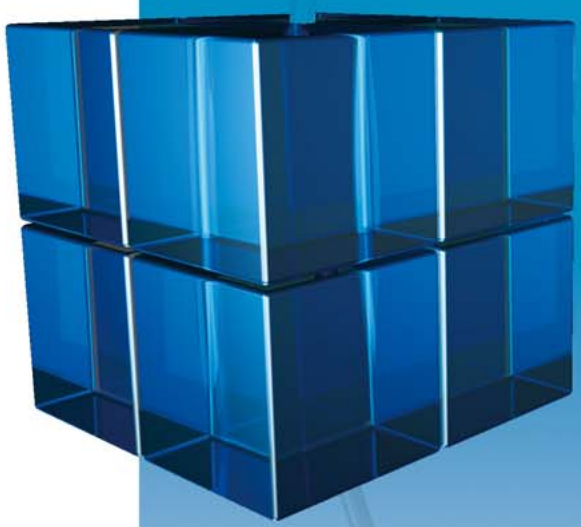
HITACHI TECHNOLOGY
2007-2008

Social Infrastructure Business

Nuclear Power
Thermal and Hydraulic Power
Electric Power Distribution
Public Facilities
Transportation
Environment



Attempts to Realize a New Nuclear Power Station in Japan

Global warming is a pressing international issue to be addressed. The main cause of global warming is supposedly carbon dioxide and other greenhouse gases. Nuclear power generation, which discharges hardly any such greenhouse gases, is being reconsidered in various countries. Japan is one of them. The Nuclear Energy National Plan presented by the Agency for Natural Resources and Energy proposes the establishment of a nuclear fuel cycle and the addition of next-generation nuclear power stations. Hitachi, Ltd. is enhancing and developing nuclear power technology that will play a central role in future energy.

Shoichiro Kinoshita (left), Department Manager, Nuclear Power Business Department; Atsushi Sasazawa (middle), Senior Project Manager, Nuclear Systems Division; Naoki Kajiyama (right), Senior Engineer, Nuclear Power Business Department, Nuclear Systems Division, Power Systems

Attempts on Nuclear Power Technology

Unit 3 at the Shimane Nuclear Power Station of The Chugoku Electric Power Co., Inc. and the Ohma Nuclear Power Station of Electric Power Development Co., Ltd., both of which are current Hitachi projects, represent the fifth and sixth ABWRs (advanced boiling water reactors) in Japan, respectively. The ABWR was jointly developed by Japanese electric utilities, plant manufacturers, and General Electric Company in the USA, based on conventional BWR (boiling water reactor) technology. It can thus be called the well-organized result of nuclear power plant technology. Hitachi, Ltd. has already constructed four ABWRs by optimizing and standardizing designs. The company is confident that, given this experience, its personnel will be able to produce even more advanced ABWRs.

Construction of ABWR (Unit 2 of the Shika Nuclear Power Station of Hokuriku Electric Power Company)

State-of-the-art Nuclear Power Plants

Unit 3 (of 1,373-MW capacity) at the Shimane Nuclear Power Station, scheduled to commence operation in December 2011, is a full-plant order received by Hitachi, Ltd. following Unit 2 at the Shika Nuclear Power Station of Hokuriku Electric Power Company. Hitachi, Ltd. handles the main components of reactors, turbines, generators, condensers, and related equipment, Babcock-Hitachi K.K. manufactures reactor pressure vessels, and Hitachi Plant Technologies, Ltd. undertakes the construction work. Consequently, this large-scale project is being undertaken comprehensively by Hitachi, Ltd. and its group companies for all processes ranging from basic planning to the manufacturing of main components, installation of reactors and other equipment, and final delivery.

The Ohma Nuclear Power Station (of 1,383-MW capacity), scheduled to commence operation in 2012, is the world's first ABWR compatible with MOX〔(mixed oxides) fuel — an oxide fuel based on a mixture of uranium and plutonium —〕in the entire core. Hitachi, Ltd. is also in charge of most main components of plants scheduled to be built in the future and will play a leading role in the construction of nuclear power plants in Japan.

Hitachi's General Expertise

Constructing a nuclear power plant is an enterprise that takes a very long time — 10 to 15 years — from planning to the onset of operation. Such an enterprise entails many personnel and much cost, and involves a technical linkage among many departments and close coordination between the main contractor with many related corporations. As such, these projects are large-scale in all aspects. Moreover, a nuclear power plant requires very long pipes and cables, innumerable valves and controllers, as well as thousands to tens of thousands of parts. Precisely assembling all these components into a completed form and commencing operation according to plan is no easy task. To address and overcome these issues, it is imperative to have high expertise and comprehensive capabilities. Hitachi, Ltd. considers itself qualified for all of that, as a corporation aiming at high-quality creative manufacturing.

As stated in the New National Energy Strategy of the Ministry of Economy, Trade and Industry, resource-poor Japan is expected to continue using nuclear as a central source of energy supporting its society in the future. Now that this energy source is being reconsidered in the USA, Germany, UK, and elsewhere around the world, the company intends to embrace a sense of mission with regard to society in connection with nuclear power and base itself on a corporate attitude of offering the technology it has cultivated domestically and supplying high-quality products on an ongoing basis, thus offering technologies for nuclear power energy to parties abroad as well.

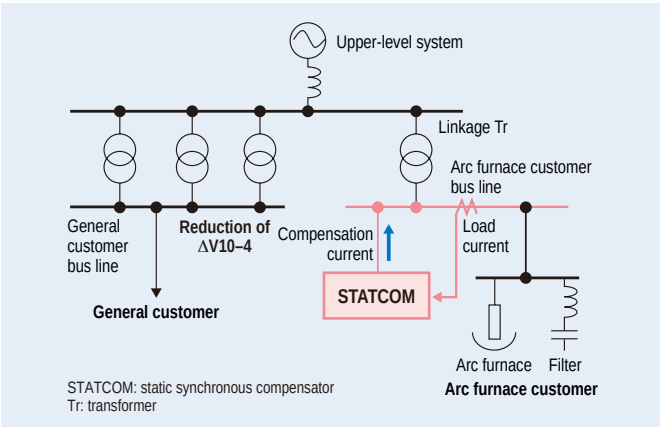
Reduced Fluctuations in System Voltage Generated in an Arc Furnace —STATCOM for Flicker Suppression

A fluctuation in voltage is caused by fluctuations in the arc furnace load generated at intervals ranging from several milliseconds to several seconds. Repeated fluctuations in voltage cause flicker. The STATCOM (static synchronous compensator) for flicker suppression was developed to suppress fluctuations in voltage that cause flicker and has been delivered to Hokuriku Electric Power Company.

Takashi Aihara (left), Senior Engineer, Power System Protection & Automation Engineering Dept., Public Utility & Energy Industry Information System Div., Information & Control Systems Division; Yasuhiro Kiyofuji (right), Senior Engineer, Power Electronics Design Dept., Electrical Control Systems Div., Information & Control Systems Division

What is the Background of Development?

The commercial-scale utility customers of Hokuriku Electric Power Company include a manufacturer that uses an arc furnace for melting metals. The voltage supplied to that arc furnace frequently fluctuates in the power company's bus line connected to the arc furnace. This voltage fluctuation is caused by fluctuating currents. There are three types of currents: active current that is used for power supply, reactive current that causes voltage fluctuations, and negative sequence current that causes voltage imbalances. These fluctuations in voltage are transmitted along with attenuation from the arc furnace bus line to the bus lines of general customers via the arc furnace transformer, upper-level bus lines, and transformers of general customers. This causes such flicker as blinks of lighting or other visual disturbances on TV screens, etc. In order to suppress such flicker at general customer sites, Hokuriku Electric Power Company had to suppress the fluctuations in voltage that cause this flicker. Hitachi successfully developed the STATCOM, an reactive power compensator employing a self-commutated converter for flicker suppression, in order to effectively suppress the flicker caused by the arc furnace. The equipment was delivered to the company in July 2006. Fluctuations in reactive current and negative sequence current are the factors that most significantly impact flicker. The STATCOM developed for flicker suppression detects fluctuations in reactive and negative sequence currents among the arc furnace load currents, and then injects compensating current into the arc furnace bus line in order to cancel out the detected fluctuations and thereby suppress flicker.



STATCOM linkage system diagram

What are the Features of the STATCOM for Flicker Suppression?

The STATCOM for flicker suppression generates higher harmonics to cause a voltage distortion. While customers demand equipment of smaller size, installing a filter as a measure against such voltage distortion would entail larger equipment. Thus, the technique of dividing the converter into six segments and applying multiple connections was employed to suppress the higher harmonics to eliminate the need for an alternate current filter, as well as to enable high-speed control.

The STATCOM with capacity as small as 20 MVA, equivalent to a fraction of load capacity, can effectively suppress flicker. This was achieved by extracting only those components causing flicker from the large load fluctuations generated in the arc furnace, and effectively compensating for those fluctuations. During the development process, various simulations were repeated based on operating data of the arc furnace to devise a means of control for effectively suppressing flicker against a number of load fluctuation patterns.

Other types of compensators have also been implemented as measures against flicker at the sites of commercial-scale utility customers that own arc furnaces. The load currents detected by the STATCOM include the pure arc furnace current and current flowing in the compensator's filter. To enable the stable control of the STATCOM, the current flowing in the compensator was separated into components, and only those components caused by only the arc furnace were extracted and compensated.

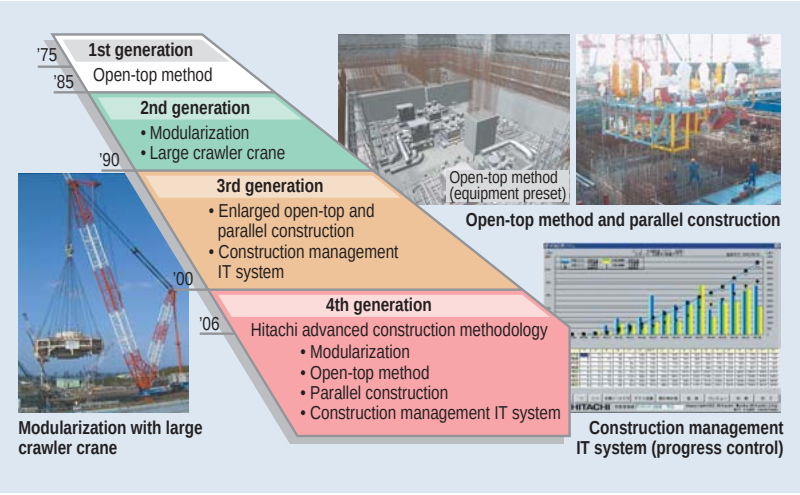
How will Converters Evolve in the Future?

Hitachi had to employ a new technique and address many related issues regarding application of the self-commutated converter for suppressing flicker. Great appreciation regarding the success of the STATCOM is expressed here for the valuable cooperation of Hokuriku Electric Power Company.

The technology utilized for the self-commutated reactive power compensator STATCOM is also applicable to suppressing transient voltage fluctuations other than flicker, and therefore, technical proposals will be proactively made to provide for more diversified fields of application. The self-commutated converter can be expanded for a number of applications, such as a frequency converter, and therefore new potential applications will be targeted at power utilities and railroad companies, etc.

Hitachi Advanced Construction Methodology for Nuclear Power Plants

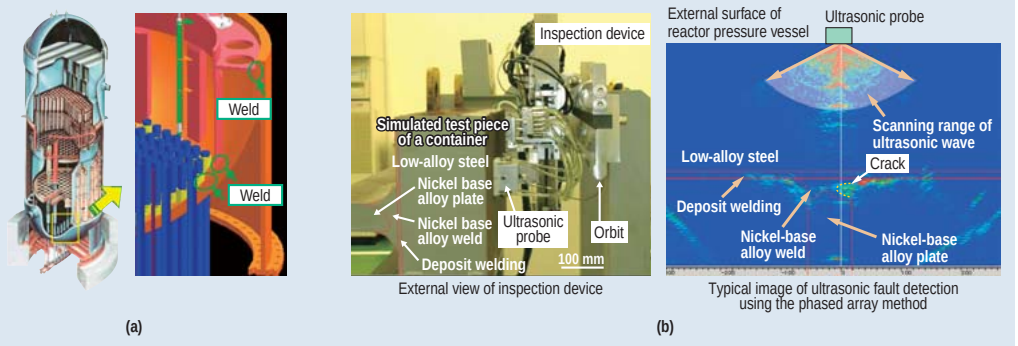
Hitachi, Ltd. has established the Hitachi advanced construction methodology for building nuclear power plants to enhance construction safety and quality and to reduce construction schedule and costs. This methodology is based on the knowledge acquired with more than 30 years of construction experience. This methodology consists of four major technologies: modularization, open-top method, parallel construction with building contractors, and construction management IT (information technology) system supported by an integrated CAE (computer-aided engineering) system. Hitachi initiated the use of a large crawler crane (lifting capacity: 930 t—45 m) in 1985 and a module dedicated factory in 2000 to increase the modularization benefit. This methodology has been used to construct an ABWR (advanced boiling water reactor) and has led to the successful construction of four ABWRs. The methodology will also be used to construct new nuclear power plants planned all over the world, especially in the United States and an ABWR plant under construction in Japan.
Hitachi will contribute to the next-generation nuclear power plant construction as one of leading suppliers to enhance more reliability and efficiency on the basis of its cultivated technology and experience.



Development of Hitachi construction methodology for nuclear power plants

Technology for Inspection of Nuclear Power Reactors

Hitachi has developed an ultrasonic flaw detection technology for detecting and sizing the cracks in the welds between reactor pressure vessels and reactor internals from outside the reactor pressure vessels of a BWR (boiling water reactor). This ultrasonic flaw detection technology combines an optimal phased array probe design with the control patterns of ultrasonic wave transmission and reception based on ultrasonic simulation, and thus significantly increases signal strength. This technology enables the detection and sizing of stress corrosion cracking in the weld metal of nickel base alloys subject to high ultrasonic attenuation.
Inspecting the welds internally attached to a reactor previously entailed placing an inspection device inside the reactor pressure vessel. With the newly developed technology, inspectors can inspect such internally attached welds from outside the vessels, and thus bypass such critical paths as those related to reactor operation during the refueling period.
Hitachi will apply this technology to the inspection of welds between the reactor vessels and the shroud supports or CRD (control rod device) stub tubes.



Typical area to be inspected in a reactor pressure vessel (a), and typical inspection device and displays of crack depth measurements (b)

Remote Monitoring System Using Optical Cableless Sensor Network System

Hitachi developed a prototype of optical cableless sensor network system for remotely monitoring high radiation areas in nuclear power plants. A patrol-type mobile system needs rails to be constructed. However, the new system does not require the construction of rails and cables. A customer has to install a LAN (local area network) cable in at least one system for the PCV (primary containment vessel) at a nuclear power plant. When necessary, anyone can easily add a cableless IP (information processing) camera or various sensors. This system can collect information from many sensors. Therefore, this system is effective when performing condition-based maintenance.

[Main features]

(1) Can use without worrying about influence from electric wave noises because it uses light radio waves.

(2) Can add cableless built-in battery at anytime.

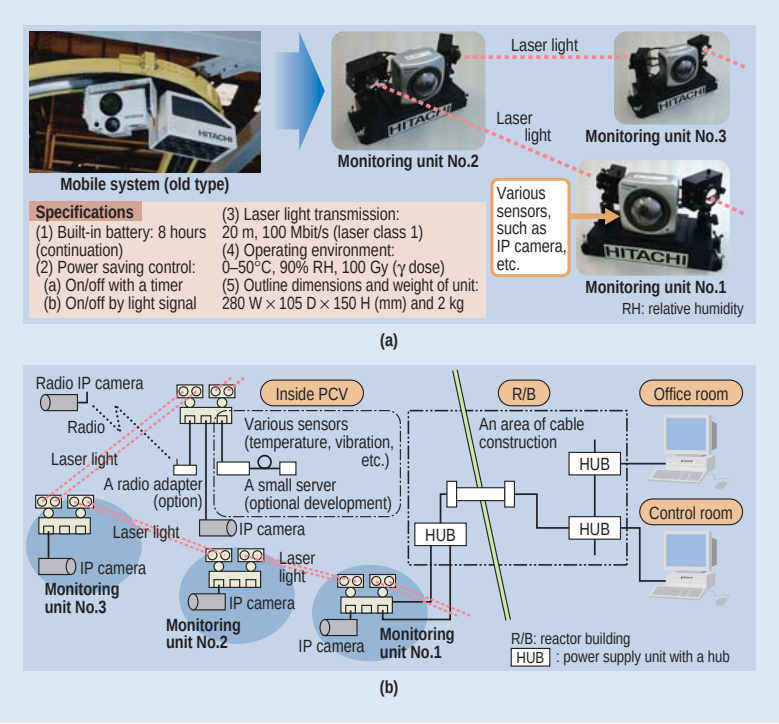
(3) Can lengthen the life of battery by controlling the power supply at required times.

[Expected benefits]

(1) Can reinforce monitoring and confirm on-site situation in real time.

(2) Can reduce radiation exposure, man-hours and workload of patrol members.

(3) Can shorten plant outage (in comparison when examination of a problem has forced the plant to stop).



Prototypes and main specifications (a), and system configuration of optical cableless sensor network system (b)

Klystron Power Supply Facility for LINAC and Electromagnets Using High Intensity Proton Synchrotron at J-PARC

JAEA (the Japan Atomic Energy Agency) and KEK (the High Energy Accelerator Research Organization) are in the process of constructing J-PARC (the Japan Proton Accelerator Research Complex) at Tokai Village, Ibaraki Prefecture. A beam commissioning started in 2006.

50-GeV synchrotron electromagnets installed inside tunnel

The power supply facility for the LINAC (linear accelerator), the first stage accelerator, was delivered by Hitachi. This facility consists of six sets of high voltage DC power supplies and 21 sets of anode modulators. The DC power supply can be driven four klystrons (3 MW, 110 kV) and the modulator has the ability to operate the klystron with fast rise time of 30 μs and high repetition rate of 50 Hz. The facility was installed and is operated with the high reliability.

Hitachi manufactured the main electromagnets for both 3-GeV (GeV=one billion electron volt) and 50-GeV synchrotron accelerators. They have already been installed at the sites.

These electromagnets are one of the largest electromagnets and have a total weight of approximately 7,000 t.

[3-GeV synchrotron]

Bending magnets: 25 units, quadrupole magnets: 60 units, sextupole magnets: 18 units, injection bump magnets: 10 units

[50-GeV synchrotron]

Bending magnets: 97 units, quadrupole magnets: 216 units

Steam Turbine Equipment for the Shanxi Wangqu Thermal Power Plant Delivered to Shanxi Lujin Wangqu Power Generation Co., Ltd., People's Republic of China

Hitachi, Ltd. received an order in September 2003 from Shanxi Lujin Wangqu Power Generation Co., Ltd. for a complete set of steam turbine generation equipment (two units of 600-MW capacity) for the Shanxi Wangqu Thermal Power Plant. Located in the city of Changzhi (950 meters above sea level), Shanxi Province, China, construction of this power plant began in December 2003. Units 1 and 2 both began commercial operation in August 2006.
This equipment was awarded jointly to Hitachi and China's Dongfang Electric Corporation. Hitachi delivered the main units of equipment (including steam turbines, generators, and controllers), while Dongfang Electric delivered the auxiliary equipment (including condensers and boiler water supply pumps).
[Specifications of the main equipment]
(1) Steam turbines
Type: Tandem compound 4 flow exhaust type
Output: 600 MW
Steam conditions: 24.2 MPa (abs) -566/566 °C
(2) Generators
Type: Horizontal shaft and cylindrical rotating field type
Capacity: 670 MVA
Voltage: 22 kV

Appearance of Shanxi Wangqu Thermal Power Plant (upper), and steam turbine generator (lower)

Completion of 1,120-MVA Turbine Generator for Huadian International Zouxian Power Plant in China

Hitachi has just completed a 1,120-MVA turbine generator (2 poles, 50 Hz) for Huadian International Zouxian Power Plant of China Huadian Corporation in China. Hitachi has carried out factory tests and found that this generator has a maximum operating capacity of 1,230 MVA, which is the highest class in the world, and is 1.6 times larger than Hitachi's previous 50-Hz maximum capacity generator (778 MVA).
Hitachi combined various technologies to meet the required design specifications, such as the highly efficient cooling structure with hydrogen gas and pure water as cooling mediums, and 27-kV high voltage insulation. Hitachi also carried out analysis to improve the performance and reliability of the generator. Analysis performed was rotor vibration, electromagnetic field analysis of the stator core, network ventilation, and stress of each part. Efficiency measurements, temperature tests, and vibration measurements were performed by Hitachi in the factory to confirm that the generator met its design specifications. Hitachi's future work will involve developing and improving power plants for use all over the world.

1,120-MVA turbine generator shop test (left) and stator frame for shipping (right)

H-25 Cogeneration Equipment Delivered to the Republic of Kazakhstan as Part of NEDO's Model Project

Hitachi has completed installing an H-25 cogeneration gas turbine for JTE (Zhaiykteploenergo), a state-run energy supplier in the city of Uralsk, West Kazakhstan, the Republic of Kazakhstan. The New Energy and Industrial Technology Development Organization (NEDO) entrusted the Tohoku Electric Power Co., Inc. to implement the Model Projects for Increasing the Efficient Use of Energy at the Uralsk Heat and Electric Power Station. After which Tohoku Electric Power commissioned Hitachi to provide a gas turbine for this project. NEDO's Model Projects for Increasing the Efficient Use of Energy has led to the introduction of technologies already proven in Japan to developing countries in order to increase their efficient use of energy. The projects also demonstrate the technology in the host countries to facilitate its establishment and dissemination. NEDO is promoting this project to be the first Joint Implementation (JI) project under the Kyoto Protocol between the two countries.

The previous boiler at JTE's thermal power plant was fueled using natural gas and has since been replaced by a combination of a highly efficient H-25 gas turbine, capable of 25-MW output, and a waste heat recovery boiler. This new equipment has increased thermal efficiency from about 50% to 70%. At the same time, the new equipment was combined with an existing steam turbine to increase power generation efficiency.

Based on this experience, Hitachi plans to continue its efforts to help address power shortages in Kazakhstan.

Existing main facility (brown building on left) of the thermal power plant and the H-25 cogeneration facility (white building on right)

H-25 Gas Turbine Power Generation Equipment to Sakhalin Energy, the Russian Federation, for the Sakhalin II Project

Hitachi has delivered four units of H-25 gas turbine power generation equipment to Sakhalin Energy Investment Company Ltd. for land-based plants that process gas and oil excavated from the seabed along the east coast of Sakhalin Island of the Russian Federation. While two units are low-NOx combustors fueled only by gas, the other two units are dual low-NOx combustors adaptable to both gas and oil for supplying some of the power needed for plant construction work. Commissioning was started in June 2006.

[Specifications of the main equipment]
(1) Gas turbine
Type: H-25 gas turbine
Output: 27,500 kW
NOx level: Less than 50 mg/Nm^3
(2) Generator
Type: Closed and air-cooled
Capacity, power factor: 32,330 kVA, 0.80
Excitation system: Brushless exciter

General view of the gas turbine generator building (left) and gas turbine generator building (foreground: lube oil cooler, roof: waste heat recovery unit) (right)

Unit 2 for the Hitachi Rinkai Power Station Completed

Unit 2 of the Hitachi Rinkai Power Station began commercial operation on June 20, 2006. Hitachi began constructing this equipment after it became the successful bidder to supply wholesale power in fiscal 1999 for Tokyo Electric Power Co., Inc. This multi-shaft combined cycle power generation equipment consisting of two H-25 gas turbines, one HRSG (heat recovery steam generator), and one steam turbine achieves a rated output of 89,680 kW (at the electric generator terminal).

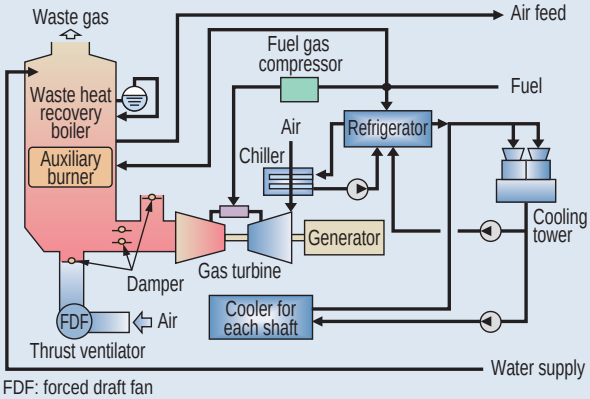
Hitachi conducted the entire process from construction to commissioning and is managing operation subsequently. Hitachi began the design process in February 2004, launched its civil and structural work in February 2005, ignited the gas turbine for the first time in February 2006, conducted a test run and made adjustments over a four-month period, started a commercial operation in June, and then completed the project on schedule after two years and five months of ongoing work. The project is characterized by a configuration that leads exhaust gas from the two gas turbines to the one HRSG. Since the equipment is installed near a residential area, it satisfies the environmental specifications in adopting a large soundproof enclosure, along with controls on noise, gas exhaust, waste water, and other emissions in an attempt to blend in seamlessly with the community.

Unit 2 of the Hitachi Rinkai Power Station

H-15 Cogeneration Plant Capable of Special Applications Completed

In April 2006, Hitachi, Ltd. completed and delivered cogeneration plant equipment for domestic chemical textile factories based on its highly efficient H-15 gas turbine. This equipment can be run for cogeneration through a single run of gas turbine generation and single run of waste heat recovery boiler operation. The system can also be set so that if the gas turbine generator makes an emergency stop, the system promptly switches to a single run of the HRSG (heat recovery steam generator), and continues to supply steam without interruption. Consequently, this plant significantly increases steam reliability. These operations are made possible by switching over the gas turbine outlet bypass damper, HRSG inlet damper, thrust ventilator outlet damper, and other dampers. Another feature is the ability to switch from a single gas turbine run to a cogeneration run with the waste heat recovery boiler.

Based on the experience acquired through such deliveries, Hitachi will continue to provide highly useful cogeneration plant equipment that ensures steam reliability.



FDF: forced draft fan

H-15 cogeneration plant (left) and system configuration (right)

Pump-turbine and Generator-motor Installation Completed at the Omarugawa Power Station of KYUSHU ELECTRIC POWER CO., INC.

The pump-turbine runner and generator-motor were installed for the Unit No.4 at the Omarugawa Pumped storage Hydroelectric Power Station of KYUSHU ELECTRIC POWER CO., INC. in March 2005 and July 2006, respectively, thus completing installation of the pump-turbine and generator-motor. The power station is scheduled to begin operation in July 2007.

This power station can control input power by changing the rotational speed during pump operation, and thereby helps stabilize power system frequency at night. Moreover, the equipment has been miniaturized by applying the highest 600-min^{-1} rotational speed achieved by large-capacity machines in the past.

[Specifications]
(1) Pump-turbine
Maximum head: 671.8 m
Maximum output: 310 MW
Rotational speed: 600 ± 24 min^{-1}
(2) Generator-motor
Capacity: 345 MVA/330 MW
Rated voltage: 16.5 kV
Excitation method: Three-phase alternating current excitation

(a) (b)

Installing a pump-turbine runner (a), and a generator motor-rotor (b)

Installation of 525-MVA/464-MW Generator-motor for Kannagawa Hydroelectric Power Station, Tokyo Electric Power Company

A 525-MVA generator-motor commenced commercial operation at the Kannagawa Hydro Power Station located in Ueno Village, Gumma Prefecture, Japan on 22nd December 2005.

This generator-motor supplies electric power as a 525-MVA generator in the daytime. The generator-motor is operated as a 464-MW motor in the nighttime to store energy by pumping up water from a lower reservoir to an upper reservoir.

With a capacity of 525 MVA, this generator-motor has the largest capacity in the world for a pumped-storage power station. This generator-motor has been developed by applying advanced technologies, particularly on ventilation and cooling, mechanical strength, and structure of the thrust bearing, for increasing generating capacity and rotation speed.

Furthermore, the environmentally-friendly materials, such as non-volatile varnish, lead-free coating material, and so on, have been used on this generator-motor. This helps to improve construction workers' safety.

To address growing environmental concerns, hydro power generation, which does not consume fossil fuel and produce carbon dioxide, has been the focus of recent attention. Hitachi will fulfill its social responsibility by supplying high-performance generating equipment to hydro power stations that has a low ecological load.

Rotor of 525-MVA/464-MW generator-motor

Transient Data Recorder Delivered to the Kashiwazaki Kariwa Nuclear Power Station of Tokyo Electric Power Company

Hitachi has upgraded the transient data recorder for Unit 4 of the Kashiwazaki Kariwa Nuclear Power Station of Tokyo Electric Power Company.

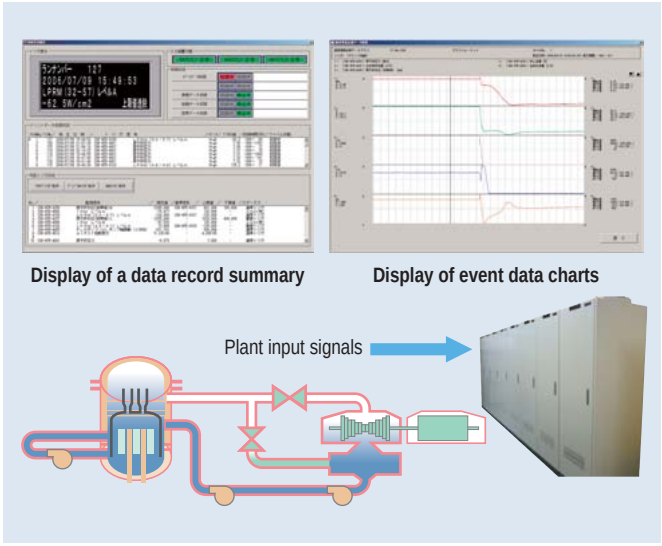
This product immediately captures and accumulates plant input signals (at the fastest interval of 1 millisecond) for a certain period in order to provide assistance in the early detection of anomalies and identification of related causes in plant equipment.

The system consists of a fast process input device that immediately enters data, a programmable controller, and an industrial PC (personal computer) that promptly records large quantities of data and provides information. For this project, Hitachi newly developed and applied a fast process input device that functions as the heart of this product. The system enjoys the following advantages over conventional products and will be applied to other plants in the future.

(1) A fast process input device that is both compact and cost-effective

(2) Comparison of data on ongoing phenomena over long periods using enlarged views of collected data

(3) DVD (digital versatile disk) output function for data recorded



Configuration of the transient phenomenon recorder and screens displayed

Comprehensive Business Assistance System Based on RFID of Thermal and Hydroelectric Power Plants

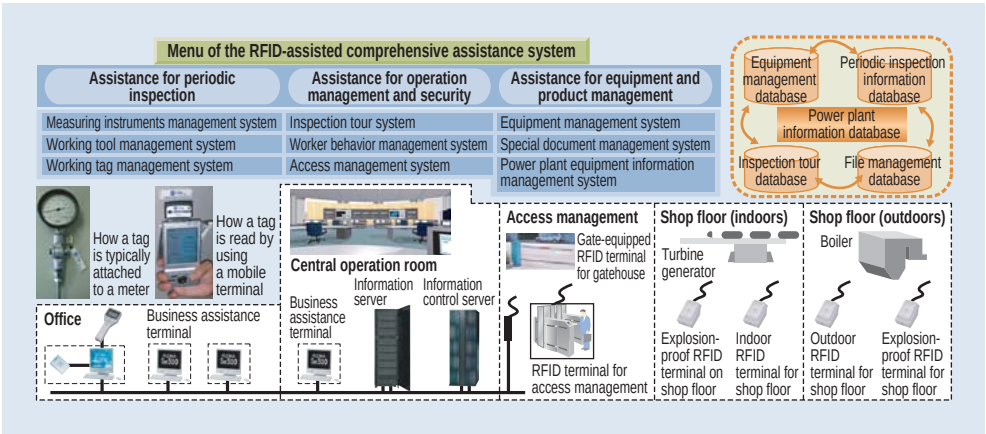
Hitachi provides solutions for comprehensive business assistance based on RFID (radio-frequency identification) in order to streamline periodic inspection, daily operation, and equipment management in thermal and hydroelectric power plants.

[Main features]

(1) A power plant's information database is used to integrate equipment specifications and other equipment information, the maintenance and repair information collected at periodic inspection, and inspection information collected in daily operation. The terminals provide maintenance service personnel and operators with the information services that they need, thereby alleviating workload in terms of management and adjustment.

(2) RFID tags are attached to power plant equipment, personnel, and documents, and thus relate all these components to the database. This facilitates database access from the shop floor by using RFID tags as the key, and thus realizes ubiquitous computing of information.

(3) The system relates the statuses of inspection, equipment maintenance and repairs, and workers to efficiently manage business assistance in drafting equipment maintenance and repair plans, efficient plans for the sharing of workers, and subsequent inspection, maintenance, and repair plans based on trends in deterioration.



Overview of the RFID-assisted comprehensive assisatance system

Advanced Energy Management System of Electrical Power Network

This system is used in the dispatching center that supervises and controls high voltage transmission network and a certain local area of medium voltage transmission network. The system supports two major groups of functions. One group is for the operation of the high voltage transmission network and the other is for the back up of the central load dispatching center system.

The functions in the former group are 'supervisory control and data acquisition,' 'switching order generation and execution under normal network status,' 'data reporting and statistics,' 'network security monitoring,' 'operation planning,' and 'operator training.' As the control area of the center is very wide, operators of the center handle vast amounts of information. Such being the case, the functions of 'network security monitoring,' 'operation planning' and 'operator training' are enhanced in order to reduce operator's load and improve operational efficiency.

The functions in the second group, 'demand and supply monitoring,' 'demand and supply control' and 'loss minimization control' were prepared for back up of the central load dispatching center system.

Thus, the system which has sophisticated functions and high reliability feature was developed.

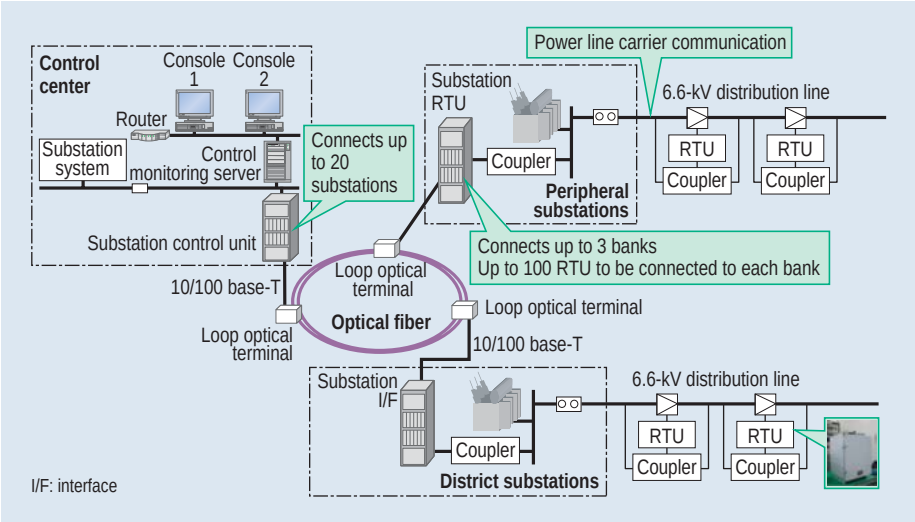
As for a common supervisory board, a large screen rear projector made by LCOS (liquid crystal on silicon) architecture was introduced. Many different kinds of visual contents can be displayed on the large screen. Thus the sophisticated HMI (human-machine interface) was realized by the combination of the large screen display and operators consoles.

(The system was put in commercial operation in March 2007)

Video projection system screen and operator consoles in dispatching room

Distribution Automation System Using Power Line Carrier Communication Delivered to Shikoku Electric Power Co., Inc.

More than 16 years had passed since Hitachi first delivered distribution automation system using power line carrier communication to Shikoku Electric Power Co., Inc. Hitachi has now begun to replace the equipment with a new model. The new model has the following features that make it adaptable to streamlined and advanced operation.



Overview of general configuration of the distribution automation system using power line carrier communication

[Main features]

(1) The new model is designed with functions of fault locating, power quality monitoring, and performance to other distribution operations in the future.

(2) The new models to be installed in control centers are adapted to integration and will replace existing main equipment. The models are configured to be able to process data from up to 20 substations and 2,000 RTU (remote terminal unit).

(3) Based on the results of field verification, a function was added to increase the transmission reliability of transmission level switchover and low-speed transmission to respond to a decline in transmission quality caused by salt damage due to a typhoon or other disasters.

Water Quality Management System Assisted by HACCP Concept

WHO (World Health Organization) calls for establishing WSPs (Water Safety Plans) to manage the quality of drinking water at a safe and reliable level. Hitachi has developed a HACCP (Hazard Analysis and Critical Control Point) information management tool assisted by the HACCP method—the basic concept of WSP.

[Main features]

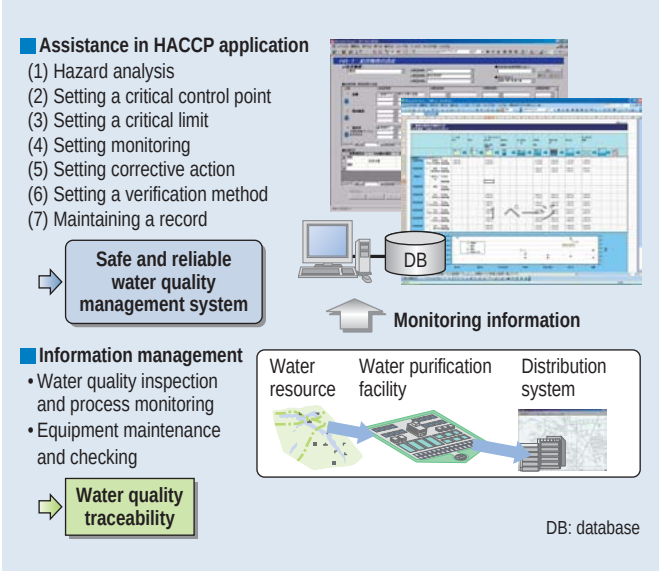
(1) Building a water management system

This system provides assistance in hazardous analysis that extracts the factors affecting the quality of city water, and the setting of standard values for operation management and appropriate monitoring positions based on such analysis.

(2) Water quality traceability

This process monitors the history of treatments based on the monitoring records of water quality and processes.

(Scheduled for commercialization: September 2007)



Overview of the tool for managing waterworks HACCP information

10000-series Train Cars Delivered to Tokyo Metro Co., Ltd.

Hitachi has delivered 10000-series train cars as the first new model cars since the privatization of Tokyo Metro Co., Ltd.

10000-series train cars of Tokyo Metro Co., Ltd.

These cars adopt an aluminum double-skin structure as used in cars delivered by Hitachi to Tokyo Metro for its Tozai Line in fiscal 2004. The structure was assembled by friction stir welding to achieve high precision and rigidity in an attempt to make the cars more recyclable, fire-resistant, and stronger in terms of the chassis.

The interior structure features a ceiling 185-mm higher than in conventional models and reinforced glass doors 900-mm wide as the through doors between the cars, with reinforced glass as large as 200-mm wide used on both sides of each door to create an open indoor space.

Externally the cars feature a curved shape by taking advantage of the characteristics of the aluminum structure. The shape was adopted for the Yurakucho Line and the cars are adopted for direct runs between that line on one hand and the Tobu Tojo, Seibu-Yurakucho, and Ikebukuro Lines on the other, as well as for Subway Line No. 13 scheduled to be launched in June 2008.

50050-series Train Cars Delivered to TOBU RAILWAY CO., LTD.

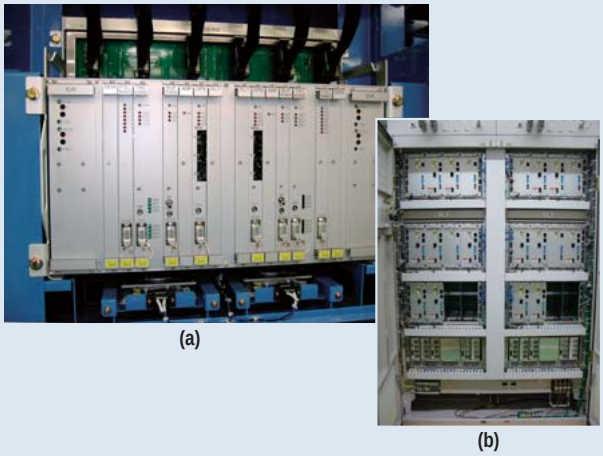
Hitachi has manufactured and delivered 60 cars for six trains of the 50050 series as new cars for the Isesaki Line of TOBU RAILWAY CO., LTD.
These cars are designed to shift from TOBU RAILWAY and pass through the Hanzomon Line of Tokyo Metro Co., Ltd., and then to the Den-en Toshi Line of Tokyu Corporation. These are the first aluminum cars to be used as commuter cars for the Isesaki Line of TOBU RAILWAY.

50050-series train cars for TOBU RAILWAY CO., LTD.

The chassis is based on the A-Train system and adopts an aluminum double-skin structure and a module rig system made of large aluminum, hollow-extruded sections. This achieves a higher degree of soundproofing inside the cars, reduces weight resulting in lower power consumption, and unifies the use of aluminum materials in different parts, thus making the cars more recyclable. Consequently, the environmental impact of these cars is significantly reduced.
The car equipment includes devices to improve accessibility for physically challenged persons and the elderly, such as door opening-closing chimes, the provision of warning colors at the entry doors, and lower car floor height, thus reducing the level differences between the entry doors and the platform, and giving consideration to all kinds of passengers. TOBU RAILWAY plans to adopt these cars as standard.

Digital ATC System Introduced throughout the Yamanote Line of East Japan Railway Company

With the Phase 1 work completed for introducing Hitachi's D-ATC (digital-automatic train control) system, the Keihin Tohoku Line (between Minamiurawa and Tsurumi) was put into advance service in December 2003. This was followed by completion of the Phase 2 work to introduce the system throughout the Yamanote Line and put it into service. Unlike conventional ATC based on a multi-step brake control system, digital ATC transmits the location of the advance train to the following train as digital information, thus performing optimal single-step brake control by using speed check profile according to line conditions. This shortens the train headway and travel time, and improves passenger comfort. The recent project conducted on the Yamanote Line made such new enhancements as adapting it to the new model cars of the E231 series, and size reduction and the high-density mounting of aboveground transmitters and receivers.



Onboard controller (a) and aboveground transmission/reception unit (b) for digital ATC

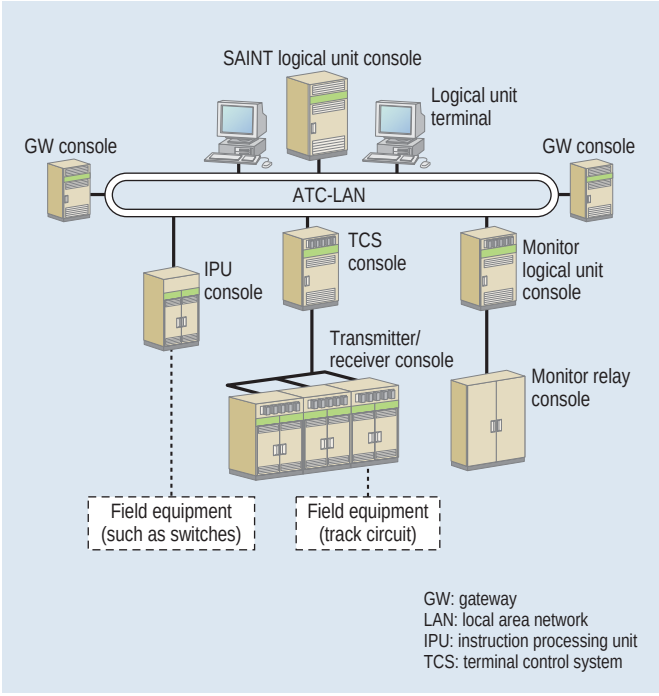
New Sentosa Express Monorail is Now Open to the Public

New Sentosa Express monorail system

The Sentosa Express in the Republic of Singapore is Hitachi's state-of-the-art monorail system and was successfully launched on the 15th of January 2007. The Sentosa Express connects the leisure island of Sentosa to the mainland and provides a unique and memorable experience for visitors to this island. Equipped with energy-efficient inverter controllers and rubber tires, the noise and vibration generated by this monorail have been greatly reduced. This allows not only environmental-friendly transportation, but also a smooth, quiet and comfortable ride for passengers. The use of rubber tires enables the monorail trains to climb gradients as steep as 6% and handle turns as tight as 40 m. These features allow the developers to be more flexible in terms of designing the monorail's track and utilizing the limited land in urban areas. Hitachi's advanced solution provides a complete monorail system integrating various areas of expertise required to operate the system, including trains and tracks, signaling systems, communication systems, operation control center, substations, and depot. Hitachi is respected as the reputable company that integrates complete systems for monorail systems and promises a reliable, safe, delightful, and advanced urban transit system to its clients.

SAINT Introduced to the Tohoku and Joetsu Shinkansen Lines (between Morioka and Shin-shirakawa) for East Japan Railway Company

SAINT [Shinkansen ATC (automatic train control) and interlocking system], a new train control system designed exclusively for the Shinkansen, has been delivered to East Japan Railway Company. In conjunction with ongoing renewal work, the new system was recently introduced to Section 1 (Morioka to Furukawa) and Section 2 (Furukawa to Shin-shirakawa) and made operational. The current version of SAINT is characterized by one major feature. Conventional trains come equipped with an independent device called "an interlocking device" that controls DS-ATC (digital communication and control for Shinkansen — ATC), which was put into operation prior to servicing of the Shinkansen section (Morioka to Hachinohe) in December 2002, along with switches and other field devices. The interlocking device is used to configure routes. The latest version of SAINT integrates this previously independent interlocking device with the main equipment and thus improves reliability and performance, as well as reducing costs. This version of SAINT is also the first system not equipped with a solenoid relay in a Shinkansen line, making it possible to directly develop electronic terminals for controlling field devices and significantly reducing equipment space requirements. Moreover, SAINT shortens the time for the trains to arrive by the digital ATC and uses single-step brake control to improve the comfort to ride in. It is scheduled for introduction to all Tohoku and Joetsu Shinkansen lines.



Configuration of aboveground devices of SAINT

Artificial Zeolitization of Incineration Ash

The Hitachi Group has developed a technology for mass-producing high-quality artificial zeolite (a porous inorganic compound based mainly on silica and alumina) out of coal ash previously used in landfills, and been promoting the reuse of artificial zeolite thus produced in cooperation with Chubu Electric Power Co., Inc. Artificial zeolite has stable functions of adsorption, ion exchange, and catalysis. It is therefore expected to find growing markets as an adsorbent of heavy metals and malodorous gases, a substitute for activated carbon, soil conditioner for planting in deserts and on roofs, and for other applications. For example, Hitachi Appliances, Inc. has developed and commercialized air cleaners that achieve a deodorization rate of 99% by using an artificial zeolite filter.

In December 2005, Hitachi Setsubi Engineering Co., Ltd. completed an experimental plant on the premises of the Juo Works, Hitachi City, Ibaraki Prefecture in Japan, based on a technical tie-up with a venture company. Hitachi Setsubi then conducted tests based on paper sludge, waste diatom earth, and other raw materials in an attempt to find a wider range of application.

The Hitachi Group intends to continue promoting such circulation of resources in conjunction with industry, academia, and government, and thus contribute to establishing a society based on recycling that accommodates the characteristics of local communities.

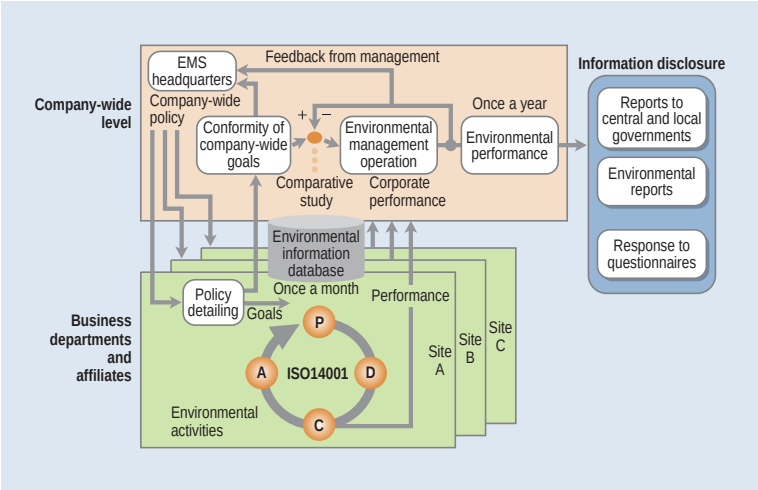
Appearance of artificial zeolitization plant delivered to Hekinan Thermal Power Plant of Chubu Electric Power Co., Inc. (a), inside the building (b), and powdered zeolite (c)

Environmental Information Collection System for Assisting Environmental Management

Corporate management must fulfill its social responsibilities by positively addressing environmental issues and reducing each company's environmental impact. Moreover, corporations also require increasingly larger amounts of environmental data relative to the management of energy, chemical substances, waste, and legal compliance.

Hitachi's environmental information collection system centrally manages the environmental information necessary for corporate management and therefore can promptly accommodate any kind of application. This system also features the capability of flexibly adapting to reorganization and revised legal requirements. Moreover, the system enables closer communication between group companies, factories, and other sites on one hand, and EMS (environmental management system) headquarters on the other, and in so doing can effectively run the PDCA (plan, do, check, and action) cycle.

Hitachi is now beginning to put into perspective its combinations with various energy-saving equipment and monitoring devices of the Hitachi Group in linkage with the greenhouse gas emissions trading system in order to promote the information system as a total solution for environmental protection and the saving of energy.



Evolution into an environmental information integration system