Global Activities of Hitachi's Electric Power Business

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ONGOING GROWTH IN GLOBAL DEMAND FOR ELECTRIC POWER

HITACHI is engaged in a variety of social infrastructure businesses, including those in the fields of thermal and nuclear power generation, electric power distribution, and renewable energy. These businesses operate primarily through Power Systems Company of Hitachi, Ltd. Global electric power generation is predicted to grow strongly, reaching about 1.7 times 2008 levels by 2030 (see Fig. 1). With extensive construction of new coal-fired thermal power plants planned for regions such as Eastern Europe and Asia, as well as the replacement of aging plants in Europe and the USA, demand is forecast to remain strong. Meanwhile, many nations, including the UK and the Republic of Lithuania, are continuing with plans for nuclear power plants, even after the Great East Japan Earthquake. Also, installation of renewable energy is accelerating around the world, and the market for electric power transmission and distribution is expected to expand, particularly in emerging economies.

Recognizing these market conditions, Hitachi's strategy is to continue the active development of its overseas businesses.

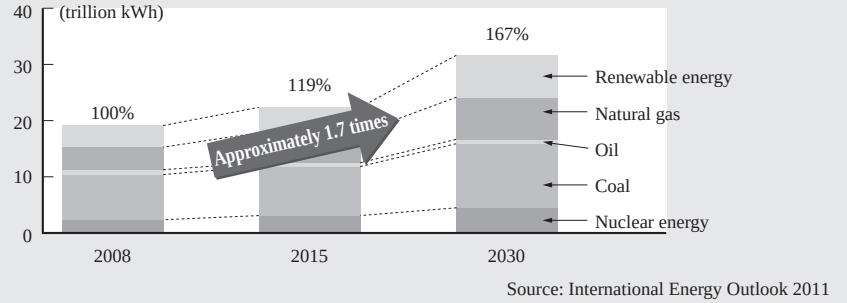
ACCELERATING GLOBALIZATION

In addition to supplying appropriate solutions to their target markets, the aims of Hitachi's various overseas electric power business operations include strengthening their marketing capabilities in all parts of the world, including nations such as India and the Republic of South Africa, so that they can offer solutions that extend across all areas from electric power generation to distribution, and boosting their engineering capabilities and their ability to undertake overseas procurement and manufacturing (see Fig. 2). To increase the proportion of overseas sales (sales outside Japan), Hitachi is undertaking a reorganization of its procurement offices to improve cost-competitiveness, making active use of overseas production facilities, and encouraging local management of business activities. These policies are included in the Hitachi Smart Transformation Project(a). Other initiatives associated with overseas procurement include taking active steps to standardize equipment specifications and sharing vendor information to cut procurement costs.

THERMAL POWER BUSINESS

Thermal power accounts for approximately 60% of global electricity demand, and consists primarily of power generated from coal or natural gas. Highly efficient, coal-fired electric power generation systems are among Hitachi's key products, with approximately 30 units currently under construction. Three operational hubs located in Japan, the USA, and Europe, with another facility in India, drive the global activities of this business. As many coal-fired electric

(a) Hitachi Smart Transformation Project
A project being undertaken by Hitachi to improve cost-competitiveness, with the aim of achieving further growth in the global market. Formulated in FY2011, the project aims at cutting the total cost of sales in FY2015 by 5% relative to FY2010 by improving cost structures.



Source: International Energy Outlook 2011

Fig. 1—Predicted Global Electric Power Generation (by Energy Source).
Global electric power generation is predicted to grow strongly, reaching about 1.7 times 2008 levels by 2030.

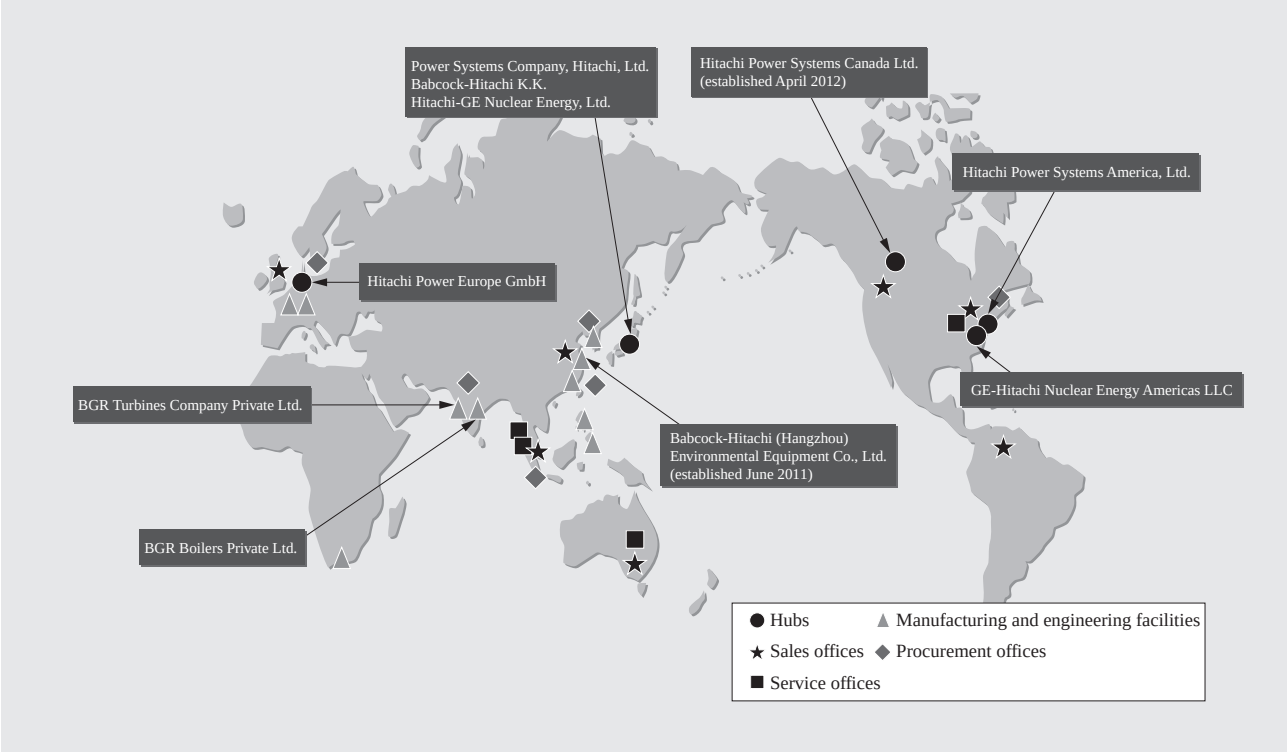


Fig. 2—International Operations.
The operational hubs of Hitachi's electric power business are located in Japan, America, and Europe, with manufacturing, engineering, procurement, and other facilities located around the world.

power plants are aging, particularly in Europe, the market for large plant upgrades is expected to grow, and Hitachi is working through its own operations and local partners to win orders for these upgrade projects.

Hitachi's overseas activities in the gas-fired electric power generation market are based around the H-25 Series gas turbine (30-MW-class output), which features high reliability and easy maintenance. More than 150 H-25 units have been delivered to customers around the world. As with its coal-fired electric power generation products, the business is structured such that maintenance services are provided from Hitachi's local operations, while core high-temperature components are currently supplied from Japan because of their high added value. However, because gas turbines are recognized as a strategic product, Hitachi is looking to achieve further cost reductions by utilizing a production facility in Dalian in the Liaoning Province of China to assemble gas turbines.

In addition to improving plant performance, Hitachi's thermal power business is also taking steps to increase sales of environmentally conscious systems such as NO*x* removal system, and to comply with more stringent environmental regulations being adopted in various nations. Stronger regulation of nitrogen oxide (NO*x*) emissions means that market growth is anticipated in China in particular, where considerable activity is taking place in the field of coal-fired power plant construction. In addition to the importance of measures that also cover existing plants, Hitachi is responding to the anticipated entry of Chinese manufacturers into the market by building a plant in China to produce the catalyst used in NO*x* removal system, and is deploying its products into the world's largest market (see Fig. 3). Meanwhile, carbon dioxide (CO_2) capture and storage (CCS[(b)]) is a new technology attracting interest around the world. With the aim of achieving early commercialization, Hitachi has signed a contract with the Saskatchewan Power Corporation, Canada for the construction of a carbon capture test facility (CCTF) that captures CO_2 from the flue gas of coal-fired power plants (see Fig. 4).

The main overseas subsidiaries of Hitachi's thermal power business are Hitachi Power Europe GmbH (HPE) and Hitachi Power Systems America, Ltd. (HPSA).

(b) CCS
An abbreviation of "carbon capture and storage," CCS is the technology for separating and capturing CO_2 from sources such as thermal power plants and natural gas fields, and storing it in stable geological strata or sequestering it in the ocean. The two main methods of CO_2 separation and capture are chemical absorption and oxy-fuel combustion.

Fig. 3—Denitrification Catalyst Factory in Hangzhou, China.
Rapid growth is anticipated in the Chinese market because nitrogen oxide (NOx) regulations are more stringent even than those in Japan, Europe, and the USA, and because a government subsidy program has been introduced.

Fig. 4—Signing of CCTF Contract.
As part of a clean coal project being undertaken by the Saskatchewan Power Corporation, Canada, Hitachi and SaskPower will collaborate on the construction of a carbon capture test facility that captures CO_2 from the flue gas of a coal-fired power plant, and also on experimental testing at the facility.

NUCLEAR POWER BUSINESS

Nuclear power generation can be thought of as an effective form of power generation for protecting the global environment, with benefits that include minimizing CO_2 emissions. Overseas, the intention to proceed with plans for nuclear power exists in a number of nations, including Lithuania, the Socialist Republic of Viet Nam, India, the Republic of Poland, and the UK, and it is anticipated that demand for nuclear power plants will continue in the medium to long term. Hitachi has established a "one team" collaboration with General Electric Company (GE) of the USA.

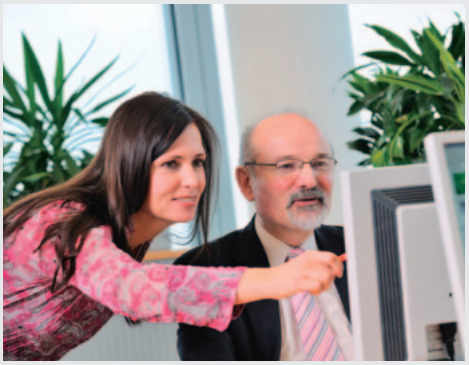
Hitachi and GE merged their nuclear power businesses in 2007, establishing Hitachi-GE Nuclear Energy, Ltd. and GE-Hitachi Nuclear Energy Americas LLC, which handles business outside Japan. Drawing on synergies between the two companies, these operations are able to supply high quality services that extend across research, design, fabrication, construction, and maintenance of light water reactors, fast-breeder reactors(c), and the nuclear fuel cycle.

Hitachi has recently been involved with the construction project for the Visaginas Nuclear Power Plant in Lithuania. Hitachi intends to continue its engagement with those nations that have an interest in nuclear power generation, and to supply nuclear power generation technology with high levels of safety and reliability.

The advanced boiling water reactor (ABWR(d)) developed in collaboration with Japanese power

(c) Fast-breeder reactor
A type of nuclear reactor that uses mixed oxide fuel containing both plutonium and uranium. While also generating electric power, a fast-breeder reactor produces more fuel than it consumes because some of the high-speed neutrons produced by the nuclear fission of plutonium transform uranium-238 into plutonium. The efficiency with which uranium material is consumed is dramatically higher than for a light water reactor

President's View 1



Staff at Hitachi's European subsidiary, Hitachi Power Europe GmbH

Klaus Dieter Rennert
CEO, Hitachi Power Europe GmbH

A 100-year track record in power plants, efficient products, and a highly motivated workforce: that is Hitachi Power Europe GmbH (HPE). We rank amongst the market and technology leaders in power plant construction, supplying key components such as utility steam generators, environmental engineering equipment, and turbines.

HPE's history goes back to 1898 and the establishment of Deutsche Babcock & Wilcox Dampfkessel-Werke AG in Berlin, Germany. In 2003, Babcock-Hitachi K.K. acquired the power engineering division (including the steam generator and combined cycle power plant departments) of the former Babcock Borsig Group. Following a full takeover by Hitachi, the company was renamed Hitachi Power Europe GmbH in 2006. The company subsequently shifted its head offices to Duisburg in North Rhine-Westphalia in 2007. Including subsidiaries, HPE employs approximately 1,800 staff (as of April 2012). In addition to power plant engineering and the supply of key components, HPE is also engaged in proactive clean ("green") energy businesses, including energy storage and the generation of electric power from biomass. The company has a lengthy and extensive track record in energy plant engineering and construction, not only in Germany but throughout the world, including work in Central and Eastern Europe, the Republic of South Africa, and India. Since 2007, HPE has installed or is currently constructing more than 20,000-MW of capacity.

An example is the two units for the Moorburg coal-fired power plant in the Port of Hamburg that, on completion, will be one of the most modern power plants of its kind in the world, with an efficiency of 45% or more. The high net efficiency provides not only a considerably greater output but also saves on resources (uses less fuel) compared to power plants constructed in the past. This also helps reduce specific emissions of CO_2, one of the causes of global warming.

A good example of the development of new markets is a project currently underway in South Africa. In early 2008, HPE has been awarded a contract by Eskom, a South African energy supplier, for 12 coal-fired, 800-MW utility steam generators. HPE and Hitachi Power Africa Pty Ltd. (HPA), our South African subsidiary, are constructing the key components for both of the project's power plant sites, Medupi and Kusile. The scope of this major order extends from design engineering to procurement and commissioning. Drawing on its 100 years or more of know-how and experience, HPE intends to continue to delivering a wide range of solutions for power plants.

companies that operate BWRs(e), GE, and Toshiba Corporation features simple construction and excellent economics, and it represents a form of electric power generation that is competitive with other energy sources because its low core output density means that output can easily be increased. The system provides easy ways for achieving higher burnup and has excellent fuel economics because of its ability to burn uranium fuel more efficiently than pressurized water reactors (PWRs). For these reasons, it is anticipated that the project in Lithuania will select a generation III + ABWR design as this is most up-to-date reactor design in actual operation, recognizing the reliability and operational experience that Hitachi-GE has built up with the ABWR.

GE-Hitachi is also taking a central role in developing the economic simplified boiling water reactor (ESBWR(f)).

Canada is the world's largest producer of uranium, the fuel used in nuclear power plants. Hitachi-GE is also working with the Government of Saskatchewan (where all Canadian uranium production takes place) on the joint research of small modular reactor designs and technology.

Nuclear power generation is an effective electric power generation technology for protecting the global

(d) ABWR
An abbreviation of "advanced boiling water reactor." ABWRs are intended to provide improvements that include better safety, making the nuclear reactor containment vessel and building more compact, and reducing radiation dose during maintenance inspections by relocating the recirculation pumps to the bottom of the pressure vessel, instead of outside the nuclear reactor pressure vessel as on conventional BWRs. Through enhancements that include improvements to the control rod drive mechanism, use of a nuclear reactor containment vessel made of reinforced concrete, better emergency cooling for the core, the adoption of digital technology, and improvements to the human-machine interface, the ABWR is intended to improve on the safety, reliability, operational characteristics, controllability, and other features of the BWR. Other advantages include economics and less radioactive waste material.

(e) BWR
An abbreviation of "boiling water reactor." Reactors that use light water (ordinary water) as a moderator and coolant can be broadly divided into BWRs and pressurized water reactors (PWRs). BWRs operate with the cooling water in a state of boiling so that the nuclear reactor pressure vessel acts as a steam generator. The resulting steam is supplied directly to a turbine to generate electric power. In contrast, the cooling water in a PWR is at high temperature and pressure, and this high pressure prevents it from boiling. This high-temperature, high-pressure water is supplied to a steam generator where a heat exchanger produces steam that is used to turn a turbine and generate electric power.

President's View 2

Henry E. Bartoli
President and CEO, Hitachi Power Systems America, Ltd.

New Jersey office of Hitachi Power Systems America, Ltd.

Hitachi Power Systems America, Ltd. (HPSA) is located in Basking Ridge, New Jersey and is responsible for sales and marketing, project execution, engineering/design, and procurement for all of Hitachi's global energy products. This consists of advanced pulverized coal boilers, heat recovery steam generators, steam, gas and hydro turbines and generators, substation equipment, and air quality control systems for new plants and retrofit applications. As a single-point supplier, HPSA offers total solution services including operation and plant assessments, engineering studies, performance optimization, emissions improvement, equipment replacement and upgrades, and spare parts.

HPSA's mission is to provide state-of-the-art equipment and services that support the improvement of efficiency and reduce the environmental impact of new and existing facilities in the thermal, nuclear, and renewable markets. The landscape of the US generation market continues to change due to uncertainty in regulation, limited demand growth, economic conditions, abundance of cheap gas, political outcomes, and so on. One area where HPSA has focused its efforts is on the development of air quality control technologies for pollution reduction. Due to stringent US regulations regarding emissions from power plants, HPSA has enhanced its portfolio of products for this market, including the recent signing of license agreements with Balcke-Dürr GmbH for fabric filter technology (in the fall of 2011) and with Solios Environment Inc. for dry scrubber technology (in March, 2012). With these two additional critical products, HPSA now offers comprehensive total pollution control systems to mitigate sulfur and nitrogen oxides as well as particulate matter, mercury, and other hazardous pollutants.

Even with all the unknowns in the marketplace, HPSA's goal is to position ourselves for future markets with technology, products and services that meet customers' needs.

environment for reasons that include reducing CO_2 emissions and being part of the best mix of energy sources, and it has also been treated as an important national policy in Japan. Hitachi-GE has continuous and deep experience in the construction of nuclear power plants in Japan, and intends to respond to demand from around the world in the future by drawing on the lessons from the accident at the Fukushima Daiichi Nuclear Power Station following the Great East Japan Earthquake to develop an ABWR with even higher levels of safety.

ELECTRIC POWER TRANSMISSION AND DISTRIBUTION BUSINESS

Together with advances in nuclear, thermal, and renewable power generation technology, improvements in electric power transmission and distribution technology will be essential to achieving balanced progress in the field of electric power.

Developed economies currently have a requirement for the upgrading of aging transmission infrastructure, and there is also a need to build up the transmission infrastructure in emerging economies where growth in energy demand is strong. Meanwhile, progress is also being made on wide-area interconnections, including between multiple countries and across continents and oceans, applications that require ultra-high-voltage alternating current and direct current transmission of electric power. Grid stabilization systems for electric power transmission networks are required to cope with greater generation of renewable energy with fluctuating output, and rapid progress is being made on smart grids that use electric power efficiently. The Japanese government is currently considering a scheme in which electric power companies will need to separate electric power transmission and generation, and Hitachi is watching developments closely as it considers what specific measures it can take to make a contribution.

From its engineering offices, manufacturing facilities, and other operations throughout the world,

(f) ESBWR
An abbreviation of "economic simplified boiling water reactor," the ESBWR is a BWR technology with improved safety and economics achieved through a simpler system design, including taking advantage of the boiling that occurs in the reactor (a characteristic of BWRs) to achieve natural circulation of water in the reactor, use of gravity-fed water from a pool above the reactor to cool the core during an emergency, and use of natural thermal radiation to minimize the pressure in the containment vessel.

President's View 3

Local and Japanese staff at Hitachi T&D Systems Asia Pte. Ltd. in the Republic of Singapore

Junji Sato
President, Hitachi T&D Systems Asia Pte. Ltd.

Japan AE Power Systems Asia Pte. Ltd. was established in the Republic of Singapore in 2004. It was subsequently renamed Hitachi T&D Systems Asia Pte. Ltd. in April 2012 as part of the restructuring of Japan AE Power Systems Corporation, becoming a local subsidiary of the Transmission & Distribution Systems Division of the Power Systems Company of Hitachi, Ltd.

With activities based mainly in Southeast Asia, the company's business is mainly in the engineering, procurement, and construction of substation equipment such as transformers and circuit breakers that are essential components of electric power transmission & distribution systems. Maintenance services represent another key pillar of our business. Singapore has a large number of substations supplied by Hitachi in the past, and we have built up a track record in the maintenance of this equipment and in extending its operating life. We are also expanding our activities further afield, including to Hong Kong, China and the Kingdom of Saudi Arabia. Similarly, PT. Hitachi Power Systems Indonesia operates a circuit breaker production facility for the Transmission & Distribution Systems Division in the Republic of Indonesia. In addition to serving the domestic market, this plant exports products to North America, the Near East, and the Middle East, and is also expanding sales of Indonesian-made products to Southeast Asia in particular.

Drawing on experience with substation construction engineering, we have recently become involved in photovoltaic power generation systems. We constructed a 1.2-MW megasolar power plant in Brunei Darussalam in 2010, and are currently working on a project in Kuala Lumpur, Malaysia.

With the building of electric power infrastructure likely to continue in the nations of Southeast Asia, our aim is to strengthen the engineering capabilities we have built up through our past experience so that we can offer solutions to our customers that optimize the overall power system rather than being limited to individual substations. We intend to work together with our many international partners to supply system solutions to the nations of Southeast Asia.

Hitachi meets the needs of different nations by supplying advanced technologies as a total package. Hitachi contributes to the provision of electric power grids in nations around the world by supplying solutions that include grid stabilization systems, smart grid systems, energy management systems, and electric power distribution management systems.

In April 2012, Hitachi signed a comprehensive agreement for collaboration in the electric power industry with Federal Grid Company of Unified Energy System, an electric power transmission company in the Russian Federation. Hitachi will plan and implement a wide range of collaborative technology trials and demonstration projects, including improvements to energy efficiency in Russia, energy conservation at load dispatch offices, remote monitoring and diagnosis of substations, and improvements in the stability and reliability of large power grids.

Following dissolution of the joint-venture Japan AE Power Systems Corporation, Hitachi, Ltd. also established a Transmission & Distribution Systems Division at its Power Systems Company in April 2012, with responsibilities that include the electric power transmission and distribution business. While Hitachi's transmission and distribution business has already sought to utilize overseas production, particularly in response to demand for upgrades or enhancements to overseas transmission system infrastructure, it is taking active steps to invest in more extensive global operations in the future, with plans to establish and strengthen overseas engineering offices, manufacturing facilities, and other operations. In particular, Hitachi is expanding its manufacturing operations in China and Indonesia to supply enhancements to transmission infrastructure needed to cope with the strong growth in energy demand in emerging economies. One such overseas subsidiary of Hitachi's electric power transmission and distribution business is Hitachi T&D Systems Asia Pte. Ltd.

RENEWABLE ENERGY BUSINESS

Wind, photovoltaic, hydro, and other forms of clean renewable energy contribute to the realization of a low-carbon society, and demand is expected to remain strong throughout the world in the future.

Hitachi is focusing on increasing sales of renewable energy systems based on wind or photovoltaic power and on the development of systems in the smart grid field for stabilizing the output of renewable energy to the grid (using techniques such as storage battery systems for smoothing output fluctuations).

Hitachi supplies a downwind turbine system and has already received orders in Japan for more than 70 wind power generation systems (of which 15 are offshore installations). Hitachi, Ltd. acquired the wind power generation systems business of Fuji Heavy Industries Ltd. in 2012. In addition to receiving a boost from the feed-in tariff (FIT) scheme adopted in Japan, Hitachi has plans to become actively involved in the global market through the development of a floating offshore wind power generation system that has the potential to become a future global standard. In the field of photovoltaic power generation, Hitachi acts as a system integrator supplying total systems for megasolar power generation. The combined capacity of 1-MW or larger systems installed in Japan to date totals 16 MW. Hitachi's total solutions for wind or photovoltaic power generation systems include techniques for smoothing fluctuations in output power using equipment such as power conditioners and storage batteries.

For its hydro power generation operations, Hitachi has established a joint-venture company with partners that include Mitsubishi Heavy Industries, Ltd. and Mitsubishi Electric Corporation. Demand in Japan is anticipated from upgrades, after-sales service, and power uprating of existing power plants. Overseas, meanwhile, strong demand is anticipated from places such as China, Central and South America, and India that have extensive water resources. With overseas suppliers having a greater presence in the market, Hitachi is taking active steps toward overseas operations, including for its manufacturing facilities.

WORKING TOWARD GLOBALIZATION OF ELECTRIC POWER BUSINESS

Based around its operational hubs, Power Systems Company of Hitachi, Ltd. takes a global approach to engineering, manufacturing, and procurement across its entire electric power business. It is working toward the globalization of its electric power business through a "one team" collaborative organization in which Babcock-Hitachi K.K., Hitachi-GE Nuclear Energy, Ltd., and its other regional subsidiaries work together as part of the Hitachi Group.

ABOUT THE AUTHOR

Hiraku Ikeda

Joined Hitachi, Ltd. in 1980, and now works at the Strategy Planning Division, Strategic Management Division, Power Systems Company. He is currently engaged in the strategic planning, public relations, and government relations. Mr. Ikeda is a member of The Japan Society of Mechanical Engineers, the Gas Turbine Society of Japan, and the Thermal and Nuclear Power Engineering Society.