configuration (compared with conventional five panels).

(2) Protection circuitry integrated on one plug-in card, thus improving reliability and maintainability.

(3) Shorter inspection time due to greatly reduced number of analog check points during inspections.

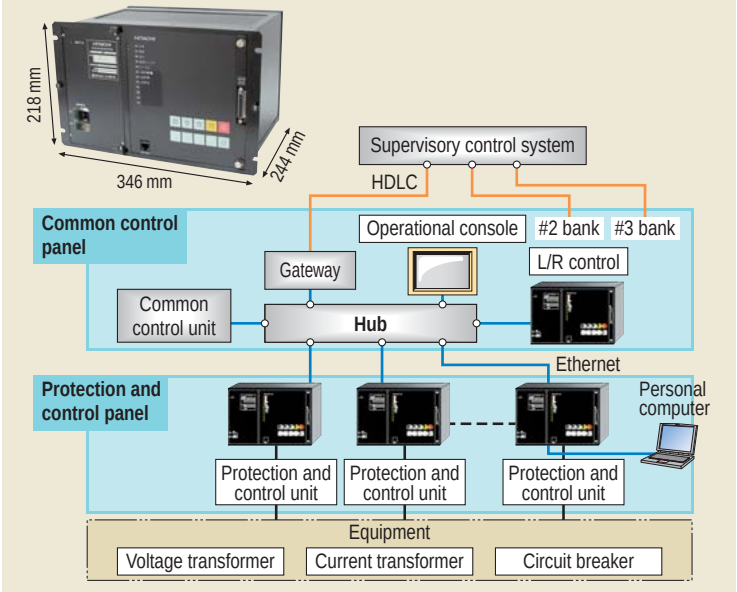


Thyristor-type start-up control protection unit

CPU: central processing unit
V/F: voltage/frequency
GPG: gate pulse generator
G/M: generator motor

System construction (above) and external view (below right) of new, digital-thyristor-type start-up control protection unit

New Digital-type Protection and Control Unit



HDLC: high-level data link control L/R: load regulation

Hitachi has developed a new digital-type protection and control unit for medium voltage systems.

A general web browser in the unit improves the user-friendliness of its human-interface, a fault recording feature increases its functionality, and a self-monitoring feature increases its reliability.

[Main features]

(1) Compatibility: Size of the panel cutout is compatible with that of the previous model unit. This makes refurbishing easier.

(2) Redundancy: Hardware, except for auxiliary VT/CT modules, is divided into main protection and fault detection elements. This prevents problems caused by failure of a single piece of hardware.

(3) Network: Complies with general network interfaces, such as Ethernet and HDLC. This can reduce wiring and provide connections with remote monitoring systems.

(4) User-friendliness: A fault recording feature provides easier fault analysis.

Image of new digital protection and control unit (above left) and structure of system (below)