Hitachi's Recent Efforts to Cope with Growing Global Nuclear Energy Market

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OVERVIEW: The current state of the international nuclear power market is that numerous countries have re-evaluated nuclear energy and announced plans to construct new nuclear power stations underpinned by concerns such as global environmental problems and sudden rises in energy prices. In response to this globalization of the market, establishing international collaborative partnerships between companies in the industrial sector and elsewhere has become an important strategy for operating a global business. General Electric Company has been a partner to Hitachi since the latter first entered the nuclear business. Hitachi, Ltd. decided to integrate its nuclear power business with that of GE and in 2007 established GE-Hitachi Nuclear Energy Americas LLC in the USA and Hitachi-GE Nuclear Energy, Ltd. in Japan. Hitachi, Ltd. and GE are utilizing their respective strengths to expand their nuclear power businesses globally based around these two companies. As part of this initiative, they established the ABWR Project Office in San Jose, California in the USA in April 2008 with the aim of winning new orders for ABWRs in the USA.

INTRODUCTION

COUNTRIES around the world are currently experiencing a nuclear energy renaissance. Behind this is a recognition of the nuclear energy's role as an

Fig. 1—ABWR Project Office, San Jose.
GE-Hitachi Nuclear Energy Americas LLC and Hitachi-GE Nuclear Energy, Ltd. jointly established the ABWR Project Office in San Jose, California in the USA to establish the international standard unified ABWR with the aim of winning orders for the ABWR in the USA.

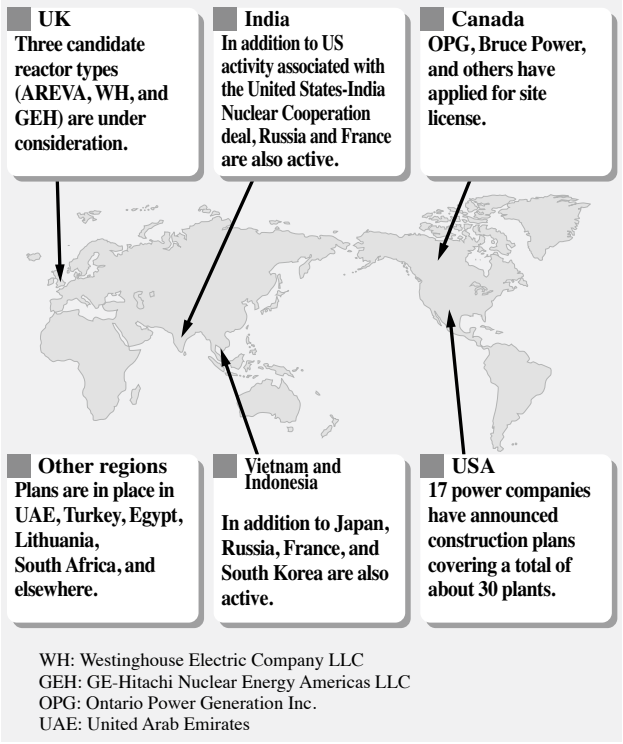

Fig. 2—Global Expansion of Nuclear Energy Renaissance. Nuclear power generation has a role as an effective tool for solving global energy issues and countries from around the world are proceeding with plans for new nuclear power plant construction.

effective tool for dealing with global energy issues such as sudden rises in energy costs, the importance of energy security, and global environmental problems. In the USA, construction of new nuclear power generation has been frozen since the accident at the Three Mile Island nuclear power plant in 1979. In recent years, however, nuclear power plants have had a good operating record and another factor in the recent resurgence of nuclear energy has been the decision by the Bush administration at the time to change policy towards encouraging the expansion of nuclear energy.

At the instigation of the government, the USA has since proceeded with various different measures aimed at promoting new construction. In particular, the incentives offered by the Energy Policy Act passed in August 2005, which included tax incentives for new nuclear power plant construction and government guarantees for financing, encouraged many power companies to start considering the building of new nuclear power plants and to date plans have been announced to proceed with approximately 30 such new plants.

As shown in Fig. 2, plans for the construction of new nuclear power plants are also underway in numerous countries outside the USA.

This article describes how the integrated nuclear power business of Hitachi, Ltd. and General Electric Company (GE) is responding to this globalization of their industry.

INTERNATIONAL CIRCUMSTANCES REGARDING NUCLEAR ENERGY

Although the expansionary trend in the international nuclear energy market continues to intensify, various issues relating to the construction of nuclear power plants have come to the fore.

The first is the issue of nuclear non-proliferation. As the number of countries adopting nuclear power for the first time increases, there have been moves to establish an international framework to allow this expansion in the peaceful use of nuclear energy to coexist with nuclear non-proliferation. In addition to the GNEP (Global Nuclear Energy Partnership) proposal from the USA and Russia's "International Nuclear Fuel Cycle Center Plan," Japan is also looking to be an active participant in the creation of such international frameworks, including support for the international expansion of the nuclear power industry as part of its "Nuclear Energy National Plan."

The second issue is the large initial investment required to construct a nuclear power plant and the investment risk faced by any utility that builds such a plant. This includes how to overcome these issues associated with financing and the time required to get a return on investment, and cost-related risk management issues such as construction schedule overruns or sudden increases in materials and labor costs.

The third issue relates to the technical capabilities of suppliers. The number of new nuclear power plant construction projects has decreased since the mid-1970s and most new construction over the past decade has occurred in certain parts of Asia, specifically in Japan, China, and South Korea. This has led to concerns about a lack of experience amongst nuclear power plant contractors and suppliers and the construction industry in America and Europe. This situation can be seen as raising expectations for Japanese companies because of their manufacturing capabilities for key items of equipment and uninterrupted experience in the successful completion of construction projects.

To respond to this expansion in the nuclear power

Fig. 3—Organization for Taking Advantage of Synergies Between GE and Hitachi.
GE and Hitachi, Ltd. have built up their businesses based on BWR technology and numerous opportunities for synergy exist between the two companies. A "Global Advisory Committee" has been established to take advantage of these synergies.

market, the situation described above calls for a strategy in which international collaboration plays an important role, not only through international cooperation at the government level, but also in the supply of technology and equipment and in the construction of nuclear power plants. It was this background that led to the integration of the nuclear energy businesses of Hitachi, Ltd. and GE in 2007.

INTEGRATION OF NUCLEAR ENERGY BUSINESSES OF HITACHI AND GE

Background and Significance of Merger

The link-up between the nuclear energy businesses of Hitachi, Ltd. and GE was announced in stages[(1)] with GE-Hitachi Nuclear Energy Americas LLC (GEH) established in the USA and GE-Hitachi Nuclear Energy Canada Inc. (GEH-C) established in Canada, both in June 2007, followed by the new company Hitachi-GE Nuclear Energy, Ltd. established in Japan in July of the same year. The business structure has remained the same since then.

The integration was aimed at expanding the companies' businesses in the growing global market through greater competitiveness achieved by utilizing both companies' nuclear power business resources each other.

Hitachi's entry into the field of nuclear power technology started with the adoption of BWR (boiling water reactor) technology from GE and Hitachi has since supported the further development of BWR technology together with GE.

The main reactor types currently competing in the international nuclear power market are the BWR and PWR (pressurized water reactor), and Hitachi and GE believed that they needed to combine their business resources and adopt a common strategy to promote the BWR globally.

The collaboration is aimed at supplying more integrated products and services based on a complementary relationship that utilizes the companies' respective strengths. Hitachi's strength lies in its research and development capabilities that support future business development and in its integrated engineering capabilities which are based on its manufacturing capabilities and uninterrupted experience in the construction of nuclear power plants in Japan. By fulfilling these roles effectively, Hitachi believes it can enhance its competitiveness and integration capabilities as a plant contractor to achieve its goal of expanding its business in the global market.

Taking Advantage of Synergies

GE and Hitachi, Ltd. have built up their businesses based on BWR technology and numerous opportunities for synergy exist between the two companies. Examples include joint research, sharing design resources, joint purchasing, and encouraging the use of both companies' manufacturing facilities each other. A "Global Advisory Committee" has been established amongst the new companies to provide a mechanism for encouraging these synergies (see Fig. 3) and to use teamwork to establish more efficient business practices by taking the best that each company has to offer in various different business processes including research and development, design, manufacturing, and procurement. As part of this plan, work is currently in progress on establishing the systems to take advantage of Hitachi's "research and development capability," "integrated engineering capability," and "manufacturing capability" strengths.

Taking Hitachi's ABWR Construction Experience Global

Currently, Japan has four ABWR (advanced BWR) power plants in operation, including Units 6 and 7 at the Kashiwazaki-Kariwa Nuclear Power Station of The Tokyo Electric Power Co., Inc. which were the first to be constructed. Also, Unit 3 at the Shimane Nuclear Power Station of The Chugoku Electric Power Co., Inc. and the Oma Nuclear Power

Station of the Electric Power Development Co., Ltd. are currently under construction. All of these ABWR construction projects have been run by Hitachi. This extensive experience will be an advantage for Hitachi in minimizing the risks in undertaking overseas ABWR construction projects in the future.

(1) The technology is already in operation and has been verified technically. Licensing risk is also reduced because design certification has already been obtained in the USA by GEH.

(2) The risk of design changes being required during detailed design can be reduced by utilizing the extensive engineering data obtained during construction in Japan. The risk of changes in procurement and/or installation costs can also be reduced because quantities can be estimated at an early stage.

(3) Experience in the use of the latest construction techniques such as large cranes and large modules also resolves problems such as construction schedule control and obtaining on-site personnel which present the greatest risks in terms of the project schedule. With the aim of winning orders for the ABWR in the USA, the ABWR Project Office was jointly established with GEH in San Jose, California in the USA in April 2008 to create unified ABWR that complies with US regulatory requirements and international codes and standards by using the latest ABWR specifications and construction experience in Japan as a base.

Technical Contribution to ESBWR Development and Construction

In parallel with the ABWR, a new type of reactor called the ESBWR (economic and simplified BWR) is currently under development in the USA. The ESBWR sets out to provide a nuclear reaction system concept that retains the characteristic simplicity of BWRs with the aim of improving reactor economics by using natural circulation and passive safety systems to employ fewer pumps, valves, and motors and reduce construction and maintenance costs.

The ESBWR is currently in the U.S. Design Certification process and GEH has led related work. In addition to helping with the design certification work in areas such as analysis, Hitachi is also supporting the detailed design of equipment with new design elements such as structural components in the reactor, the control rod drive mechanism, and storage containers by utilizing its design and manufacturing capabilities for key items of equipment (see the article in the current issue entitled "Development of Next-generation Boiling Water Reactor").

Development of ACR-1000 and Contribution to Commercialization

In addition to BWRs and PWRs, another type of reactor under operation in the world is the heavy water reactor. Canadian entity, GEH-C, formed by GE and Hitachi, Ltd. has taken over CANDU fuel and reactor equipment businesses that used to be a part of GE Canada's nuclear business.

Atomic Energy of Canada Ltd. (AECL) has been developing ACR-1000 heavy-water-moderated, light-water-cooled reactor and GEH-C is supporting this new CANDU reactor as a member of Team CANDU along with Hitachi, Ltd. which is supplying turbines, generators and distributed control systems. This is another area of business where the two companies share a common strategy. ACR-1000 has also taken advantage of the experience Hitachi gained through "Fugen" reactor which is of the same type.

FROM THE MERGED BUSINESS WORKPLACE

Applying Design and Manufacturing Technology in the USA

To comply with the contract terms for supplying nuclear reactor equipment to Lungmen in Taiwan, Hitachi reacquired certification from the American Society of Mechanical Engineers (ASME) (what is known as "N code symbol stamp" certification) in 1997 and has maintained that certification since (see Fig. 4). This involves establishing a quality assurance program that complies with the ASME codes and standards (which specify standards for design, manufacture, inspection, and similar) required by regulations in the USA, primarily for components that have pressure boundaries.

This quality assurance program is currently being revised based on the requirements specified in the 10CFR21 and 10CFR52 (CFR: Code of Federal Regulations) rules (Combined Construction and Operating License) and elsewhere to satisfy the regulatory requirements for constructing nuclear power plants in the USA. This review is being undertaken with the full cooperation of GEH.

Sharing and Conversion of Engineering Data

To perform engineering work efficiently on a global basis, a base system that allows data to be shared with partner companies and customers in the

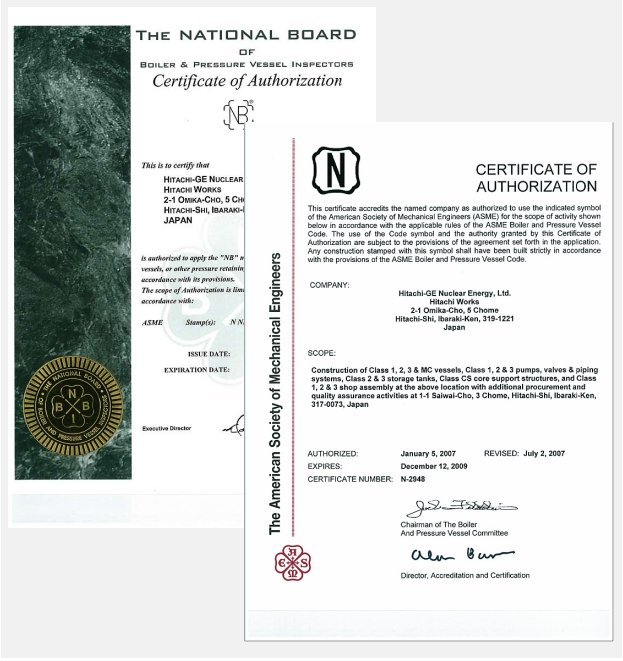

Fig. 4—ASME Certification and Registration with National Board.
Because certification by the American Society of Mechanical Engineers (ASME) remains valid for three years, an ASME survey team carries out a survey every three years to renew certification. To demonstrate the capability to perform design, manufacture, and inspection in accordance with ASME standards, an actual demonstration fabrication is undertaken so that it can be audited.

USA is required to make effective use of the latest ABWR design resources from Japan.

Although Hitachi uses an in-house CAD (computer-aided design) system for projects in Japan, GEH and other nuclear plant contractors/subcontractors in North America use the SmartPlant system from Intergraph Corporation. Accordingly, the data conversion system shown in Fig. 5 is being developed and infrastructure systems are planned to be introduced for sharing this data.

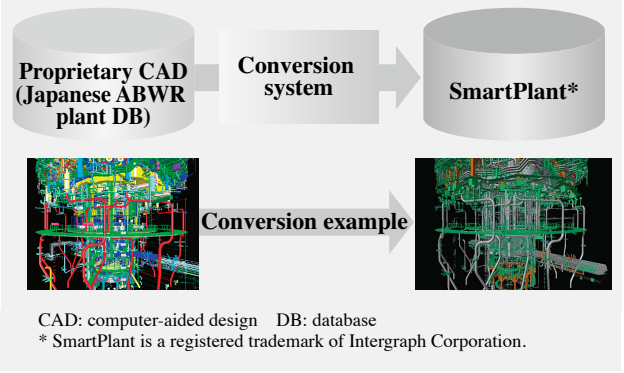

Fig. 5—Engineering Data Conversion System.
The engineering data conversion system allows design resources from the latest Japanese ABWR to be utilized and data to be shared with partner companies such as GEH.

CONCLUSIONS

This article has described some specific examples of the response to globalization by the integration of the nuclear power businesses of Hitachi, Ltd. and GE.

Hitachi-GE Nuclear Energy, Ltd. and GE-Hitachi Nuclear Energy Americas LLC are working to expand their business in a nuclear power market that is growing globally and improve their competitiveness by exploiting synergies to help solve global environmental problems and other global energy issues.

REFERENCE

(1) M. Hanyu, "Challenges to Achieve Globalization of Nuclear Business," Hitachi Hyoron **90**, pp. 153 - 155 (Feb. 2008) in Japanese.

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