



# Social Infrastructure & Industrial Systems

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Building Systems



Rail Systems



Construction Machinery



Public Facilities



Defense Systems



Industrial Systems



Production Plants



## Trials of Distributed EMS for Smart, Next-generation Factories

Omika Works of the Infrastructure Systems Company, Hitachi, Ltd. has commenced trials of a distributed EMS to save energy, reduce CO<sub>2</sub> emissions, improve the efficiency of energy use, and enhance its BCP measures. The system integrates photovoltaic panels, batteries, and other technologies to implement peak shift and peak cut control in ways that cause minimal disruption, and to ensure that an adequate backup power supply is available to maintain essential operations during a disaster. In addition to collecting data from the trial, the aim is to incorporate further smart functions, particularly in relation to integration with production systems and the wider community.

### Plans Extended Based on Earthquake Experience

Hitachi used environmental management to help create a sustainable society and was proceeding with an eco-factory plan at its Omika Works that includes the installation of renewable energy sources, batteries, and other equipment, and had as its primary aim the reduction of carbon dioxide (CO<sub>2</sub>) emissions.

However, it was during the formulation of this plan that the Great East Japan Earthquake occurred, resulting not only in considerable damage to the plant, but also forcing it to shut down due to the subsequent power cuts. This led to a revision of the original plan, expanding it beyond CO<sub>2</sub> emissions reduction to also incorporate the strengthening of business continuity planning (BCP) measures that would allow operations to continue during a disaster. Specifically, the capacities of photovoltaic panels and batteries were increased. Also, significant damage to surrounding areas made Omika Works strongly aware that it was a part of the local community. Rather than considering the site in isolation, the plan was changed to one that sought to trial energy management across an entire community. Instead of controlling the entire site from a single energy management system (EMS) as originally intended, the new plan involved the construction of a distributed EMS that treated Omika Works as a virtual community and performed integrated control of the EMSs installed in each building.

### 23% Reduction in Peak Demand from Grid

The installed system consists of 940 kW of photovoltaic panels split between two locations at the site, two 500-kW power conditioning systems (PCS), 4.2 MWh of battery capacity, and three 500-kW PCSs for the batteries. The batteries are charged overnight and discharged during the daytime peak to help shift the peak in demand for grid power. They also function as a backup power supply in case of power outages.

Control of this equipment is performed by a distributed EMS installed for six different buildings. The system optimizes battery operation, including management of charging and discharging, both by the visualization and prediction of each building's power consumption, and by prediction of photovoltaic power generation based on solar radiation forecast data for the day. To improve the efficiency of energy use, waste is reduced through the centralized management of air conditioner temperature settings. The system also uses these functions to perform peak cut control, whereby measures such as shutting down air conditioners or changing their temperature settings are performed automatically if electric power usage exceeds the target. Steps have also been taken to increase awareness of power saving among staff, including the installation of 900 electric power sensors or smart meters around the site.

As a result, peak demand for grid power during the summer of

2012 has been reduced by 23% compared to 2010.

### From Smart Next-generation Factories to Smart Cities

Behind the construction of this distributed EMS is the intention to treat Omika Works as a virtual community and to utilize knowledge about information and control systems acquired from the site in Hitachi's smart city business, a field to which Hitachi is devoting considerable effort. Accordingly, the project is being treated as a trial of smart next-generation factories, and the system is being continuously improved.

For example, optimum control of the peak cut and peak shift functions is made difficult by the inevitable differences between predicted and actual values. However, more fine-grained control was achieved by shortening the frequency of prediction updates from once a day to once an hour.

In the future, the aim is to achieve a higher level of overall optimization by implementing a symbiosis-autonomous decentralized EMS in which the individual EMSs coordinate with each other while still continuing to operate autonomously. Other plans under consideration include trialing the coordination of peak shift measures with factory production plans and production equipment, and collaborating with other nearby Hitachi companies to trial multi-site virtual energy sharing arrangements.

Omika Works has become the first electrical equipment manufacturer in Japan to receive certification under the ISO 50001\* international standard for EMSs in July 2012, the same month it commenced this trial of smart, next-generation factories. In addition to ongoing efforts to improve unit energy use, Hitachi also hopes to use smart, next-generation factories as a path toward smart cities.

(Unit energy use: quantity of energy consumed to produce a unit of production output)

\*ISO 50001: an international standard published by the International Organization for Standardization (ISO) in June 2011 for the management and ongoing improvement of energy use at corporations and other organizations.



Akira Tamura (left); Masahiro Yoshioka (right), Senior Engineer, Industrial Systems Engineering Department, Infrastructure Security & Energy Solutions Division, Infrastructure Systems Company, Hitachi, Ltd.





## New Destination Floor Reservation System

The destination floor reservation system (DFRS) reduces elevator congestion by having passengers specify their destination floor while waiting in the lobby. The system then notifies passengers in advance of which elevator they should use.

The new DFRS also gets passengers to their destination floor

more quickly. It learns from daily elevator usage data so that it can give priority to congested floors, during peak morning hours for example, and save energy by operating in accordance with the level of traffic.

(1) Handling capacity preference operation

The new DFRS learns the patterns of daily use, including congestion. When the number of passengers increases, it allocates elevators in such a way that it gets as many passengers as possible for a particular destination floor to use the same elevator. This is done by searching through its previously learned patterns to identify one that matches the current situation, and then using this as a basis for predicting the future passenger load. This increases the total passenger carrying capacity and reduces the number of floors at which the elevator stops on each trip. Computer simulations conducted by Hitachi indicate that capacity during the morning peak is improved by up to 50% compared with conventional group control\*<sup>1</sup>.

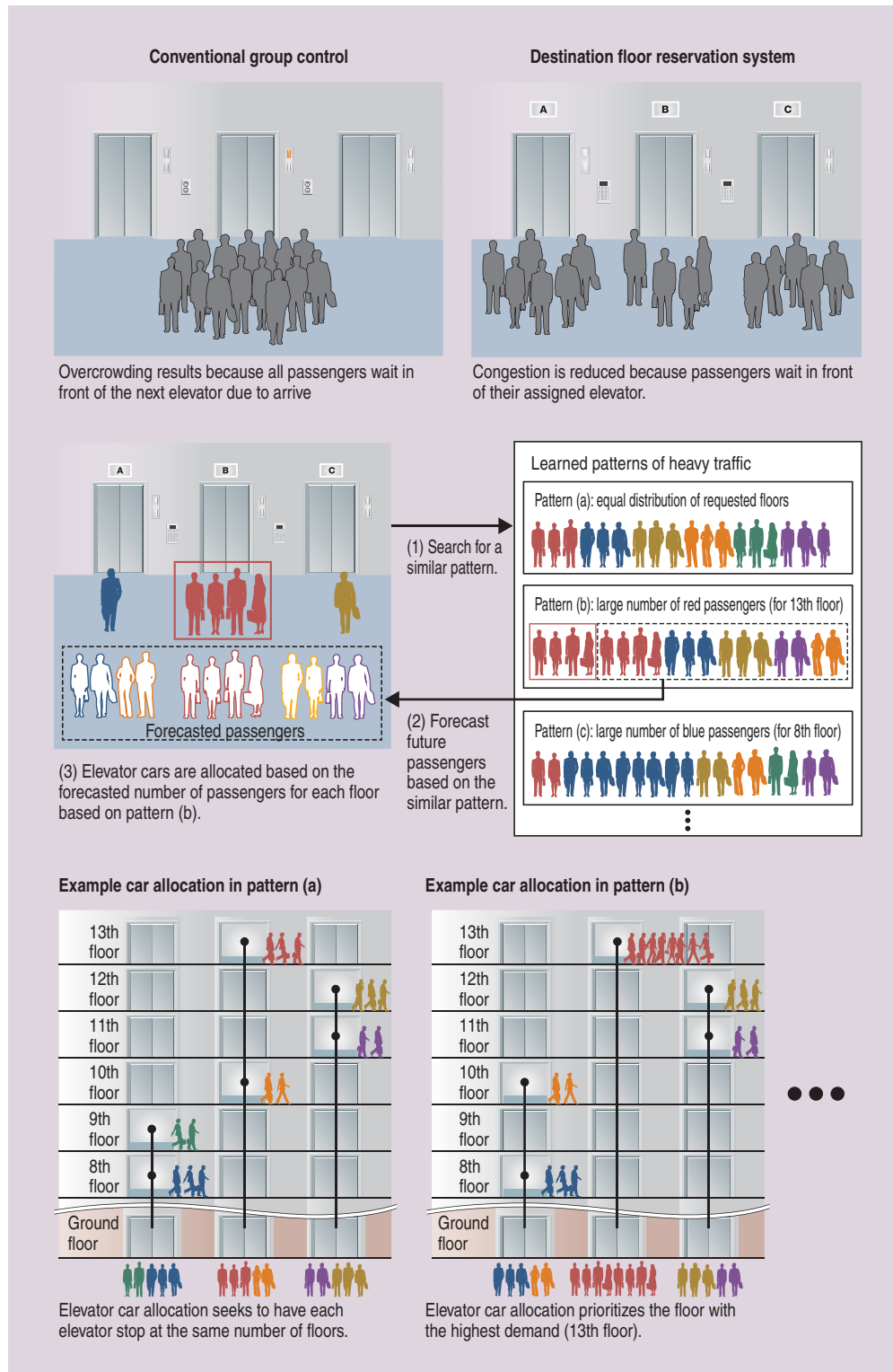
(2) Energy saving operation

This mode balances convenience with reducing elevator energy consumption by forecasting elevator car routes and occupancy rates during periods with low traffic. Computer simulations by Hitachi found that this mode reduces daily electric power consumption by approximately 10% compared with the previous Hitachi system\*<sup>2</sup>.

Hitachi intends to continue developing systems and functions aimed at improving elevator comfort and saving energy.

\*<sup>1</sup> The actual improvement in capacity may vary depending on elevator specifications and operating conditions.

\*<sup>2</sup> Actual energy savings may vary depending on elevator specifications and operating conditions. Waiting times may be a few seconds longer than when this mode is turned off.







## Defogger for Surveillance Camera Module Intended for Chinese Market

By volume, China accounts for almost 50% of the global market for surveillance cameras<sup>\*1</sup>, with demand expected to continue growing at an annual rate of more than 20%. Having led its competitors in releasing 1.3-Mpixel high-definition (HD) and 2.1-Mpixel full HD camera modules on the market, Hitachi Digital Security System (Shanghai) Co., Ltd. is the leading supplier of HD and full HD camera modules in China<sup>\*2</sup>.

However, one problem faced by surveillance cameras is the image quality degradation caused by the fogs that are particularly common around China's major rivers, and by the "yellow sand" dust that originates in the interior and is spread around the country.

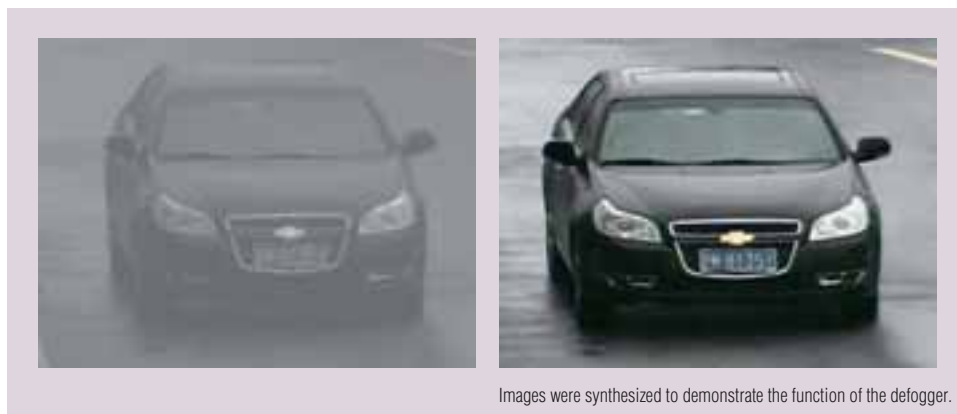
In response, Hitachi developed a defogger and started selling camera modules equipped with this function in July 2012. The function works by detecting the extent of fogging on the camera images and adjusting the contrast accordingly to produce crisper images.

Having pioneered the megapixel

market with HD and full HD camera modules, Hitachi's plan for the future is to expand its business in the Chinese market by enhancing the competitiveness of these products through the incorporation of the defogger.

<sup>\*1</sup> From research by IMS Research (2012)

<sup>\*2</sup> As of March 2012, based on research by Shenzhen Discover Video Enterprise Co., Ltd.



Comparison of images before (left) and after (right) correction by defogger



## Cloud Service for Integrated Management of Building Facilities

Hitachi has released the cloud service for integrated management of building facilities. The service is targeted at small to medium-sized buildings with a floor area of 20,000 m<sup>2</sup> or less.

Whereas building energy management in the past has focused mainly on minimizing total consumption in large buildings, there is also a need to minimize total and peak power consumption in all buildings including small to medium-sized buildings, with the constrained situation for electric power supply and demand since the Great East Japan Earthquake being a background factor.

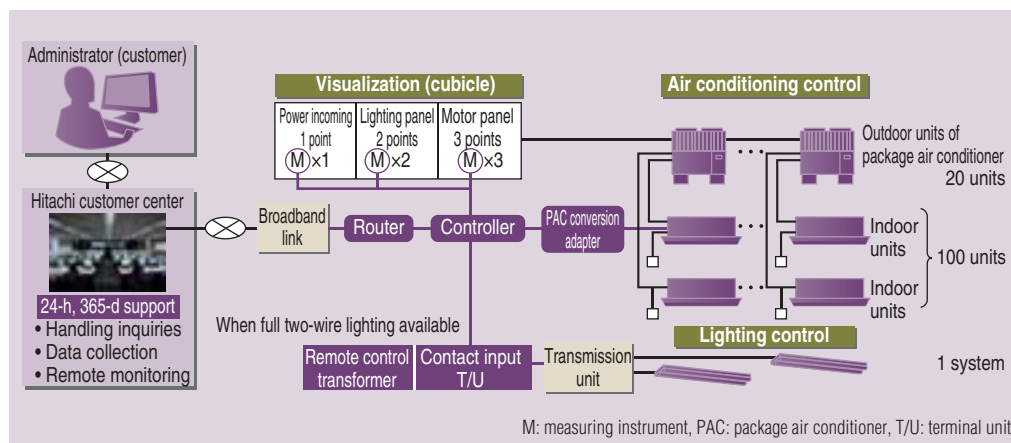
Hitachi has been designated a building energy management system (BEMS) aggregator, which means promoting the installation of BEMSs by high-voltage/small-scale consumers with supply contracts of up to 500 kW. This program subsidizes one-half or one-third of the cost to the consumer of installing a BEMS that targets power savings of 10% in Japan.

The service incorporates functions for visually displaying electric power usage, scheduling air conditioning and lighting use, intermittent operation, patrol operation, and staged shutdown

during periods of peak demand (demand control), and satisfies aggregation requirements, which include support for remote shutdown in response to emergency orders when the power supply and demand balance is tight.

In the future, Hitachi intends to contribute to encouraging energy savings throughout society by supplying this service to large numbers of sites, including those covered by the aggregator subsidy scheme.

(Commencement of service: March 2012)



Example configuration of energy management cloud service





## SiC Hybrid Inverter for Rolling Stock Powered by 1,500-V DC Overhead Contact Lines

Hitachi has developed a silicon carbide (SiC) hybrid inverter for rolling stock powered by 1,500-V direct current (DC) overhead contact lines that both reduces power losses in traction drives and allows systems to be made smaller and lighter.

The inverter incorporates a newly developed 3.3-kV SiC hybrid module and uses a simple two-level circuit configuration. To minimize both losses and noise during semiconductor switching, it also uses a soft gate control technique optimized for SiC that was originally developed by Hitachi for silicon (Si) inverters.

Hitachi has also applied fluid analysis to develop a technique for minimizing the temperature difference between the upwind and downwind sides that allows the cooling system to be made smaller and lighter. As a result of these new technologies, the new inverter realizes 35% lower power losses than current Si inverters as well as a 40% reduction in weight and volume.

By incorporating this new inverter into different types of trains in the future, Hitachi intends to contribute to producing railway systems with superior environmental performance.



Conventional model

Si inverter



New model

Inverter fitted with SiC hybrid modules

Conventional Si inverter and new SiC hybrid inverter





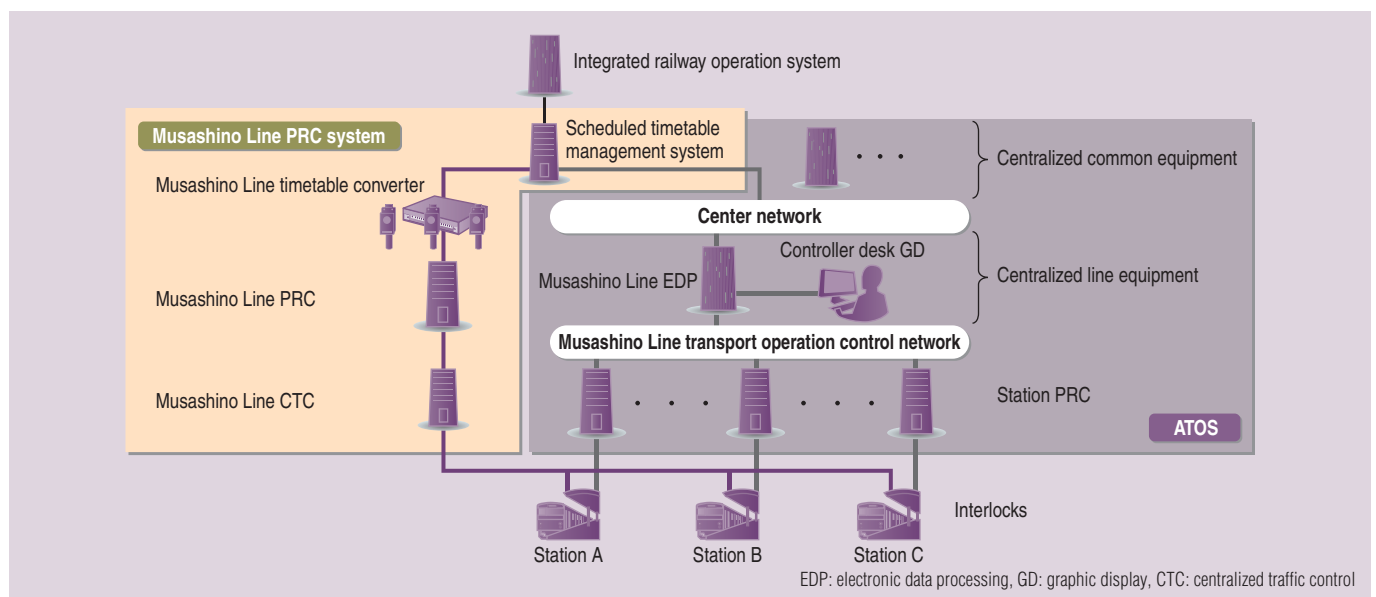
## Traffic Management Systems for Musashino Line of the East Japan Railway Company

Autonomous Decentralized Transport Operation Control System (ATOS) of the East Japan Railway Company in the Tokyo metropolitan area manages the high-density railway lines of the Tokyo region. Hitachi has recently extended this system to cover the Musashino Line as a replacement for its aging programmed route control (PRC) system (between the Shin-Tsurumi Signal Station and Nishi-Funabashi Station).

The Musashino Line is characterized by frequent changes between sections of line that belong to different supervisory areas

(Tokaido, Chuo, Tohoku, Joban, and Keiyo supervisory areas). The new system commenced operation in January 2012. The shift to the new system has improved the overall efficiency of ATOS operation, not only on the Musashino Line but also on other associated lines.

Hitachi intends to utilize the know-how gained from this project for future ATOS to contribute to the ongoing development of the railway system.



Configuration of traffic management systems for Musashino Line of the East Japan Railway Company



## Regenerative Energy Storage System for Haijima Substation of East Japan Railway Company's Ome Line

Hitachi has installed its regenerative energy storage system at the Haijima Substation of East Japan Railway Company's Ome Line. The system stores regenerative electric power generated during train deceleration in automotive lithium-ion batteries so that it can be reused. This is the first time that the East Japan Railway Company has installed a regenerative energy storage system for commercial operation.

For reasons of acoustic noise, electromagnetic compatibility (EMC), and other factors that affect the surrounding environment, Hitachi's regenerative energy storage system is designed for outdoor installation, with its electrical conversion equipment housed in an aluminum package. The lithium-ion battery modules are also housed in an outdoor enclosure. The decision to install the system was based on the energy savings it provides and also its operational track record, with the system already operating successfully at the Kobe City Subway and on the Seoul Metro9 subway in South Korea.

Hitachi intends to continue contributing to energy efficiency by installing regenerative energy storage systems in Japan and elsewhere.



Regenerative energy storage system supplied to Haijima Substation of East Japan Railway Company's Ome Line [battery housing (left) and chopper (right)]





## Hydraulic Excavator Compliant with European Stage IIIB Exhaust Emission Standards

Hydraulic excavators are subject to demands for better energy efficiency and cleaner exhaust emissions for reasons that include preventing global warming and compliance with Europe's Stage IIIB exhaust emission standards.

Hitachi Construction Machinery Co., Ltd. has developed the energy-efficient three-pump/three-valve hydraulic system that is capable of operating with approximately 10% lower fuel consumption than previous models performing the same work. To reduce exhaust emissions, a ceramic filter inside the muffler filter is used to collect the particulate matter (PM) produced by the engine and efficiently burn it in a proprietary exhaust temperature control system. Similarly, nitrogen oxide (NOx) emissions are reduced by using a variable turbo and a cooled exhaust gas recirculation (EGR) system with a large capacity.

Safety features include compliance with the roll-over protective structure (ROPS) requirements of the International Organization for Standardization (ISO) to protect operators even if the machine overturns, and a rear-view monitor included as a standard feature that is located where operators can use it to check the safety of the area around the excavator without turning their head.



ZX350LC-5B hydraulic excavator

(Hitachi Construction Machinery Co., Ltd.)



## Wheel Loader Compliant with European Stage IIIB Exhaust Emission Standards

Hitachi has released its ZW-5B series of wheel loaders in the European market. This new series complies with the latest European, North American, and Japanese exhaust emission standards, delivering improved work performance while also reducing the load on the environment.

The ZW-5B series incorporates an engine control system that

minimizes fuel consumption by determining the vehicle's operating conditions, reducing fuel use under actual operating conditions by approximately 10% compared to the previous model. Because of the emphasis placed on cabin comfort in Europe, the product attractiveness of the loaders has been enhanced through measures that include upgrading the design of interior paneling

and significantly cutting interior noise levels. The other main features of the new series are as follows.

- (1) Operating modes include standard mode, which reduces wasteful acceleration, and P mode for superior acceleration and heavy-duty loading performance.
- (2) New parallel/tandem circuit switches between combined operation of arm and bucket depending on the height of the lift arm.
- (3) Lift arm soft-stop function and ride control system provided as standard features to reduce operator workload
- (4) Cooling fan with automatic reversing function included as a standard feature
- (5) A rear-view monitor with excellent visibility is built into the meter panel.

(Hitachi Construction Machinery Co., Ltd.)



ZW250-5B wheel loader compliant with European Stage IIIB exhaust emission standards





## Global Expansion of Hitachi's Seawater Desalination Businesses

The total fresh water resource on Earth is strictly limited. Also, the availability of fresh water is unevenly distributed geographically. However, water consumption rises sharply with growth in the global population, urbanization, and economic development. This has resulted in serious problems with water shortages and the deterioration of water quality. Rapid industrialization is taking place in developing countries in particular, causing shortages of industrial water. Accordingly, Hitachi is looking at seawater as a potential alternative to existing lake and river water sources in order to resolve these problems.

Reverse osmosis (RO) membranes have been widely used for seawater desalination in recent years. Unfortunately, the problems with using this technology for high-volume water production include its high cost and energy consumption. Also, the high salinity of the brine left over from the process can have an adverse impact on the marine environment.

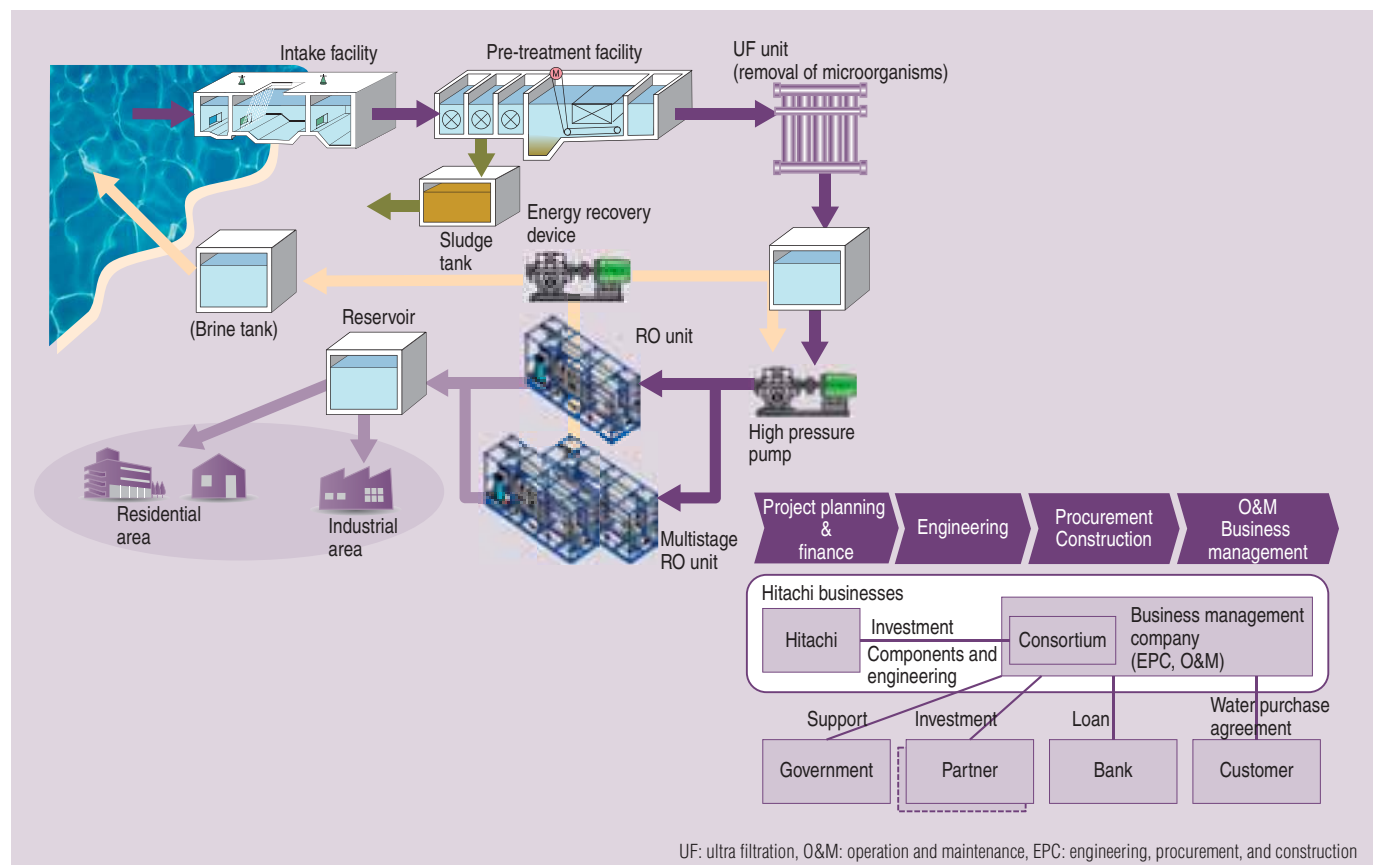
Hitachi is a member of the Global Water Recycling and Reuse Solution Technology Research Association (GWSTA), an organization established to develop energy-efficient, low-cost, and environmentally conscious water production systems. In Japan, these innovative systems are already in use at Water Plaza Kitakyushu funded by New Energy and Industrial Technology Development Organization (NEDO), where the seawater desalination process is integrated with a sewage reuse system. Hitachi is also participating in the Mega-ton Water System project supported by the Funding Program for World-Leading Innovative R&D on Science and Technology (FIRST program). The project aims to build the world's

largest desalination system using RO technology, which will have a capacity of million t/d, and to significantly reduce both its capital and operational costs in order to make it more competitive. Hitachi is heavily involved in the development of state-of-the-art water treatment technologies, and is seeking to develop desalination systems suitable for conditions in different parts of the world in collaboration with universities and companies in India, China, the Middle East, and elsewhere.

Hitachi sees seawater desalination as a growth field within its water and environmental solutions business, where it seeks to provide total solutions that include not only components, systems, and plant construction, but also operation and management. Hitachi participates in all stages of these projects from planning to business management. Its services include engineering, procurement, construction, operations, maintenance, and business management.

In India, Hitachi is working on one of the Delhi-Mumbai Industrial Corridor projects promoted by the Japanese and Indian governments. Hitachi and Hyflux Ltd. have formed a consortium to construct a seawater desalination plant at the Dahej Special Economic Zone (SEZ), an industrial park in Gujarat. Once completed, the project will provide a reliable supply of industrial water over the next 30 years (including the construction period).

Hitachi intends to be actively involved as the lead contractor in overseas projects, where it hopes to contribute to solving the problems faced by regions of water scarcity all over the world.



Overview of seawater desalination process and business scheme





## Information System for Nagaoka City Crisis Management and Disaster Prevention Headquarters

Drawing on experience from the response to disasters such as the Niigata Chuetsu Earthquake and Niigata-Fukushima Heavy Rains, an information system was supplied to the Nagaoka City Crisis Management and Disaster Prevention Headquarters (in Nagaoka City, Niigata Prefecture, Japan). The system entered service in April 2012.

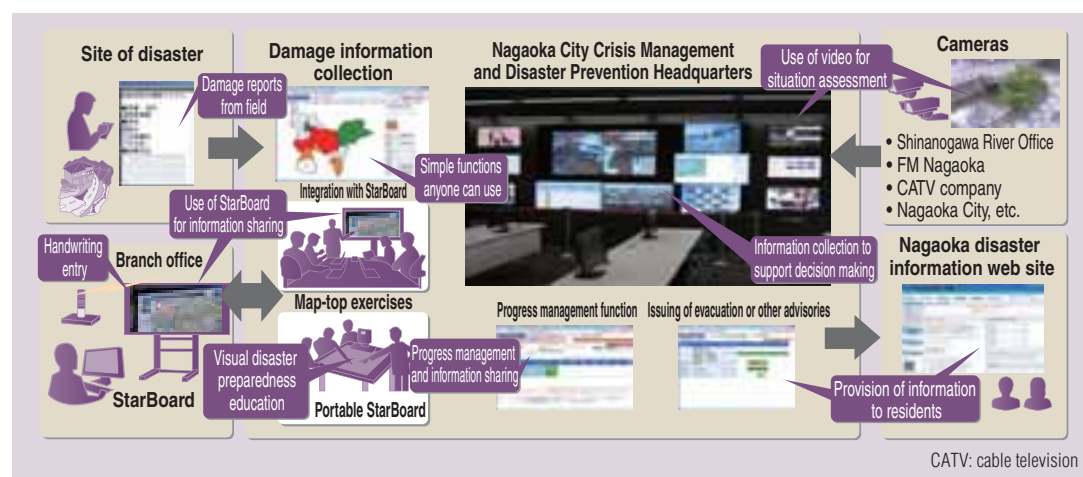
The system features simple and easy-to-use functions designed for use in the early stages of an emergency. These include the use of mobile phones to enter damage reports from the field, simple handwriting-based data entry using StarBoard\*<sup>1</sup> (interactive whiteboard), maps (GeoPDF\*\*<sup>2</sup>), progress management functions, use of large displays for information sharing, and use of river

surveillance cameras for realtime assessment of actual conditions.

The system enables fast and accurate decision making, with benefits that include comprehensive information sharing encompassing not only numeric data, such as information on the weather or river conditions, but also the use of realtime images from the field to aid in assessments. In addition to strengthening its ability to respond to disasters, Nagaoka City also utilizes these resources to provide a more diverse range of responses to emergencies and to enhance disaster awareness among residents, including the use of the portable StarBoard in disaster preparedness education.

Given the growing awareness of community safety and security,

Hitachi intends to continue supplying systems that help prepare for and reduce the impact of disasters, including by focusing on enhancements such as the centralized distribution of information to residents via a wide range of media.



Information system for Nagaoka City Crisis Management and Disaster Prevention Headquarters

\*<sup>1</sup> StarBoard is a trademark of Hitachi Solutions, Ltd.

\*<sup>2</sup> GeoPDF is an easy-to-use GIS solution. See "Trademarks" on page 91.



## Gamma Camera: Radiation Measurement Device

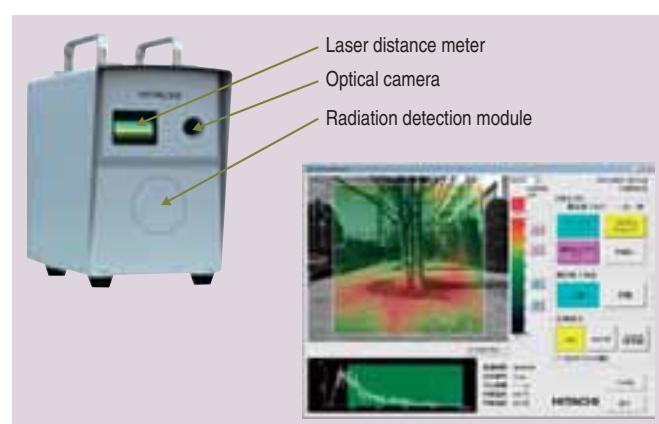
Hitachi Consumer Electronics Co., Ltd. has developed a radiation measurement device that can measure amounts of radiation over a wide range and show them in an easy-to-view color-coded display.

This device features highly sensitive and precise measurement as well as excellent usability (easy operation), and contributes to efficient decontamination work for recovery from the nuclear accident in and around Fukushima Prefecture in Japan. It is used together with a laptop computer to superimpose the gamma ray dose rate over the image shot taken with the optical camera in a color-coded display on the computer screen.

It is equipped with a semiconductor radiation detection module (with high energy resolution and sensitivity), an optical camera, and a laser distance meter. It can measure amounts of radiation in a wide area (8 m × 8 m area from a distance of 10 m). This allows high-dose locations (hot spots) to be identified without approaching the measurement target, which makes it possible to streamline measurement work while securing the safety of workers.

In addition, the types of radiation measured (cesium-134,

cesium-137, or iodine-131) can also be identified. (Hitachi Consumer Electronics Co., Ltd.)



External appearance of gamma camera radiation measurement device (left) and example of usage (right)





## Disaster Prevention Management Solution for National Security

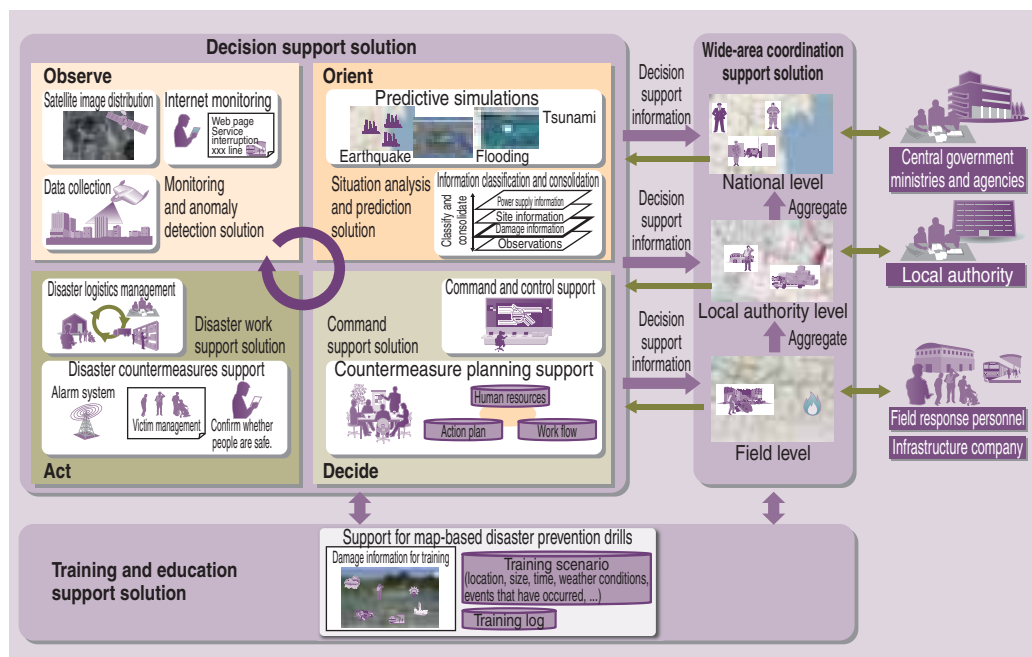
Based on lessons from the Great East Japan Earthquake, there is an urgent need to establish organizations and schemes and provide facilities and systems aimed at mitigating disasters. In particular, in the case of large disasters that affect a wide area and in which the situation changes rapidly with time, it is vital that national and regional agencies, as well as the general public, work together efficiently in order to reduce the amount of damage and

speed up the subsequent recovery and reconstruction.

Hitachi already supplies disaster response support systems to central government ministries and agencies as well as local authorities. Currently, Hitachi believes that the best way to ensure national security is by raising awareness through education and training and through wide-area coordination and decision making that takes account of operational concepts in times of emergency.

Hitachi is working to expand disaster prevention management solutions intended to achieve this.

In the future, Hitachi aims to contribute to the achievement of national security, in which central government, local authorities, private-sector companies, and the general public work together, by helping to achieve safety and security from the perspective of disaster prevention in smart cities and other types of next-generation cities (a field that Hitachi is pursuing globally), while also keeping in mind the prospects for initiatives such as international cooperation on disaster prevention and relief aid when disasters strike.



Disaster prevention management solution

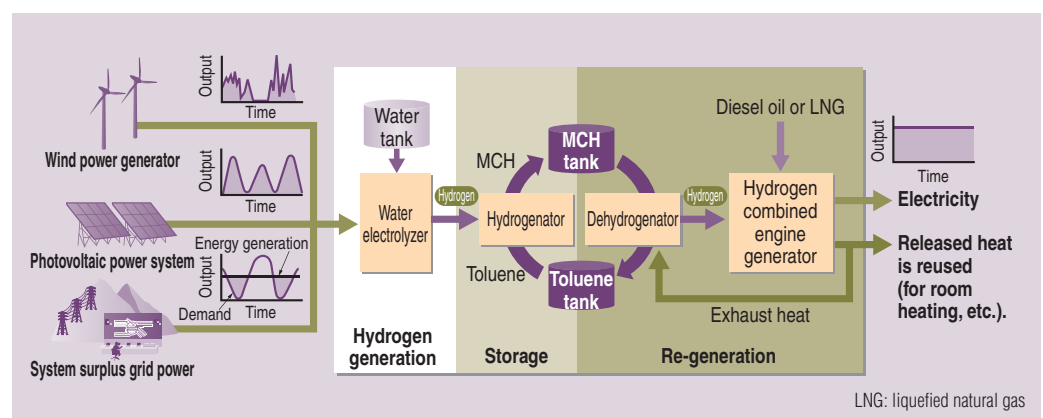


## Carbon-hydrate Energy Storage System

While hydrogen is a difficult material to handle, the carbon-hydrate energy storage system facilitates its transportation and long-term storage by storing it in the form of methylcyclohexane (MCH), a stable liquid. Because it facilitates the use of hydrogen as a form of energy, the system contributes to long-term storage and the steady supply of power from renewable energy sources that are characterized by fluctuating output.

Hitachi aims to utilize the system as a way of accelerating moves toward the realization of a low-carbon, hydrogen-based

society with greater energy self-reliance in Japan by increasing use of renewable energy.



Configuration of carbon-hydrate energy storage system



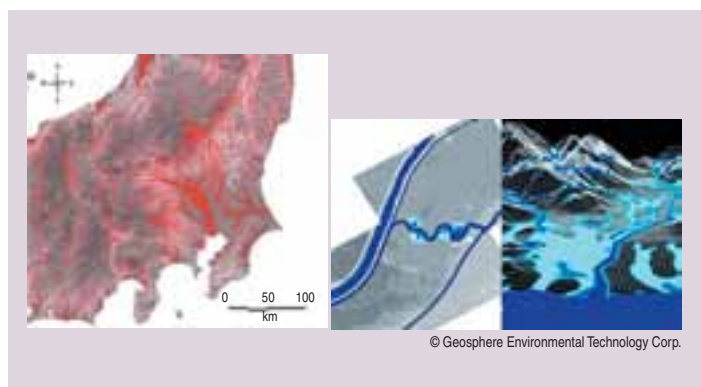


## Water Resource Cycle Simulation System

Hitachi is collaborating with Geosphere Environmental Technology Corporation on the development of a water resource cycle simulation system that contributes to water resource management and water disaster countermeasures.

The system performs an analysis that fully integrates modeling of both surface water and groundwater, and can provide quick and easily interpreted visual representations of the results in a wide range of formats. This improves the accuracy with which the current situation can be assessed and future predictions made regarding water resources or water disasters.

In the future, Hitachi intends to use this system to help resolve the various problems associated with water disasters and the securing of water resources, issues that exist on global scale.



Groundwater flow analysis (left) and flood prediction (right) produced by water resource cycle simulation system

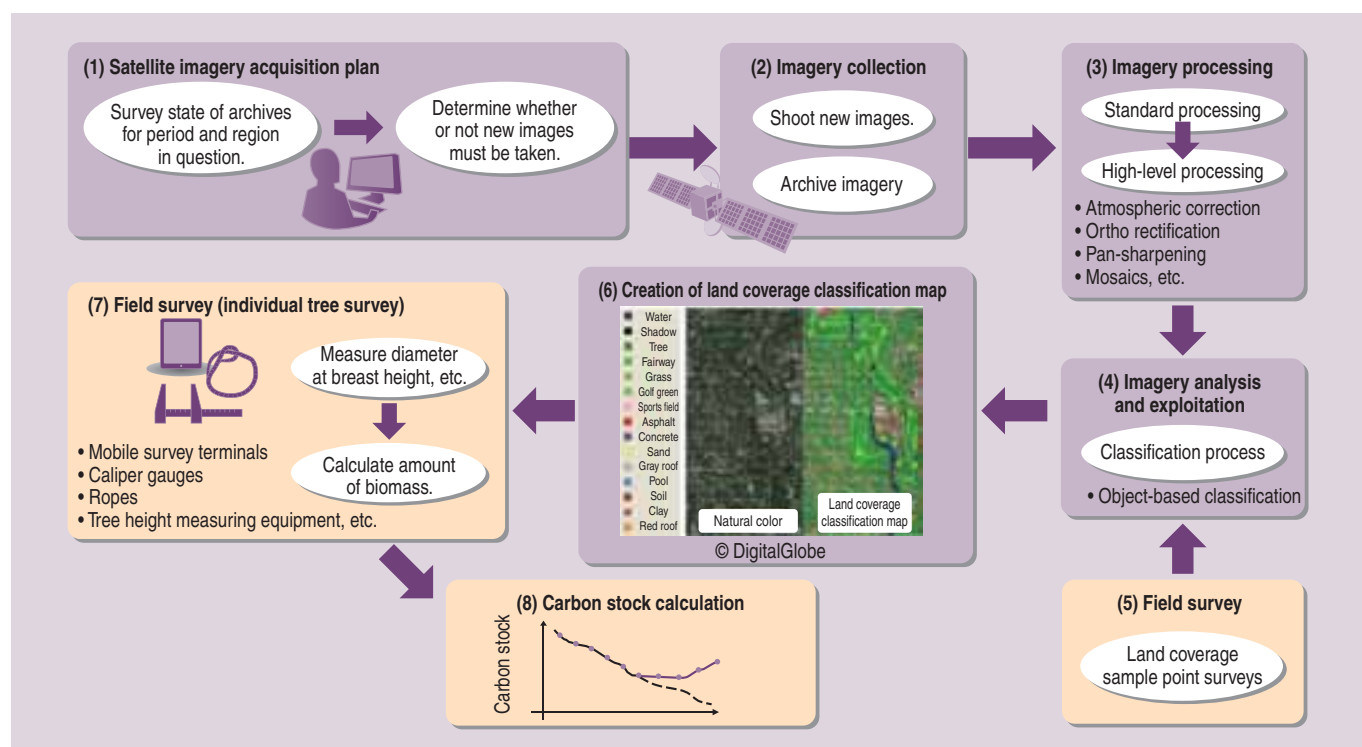


## Satellite Imagery Solutions

Debate on global-scale climate change and threats to biodiversity continue along with the introduction of countermeasures, primarily through the Conference of the Parties to the United Nations Framework Convention on Climate Change and the Convention on Biological Diversity. The monitoring of satellite imagery, for which past time-series data is available, provides an effective technique for quantitatively assessing measures for the conservation of forests and other ecosystems. To meet this need,

Hitachi supplies satellite imagery analysis solutions and monitoring systems that handle everything from imagery collection through to processing and analysis.

It is anticipated that the future will see a growing number of measures being taken for the conservation of forests and other ecosystems, and Hitachi aims to contribute to their assessment through the supply of its satellite imagery solutions.



Satellite imagery analysis solution for monitoring forest conservation





## Prefabricated Supporting Bridge Systems

As a nation with many rivers and ravines, Japan relies on a large number of bridges to ensure the delivery of essential services.

Hitachi supplies two different prefabricated supporting bridging systems to the Japan Ministry of Defense for use when bridges are destroyed by natural disasters such as earthquakes or floods. The two bridges are suitable for different situations, with the Type 92 floating bridge (a prefabricated temporary floating bridge) being designed to float on a river and support vehicle traffic, while the Type 07 mobility support bridge (a prefabricated temporary span bridge) can span rivers or ravines without requiring piers. Japan's Ground Self-Defense Force uses these products for purposes that include civil defense training drills conducted by regional governments. In the Great East Japan Earthquake, a Type 92 floating bridge was used as a ferry to transport construction machinery to an island that had become isolated.

With the prospect of civilian applications in mind, Hitachi intends to continue developing supporting bridge systems that can contribute to recovery work during disasters.



Bridge construction and vehicles driving over Type 92 floating bridge



Deployment of prefabricated temporary span bridge for civilian use



Type 07 mobility support bridge in deployed configuration



Deployment of prefabricated temporary floating bridge for civilian use

Bridge concept and civilian use of Type 92 floating bridge and Type 07 mobility support bridge



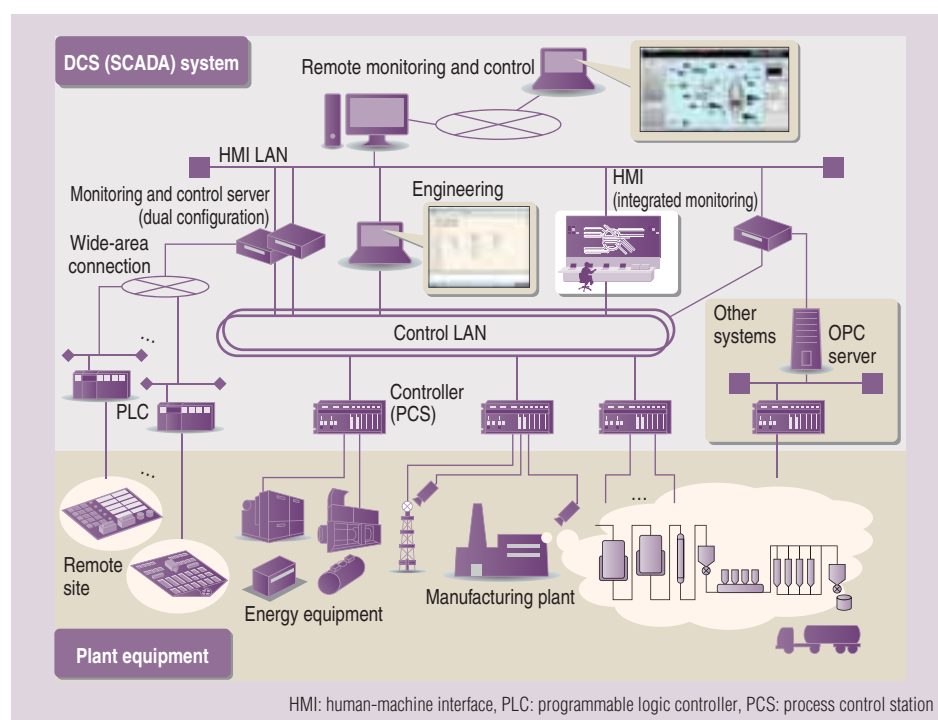
## Hitachi Integrated Autonomic Control System for Manufacturing Plants

Hitachi has released a middleware, a new product in its middle software series of supervisory control system platforms for manufacturing plants. The middleware uses a common architecture to provide extensive scalability in applications ranging from supervisory control and data acquisition (SCADA) to distributed control

systems (DCSs).

With features that include a highly reliable fault-tolerant local area network (LAN) designed for control applications and support for redundant hardware configurations, the middleware can be implemented as a highly reliable control system. The system includes alarm management that complies with the EEMUA 191 international standard and provides alarm and operational analysis screens that reduce operator workload. To improve engineering efficiency, the system incorporates controller-less simulation functions and uses a sequence programming language that complies with the IEC 61131-3 international standard. Support for object linking and embedding for process control (OPC) facilitates integration with systems from other vendors, and the system provides the flexibility to configure systems using general-purpose personal computers (PCs) and LANs. Enhanced security functions include user authentication, access control for operational functions, and operation log management.

In the future, Hitachi intends to make further progress on compliance with global standards and supply products that are easier to use.



Configuration of a new product; integrated supervisory control system for manufacturing plants





## HF-W6500 Model 45/40 Industrial Computer


HF-W series of industrial computers suit a variety of different industries, and feature long operating life and product availability. Use of HF-W series computers is growing in applications such as information and telecommunications including communication and broadcasting systems as well as in monitoring and control

systems and industrial systems.

To this product range, Hitachi has added the HF-W6500 Model 45 and Model 40 as part of its mainstream HF-W6500 series. The new models have been designed to facilitate migration from existing systems. External dimensions are compatible with

previous models, and like their predecessors, the new models continue to support the Peripheral Component Interconnect (PCI) interface and can run with ambient temperatures between 5 and 40°C, an important consideration for devices intended for industrial sites or other forms of embedded installation. Other features include enhanced functions for use as a display terminal, including support for dual display (digital display) of full high definition (HD).

The new models designed for overseas use have a multilingual user interface (MUI) that supports a number of different languages, and provide strong support for installation in systems outside Japan, including the availability of models that comply with overseas safety standards.



**Model 45**  
Intel® Core™ i7 processor (2.53 GHz)

**Model 40**  
Intel Celeron® processor (1.86 GHz)

100 mm  
Width × Depth × Height: 400 × 450 × 150 mm

**Compatible with previous models**

- External dimensions are compatible with previous models to facilitate upgrading to new models.
- Availability of seven extended PCI bus slots (4 × PCI Express slots, 3 × PCI slots) allows continued use of existing PCI boards.

**Designed for long life**

- Design life: 24 h × 10 years
- Operating life is six times that of conventional office PCs (8 h/d × 5 years).

**Enhanced display terminal functions**

- For use as a display terminal, digital display support allows dual display at full HD resolution.

\* See "Trademarks" on page 91.  
PC: personal computer

HF-W6500 Model 45/40 industrial computer



## Amorphous Transformer for Photovoltaic Power Generation

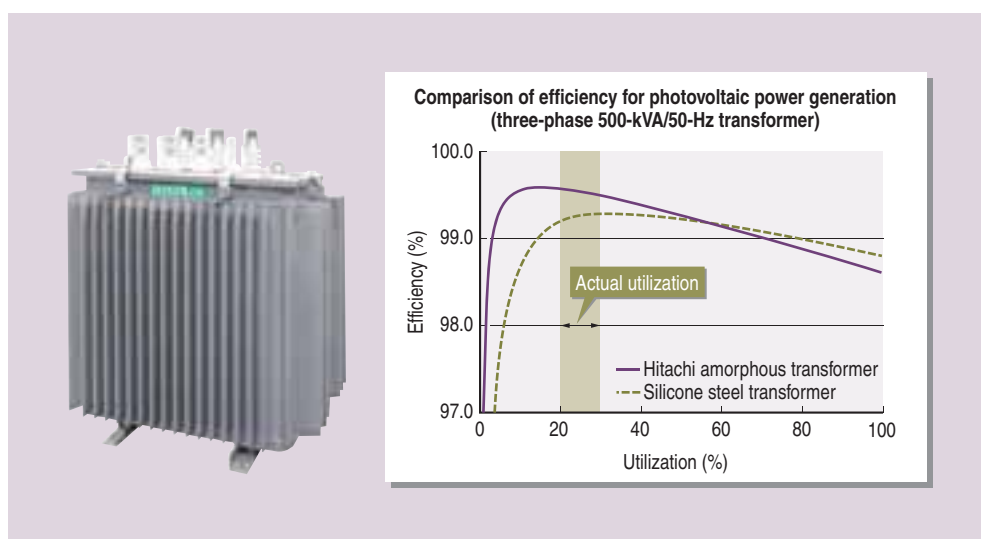
While the installation of photovoltaic power generation equipment is spreading rapidly, their overall efficiency of use is only 15 to 20% due to the long periods of time when they are not generating power, such as at night, and the presence of no-load losses means that during these times they are actually consuming electric power. Accordingly, photovoltaic power generation systems need transformers that are highly efficient under low load.

For this reason, Hitachi uses amorphous transformers for the dedicated step-up transformers used to connect the photovoltaic system to the grid. Amorphous transformers significantly reduce the size of no-load losses by using a core made of amorphous alloy.

Hitachi intends to continue developing products with even

higher levels of efficiency.

(Hitachi Industrial Equipment Systems Co., Ltd.)



Amorphous transformer for photovoltaic power generation





## Three-phase Induction Motors that Comply with Efficiency Regulations



3.7-kW, four-pole, three-phase induction motor that complies with efficiency regulations

Growing demand for energy efficiency has led to the introduction of motor efficiency regulations in markets such as the USA and China, while Japan has decided to introduce its Top Runner Program.

Hitachi has released a series of three-phase induction motors that comply with these regulations (two-, four-, and six-pole, 0.75–300 kW). Measures for improving efficiency have included the use of three-dimensional analysis to produce optimized designs. In addition to satisfying the various national regulations, the new motors maintain the same installation dimensions as their previous standard models.

In the future, Hitachi intends to improve the efficiency of various different types of motors, including special-purpose motors.  
(Hitachi Industrial Equipment Systems Co., Ltd.)



## NE-S1 Series of Small Inverters

Hitachi has released the NE-S1 series of small inverters. To facilitate installation in control panels, the width and height of this new series are compatible with the dimensions of the current WJ200 series of standard inverters. The inverters also incorporate a sirocco fan for cooling that allows them to be made smaller in the depth direction than previous models.

When adding the sirocco fan, Hitachi researched the ideal

shape to minimize fan noise. The design also sought to minimize total costs by not having any ventilation slits on the sides of the inverters, allowing them to be installed side-by-side without an intervening gap, and thereby reducing the size of control panel required for their installation.

(Hitachi Industrial Equipment Systems Co., Ltd.)



NE-S1 series small inverter





## Resource-efficient Amorphous Ferrite Motor

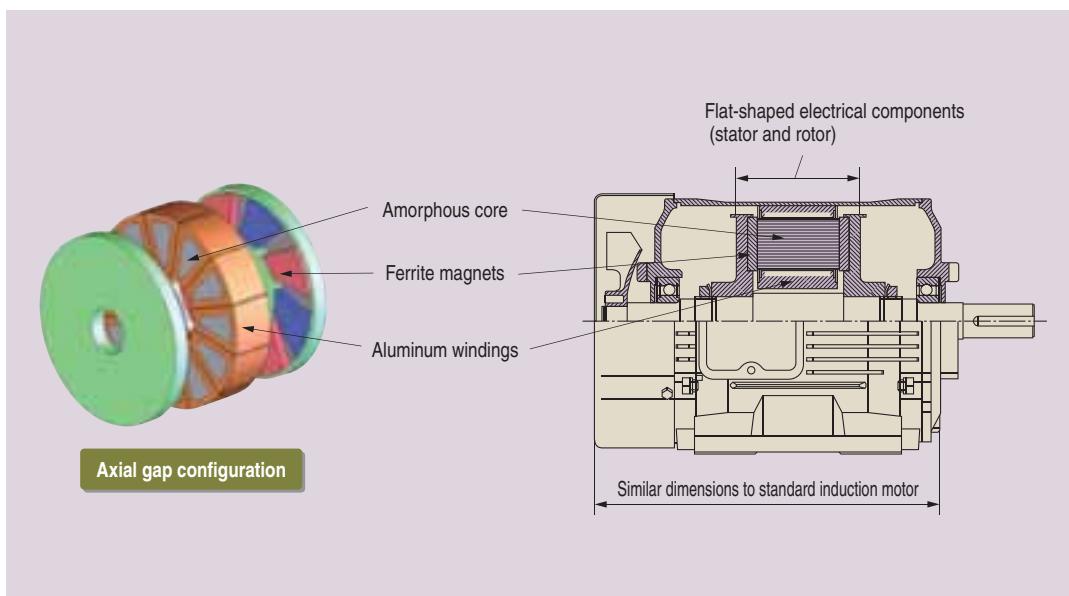
In response to the rapid rise in the price of rare earth metals, Hitachi has developed a resource-efficient amorphous ferrite motor that achieves equivalent or better electromagnetic performance than existing motors as well as improved motor characteristics, without the use of rare earths.

The motor core is made from laminated iron-based amorphous metal and is updated from the structure used previously. Hitachi is also making manufacturing technology improvements to facilitate mass production of this new design. Because it uses ferrite magnets and aluminum windings, and has optimized the design of the double-rotor, axial gap configuration, the new motor minimizes the procurement risk associated with using rare earths (neodymium and dysprosium) or copper.

Despite being no

bigger than a standard induction motor, the new motor achieves the IE4 (super premium efficiency) international standard for motor efficiency set by the International Electrotechnical Commission (IEC).

(Hitachi Industrial Equipment Systems Co., Ltd.)



Structure of resource-efficient amorphous ferrite motor



## Logistics Support Robot

Production lines at factories that assemble advanced electronic equipment require frequent transportation of both components



Logistics support robot

for assembly and completed products along the aisles of multi-story buildings fitted with elevators. At the majority of such sites, parts and products are transported by hand. In response, Hitachi has developed the logistics support robot to automate this task.

Because the robot is configured to operate as a self-driving system, it does not require the magnetic tape, white lines, or other markers used by conventional automated guided vehicles (AGVs) to indicate the route. Using a positioning system based on a laser range finder, the robot is able to drive itself by automatically detecting its own position and direction of travel on a map stored in its memory. It also uses the laser range finder to detect the position and direction of trollies loaded with parts that it automatically links together and pulls along in a convoy formation. The system can also communicate with the elevator to call it up automatically when it needs to travel between floors.

These functions have been used to implement the self-driving system at an actual plant where it is designed to operate alongside people.

In the future, Hitachi is also planning to supply the positioning system based on a laser range finder that it developed for the robot as a standalone sensor system.

(Hitachi Industrial Equipment Systems Co., Ltd.)



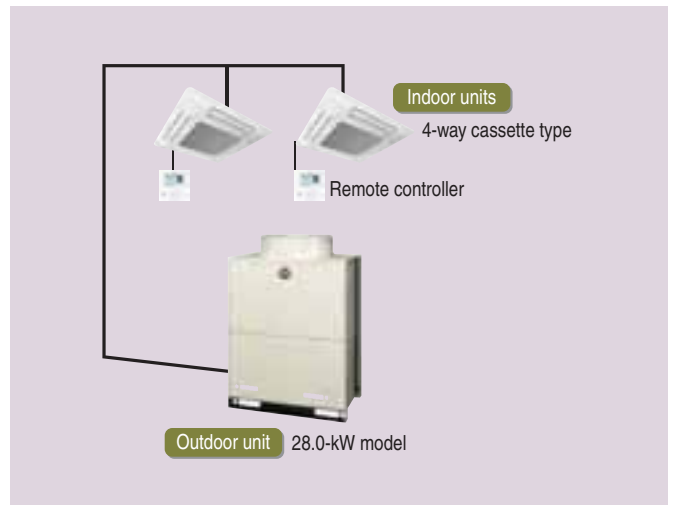


## VRF (Variable Refrigerant Flow) Air Conditioning System for Building (High Efficiency Series)

The high efficiency series of distributed, variable refrigerant flow (VRF) air conditioning systems for buildings allow the connection of multiple indoor units. All applicable models\*<sup>1</sup> in the series have achieved the 2015 standards stipulated in Japan's Energy Conservation Act.

VRF air conditioning systems are modular, supporting configurations with outdoor units ranging between 14.0 kW and 100.0 kW, and the same outdoor units can be used both in systems capable of simultaneous heating and cooling and in systems that switch between heating and cooling operation. The annual power consumption of the 28.0-kW model is approximately 46% less than products of 15 years ago, corresponding to an annual reduction in carbon dioxide (CO<sub>2</sub>) emissions of about 1,604 kg\*<sup>2</sup>.

Efficiency improvements include the use of motors with high-flux-density magnets and optimization of the over-compression reduction mechanism on the new scroll compressor, which has reduced losses when operating at low load. The heat transfer area of the condenser has also been enlarged. The installation requirements for coolant piping between the outdoor and indoor units have also been simplified to provide more flexibility in air conditioning equipment design.  
(Hitachi Appliances, Inc.)



Example of 28.0-kW VRF air conditioning system for buildings

\*<sup>1</sup> Only applies to 50.4-kW and smaller models. Combination models are excluded.

\*<sup>2</sup> Estimate by Hitachi Appliances, Inc.



## Pumps for El Ain El Sokhna Supercritical Thermal Power Plant in Arab Republic of Egypt

Hitachi received an order from the East Delta Electricity Production Company (EDEPC) in the Arab Republic of Egypt for pumps for the 2×650-MW El Ain El Sokhna Supercritical Thermal Power Plant. This power plant is currently under construction on the

shores of the Red Sea near the Suez Canal, and is the first supercritical pressure thermal power plant to have been built in Egypt.

The order was for a total of 32 pumps of nine different types, with uses that include boiler feedwater and circulating water.

Key features of this project are as follows.

(1) Performance testing of large boiler feedwater pumps covering all speed and load conditions

Performance testing of the boiler feedwater pumps was conducted for all speed and load conditions. A newly constructed large-scale test facility was used to conduct the testing over all load conditions requested by the customer. The major advantages of performing tests under the same conditions as would apply at the site are that reliability can be confirmed and on-site commissioning can be completed quickly. Based on this experience, Hitachi intends to take an active approach to boiler feedwater pumps for overseas market.

(2) Corrosion resistance improvements and shorter lead time for circulating water pumps

Because the system uses highly corrosive seawater, the reliability of the circulating water pumps was improved by using highly corrosion-resistant stainless steel for all components, which contact with water. The use of fabricated steel plate construction also shortened the manufacturing lead time compared to pumps made from castings.

As supercritical pressure plants are becoming the norm for thermal power generation projects in Egypt and elsewhere, Hitachi believes that its experience from this project will make a major contribution to future work.



Boiler feedwater pump for El Ain El Sokhna Supercritical Thermal Power Plant in Egypt





## FPSO Process Centrifugal Compressor

Rising global energy demand is driving the development of offshore resources. Hitachi has recently applied the technologies it has built up over many years in the design and manufacture of centrifugal compressors to supply a floating production, storage

and offloading (FPSO) process centrifugal compressor to MODEC, Inc. Group.

Base plate strength and vibration are key issues for FPSO compressors because of the need to cope with the static and dynamic pitching and rolling that occurs on a floating structure. For this reason, a vibration isolator (called an “anti vibration mount”) is fitted under the base plate. Vibration and strength analyses of both the base plate and rotor and their linkage were conducted in collaboration with Hitachi Research Laboratory to establish a design technique for preventing resonant vibrations. The FPSO facility is located off the coast of the Federative Republic of Brazil, one of the most active regions in the world for offshore oil and gas developments, and is operated by OSX 3 Leasing B.V., a Brazilian company that owns FPSO.

In the future, Hitachi hopes to expand its business further and contribute to its social infrastructure business by participating in the ocean market in earnest.



FPSO process centrifugal compressor



## Establishment of Overseas Production of Hitachi Oil-free Screw Compressors

Air compressors are an important category of equipment, being used for applications such as powering pneumatic tools (including sprays, air hammers, and air grinders) in industries as diverse as steel, electric power, car making, shipbuilding, textiles, electronics, chemicals, and mining. Industrial growth in emerging nations in particular is driving increasing demand, with China predicted to become the world's top producer and vendor of air compressors. In response to these circumstances, Hitachi has established a company in China to produce its AIRZEUS\* series (100 kW–500 kW) of medium-sized and large oil-free screw compressors that in the past have been produced only at a plant in Japan.

Established in November 2012, the new company, called Hitachi Hanbell (Shanghai) Precise Machinery Co., Ltd., is a joint venture with Shanghai Hanbell Precise Machinery Co., Ltd., an existing Chinese manufacturer of compressors, and will handle the production, servicing, and sales of air compressors. The company headquarters and its production and maintenance facilities are located at Shanghai Hanbell's Shanghai plant. The core component of a compressor is called as the air block (screw rotor part). The compressors made by the new company will use air block assemblies made at the Japanese plant and these will be assembled together with other components sourced locally in China.

In addition to the original aim of establishing this new company in Shanghai as a manufacturing base for servicing

the Chinese market, where strong ongoing demand is anticipated, the plans also include expanding the plant to supply international markets and increasing sales of new compressors in emerging markets such as in Southeast Asia.

\* AIRZEUS is a trademark of Hitachi, Ltd.



New oil-free screw compressors (produced by new company, Hitachi Hanbell (Shanghai) Precise Machinery Co., Ltd.)





## Development of System for Maintenance and Health Managing Against Lightning Surge Strike

The impact of lightning strike, earthquake, flooding, or other natural disasters on structures such as office buildings or towers can result in a loss of health of the structures themselves and in

the equipment they house.

Southeast Asia countries experience frequent thunderstorms and it is standard practice to install protection devices (such as surge protective devices) to prevent the equipment in buildings from suffering electrical damage due to the induced currents and other effects of lightning strikes. However, cases have been reported from the Republic of Singapore and elsewhere of equipment being affected since they were not maintained correctly in spite of deterioration in those protection capabilities in buildings by receiving a number of lightning strikes each year.

In response, Hitachi has developed a system for managing the health of protection devices in multiple buildings by measuring the lightning surge currents and other parameters that trigger their operation and managing this information centrally. The system also plans optimization for the timing of preventive and other maintenance. After trialing the system in Singapore, Hitachi intends to market it to customers in Southeast Asia, such as building management companies or telecommunications companies that operate radio towers.



Screens showing status information such as health of protective devices in buildings

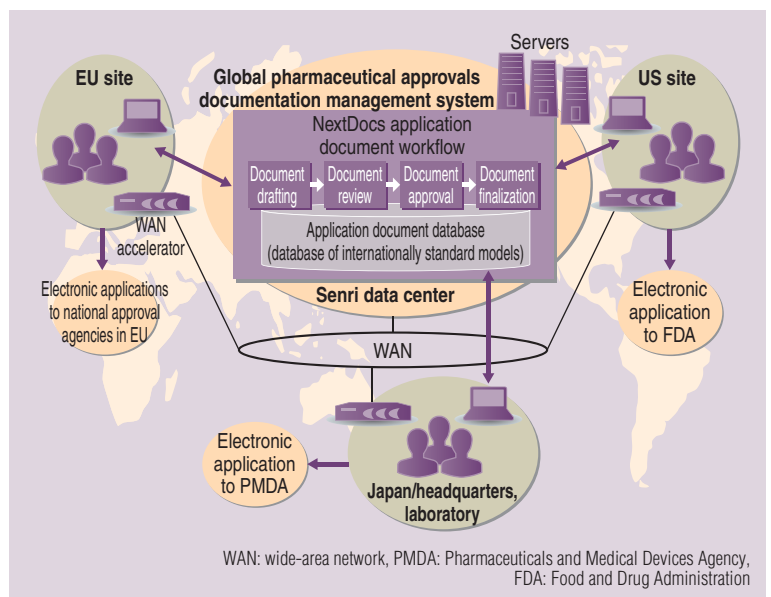


## Global Documentation Management System for Pharmaceutical Approvals

Hitachi has supplied a global documentation management system for pharmaceutical approvals to Santen Pharmaceutical Co., Ltd. to support the preparation of documentation used in applications for approval of new pharmaceuticals at its operations in Japan, the USA, and the European Union (EU).

It is becoming increasingly common in the pharmaceutical industry to apply for approval of new drugs in Japan, the USA, and the EU in parallel, with the regulatory agencies in each jurisdiction adopting common international assessment standards, together with greater standardization and use of electronic formats for application documentation. This system supports the joint preparation of electronic application documents by staff from different sites in accordance with these regulatory requirements.

The software platform for the system is the NextDocs\* document management package. A system capable of consistent use and operation across the three sites was implemented by utilizing NextDocs features such as standard workflows and its international standard application document database model, and by configuring the system so that it can respond flexibly to the different practices at each site. The system's servers are centrally managed at Hitachi's Senri data center and network accelerators have been installed at each site to ensure that use of the system from overseas is not impeded by slow access speed.



Global pharmaceutical approvals documentation management system

By supplying this system, Hitachi is contributing to more efficient applications for new pharmaceuticals throughout the world.

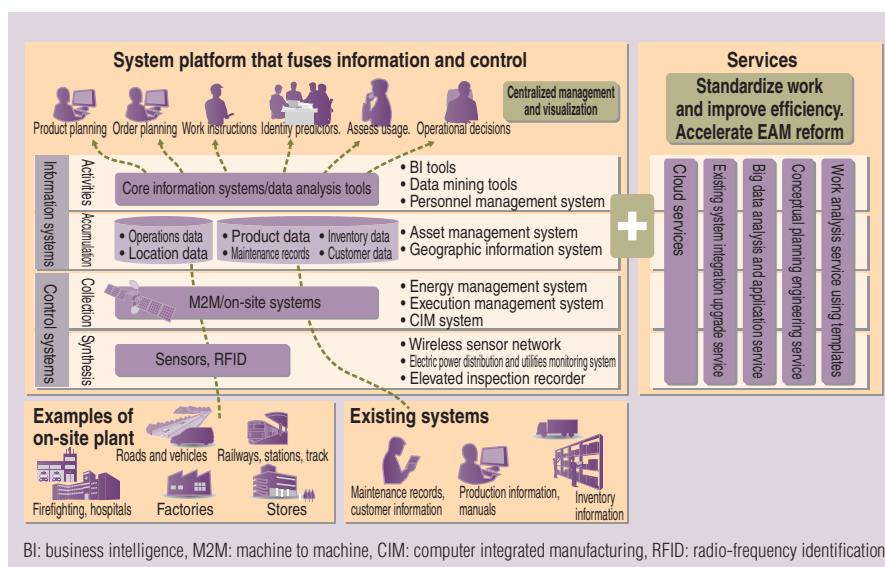
\* See "Trademarks" on page 91.



## EAM Solution for Public and Industrial Sectors

Increasing attention has been paid to enterprise asset management (EAM) in both the public and industrial sectors in recent years against a background of rising running costs resulting from the aging of existing plant and constrained budgets for equipment maintenance due to the stagnant economic.

In response, Hitachi has put together an EAM solution that combines the operations and maintenance know-how relevant to equipment maintenance that Hitachi has built up over time with EAM products that have been proven in a wide range of applications, and advanced technologies from its research laboratories. This solution utilizes this know-how and these products and technologies to provide centralized management and visualization support both for equipment and for the data collected from equipment. The aims are to reduce costs and maximize the asset value of plant by improving the standardization and efficiency of the operation and maintenance tasks associated with their management, while also ensuring that social infrastructure is safe, secure, comfortable, and takes account of the environment. Specifically, it comprises a system platform that fuses information and



EAM solution for public and industrial sectors

control to seamlessly link on-site plant to existing core information systems and supply valuable information to a variety of different users, and a range of services that provide total support from the conceptual planning stage of EAM reform through to the development and operation of systems and their bedding in.

## Global Expansion of Electrical Control System for Cold Rolling

Demand for steel remains strong, particularly in the emerging economies of Asia, and this is underpinning vigorous capital

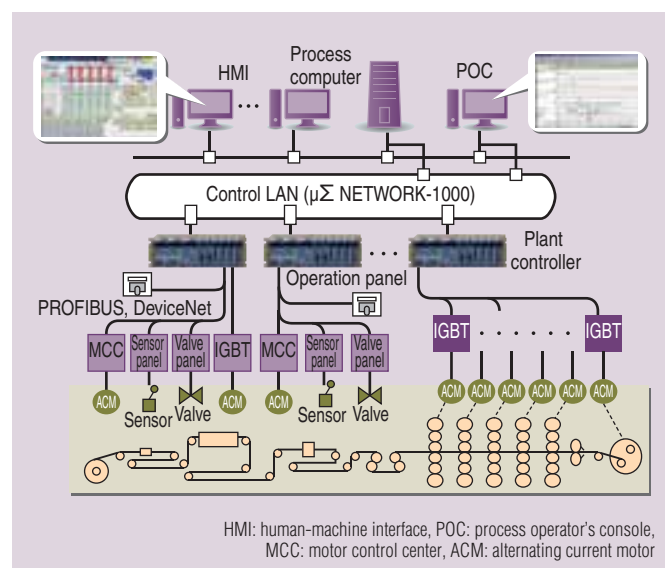
investment.

Hitachi has recently shipped a total of eight new pickling line and tandem cold mill (PL-TCM) systems at sites in China, South Korea, India, North America, and elsewhere. For parallel production in short period, Hitachi reutilizes design resources and know-how built up through past experience to minimize the amount of design work needed to deal with differences in equipment.

In the standard PL-TCM control system configuration, fast-response insulated-gate bipolar transistor (IGBT) drives are used for the main mill motors, a high-speed (1 Gbit/s)  $\mu\Sigma$  1000 control local area network (LAN) is used to link the plant controllers and RS90 process computer, and active use is made of technologies such as PROFIBUS\* and DeviceNet\* for the connection of inputs and outputs (I/O). The plant controllers support high-speed computation and the RS90 process computer uses the Linux\* operating system. The system functions incorporate control technologies that have been developed over time to enable the precision production of high-quality products, including strip thickness and shape control.

Hitachi intends to utilize recent technologies such as remote maintenance to help ensure smooth plant operation.

\* See "Trademarks" on page 91.



Standard PL-TCM control system configuration





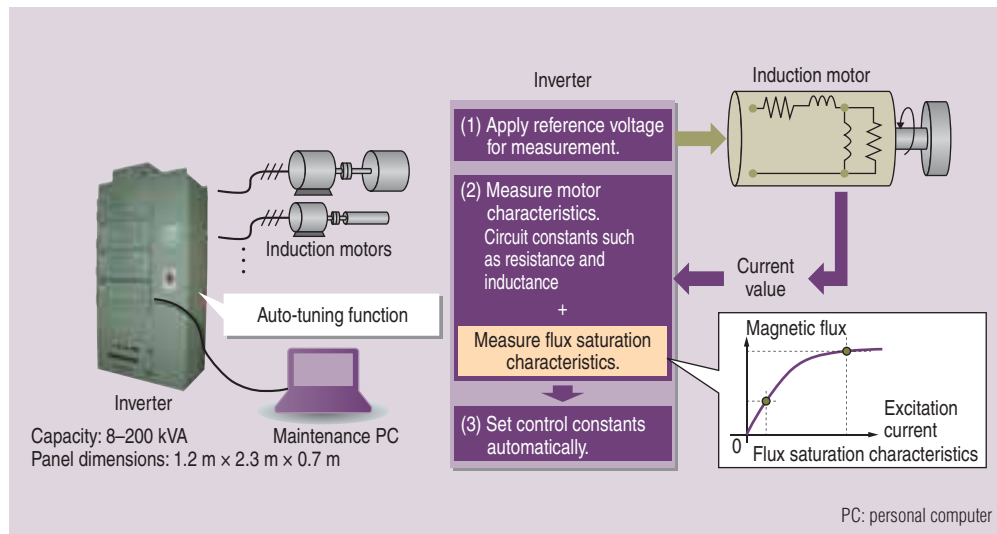
## Auto-tuning Function for Small Inverters Used in Steel Industry

The steel industry uses large numbers of small (8–200 kVA) inverter systems in process line and other applications, with sites having anywhere between several dozen to several hundred such inverters. Depending on use, these include both systems without speed sensors and systems that use speed sensors for vector control. Control systems are designed based on motor characteristics, and Hitachi has now developed an auto-tuning function to facilitate maintenance tasks such as on-site tuning.

This function uses the inverter itself to measure the motor characteristics, which may initially be unknown, and automatically performs detailed control system setup. It is a practice in the steel industry to use field weakening control, whereby the magnetic flux in the motor is varied depending on the speed, to expand the range of motor output characteristics, and this requires consideration of the non-linear characteristics that result from flux saturation. For this reason, Hitachi has incorporated a

function for measuring flux saturation characteristics that measures how the non-linearity varies with speed, including when the motor is in a state of flux saturation.

In the future, Hitachi intends to make further improvements in ease-of-maintenance, including by extending the auto-tuning function to larger inverter sizes.



Auto-tuning function for small inverters used in steel industry



## Drive Network for Inverter Drives

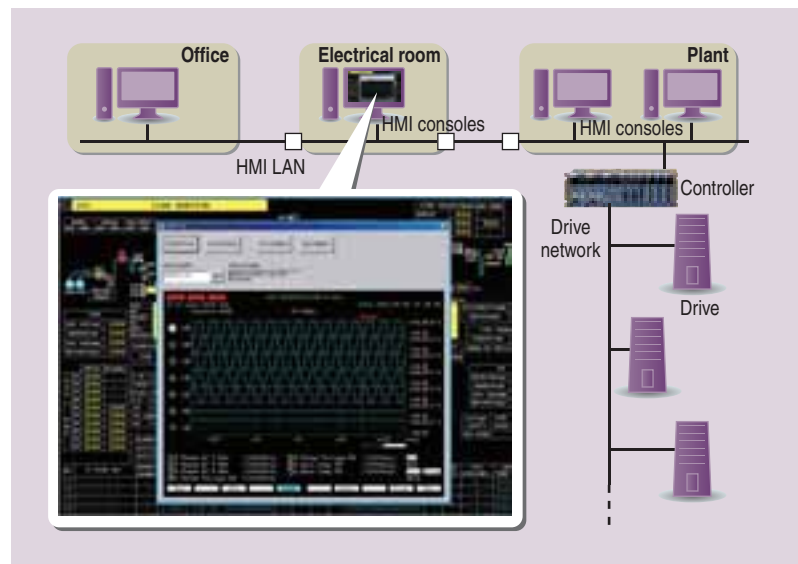
In steel plant systems, a single facility can have between several dozen and several hundred motor drives. Their tuning and main-

tenance poses considerable difficulties.

Hitachi has made this work easier by developing a drive network that extends the protocols used on conventional field network cabling between drives and controllers, and by providing support for this new network in its products. In the new network, data communication with drives is carried on existing cabling but operates in a way that does not interfere with control functions. It can be used to access remotely located drives via the controller from any human-machine interface (HMI) console connected to the control system, supporting operations such as retrieving detailed information, uploading failure data, resetting, specifying control parameters, and loading programs.

In the past, these functions required the installation of maintenance consoles and a local area network (LAN) that connected each drive unit. The newly developed drive network uses the HMI in place of the maintenance console and eliminates the need for LAN installation and connection.

Hitachi intends to expand use of the drive network in the future.



Example HMI screen for drive maintenance and monitoring



## Integrated Solutions for Overseas Plants

With growing demand for the globalization of manufacturing industry, the establishment of overseas production facilities is expected to continue to increase. Hitachi provides its customers

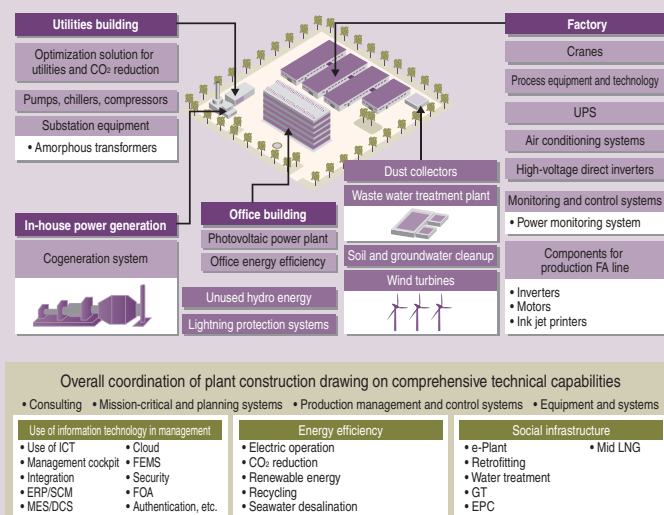
with a one-stop service for their overseas operations by combining products in which it has a strong presence, and by providing support from the planning stage of plant construction through to infrastructure provision, design, construction, and post-commissioning logistics and maintenance. These solutions are characterized by the following four features that relate to construction and engineering in particular.

(1) Total solutions that extend from the planning stage of plant construction through to operation and maintenance

(2) Integrated supply of civil engineering, construction, and installation of machinery, including the provision of electric power, water treatment, and other infrastructure

(3) One-stop global support that includes the adoption of information technology into management, including the use of information and communication technology (ICT) and cloud computing; energy efficiency measures such as carbon dioxide (CO<sub>2</sub>) reduction, recycling, and the use of renewable energy; and the provision of social infrastructure such as e-Plant, mid liquefied natural gas (LNG) and water treatment

(4) Support for regulatory consent applications to authorities that takes account of local circumstances, selection of contractors



UPS: uninterruptible power supply, FA: factory automation, ERP: enterprise resource planning, SCM: supply chain management, MES: manufacturing execution system, DCS: distributed control system, FEMS: factory energy management system, FOA: flow oriented approach, GT: gas turbine, EPC: engineering, procurement, and construction

Integrated solutions for overseas plants

## Integrated Solutions for Oil & Gas Industry

Against a backdrop of vigorous investment in the oil & gas industry throughout the world, Hitachi provides one-stop solutions that extend from construction to services, and from the upstream (wells in oil and gas fields) to the downstream [oil refineries and liquefied natural gas (LNG) plants] ends of the value chain. The solutions are characterized by the following four features.

(1) Project management and engineering, procurement and construction (EPC) coordination that take account of the life cycle from well site to plant

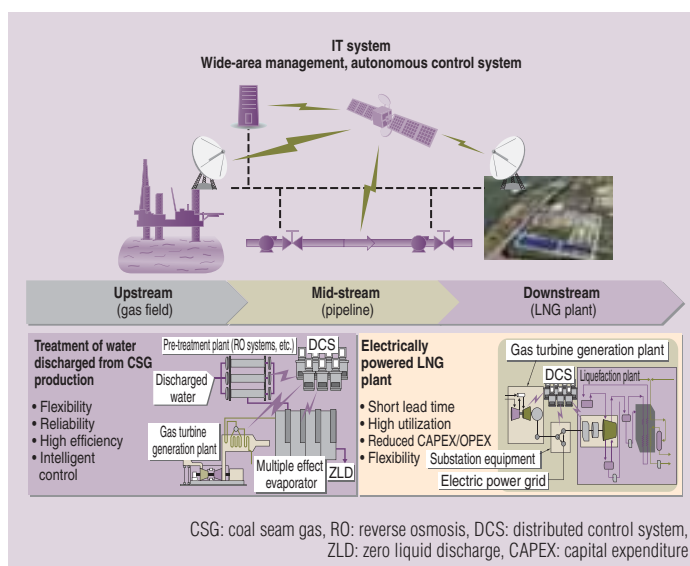
(2) Use of core Hitachi technologies such as highly efficient compressors, permeable membrane water treatment, and flocculation-magnetic separation to reduce load on environment

(3) Lower costs and shorter lead times achieved through integration based on modular designs

(4) Use of information technology (IT) to reduce operating expenditure (OPEX)

In addition to these solutions, Hitachi is also currently developing its own precipitation technique for the treatment of water discharged from gas fields, something that has become a particular concern in recent years. By developing and supplying new technologies like this, Hitachi intends to

continue supplying solutions that meet customer needs.



Integrated solutions for oil & gas value chain