Power Systems

Thermal Power

Hydraulic Power

Nuclear Power

New Energy

Electric Power Distribution

HIGHLIGHTS 2012-2013

Thermal Power Recovery Project for Rapid Restart after Disaster-triggered Shutdown

The Great East Japan Earthquake wrought devastation across the Tohoku region, including damage to many thermal power plants located along the Pacific coast. Amid concerns about power shortages over the summer, Hitachi established a thermal power recovery project in the immediate aftermath of the earthquake to mitigate this risk and set about getting the power stations back in operation. In this article, the people who worked on the front line, speedily restoring these thermal power plants to operation, talk about how they went about restarting 15 plants with a combined capacity of 8,668 MW, and about their plans for the future.

Plants covered by thermal power recovery project

Rapid Instigation of Thermal Power Recovery Project

The March 11, 2011 earthquake and subsequent tsunami caused damage to the many power plants located along the Pacific coast of eastern Japan. This resulted in a crisis situation with the potential for severe power shortages over a wide area during the summer period when the balance between supply and demand is tight.

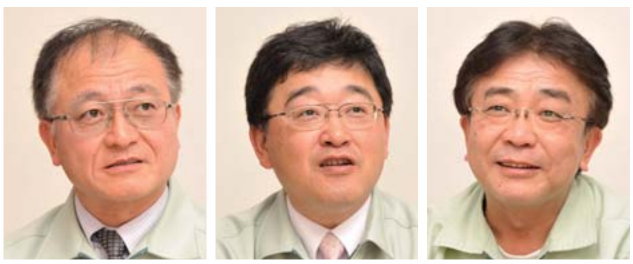
In response, Hitachi quickly established a Thermal Power Response Division (later renamed the Thermal Power Recovery Division), which worked with electric power companies to restart the thermal power plants that had been put out of action by the earthquake and to get mothballed thermal power plants back into operation quickly. The first step was to survey and inspect the damaged power plants. Inspection teams made up of personnel from different companies within Hitachi were dispatched to develop proposals for restarting the plants as well as reporting the results of their inspections to the customers. Equipment at some power plants had been damaged through inundation with water and other causes, while other plants suffered from inadequate lighting, which forced the people carrying out the inspections to rely on headlamps.

Very Rapid Recovery Achieved through Actions of Production Management Departments and Others

The next step was to ascertain whether equipment was still usable. Detailed equipment inspections were conducted on-site or at Hitachi business offices, including Hitachi Works. Equipment that had been immersed in seawater was cleaned and reassembled then sent back to the power plant, while equipment such as electrical panels that could not be restored were instead replaced. Although there were concerns about how long it would take to manufacture replacement equipment, very fast delivery times were achieved thanks to the efforts of the design and production departments, and also the contribution of others such as the production management departments responsible for logistics. Meanwhile, work at the power plants continued around the clock. In particular, it was critical that the Hirono Thermal Power Station of The Tokyo Electric Power Co., Inc. (total capacity: 3,800 MW) be ready in time for summer. The area where this power plant was located remained severely damaged with various infrastructures yet to be fully restored, including telecommunications as well as the water supply and sewage services. Although it was considered impossible to have the power plant operating by summer, thanks to the enthusiastic efforts of the Hitachi business offices and on-site supervisory staff, the unit 2 (boiler) and unit 3 (turbine) plants for which Hitachi was responsible were restored by mid-July. Subsequently, all 15 plants, with a total capacity of 8,668 MW, were brought back into operation as of July 20. The customer expressed their gratitude for this response.

Stabilization of Electric Power Supply

In fact, the issue of whether it would be possible to restore unit 3 at the Hirono Thermal Power Station to operation on schedule was still in doubt back in May. Also, looking back at the miraculous success of the recovery work serves to reinforce appreciation for the high level of the many technical staff working in the power generation field, not only at Hitachi in its role as a supplier. Despite this, it is still too early to relax as recovery work still continues at plants such as unit 2 at the Haramachi Thermal Power Station of the Tohoku Electric Power Co., Inc. Hitachi intends to continue working on this project to help stabilize the supply of electric power.


Satoshi Kusaka (left), Chief Project Manager, Thermal Power Systems Development & Management Division, Thermal Power Plant Engineering Department; Atsushi Matsuo (middle), General Manager, Thermal & Hydroelectric Systems, Quality Assurance Department; Kaoru Aoki (right), Nuclear Business Manager, Turbine Manufacturing Department, Hitachi Works, Power Systems Company, Hitachi, Ltd.

HIGHLIGHTS 2012-2013

Commencement of Operations at Omarugawa Power Plant of Kyushu Electric Power Co., Inc. with World-class Adjustable-speed Pumped Storage System

In addition to helping smooth demand for electric power and stabilize the frequency on the power system, adjustable-speed pumped storage systems are also attracting attention for their use as energy storage mechanisms. Against this background, the final unit of the adjustable-speed pumped storage system at the Omarugawa Power Plant of Kyushu Electric Power Co., Inc. commenced operation in July 2011 and, over the following summer period, helped maintain a reliable supply of electric power in Japan, where the power supply had been destabilized by the Great East Japan Earthquake. Omarugawa Power Plant is one of the world's leading adjustable-speed pumped storage systems in terms of its capacity, speed, and head. This article talks to the people who worked on the project about the development of the adjustable-speed pumped storage system for Omarugawa Power Plant, and the potential for adjustable-speed pumped storage in the future.

Yukio Hongawa (upper left), Senior Engineer; Osamu Nagura (upper right), Chief Engineer, Adjustable Speed System Center, Overseas Plant Engineering Department; Yoshihiro Iwasaki (lower left), Chief Engineer; Masami Harano (lower right), Lead Engineer, Turbine Engineering Department, Hitachi Mitsubishi Hydro Corporation

Contribution to Electric Power Supply in Aftermath of Great East Japan Earthquake

Unit 2 at the Omarugawa Power Plant of Kyushu Electric Power Co., Inc. entered commercial operation in July 2011, the last of the power plant's four units to be commissioned. The four adjustable-speed pumped storage systems have a combined maximum output of 1,200 MW when operating in generation mode. Pumped storage involves using electric power to pump water up to the upper reservoir during the night when demand is low, and then allowing it to flow back to the lower reservoir to generate power during the daytime demand peak. In addition to working in tandem with thermal power plants to balance supply and demand, the system also helps reduce carbon dioxide (CO_2) emissions by reducing the operating time of thermal power plants.

Unlike constant-speed systems used in the past, the adjustable-speed pumped storage system adopted for the Omarugawa Power Plant is capable of both rapidly adjusting the level of power generated during the daytime and changing the input power used to pump water by continuously varying the speed of the motor-generator as required (600 ± 24 min^{-1}). Also, the ability of the system to produce power similar to a nuclear power plant with only two and a half minutes' notice means it can serve as an emergency source of power generation during power shortages such as when a disaster strikes.

World-class Adjustable-speed Pumped Storage System

The Omarugawa Power Plant is a large-capacity, high-speed pumped storage system with a 700-m difference in head between the upper and lower reservoirs and a generator that is the first in the world to achieve 600 min^{-1} on a 300-MW class machine. Both the motor-generator and pump-turbine required an extremely high level of technology, and the system also had to overcome a number of technical challenges including the achievement of greater efficiency and smaller size. The result is one of the world's leading adjustable-speed pumped storage systems.

At the time of the initial order, Hitachi, Ltd., and a consortium of Mitsubishi Electric Corporation and Mitsubishi Heavy Industries, Ltd., were each to take responsibility for two units. However, the companies subsequently combined their hydroelectric power businesses in October 2011 to establish Hitachi Mitsubishi Hydro Corporation. It will be able to tap into even greater synergies and be able to select between either of the two companies' technologies depending on the particular geographic conditions at a hydro power plant by sharing the different technologies they have built up over time, such as line-commutated or self-commutated exciters, for example.

Complementing Renewable Energy through Supply of High-quality Electric Power

Pumped storage has attracted attention in recent years as a means of energy storage. Pumped storage plays an important role as a type of battery in situations such as emergencies or when power demand spikes. Meanwhile, as power supplies become more unstable due to growing use of renewable energy, prompted by restrictions on CO_2 emissions, the ability of pumped storage to supply high-quality electric power with stable frequency and voltage is likely to make it increasingly important.

In the future, in addition to retrofitting adjustable speed capabilities to existing pumped storage power plants in Japan, Hitachi Mitsubishi Hydro Corporation also aims to contribute globally to the stable supply of electric power by expanding its markets into other countries, particularly in Europe where use of wind power is growing.

Omarugawa Power Plant of Kyushu Electric Power Co., Inc.

Keephills 3 Power Plant in Canada

Keephills 3 Power Plant (gross output: 495 MW) in Canada began commercial operation from September 2011. Hitachi, Ltd. and Babcock-Hitachi Kabushiki Kaisha received an order for the plant from a limited partnership involving Capital Power Corporation and TransAlta Corporation of Canada.

Following on from work on Genesee 3, Canada's first supercritical thermal power plant, Hitachi, Ltd. and Babcock-Hitachi supplied the complete set of power plant equipment (boiler, turbine, generator, air quality control system, and auxiliaries). Hitachi, Ltd. and Babcock-Hitachi participated up until the completion of the plant, including supplying technical advisers for installation work (managed by the customer) and conducting commissioning (jointly with the customer).

Building on this success, Hitachi, Ltd. and Babcock-Hitachi intend to expand its thermal power business globally.

Keephills 3 Power Plant in Canada

Enhancement of Production Organization at Chinese Manufacturing Facility

Strong demand for electric power is expected to continue to grow in China. To enhance its production organization to cope with an increase in orders for power generation equipment from that country, Hitachi has decided to expand its Dalian Hitachi Machinery & Equipment Co., Ltd. manufacturing subsidiary in Dalian City, Liaoning Province, and also to move it to Industrial Port Zone of Puwan New District.

The aims are to gain more orders for power generation equipment and enhance competitiveness in the global market against a background in which installation of distributed power plants that use small to medium-sized gas turbines is increasing in China.

Construction of the new facility started in August 2011.

Signing ceremony (left) and construction groundbreaking ceremony (right) at the new plant for Dalian Hitachi Machinery & Equipment Co., Ltd.

Combined Cycle Gas Turbine Generator for Unit 5 at Niigata Thermal Power Station of Tohoku Electric Power Co., Inc.

The H-25 is a highly efficient, single-shaft combined cycle power generation system. The first H-25 to be supplied to a Japanese power company entered commercial operation at the Unit 5 gas turbine power plant at Niigata Thermal Power Station of Tohoku Electric Power Co., Inc. in July 2011. Unit 5 has a total capacity of 109,000 kW and a rated output: 54,500 kW×2 shafts.

The plant features high efficiency to cut fuel costs and reduce carbon dioxide (CO_2) emissions and a design suitable for installation in the vicinity of urban areas for use as a regional distributed power plant. Plant construction also succeeded in conducting installation work in a confined space and short period of time by adopting just-in-time engineering practices for delivery of the product to the site. Work started in September 2010 and, thanks to hard work by installation staff and unstinting support from the customer, has since been completed with no accidents or other incidents, despite difficult on-site working conditions. These included some mechanical installation and civil engineering work being undertaken in parallel, outdoor work during winter, and installation work in confined spaces.

The plant has also achieved its initial design performance target that was to be a 50-MW class plant with a higher heating value (HHV) efficiency of 46% or better (compared to previous Hitachi's products), and also its target plant output of 54,500 kW per shaft (adjusted for ambient temperature). Targets for operational parameters were also achieved, including startup and shutdown characteristics (daily startup and shutdown, weekend startup and shutdown), load fluctuation rate, and startup time.

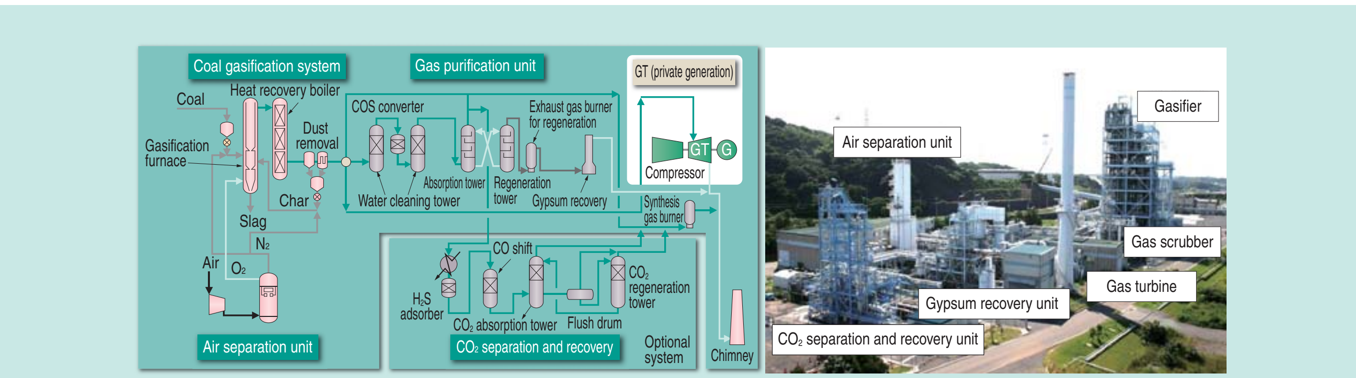
Unit 5 at Niigata Thermal Power Station of Tohoku Electric Power Co., Inc.

While H-25 gas turbines are already in widespread use as heavy-duty gas turbines in Japan, this was the first time one was installed for power company use. In the future, Hitachi hopes to win further orders from Japanese power companies for this product for use as a medium-capacity distributed power plant with high efficiency.

Gas Turbine Clean Combustion Technology for Next-generation Coal-fired Power Plants

Integrated coal gasification combined cycle (IGCC) generation involves the partial oxidation of coal in a gasification furnace and its conversion into a combustible gas, comprised primarily of hydrogen (H_2) and carbon monoxide (CO), which is burnt in a gas turbine (GT) to drive a combined cycle generator. The transmission end efficiency can be improved by utilizing efficiency enhancement techniques used on GTs fueled with natural gas.

Hitachi has already supplied a full set of equipment and provided support for commissioning through its participation in the Coal Energy Application for Gas, Liquid and Electricity (EAGLE) project for developing multipurpose coal gasification manufacturing technology being run in collaboration with the Incorporated Administrative Agency New Energy and Industrial Technology Development Organization (NEDO) and Electric Power Development Co., Ltd. Based on this experience, it is continuing with development aimed at scaling up the demonstration and subsequent commercialized unit of combustion, and improving its environmental performance.



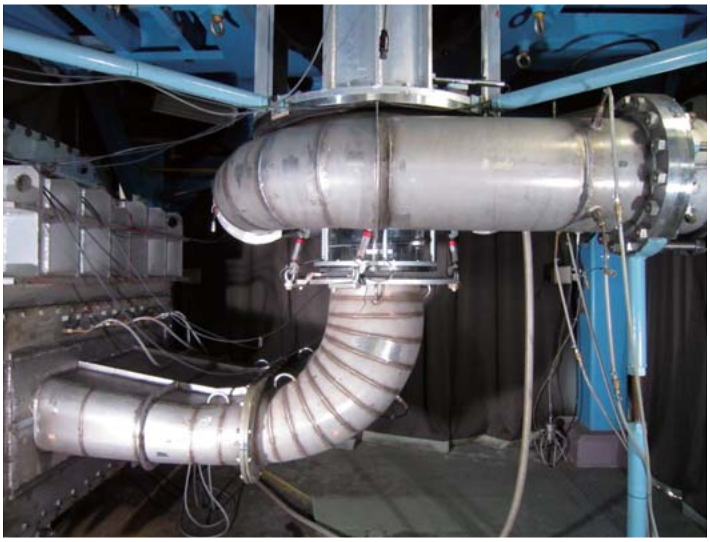
O_2: oxygen, N_2: nitrogen, COS: carbonyl sulfide, G: generator, H_2S: hydrogen sulfide

System configuration of EAGLE pilot plant

S&B Order for 96-MW Francis Turbine and Generator for Chingshan Branch Retrofit Project of Taiwan Power Company

Equipment at the Chingshan Branch Retrofit Project was buried in a landslip during a typhoon in July 2005. The bid for Phase II of the reconstruction work, a scrap and build project involving the supply of four 96-MW turbines, generators, and controllers to replace the existing plant (supplied by Mitsubishi Electric Corporation and Mitsubishi Heavy Industries, Ltd.), submitted by a consortium comprising Hitachi, Ltd., Mitsubishi Electric Corporation, Mitsubishi Heavy Industries, Ltd., and Chung-Hsin Electric and Machinery Manufacturing Corporation in September 2011, was accepted in November 2011. The awarding of the contract followed on from the successful completion of the scrap and build project for the Kukuan Branch Recovery Project of Taiwan Power Company and recognized the high level of performance achieved. The Kukuan contract was awarded in 2003, and the plant commenced operation in 2008.

Equipment design will be performed by Hitachi Mitsubishi Hydro Corporation, with Hitachi, Ltd. producing the turbines, Mitsubishi Heavy Industries, Ltd. producing the inlet valves, and Mitsubishi Electric Corporation producing the generators and controllers. This will be the first plant construction project after Hitachi Mitsubishi Hydro Corporation was established in October 2011. Although the power plant is scheduled to commence operation in 2016, the project demands a short lead time with Unit 1 to commence operation in November 2014. Testing work is currently in progress within the company aimed at conducting testing of a model turbine in May 2012 with the customer in attendance.
(Hitachi Mitsubishi Hydro Corporation)



Model Turbine for Chingshan Branch Retrofit Project in Taiwan

Model Turbine for Refurbishment of Non-Hitachi 42-MW Pump Turbine at Lewiston Pump Generating Plant in USA

The Lewiston Pump Generating Plant of the New York Power Authority in the USA is a pumped-storage power plant with 12 pump-turbines, each with an output of 42 MW, that takes its water from the Niagara Falls located on the border between the USA and Canada. The current plant, which entered service in 1961, was supplied by another company. Hitachi's bid for a major refurbishment, including runner upgrades, was successful thanks to the reputation it established through a similar characteristics improvement project at the Blenheim-Gilboa Pumped Storage Power Project.

With the maximum head of 36.6 m being very low for a pump-turbine plant and the flow performance also being affected by the S-shaped pipe that carries water between the upper reservoir and pump-turbines, one of the features of the project was the use of model testing that included simulation of this pipe. The plant has a wide operating range with a ratio of 2.1 between the maximum and minimum pumping head, and the runners have a diameter of 4.6 m to cope with the roughly 130 m^3/s of water that passes through each unit during generation or pumping.

In addition to the runner upgrade, the refurbishment project also includes characteristics improvement achieved by changes in the stay vane and guide vane shapes. Another aspect of the project is the manufacture of a model turbine (with a scale factor of 1/13.73 and a shape designed using computational fluid dynamics) to confirm that the target turbine characteristics will be achieved. Testing with the customer in attendance was completed in October 2011. Compared to the existing plant, the characteristics of the new design will deliver an efficiency improvement of between 2 and 5% and an increase in maximum output of between 8 and 20%. The model turbine has been completed and work is now underway on the actual turbine.
(Hitachi Mitsubishi Hydro Corporation)

1/13.73 scale model of turbine for Lewiston Pump Generating Plant in the USA

Installation of New Hydro Generation Equipment at Hokkaido Bureau of Prefectural Enterprises' Shuparo Power Plant

Installation of new hydro generation equipment has commenced for Unit 1 (24,800 kW) and Unit 2 (1,800 kW) at the Shuparo Power Plant of the Hokkaido Bureau of Prefectural Enterprises.

Located in Yubari, Hokkaido in Japan, the power plant is a dam-fed hydroelectric plant that takes its water from the Yubari Shuparo Dam. It is scheduled to commence operation in April 2015.

The key features of the plant are as follows:

(1) Highly efficient turbine runners designed using the latest computational fluid dynamics techniques

Lower draft tube for turbine–Unit 1 at Hokkaido Bureau of Prefectural Enterprises' Shuparo Power Plant

(2) Use of air-cooled generator bearings to eliminate the need for a cooling water supply

(3) Use of water-lubricated turbine bearings to eliminate the need for lubricating oil in the turbine bearings

(4) Use of electrically operated governors, inlet valves, and brakes to eliminate the need for hydraulic oil and compressed air

In the future, Hitachi intends to contribute in ways that include making effective use of renewable energy, reducing oil spills and other environmental risks, and improving ease-of-maintenance through the supply of new hydro power plants or scrap-and-build projects on existing power plants.

(Hitachi Mitsubishi Hydro Corporation)

Involvement in New Nuclear Power Plant for Republic of Lithuania

Hitachi, Ltd. has been selected to be a strategic investor (SI) in a construction project for the Visaginas Nuclear Power Plant planned by the Republic of Lithuania, granting the company priority in negotiations aimed at formalizing a contract.

Planned site of Visaginas Nuclear Power Plant (artist's impression)

The project involves supply of fuel, operational support, and financial investment, as well as engineering, procurement, and construction (EPC), and Hitachi is currently engaged in exclusive negotiations aimed at formalizing a contract that will include the concession agreement (CA) and EPC terms. Hitachi is proposing a 1,350-MWe-class advanced boiling water reactor (ABWR) with enhanced safety including measures for dealing with the type of accident that occurred at the Fukushima Daiichi Nuclear Power Station. Technical negotiations took place in advance of signing an EPC contract with Visagino Atominė Elektrinė, the state power company and project coordinator. These technical negotiations have completed and provisional signoff on the CA took place in December 2011.

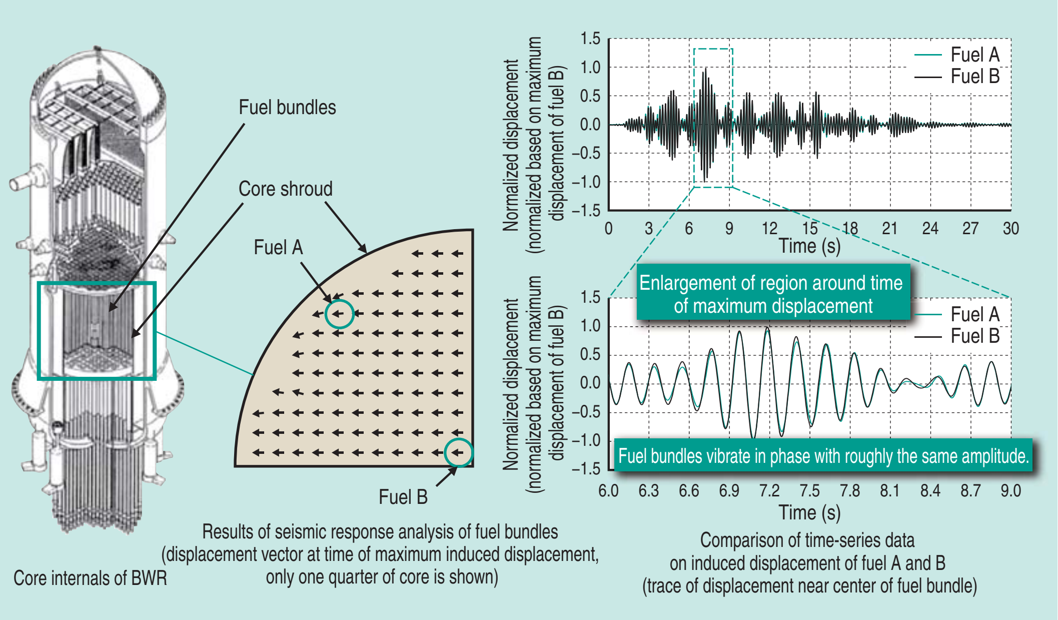
In the future, Hitachi intends to take earnest steps through a robust organization that it aims to strengthen further, including working with General Electric Company (GE), Hitachi's alliance partner in the nuclear business.

(Hitachi-GE Nuclear Energy, Ltd.)

Three-dimensional Seismic Response Analysis for Fuel in BWR Core

This technique is useful for assessing the seismic safety of boiling water reactors (BWRs) because it can individually assess the behavior during an earthquake of the several hundred fuel bundles that make up a reactor core.

Current fuel bundle design uses a model of a single bundle that treats it as a beam with lumped mass and takes account of the effect of the reactor water, the validity of which has been confirmed through historic vibration tests*. In contrast, a feature of the new technique is that it considers the effect of coupling between fuel bundles mediated by the reactor water and models each fuel bundle individually as a beam with lumped mass. The validity of this technique has been confirmed through comparison with historic vibration testing. Its use makes it possible to assess in detail the behavior of fuel bundles during an earthquake. The results of seismic response analysis conducted using this technique found that fuel bundles vibrate in phase with roughly the same amplitude.



Results of seismic response analysis of fuel bundles

Hitachi intends to continue enhancing techniques for assessing seismic resistance to help further improve seismic reliability.
(Hitachi-GE Nuclear Energy, Ltd.)

* Source: Proving Tests on The Seismic Reliability For Nuclear Power Plant, Nuclear Power Engineering Center, 1988 and other sources

Converter for Wind Power Generation

Converter for 2-MW PMG wind power generation plant

The Chinese government is encouraging greater installation of renewable energy generation plants. Hitachi has been involved in the Chinese market for wind power generation plant converters since 2008. For wind power plants that use converters for 1.5-MW doubly-fed induction machines, Hitachi has received certification from the China Electric Power Research Institute for a low voltage ride through (LVRT) function that allows the converter to continue generation even if a short-duration grid fault occurs. Hitachi has supplied approximately 560 wind power converters equipped with this LVRT function.

In response to the trend in the wind power market in recent years to equip wind power plants with permanent magnet synchronous generators (PMGs) in the 2-MW to 3-MW class, Hitachi has also developed a converter for use with a 2-MW PMG wind power generator that was released on the Chinese market in 2011.

Together with power conditioners for battery energy systems, Hitachi intends to utilize its technology in smart grid and smart city applications, including systems that are designed to improve power system stability in terms of power fluctuations caused by wind and other sources of renewable power.

Commencement of Operation at Ohgishima Solar Power Plant, Japan's Largest Photovoltaic Power Plant

Construction of the Ohgishima Solar Power Plant owned by The Tokyo Electric Power Company completed in December 2011 and the plant commenced operation. The capacity of the completed plant was the largest of any photovoltaic power plant in Japan. The plant covers an area of 23 ha (0.23 km^2), has a maximum output of 13 MW, and is located in Kawasaki city, adjacent to Tokyo, the capital of Japan. It is expected to generate approximately 13,700 MWh annually, which is enough to power 3,800 homes.

Functions to minimize the impact of the plant on the grid were included during design and construction, along with measures for cutting costs and improving system efficiency. A key feature of the plant is that it incorporates solutions to grid problems that are likely to arise in the future if large amounts of photovoltaic generation capacity are introduced. These solutions are designed to achieve harmonious operation with the grid, and include a fault ride through (FRT) function that allows the plant to continue to operate through grid faults, and reactive power control to suppress fluctuations in the grid voltage. With a feed-in tariff (FIT) scheme to be introduced in Japan in July 2012, it is anticipated that many more large photovoltaic power plants will be built in the future. Hitachi hopes to draw on its experience with the construction of the Ohgishima Solar Power Plant in future megasolar construction projects.

Overview of Ohgishima Solar Power Plant (output: 13 MW, largest photovoltaic power plant in Japan at the time operations commenced)

New Digital Protection Equipment

Protection equipment for electric power grids maintains a stable supply of electric power by rapidly isolating faulty sections from the rest of the grid when a grid incident such as a lightning strike occurs. Such equipment must be highly reliable and satisfy strict realtime performance requirements. While these requirements have traditionally been met by the protective relay sector, Hitachi has now developed new-generation digital protective relay units that will be compatible with the next generation of information and telecommunications networks where progress is rapid. This new series of digital relays delivers the required level of reliability and realtime performance in a protective relay that is equipped with a standard Ethernet interface.

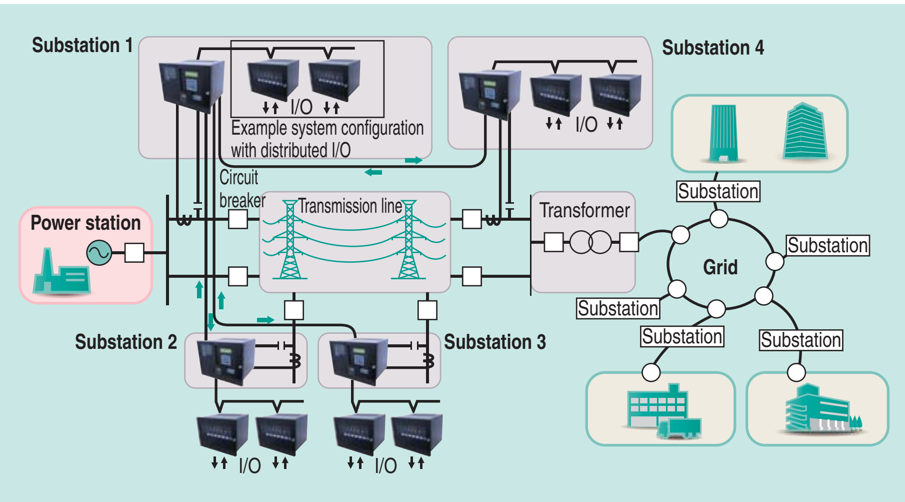
The key features are as follows:

(1) Achieves 1 µs or better sampling synchronization accuracy using network synchronization that operates on the same principle as IEEE1588. The series is suitable for relay systems that require synchronous performance, such as current differential relays for transmission lines, and will also be useful during the future migration of network infrastructure from synchronous to asynchronous networks.

(2) Highly reliable memory system incorporating error checking and correcting (ECC) and memory patrol functions to improve the reliability of protective relay systems that operate over long periods of time.

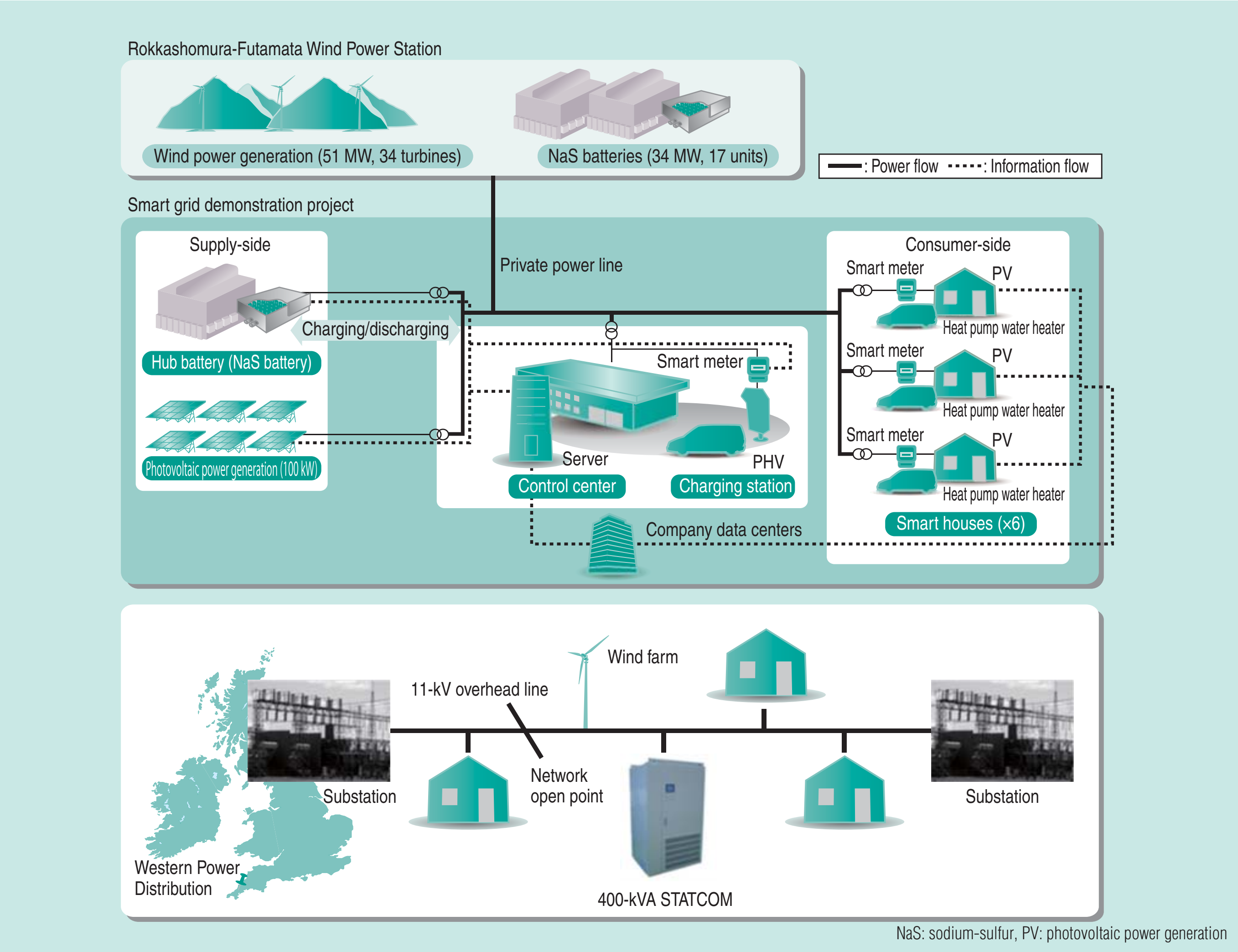
(3) By separating the relay processor and input/output (I/O) sections of the relay, use of a distributed I/O architecture incorporating serial links minimizes wiring and allows for greater flexibility in where to locate relays. The relays also allow units to be swapped to satisfy the demand in recent years to extend service lives.

In the future, Hitachi intends to expand its product range and develop new protective relay systems that will be compatible with the next generation of telecommunication networks.



New digital protection equipment

Hitachi's Grid Stabilization Technology for Overcoming Challenges Posed by Renewable Energy



Rokkasho Village Smart Grid Demonstration Project and voltage control system demonstration project by 400-kVA STATCOM

The adoption of renewable energy has been encouraged in recent years to help create a low-carbon society. However, because its output is impossible to control, being subject to changing weather conditions, the adoption of renewable energy is also accompanied by numerous challenges.

This article describes the actions Hitachi is taking in response to these challenges.

(1) Rokkasho Village smart grid

The grid equipment at the site of the smart grid demonstration project is operationally separate from the power company grid and comprises smart houses, locally installed batteries, photovoltaic power generation, and charging stations. The equipment in the smart houses includes a home energy management system, photovoltaic power generation, and plug-in hybrid vehicle (PHV).

The demonstration project involves the application of grid control and advanced metering infrastructure (AMI) technologies built up to make effective use of renewable energy and to develop technologies for improving the stability of the power system, such as local voltage regulation and control of power flow through interconnection lines by realtime control of reactive and active power using locally installed batteries.

(2) STATCOM for Western Power Distribution in UK

A feed-in tariff scheme guaranteeing a fixed purchase price for renewable energy has been introduced in the UK since April 2010. With rapid progress being made on the installation of small wind power generators in rural areas and photovoltaic power generation in urban areas, there are concerns that this will lead to grid instability due to greater voltage fluctuations in the power distribution grid. In response, UK company, Western Power Distribution (WPD) is undertaking trials including an introduction of a static synchronous compensator (STATCOM) to improve grid stability by suppressing voltage fluctuations in the power distribution grid. Hitachi has developed a 400-kVA STATCOM for the trial, which completed on-site testing in January 2012 and is currently in trial operation.

The STATCOM is equipped with a voltage fluctuation suppression function that utilizes the high-speed response characteristics of self-commutated converters, and the next plan is eventually to have four units operating to suppress voltage fluctuations through coordinated control.