



Social Infrastructure & Industrial Systems

 Rail Systems

 Construction Machinery

 Public Facilities

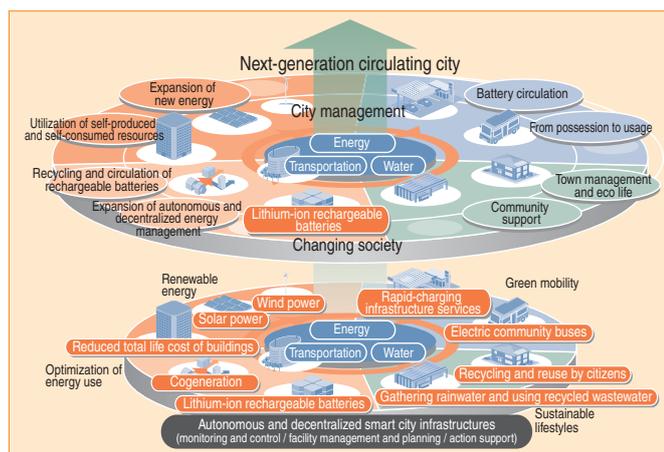
 Defense Systems

 Industrial Systems

 Production Plants

Global Development of "Smart Cities" that Combine a Small Carbon Footprint with Economic Development

As the global warming problem increases in severity, interest has risen in next-generation smart cities that can use smart grids and other advanced technologies to achieve a small carbon footprint while simultaneously moving forward with economic development and improvements in the living environment. As these types of construction plans and related technological development projects have been gaining steam both domestically and internationally, Hitachi, Ltd. established its Smart City Business Management Division in April 2010. This division has been contributing to the construction of smart cities by bringing together the related technologies from across the various fields in which the Hitachi Group specializes.



Construction of a next-generation circulating city by Hitachi

Optimizing Society through Convergence of IT and the Social Infrastructure

Although there are many ways to interpret the phrase "smart city," Hitachi thinks of this as a city that can achieve improvements in the QoL (quality of life) of people who live there while working towards sustainable development, by combining a small carbon footprint with economic growth, linking and fusing the social infrastructure with IT (information technology), and optimizing the way the city uses both resources and energy.

This is supported by a next-generation energy distribution network (smart grid), energy management systems for regions, buildings, and homes, a next-generation transportation system that achieves smooth transportation with a small carbon footprint, an intelligent water system that efficiently utilizes water resources, and other components of a system that works to optimize society as a whole by constructing (fusing) an information system infrastructure that will act as a central control hub.

Establishment of the Smart City Business Management Division

Hitachi possesses a wide range of fundamental technologies without which smart cities will not be achievable, including electric power and energy-related systems, railway system and EV (electric vehicle)-related technology, water treatment systems, resource recycling, health care technologies, information and communication technologies, various authentic technologies, security technologies, etc.

In order to contribute to the construction of smart cities around the world by optimally combining these technologies, in April 2010 Hitachi, Ltd. launched its Smart City Business Management Division within the corporation, directly answering to the company president. This new organization, to which we also belong, coordinates research, development, and other operations related to smart cities across the entire group, collaborating with partners both domestic and international while promoting technologies and the upgrade of local standards to international standards, as well as promoting participation in city development projects in countries around the world.

Applying Hitachi's Strengths on a Global Stage

The ideal form taken by a smart city will vary depending on the country or region, and details will differ as well. Furthermore, this movement is rapidly evolving, with the adoption of M2M (machine to machine) networks and developments in the IOT (Internet of things) field taking place throughout the world. Three representative projects are currently ongoing in China. One example underway is the large-scale Tianjin Eco-City that is being jointly developed by China and Singapore, followed by the Guangzhou Knowledge City project in which Hitachi is cooperating in the areas of energy management, information control infrastructure, and an energy-saving data center, as well as other areas. In addition, we are also participating in another next-generation city project under development by the city of Dalian in China, including a smart grid, a water treatment system, and so on.

As for other global projects spearheaded by New Energy and Industrial Technology Development Organization (NEDO) following the New Mexico Project, Hitachi is also participating in the following new projects. First is the ZEM2ALL (zero emissions mobility to all) project in Malaga, Spain with a worldwide operator, a European utility giant, and other partners working together to support the penetration of EV. Another project in the USA is an advanced island smart grid demonstration project in Maui, Hawaii, which is based on the Japan-U.S. Clean Energy Technologies Action Plan. Hitachi is taking a leading role, and is coordinating the entire project.

In Japan, Hitachi is using a variety of different projects to verify and put to practical use its cutting-edge technologies, with smart grid demonstration experiments at Rokkasho Mura in Aomori Prefecture, a next-generation transportation system demonstration experiment at Yokohama in Kanagawa Prefecture, and an EV recharger management solution on Okinawa Island.

A senior employee once told us that "Hitachi respects a sense of idealism." The construction of sustainable next-generation cities is work that fits this bill perfectly, and knowledge accumulated by Hitachi as part of various social infrastructure projects is being cultivated into strengths that we will continue to apply to a large and growing number of smart city projects around the globe, by which we will contribute to the development of society and the protection of the global environment.



Fumitoshi Emura (left), Department Manager, Project Promotion Department, Global Business Promotion Center; Yuichi Mashita (right), Department Manager, Smart City Middleware Development Center, Business Incubation Division, Smart City Business Management Division, Hitachi, Ltd.

Electric Products for Line 2 of the Xi'an Metro Rolling Stock in China



New train for Line 2 of the Xi'an Metro (completion ceremony at the Chinese rolling stock manufacturer)

Line 2 of China's Xi'an Metro (covering a total length of approximately 26.3 km with 21 stations) is the first subway in the city of Xi'an, and runs through the political and economic center of the city along a north-south axis.

In cooperation with Yongji Xinshisu Electric Equipment Co., Ltd., as well as Hitachi Yonge Electric Equipment (Xi'an) Co., Ltd. (which is based in the city of Xi'an), Hitachi has delivered electric traction systems including traction motor and traction inverter devices, auxiliary power systems including static inverter devices, train monitoring control systems with command transmission functions, and brake systems. The first train's test run has been completed, and shipments of electric products for production of rolling stock are continuing apace. After the trial operations starting in September 2011, and once the system is open for business, it will take its place as a key transportation route in the city of Xi'an, with high expectations for the relief of road traffic congestion.

Digital ATC Systems for the Japan Railway Construction, Transport and Technology Agency's Aomori Extension of the Tohoku Shinkansen

Hitachi has delivered DS-ATC [digital ATC (automatic train control)] ground systems with support for uninsulated track circuits (TS2 type) as well as feeder section control track circuit systems (TS2 type) for the Aomori extension of the Tohoku Shinkansen (Shichinohe-Towada and Shin-Aomori stations, between Hachinohe and Shin-Aomori) built by the Japan Railway Construction, Transport and Technology Agency (JRJT). Training operations for the new systems began in September 2010.

These systems are characterized by support for uninsulated track circuits. Unlike traditional insulated track circuits, since insulators on the track, impedance bonds, and other on-site equipment are not required, a major reduction in both initial costs and maintenance costs can be expected.

After the completion of training operations, commercial operations began in December 2010.

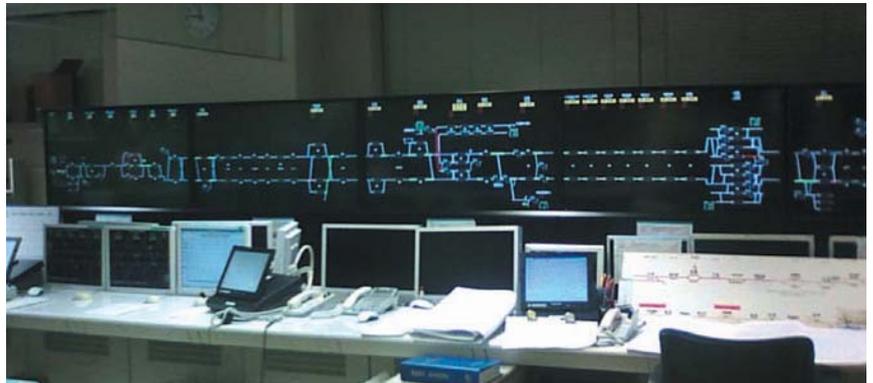


Digital ATC systems

Traffic Control System of JR Takarazuka, Tozai, and Gakkentoshi Lines for West Japan Railway Company

The traffic control system of the JR Takarazuka, Tozai, and Gakkentoshi Lines is a centralized traffic control system responsible for 27 stations between Shin-Sanda and Hosono (covering approximately 94 km). This line control system is characterized by its ability to mutually coordinate various systems that enable the line's convergence with the Tokaido Line at Amagasaki Station and with the Osaka Higashi Line at Hanaten Station by communicating various types of information with other systems in operation (the JR Kyoto/Kobe Line system, and the Osaka Loop/Yamatoji Line system).

On-site testing and adjustment took place at the Shin-Osaka General Control Center, and use of the system began in March 2011. Now that this system is operational, this represents the complete installation of the "Urban Network" series of traffic control systems by the West Japan Railway Company.



JR Takarazuka, Tozai, and Gakkentoshi Lines traffic control system (on-site testing and adjustment at the Shin-Osaka General Control Center)

In the future, the technology and functionality cultivated here will be applied to the next-generation Hanwa Line system, and will contribute to further expansions in railway systems.

East Japan Railway Company's New Series E6 Available for Both High-speed Dedicated Line and Conventional Line

The East Japan Railway Company introduced the prototype train sets of Series E6 which is able to run at maximum speed of 320 km per hour on Akita Shinkansen on high-speed dedicated line (completed in July 2010). JR East plans to operate Series E6 connected with Series E5, and plans are for it to start running at a maximum speed of 300 km per hour in March 2013, and at a maximum speed of 320 km per hour in March 2014. Just like Series E5, Series E6 has adopted state-of-art technologies.

Every train set achieves environmental friendliness with a long-nose shaped front face, high drive performance with improved brake system, and comfortable riding experience with full-active suspension system in all cars.

In addition, Series E6 can run through sharp curves in the conventional line more smoothly. Series E6 also offers environmentally conscious performance as well as a full range of barrier-free facilities.



East Japan Railway Company Series E6 Shinkansen train (prototype train car)

500-t Large Crawler Crane



Standard specifications with conventional boom (left) and heavy-lift attachment specifications with long mast (right)

This large crawler crane with its 500-t lifting capacity responds to the diverse needs of the current market, with a jib attachment to meet the globally brisk demand for wind generator installations, or with a heavy-lift attachment* to carry higher-lift and larger packages during the expansion of nuclear power plants and environmentally responsive upgrades of chemical plants.

For safe and efficient assembly/disassembly, this machine is equipped with a self-assembly device with a self-alignment feature and a retaining device for disconnected parts to prevent loss during shipping, and these features reduce assembly/disassembly time to two days, or approximately one-third of the time required for previous models.

In addition, the different supported transportation methods suit widely used trailers and trucks in order to comply with regional shipping regulations around the world.

[Key features]

(1) Standard and heavy-lift attachment specifications

(2) 500-t base rating capacity with conventional boom, 250-t base rating capacity with luffing attachment

(3) Conventional boom length from 24 m to 126 m, luffing attachment length from 24 m+24 m to 84 m+84 m

(4) Transportation weight—32 t or less, width—2.99 m or less, height—3.8 m or less on trailer (for Japanese specifications)

(5) Engine complies with Tier 3 emission regulations

(6) Rated capacity limiter system with large LCD (liquid crystal display) provides useful geometrical data.

(7) 1.2 m wide operator's cab with tilt device up to 15 degrees, seat with suspension and wind speed indicator

(Hitachi Sumitomo Heavy Industries Construction Crane Co., Ltd.)

* The mast and counterweight are located in the back of the crane, thereby increasing the level of stability with a device that improves lifting capacity over the standard specifications.

A High-performance, 2.1-Mpixel High-resolution Full HD-compatible Chassis Camera

The international market for surveillance camera has been expanding lately as they have been recognized by the public as an extremely effective tool for security, and it is anticipated that demand will continue to grow steadily. Hitachi has reacted to the market demand for better clarity in surveillance camera images by developing the advanced and compact DI-SC220 zoom chassis camera.

[Key features]

(1) A 2.1-Mpixel high-resolution 20x zoom lens

The DI-SC220 has a CMOS (complementary metal oxide semiconductor) sensor with full HD (high-definition) 1,920×1,080 resolution. Its HiLD (high index low dispersion) optical 20x zoom lens supports both outdoor and indoor surveillance. This lens uses HiLD glass that permits the efficient capturing of images with a minimum of the chromatic aberration that generally affects long focal point lenses.

(2) Technology for low-light performance

Complementing the HiLD lens and CMOS sensor, Hitachi's proprietary HD-DSP (high-definition digital signal processor) achieves a minimum sensitivity (subject illumination) of 1.6 lx. What's more, the image processing engine in the HD-DSP also increases visibility and reduces noise. This is an HD system with impressive nighttime surveillance capabilities.

(3) Wide dynamic range modes

Images in which the luminous intensity varies greatly between indoor and outdoor areas, such as those taken at the entrance of a building, are prone to the occurrence of whiteout or the loss of dark details, reducing visibility. Two methods are used in order to double the effectiveness of the previous model (VK-S654N). The first is to combine two images taken at different shutter speeds, and the second is to use a contrast offset function in order to correct the contrast of each pixel in the image. Even in scenes with widely varying luminous intensity levels, the improved visibility makes it possible to perceive the subject.

(4) Four selectable HD video modes

High output flexibility meets the requirements of many different kinds of surveillance systems.

(a) Full HD mode: 1,920×1,080/60i, 50i

(b) Full HD progressive mode: 1,920×1,080/30p, 25p

(c) Full HD PsF mode: 1,920×1,080/30PsF, 25PsF

(d) HD progressive mode: 1,280×720/60p, 50p

(5) Digital output for the transmission of high-quality images

The Hitachi DI-SC220 supports the digital output of image signals, maximizing camera performance by permitting the transmission of lossless, low-noise image data with no need for decoding.



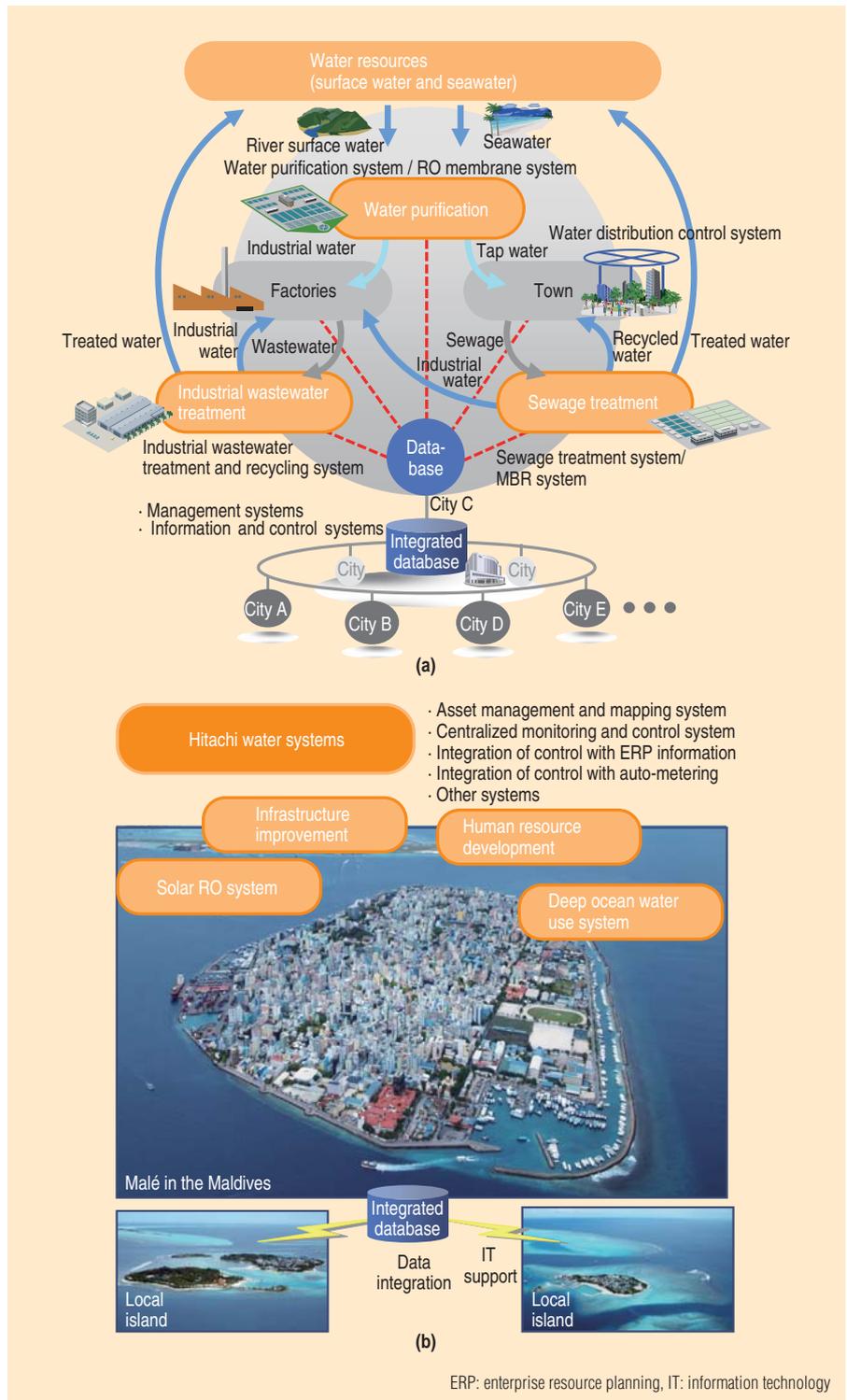
DI-SC220

Global Expansion of Hitachi's Water Businesses: Hitachi Water Systems

Water is essential to our way of life, and must always be safe, easily accessible, and dependably high in quality. There is also a need to reduce the burden placed on the environment by the processes of supplying and treating water. In response to these needs, Hitachi has proposed a concept of Hitachi Water Systems that aims to implement comprehensive management of the water cycle at a regional or municipal level by integrating water treatment technologies, such as RO (reverse osmosis) and MBR (membrane bio-reactor) applications, with information and control technologies.

Water is present in the environment in the form of a cycle that includes water resources, water purification and supply (tap water and industrial water), as well as recycling (sewage and recycled water). The water cycle is spread geographically over catchments and cities, and so its stakeholders include citizens, industry, and agriculture, in addition to the need to protect biodiversity and other aspects of the natural environment. Hitachi Water Systems are characterized not only by specific water treatment technologies that improve the efficiency of individual equipment, but also by the way facilities are managed. Information regarding individual equipment is aggregated and analyzed, and then commands are issued to all equipment in such a way that every facility works smoothly, cooperating with each other and functioning optimally as a system.

Here is one example of the efforts aimed at realizing the Hitachi Water System vision. On January 11, 2010, Hitachi Plant Technologies, Ltd. reached an agreement with the government of the Republic of Maldives to take a 20% stake in the Maldivian water and sewage company Malé Water & Sewerage Company Pvt. Ltd. (MWSC), and to participate in the operation of MWSC. This company services approximately 40% of the entire population of the Maldives, and is expected to further expand its business going forward. One of the various initiatives started as part of Hitachi's participation in the management of MWSC is the introduction of the Hitachi Water System vision, which will be reflected in upgrades to the water supply and sewage services of the Maldives through Hitachi's involvement in operations. As a part of this trial, facility management will be simplified through the introduction of GIS (geographical information system) equipment, and the centralized monitoring and control of seawater desalination equipment are



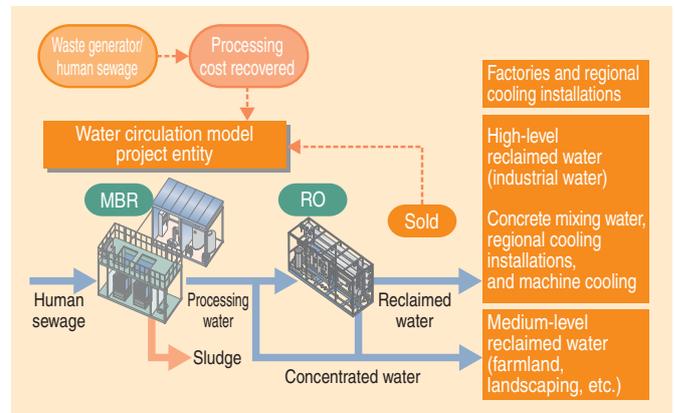
Overview of Hitachi Water Systems (a) and Hitachi Water System in the Maldives (b)

also under consideration. Hitachi will acquire further expertise in water supply and sewage operations and management, and will expand its water supply and sewage service businesses on a global scale, including Southeast Asia and the Middle East. This will also allow Hitachi to expand from its prior focus on EPC (engineering, procurement, and construction) businesses into comprehensive water services.

Small-scale Decentralized Water Reclamation Demonstration Project in the Middle East

Hitachi is currently involved in a water reclamation project covering emerging economies around the world, centered on the Middle East. These are regions where the water infrastructure has not kept pace with rapid urbanization, and this business model demonstration project utilizes MBR (membrane bioreactor) and RO (reverse osmosis) systems to ensure wastewater is capitalized on as a new water resource for producing reclaimed water that can then be sold to surrounding regions for planting trees and industrial uses.

A demonstration plant was built in the Al Ghail Industrial Park of the UAE emirate of Ras Al Khaimah, including both MBR facilities (with a daily processing capacity of approximately 2,000 m³) and RO facilities (with a daily processing capacity of approximately 1,000 m³). Demonstration operations started here in May 2010. Since these types of facilities reduce the shipping distances for both wastewater and reclaimed water, they help save energy. Following these demonstration operations, Hitachi will establish this business model while expanding the project to other nations and regions in the Middle East with similar needs. This project is being run as a research project sponsored by the



Small-scale distributed water circulation demonstration project in the Middle East

New Energy and Industrial Technology Development Organization (NEDO).
(Hitachi Plant Technologies, Ltd.)

Niigata City Disaster Information System



Niigata City disaster information system

Hitachi delivered a disaster information system to Niigata City, which has made "the creation of a safe and secure city" one of its key policies.

This system was constructed to provide the core functions of Niigata's disaster measures center, to consolidate in a unified fashion the various types of information and local damage situations when a disaster occurs, and to support decision-making with respect to the city's emergency response policies. In addition,

during ordinary times, the system works to promote the spread of knowledge regarding the prevention of disasters.

[Key features]

(1) Various types of information are shown on a 108-inch display with a large video display function designed to promote the sharing of information between relevant personnel.

(2) Video footage of the damage can be taken with video cameras at the location of the disaster and transmitted to the center in real-time with an on-site video acquisition function.

(3) A flood simulation function supports the issuance of rapid and accurate evacuation orders by predicting which regions will be flooded, the depth of flooding, and the arrival time of flood waters.

(4) A disaster information function uses kiosk terminals to provide citizens with hazard maps as well as guides regarding what actions to take during disasters.

In addition, seismic isolation equipment secures the information system's earthquake resistance, along with power sources, a communication network, and

other center facilities.

Hitachi will continue to provide consultation, planning, and development services in order to support the continuity of national and municipal governments, as well as emergency countermeasures not only against traditional natural disasters, but against terrorism, new types of influenza, and a growingly diverse range of other crises.

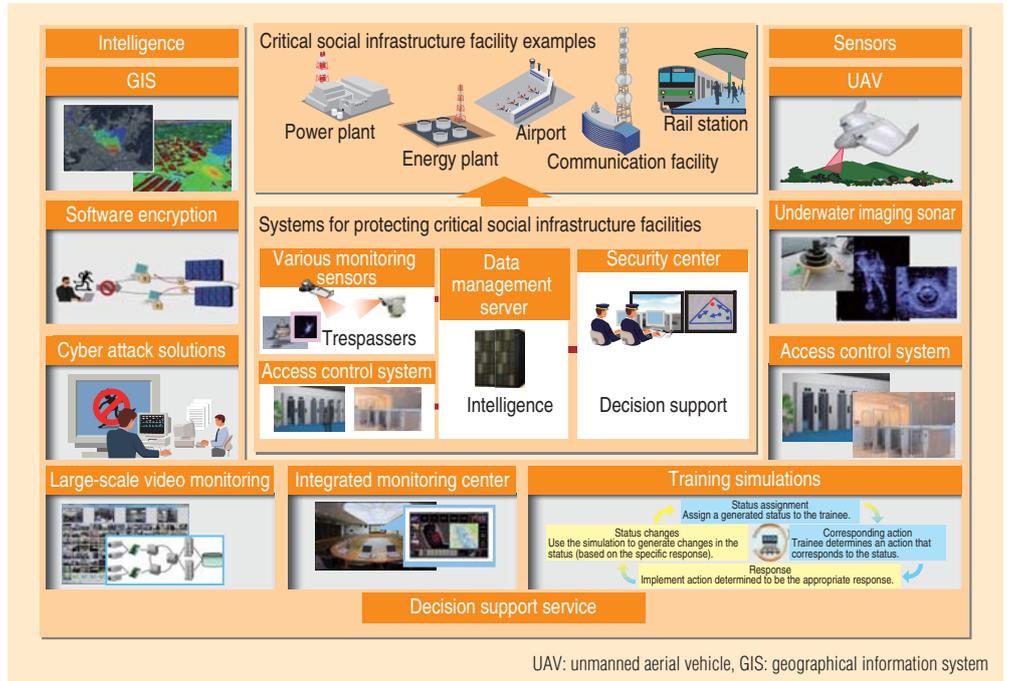
(Delivered: March 2010)

Critical Infrastructure Protection System Solutions

As cyber and physical terrorist attacks occur frequently around the world today, security concerns have been on the rise. In particular, the protection of social infrastructure facilities such as energy, traffic, and communication has become an indispensable part of achieving a safe and secure society.

For many years, Hitachi has provided the Japanese Ministry of Defense with countless systems and products, and Hitachi is also applying the wide range of technology and know-how it has cultivated over time in the area of crisis management in order to respond to the need to defend the critical facilities that make up the society's infrastructure.

In addition to software encryption and other aspects of the cyber security field, various sensors, access control systems, and other aspects of the physical security field, Hitachi has developed a lot of diversified systems for protecting critical infrastructure, from providing analysis and visualization of collected information to running training simulations, achieving decision support of the command and control.



System solution efforts for protecting critical infrastructures

Hitachi will continue bringing together all of these capabilities in order to offer multi-level security solutions as a one-stop service that can satisfy the needs of every user, thereby contributing to the construction of a safe and secure society.

Products that Reduce the Environmental Burden of Power Substation Systems



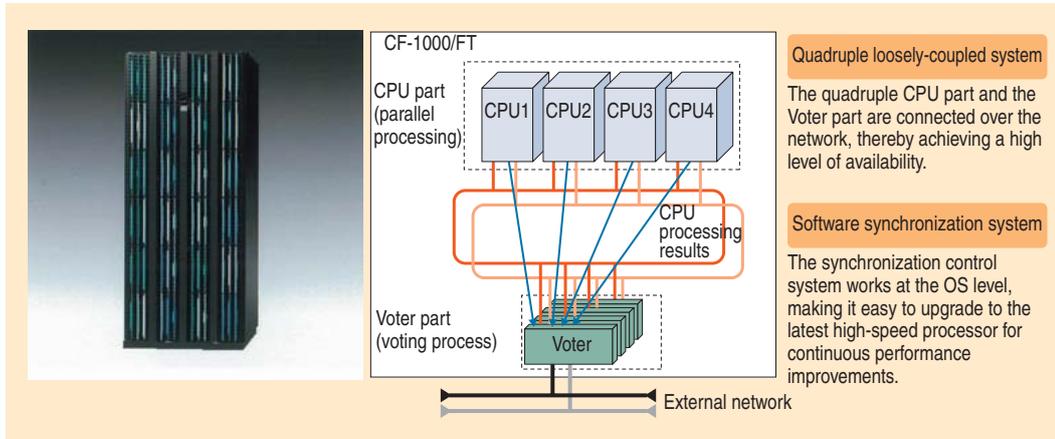
72-kV eco-GIS (left) and 24-kV C-VIS (right)

SF₆ (sulfur hexafluoride gas), which is widely employed as an insulating material in extra-high voltage power substation facilities, has a global warming coefficient that is 23,900 times as high as that of CO₂ (carbon dioxide), and therefore usage amounts must be reduced. This is why Hitachi offers products that reduce

the environmental burden of power substation facilities by not using SF₆ gas.

- (1) 72-kV eco-GIS (gas insulated switchgear)
Instead of SF₆ gas, dry air with a global warming coefficient of zero is used as the insulating medium. A greaseless electromagnetic operating unit is used that requires less maintenance.
- (2) 24-kV C-VIS (cubicle type-vacuum insulated switchgear)
Instead of SF₆ gas, a solid insulation is used for the bus part, and vacuum insulation is used for the interrupter part. The recharger part of the main circuit inside the panel is not exposed, which ensures safety. Hitachi will continue working to help prevent global warming by offering products that reduce the environmental burden of power substation facilities.

CF-1000/FT: Information and Control Platform Fault-tolerant Model



CF-1000/FT fault-tolerant model

The CF-1000 control server is provided for use with the various types of control systems utilized for electric power systems, railway systems, and other components of a society's infrastructure. This newly released CF-1000/FT fault-tolerant model was designed to achieve a high level of data reliability and continuity for systems that would be greatly affected by even short service stoppages.

This product is a quadruple loosely-coupled system configured in such a way as to connect a quadruple CPUs (central processing units) and a Voter processing device over a network in order to achieve a high level of availability. In addition, the application program is parallel-processed on a quadruple CPU system, and the results of each CPU's processing are sent to the Voter, which determines the result with the most votes and outputs it to an external network in order to achieve highly reliable data processing. Also, synchronization control is performed at the OS (operating system) level over the parallel-processing CPUs, thereby removing the dependency on CPU hardware for synchronized processing and enabling continued performance improvements through the upgrading of processors.

HF-W7500 Model 30 Industrial Computer

The HF-W series of industrial computers are long-lasting computers that can be used not only for monitoring, control, and disaster prevention systems, but also in communications, broadcasting, and a growing range of other information and telecommunications fields. Hitachi has introduced the HF-W7500 Model 30 as a high-performance model in the high-end HF-W7500 series, with an even greater focus on improved performance over previous industrial computer models.

This product is designed for high performance, and includes a high-performance processor (approximately 1.8 times as fast as processors in previous Hitachi products), a 64-bit OS (operating system), and up to a maximum of 16 Gbyte of memory. In addition, a SAS*¹ [serial attached SCSI (small computer system interface)] hard disk is used that is suited for high-speed and highly reliable processing of large amounts of data, making it possible to use the product as a data logger, or for other such applications. In addition, the power supply also includes UPS*² (uninterruptible power supply) functionality that enables continued operation even in the case of an instantaneous power failure, thereby increasing both dependability and availability.

420 wide × 450 deep × 176 high (mm)

- Includes a high-performance CPU and a high-speed hard disk.
Intel Xeon processor E5540 (2 GHz)
Supports SAS disks up to a maximum capacity of 1.5 Tbyte with support for hot swapping and hot spares.
- Uses a power source with UPS functionality.
The internal battery unit prevents sudden system downtimes due to instantaneous power failures by enabling continued operation (optional).
- Designed for a long operating life
Expected to last 10 years while operating continuously, 24 hours per day.
This operational lifetime is approximately six times as long as that of a general office-use PC (assuming a five-year lifetime while operating eight hours per day).

CPU: central processing unit, PC: personal computer

HF-W7500 Model 30 industrial computer

*¹ An interface for connecting a hard disk or other such device to a computer. A serial transfer method is used to enable high-speed data transfer.

*² Even if a power failure or other such anomaly occurs in the input power source, this device can continue providing power for a certain length of time without a disruption in power.

R800FS/HSC800FS Functional Safety Controller



CPU (central processing unit) for the R800FS functional safety controller and certification by TÜV Rheinland

Responding to the market demand for safety and dependability, Hitachi has developed the R800FS/HSC800FS functional safety

controller, which has been certified by TÜV Rheinland Industrie Service GmbH at SIL (Safety Integrity Level) 2 according to the IEC 61508 series functional safety standard.

R800FS/HSC800FS uses two SuperH (SH) microprocessors, and compares the results of execution to assure both the safety and the performance of processing. Its fail-safe functionality, which prevents the output of unintended dangerous signals to the plant in the case of a hardware fault, has been strengthened by sophisticated self-diagnostics. For example, the SH microprocessor cores are incorporated inside the ASIC (application specific integrated circuit) so as to detect faults, which had been difficult in the past. The R800FS/HSC800FS can cover a wide range of applications by being able to execute both functional safety tasks and general control tasks. It also supports more than 4,000 input/output points at the high performance required for large-scale and high-level plant control systems.

For the global market, the R800FS/HSC800FS is also compatible with the IEC 61131 series of international standards for programmable controllers, which covers programming languages, electrical safety, environmental conditions, and EMC (electromagnetic compatibility).

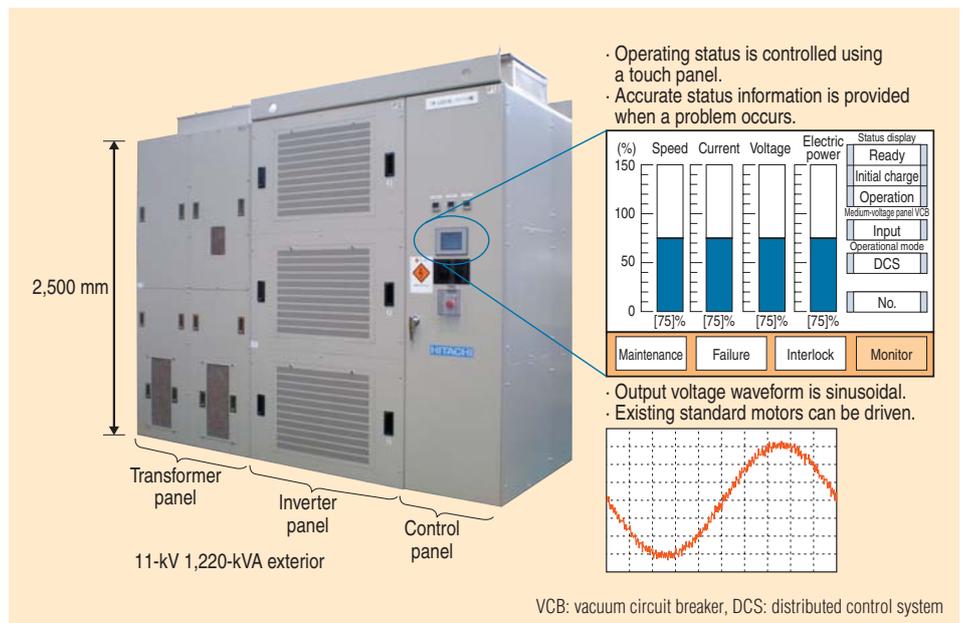
11-kV Medium-voltage Direct Inverter Device

International demand are on the rise for medium-voltage direct inverter devices that can drive medium-voltage motors at an adjustable speed, and the need for 11-kV class products that can meet the demand for adjustable-speed 11-kV motors is increasing from the perspectives of both energy conservation and global warming prevention.

In addition to the 3-kV and 6-kV class products already on the market, Hitachi has now created an 11-kV series of products. This brings its lineup to a total of 25 models designed to meet a variety of customer needs, with 360 to 5,000 kVA for the 3-kV class, 500 to 10,000 kVA for the 6-kV class, and 830 to 4,900 kVA for the 11-kV class.

[Key features]

- (1) Can directly drive medium-voltage 11-kV motors without a step-up transformer.
- (2) The output voltage waveform is sinusoidal, and existing standard motors can also be driven (line voltage level: 33 levels [during 11-kV output]).
- (3) Uses a base structure that is designed for easy maintenance (front panel maintenance shape structure).
- (4) Reduced running costs (uses an electrolytic capacitor with a



11-kV medium-voltage direct inverter device

long life span.)

- (5) Commercial synchronous switching control makes it possible to switch to starter applications and commercial power sources with hitless protection switching.
- (6) Can drive induction and synchronous motors without sensors.

22/37-kW Outdoor Oil Injection Screw Compressor

Although air compressors are generally installed indoors where the surrounding environment does not influence the equipment much, demand is increasing for outdoor installations due to facility expansions, relocations, and other such needs. In response, Hitachi has released an outdoor oil injection screw compressor 22/37-kW model (constant speed type) that is in compliance with IPX3 waterproofing specifications, and which comes standard with a dustproofed intake vent.

This model's main motor is a high-efficiency permanent magnet motor that further improves energy-saving characteristics in a 22/37-kW adjustable-speed controller addition to the Hitachi's outdoor oil injection screw compressor lineup.

Hitachi will continue supporting the wide-ranging needs of its customers by adding to its outdoor air compressor series of models as well.

(Hitachi Industrial Equipment Systems Co., Ltd.)



Outdoor oil injection screw compressor (22-kW adjustable-speed controller)

HSP900 Series of Power Conditioners for Solar Power Systems



HSP900 series of power conditioners for solar power systems

Hitachi developed and began selling the HSP900 series of 100-kW power conditioners in order to support medium- and large-scale solar power systems, which are projected to increase in number in the future.

By adopting the transformer insulation method and providing a lineup of wide DC (direct current) input models, the series has raised the level of flexibility available for the construction of systems. In addition, by fusing amorphous transformer technology with drive inverter technology, high efficiency, high performance, and high reliability were achieved.

Also developed is a new MPPT (maximum power point tracking) algorithm in order to efficiently follow the shifting point of maximum efficiency for the solar cells. This system takes advantage of the small no-load loss properties of amorphous transformers in order to improve conversion efficiency in an output range that corresponds to actual weather conditions (solar radiation), thereby increasing total power generation.

We will continue developing this system as the core of our new-energy business.

(Hitachi Industrial Equipment Systems Co., Ltd.)

New Series of Pump Units with PM Motors

In Europe, the USA, and Asia, machines and systems have been growing increasingly efficient recently, including those with motors subject to high-efficiency regulation. General-purpose pumps have led this trend in the industry, and Hitachi has begun taking orders for the land-based pump units that incorporate PM (permanent magnet) motors, which are expected to become the highest standard for motor efficiency.

At present, directly-coupled land-based pumps of up to 90 kW are supported, and Hitachi has achieved motor efficiency improvements of 5 to 10% or more over pumps with current standard motors (based on Hitachi's comparisons). In addition, PM motors support the same variable-speed operation as inverter-driven models, and this allows for energy-saving effects through rotational frequency control in response to load.

The introduction of this series of pump units as a part of building equipment design specifications is currently under consideration at a large number of locations, in particular as next-generation energy-saving products for use in air conditioning and sanitary equipment, which are applications for which the products are attracting a high level of attention.



New series of pump units with PM motors

(Hitachi Industrial Equipment Systems Co., Ltd.)
(Orders First Received: May 2010)

Standard 0.2- to 90-kW PM Motor Series



Standard 0.2- to 90-kW PM motor series

As the demand for energy-saving products has grown in recent years from the perspective of the prevention of global warming, there has been a particularly strong need to increase the efficiency of motors, which account for approximately 40% of the demand for electric power.

It is against this background that Hitachi has developed PM (permanent magnet) motors that feature high efficiency, compactness, and a light weight, in a series ranging from 0.2 to 90 kW. These products bring together all the technologies Hitachi has cultivated in creating dedicated devices for use in pumps, air compressors, and other applications, and contribute to savings in both energy and resources.

[Key features]

(1) High efficiency

Motor efficiency satisfies the IE3 requirements of the IEC60034-30 international standard for high-efficiency motors.

(2) Compact and lightweight

Volume is approximately 50% of previous standard induction motors, and mass is approximately 60% (compared with Hitachi's 3.7 kW 3,600 min⁻¹).

(3) Sensorless vector control

Hitachi is working to support higher capacities and the even higher-efficiency standard (IE4) that is expected to be enacted.

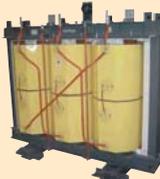
(Hitachi Industrial Equipment Systems Co., Ltd.)

Amorphous Transformers

Oil-immersed transformer	"Top runner" benchmark achievement rate	Molded transformer	"Top runner" benchmark achievement rate
Super amorphous XSP series Series boasting the highest efficiency in the industry	205%	Super amorphous XMS series Disaster-prevention ultra-high energy-saving type	186%
Super amorphous XS series Classic ultra-high energy-saving type	198%	Super amorphous XMC series Compact and lightweight disaster-prevention ultra-high energy-saving type	148%
Super amorphous XC II series Compact and lightweight ultra-high energy-saving type	122%	* Example shows three-phase, 300 kVA, 50 Hz.	



Super amorphous XC II series



Super amorphous XMC series (2,000 kVA)

Amorphous transformer lineup

In order to pursue energy savings in the transformers used for power distribution, customers are demanding products that can support a wide range of installation conditions with a superior level of efficiency. Among these products, amorphous transformers boast excellent energy-saving performance thanks to their use of amorphous alloys for the iron core materials in the transformers themselves.

With compact and lightweight amorphous oil-immersed transformers, improvements in winding technology are aimed at increasing coil short-circuit strength, and mass is reduced approximately 10% (three-phase, 300 kVA, 50 Hz) in the new XC II series models. This makes these transformers even easier to install in locations with mass restrictions.

In addition, a high-capacity 2,000-kVA model has been added to the XMC series of amorphous molded transformers, which use a disc coil structure that offers excellent short-circuit strength, and which boast a reduced stray loss design with excellent energy-saving performance. This extends the superior benefits of amorphous transformers to high-capacity models as well.

(Hitachi Industrial Equipment Systems Co., Ltd.)

Pumps for Chinese 1,000-MW-class Ultra-supercritical Coal-fired Thermal Power Plants

China has been implementing a shift to nuclear power generation as a cornerstone of its strategy for satisfying the Chinese demand for electricity. However, China does possess massive coal reserves, and so coal is still the most dominant power-generating resource in the country. For this reason, China is faced with the challenge of achieving high-efficiency power generation at its thermal power plants, in order to reduce global warming gas emissions.

It is expected that 1,000-MW-class ultra-supercritical coal-fired thermal power plants will continue to be built in order to implement this goal. To this end, Hitachi delivered circulating water pumps and boiler feedwater pumps for thermal power plants.

[Features]

Major recent orders received and delivered are as follows:

(1) Delivered to Tianjin Beijiang Power Plant: (2 × 1,000 MW)

Four circulating water pumps (2 pumps/unit × 2 units)

2,600-mm outlet diameter, 31.5-m total pump head

14.2-m³/s discharge, 6,000-kW driver output

(Current status: Delivery completed in September 2010)

(2) Delivered to Guodian Jianbi Power Plant: (2 × 1,000 MW)

Four boiler feedwater pumps (2 pumps/unit × 2 units)

400 × 450-mm inlet and outlet diameter, 31.05-MPa total pump head

1,596.3-t/h discharge, 19,243-kW driver output



Circulating water pumps (external view of facility) (left) and boiler feedwater pump (external view, before shipment to plant) (right)

(Current status: Unit 1 undergoing commissioning as of May 2011, Unit 2 ordered in July 2010, currently under construction)

[Future expansion]

Since the Chinese electrical power market, with its massive power generation capacity, is expected to place a strong emphasis on environmental measures in the construction of its power plants, Hitachi is seeking to increase the number of orders it receives even further in the fields of thermal and nuclear power.

Also, in order to reinforce its competitiveness in the market, Hitachi will continue strengthening its collaboration with Hitachi Pump Manufacture (Wuxi) Co., Ltd., which is a member of the Hitachi Group as well as a Chinese joint venture that manufactures and distributes large pumps.

(Hitachi Plant Technologies, Ltd.)

The World's First Compressor for a Commercial Bioethylene Plant



Bioethylene plant Projeto Eteno Verde

Hitachi delivered process compressors to the commercial bioethylene plant Projeto Eteno Verde ("Green Ethylene Project") of Brazil's largest petrochemical firm Braskem S.A. This plant, which is currently the largest of its kind in the world, takes sugarcane as the raw material for ethanol, and uses it to manufacture ethylene as the raw material for plastic.

This project is significant in that it involved the delivery of key equipment to a bioethylene plant using bioethanol (which is a national focus for Brazil) in a new way in order to support sustainable production activities, which are expected to become even more critical in the future.

The plastic produced by this ethylene plant is characterized by its ability to overall effect of absorbing atmospheric CO₂ (carbon dioxide). The CO₂ sugarcane removes from the atmosphere as part of its growing process is greater than the CO₂ emitted as part of the plastic production process, and so for every 1 kg of the final product of polyethylene produced, 2.5 kg of CO₂ is thought to be absorbed (based on Braskem's analysis). This is why companies in Japan and around the world are focusing on the product of this plant.

Hitachi will continue to expand its business based on the results achieved at this plant.

(Hitachi Plant Technologies, Ltd.)

AIRZEUS Turbo Compressor Series

The electric power consumption of compressors in Japan is said to account for approximately 5% of the total, making the saving of energy in compressor facilities an urgent issue in terms of reducing greenhouse gas emissions.

Hitachi has already started out by introducing to the market the AIRZEUS screw compressor series for the 100–450-kW range, as the first step of its plans to provide energy-saving air compressors between 100 and 1,000 kW. Next, based on the turbo compressors that are used above 400 kW, Hitachi developed the AIRZEUS turbo compressor series of new models that offer both energy-saving features and functionality for the 500–800-kW range.

These compressors are configured with two high speed rotors and a three-stage compression design. This compact design is achieved with a rotor speed of more than 50,000 min⁻¹, and durability and maintainability are improved through the application of new materials as well as the new design. In addition, many years of research in improving the efficiency of impellers and diffusers, as well as a successful reduction in loss via the compressed gas flow channel through the use of the latest CFD (computational fluid dynamics), have improved the compressor efficiency by approximately 2% in the 700-kW class (compared with Hitachi's conventional models). This corre-



AIRZEUS turbo compressor series

sponds to a reduction in CO₂ (carbon dioxide) emissions of up to a maximum of approximately 50 t per year.

Hitachi will continue expanding this series with new models as part of its solution for saving energy in compressor facilities, while expanding its business as an integrated compressor manufacturer.

(Hitachi Plant Technologies, Ltd.)

JFE Steel Corporation East Japan Works Keihin District Hot Rolling Mill Finisher Main Motor and Drive Upgrade

The motor and drive system of the No. 3 finishing mill at the East Japan Works Keihin District hot rolling mill of JFE Steel Corporation have been upgraded from direct to alternating current types. The upgraded AC (alternating current) motor's capacity is 10 MW, and the upgraded drive system utilizes a 6-kV water-cooled IGBT (insulated gate bipolar transistor).

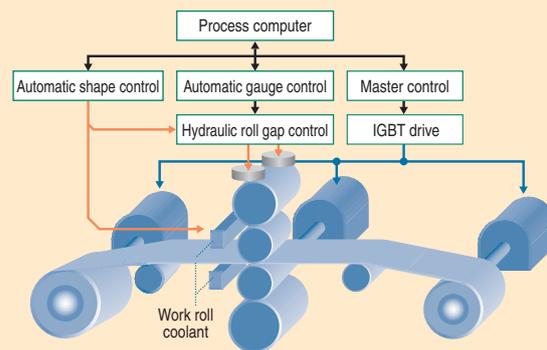
During finishing rolling, holding the reduction in speed when the strip head enters the rolling mill underneath a constant value is extremely vital for operations. In addition, since only one stand among the tandem finishing rolling machines was upgraded this time, the upgraded configuration is such that the previous stand uses a DC (direct current) motor, the upgraded stand uses an AC motor, and the next stand once again uses a DC motor, and therefore it was necessary to consider compensating for the differences in responses between stands. In order to deal with these issues, Hitachi enlisted the cooperation of JFE Steel, which also assisted in faithfully reproducing the operations of existing facilities using RTS (real-time simulator) to derive optimal control gain parameters, while installing the new drive system.

After the new equipment was launched at the site, no problems arose as a result of this upgrade, the upgrading process was completed on schedule, and the upgraded system continues to operate smoothly.



JFE Steel Corporation East Japan Works Keihin District hot rolling mill No. 3 finishing mill induction motor

CSAC (Taiwan), Electronic Equipment Modernization for an Aluminum Cold Rolling Mill



IGBT: insulated gate bipolar transistor

Operation room of CR5 aluminum cold rolling mill (left) and overview of applied control system (right)

Hitachi has modernized electronic equipment and control systems for the CR5 aluminum cold rolling mill of C.S. Aluminium Corporation (CSAC) in Taiwan.

CR5 is a cold rolling mill that produces the aluminum sheets for which demand has been increasing recently for LCD (liquid crystal display) televisions and other such products. Aluminum and aluminum products include many different types of alloys, and depending on the alloy, hardness can vary widely from soft to hard materials. The aluminum rolling process requires high levels of control accuracy and technology.

Hitachi has revamped electronic equipment made by other companies and improved operability, productivity, and maintainability,

while following the operational methods of the existing systems. An adjustment tool for hydraulic roll gap control makes it possible to save time during the gap control response adjustment. CR5 started operation and production after an extremely short construction and commissioning period. In addition, product quality and productivity have been improved by highly-responsive hydraulic roll gap control, as well as new types of automatic gauge control and shape control systems that were developed for aluminum cold rolling mills.

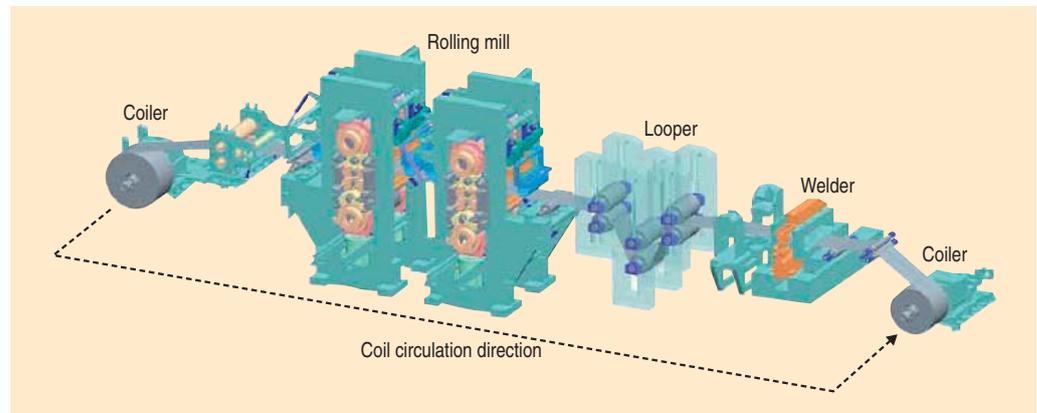
Hitachi plans to apply these control technologies to various facilities as the demand for aluminum rolling mills increases.

(Date of commencement of commercial operation: January 2010)

Control Technology of a Coil Circulation Type Continuous Cold Rolling System

The coil circulation type continuous cold rolling system is capable of flexible production by circulating coils according to production amounts and product specifications. Although this system enables a compact facility with a low level of equipment investment, it still offers greater production amounts than those of traditional reversing type rolling mills, while reducing product defects and off-gauges. The control technology for this type of rolling system was developed in a joint project with Mitsubishi-Hitachi Metals Machinery, Inc.

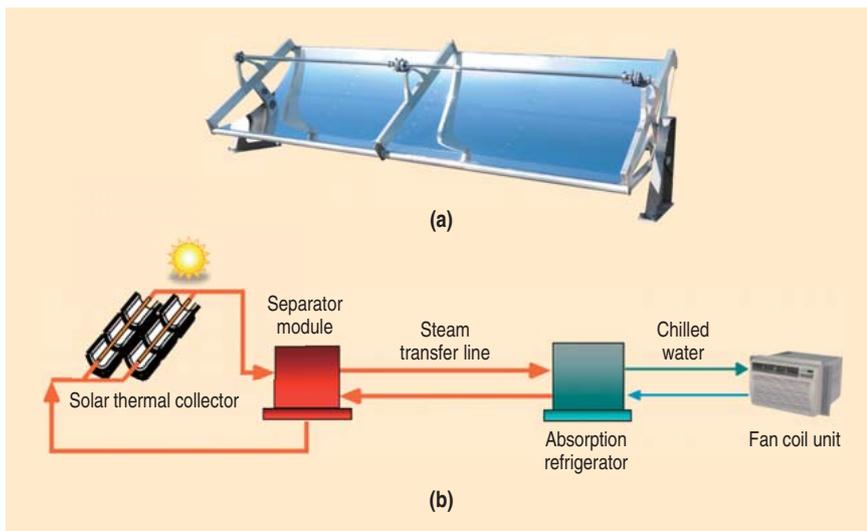
To perform continuous rolling with this kind of compact system, the looper system used to stock the metal sheet during welding must be reduced in size, and welding must be done under critical welding conditions with the coil before rolling and with the coil after the cold rolling process. For this reason, a new gauge control technology for stable rolling from extremely low speeds (when



Overview of a coil circulation type continuous cold rolling system

compared to traditional systems) to high speeds was developed, as well as flying roll gap opening and touching control technologies that can reliably make the roll past the critical welding point while continuing the rolling operation. The effectiveness of these newly developed technologies has been confirmed during test rolling at a laboratory rolling mill, enabling the realization of a coil circulation type continuous cold rolling system.

Solar-activated Air Conditioning System



The new trough type solar thermal collector of Hitachi Plant Technologies, Ltd. (a) and its system flow (b)

The Hitachi SAACS (solar-activated air conditioning system) has been developed to effectively utilize sustainable solar energy for air conditioning services. This system reduces the consumption of fossil fuels by lowering the peak of electric power demand (especially in the summer season), greatly reducing CO₂ (carbon dioxide) emissions by employing a solar thermal collector devel-

oped by Hitachi that effectively concentrates the inexhaustible solar energy. In addition, the system provides high performance at a low operating cost thanks to its totally computerized and optimized operational system. The Hitachi SAACS comes with trough type parabolic solar thermal collectors that not only offer a high level of efficiency, but also have a structure solid enough to concentrate the sunbeam precisely on a vacuum-insulated and specially coated receiver with a sophisticated and newly designed sun tracking system that is manufactured based on Hitachi's long years of experience and invaluable database of information going back to the 1980s. In addition to the superior solar collecting equipment Hitachi can provide, the company also consolidated its worldwide chemical plant EPC (engineering, procurement and construction) and air conditioning EPC knowledge in order to achieve an environmentally conscious system that is perfect for the current era. Furthermore, this solar thermal collecting system can be utilized in a variety of different ways, including the provision of a clean energy supply, steam utilities, hot water utilities, the pre-heating of gases or other media, heat storage systems, and so on. (Hitachi Plant Technologies, Ltd.)