

Hitachi's Involvement in Use of Nuclear Power Generation to Resolve Energy Issues

Masahiko Nakane
Takashi Masui
Masahiro Hamamoto
Mizuki Igarashi

OVERVIEW: Despite significant changes in the status of nuclear power generation around the world since the accident at the Fukushima Daiichi Nuclear Power Station of Tokyo Electric Power Co., Inc., considerations such as global environmental problems and energy security mean that many countries still have plans to introduce nuclear power under study or in progress. Regarding the adoption of nuclear power generation by countries that are pursuing the peaceful use of nuclear energy, Hitachi is collaborating with its BWR technology partner, GE-Hitachi Nuclear Energy Americas LLC, to make further safety improvements and to work toward resolving global energy issues.

INTRODUCTION

WHEN the future of nuclear power is considered, factors such as the shale gas (unconventional natural gas) revolution in the USA and changes in policy by national governments after the accident at the Fukushima Daiichi Nuclear Power Station mean that circumstances have changed significantly from the “nuclear renaissance” that people spoke of only a few years ago. Nevertheless, highly economic nuclear power has a contribution to make to society and still retains an important role as a way of overcoming global challenges such as global environmental problems and energy security. Keeping in mind the opportunity to enhance safety further by learning from the accident, those countries that have a policy for utilizing nuclear power are proceeding with plans for new nuclear power plants, and are pressing ahead with their implementation. Meanwhile, human resource development is a critical issue for those countries with plans to introduce nuclear power generation for the first time, and there is a need for cooperation through international aid.

This article describes Hitachi's involvement in the nuclear power business in major markets, focusing in particular on the activities of Hitachi-GE Nuclear Energy, Ltd. (HGNE).

ACTIVITIES IN REPUBLIC OF LITHUANIA

The Republic of Lithuania operated two nuclear reactors at the Ignalina Nuclear Power Plant built when the nation was still part of the Soviet Union, and was an exporter of electricity with nuclear power accounting for approximately 80% of its total power

generation. However, because the Ignalina power plant used the same light-water-cooled, graphite-moderated reactors as the Chernobyl Nuclear Power Plant, Unit 1 was shutdown in late 2004 and Unit 2 in late 2009 as part of the terms of the nation's accession to the European Union (EU), and the reactors are

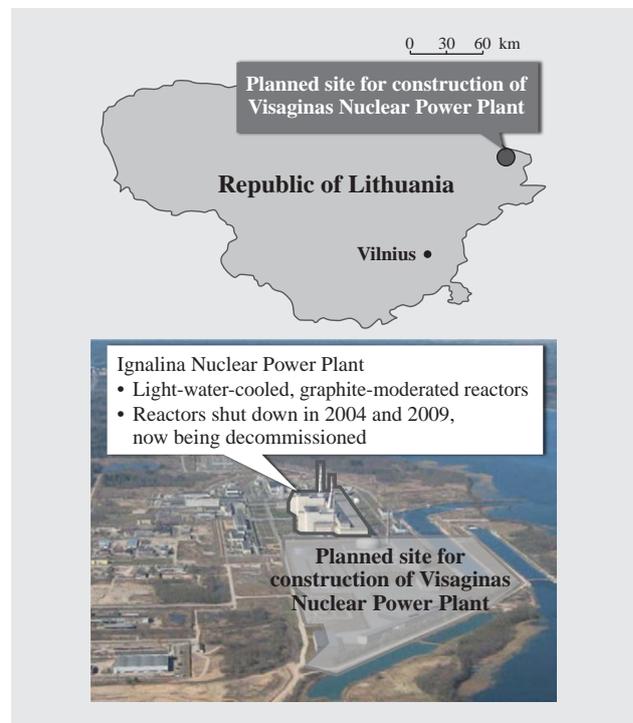


Fig. 1—Planned Construction Site of Visaginas Nuclear Power Plant.

The Visaginas Nuclear Power Plant is to be constructed on a site adjacent to the existing Ignalina Nuclear Power Plant (currently being decommissioned).

now being decommissioned. As a result, Lithuania is now a net electricity importer. When imports of natural gas are included, the nation is dependent on the Russian Federation for approximately 80% of its energy consumption.

To overcome this problem of energy security, the three Baltic states, the Republic of Lithuania, the Republic of Estonia, and the Republic of Latvia, together with the Republic of Poland, reached an agreement in 2006 to proceed with the construction of a nuclear power plant. Visagino Atominė Elektrinė (VAE) was established in 2008 to undertake the construction of the Visaginas Nuclear Power Plant on a site adjacent to the existing Ignalina Nuclear Power Plant (see Fig. 1).

Hitachi, Ltd. and Westinghouse Electric Company LLC entered bids in the May 2011 tender process for selecting a strategic investor (SI) to partner in the Visaginas Nuclear Power Plant construction project. Hitachi, Ltd. was subsequently appointed SI in July 2011 and given preferred bidder status for negotiating a formal order.

In addition to Hitachi's extensive construction experience in Japan, one of the factors behind Hitachi gaining preferred bidder status was the fact that it was quickly able to produce a proposal that included finance and was satisfactory to the customer by drawing on its experience and know-how in overseas engineering, procurement, and construction (EPC) projects. These have included work in the United Arab Emirates. It is also likely that this customer, who values long-term partnerships, has a high regard for Hitachi's stance of frank dealing, including in the period after the Great East Japan Earthquake.

Now that preferred bidder status has been acquired, Hitachi will be undertaking an exclusive process of negotiating and coordinating requirements with the aim of finalizing the concession agreement (CA), EPC contracts, and other arrangements with VAE, the local partners (the national electric power companies of Estonia and Latvia), and the project company (PCO) financed and set up by the SI.

Hitachi's proposal for the Visaginas Nuclear Power Plant is a 1,350-MWe-class advanced boiling water reactor (ABWR) with enhanced safety incorporating countermeasures to the accident at Fukushima Daiichi Nuclear Power Station (see Fig. 2). Hitachi then worked with VAE to finalize the technical aspects of the project's basic requirements, including the schedule and allocation of work, the checks and modifications required for the approvals process,



Fig. 2—Three-dimensional Image of Visaginas Nuclear Power Plant.

Hitachi has proposed a 1,350-MWe-class advanced boiling water reactor (ABWR) with enhanced safety incorporating countermeasures to the accident at Fukushima Daiichi Nuclear Power Station. The existing Ignalina Nuclear Power Plant (currently being decommissioned) is visible in the rear.

including the approvals agency, and the design conditions, including the geology and surrounding environment at the construction site. This phase completed in December 2011.

In June, the Parliament of the Republic of Lithuania passed a number of laws associated with the project by majority vote, including the CA. The laws were then signed by the President and put into effect. Also in June, Lithuania issued a request to the European Commission under the terms of the Euratom Treaty to which the Commission responded by issuing a statement of support for the project, indicating that the environment for the project to proceed is in place.

Following a general election and referendum in October 2012, the Lithuanian government has indicated that it will formulate a general energy policy by May 2013 and submit the laws required to implement this policy to the Parliament of the Republic of Lithuania. VAE, the local partners, and Hitachi, Ltd. in its role as the SI, intend to continue discussions on how to proceed with the project.

In addition to providing energy security for Lithuania, this project is seen as having an important role in the energy strategy of the three Baltic states, and it also plays a part in the integration with European electric power markets through the Baltic Energy Market Interconnection Plan (BEMIP).

ACTIVITIES IN ASIA

Asia is experiencing strong economic growth and many Asian nations have adopted the introduction of



Fig. 3—Image of Nuclear Power Plant for Socialist Republic of Viet Nam.

The main building and emergency equipment are located 15 m or more above sea level in case of tsunamis.

nuclear power generation by early 2020 as a national policy, with objectives that include satisfying the increase in demand for electric power brought about by this growth and reducing reliance on fossil fuels. While progress on plans for achieving this varies between nations, and some have decided to review their plans in light of the accident at Fukushima, recognition of the need for nuclear power generation in the medium to long term remains very high.

Given these circumstances, Japan and Hitachi are cooperating in a variety of ways with the introduction of nuclear power generation in neighboring Asian nations. Japan is a leader in the field of nuclear power, and Hitachi has been developing technology for nuclear power generation for many years and has built a large number of plants. Rather than just supplying nuclear power generation equipment that is safer and has excellent economics, this also represents a valuable opportunity to contribute to initiatives such as international security, the promotion of international collaboration, and cooperation on human resource development.

Socialist Republic of Viet Nam

HGNE has been supporting the adoption of nuclear power generation by the Socialist Republic of Viet Nam for many years. In October 2010, the governments of Japan and Vietnam agreed on Japan being made a partner in the construction at the second nuclear power plant site in Ninh Thuan Province. International Nuclear Energy Development of Japan Co., Ltd. (JINED) was established by Japan to coordinate nuclear power generation exports. In September 2011, JINED signed a memorandum of understanding with Vietnam Electricity Holding Company (EVN) to establish the collaborative

framework for the introduction of nuclear power generation to Vietnam with the Japanese government and private companies working together. To meet the requirements of Vietnam, HGNE has proposed ABWR technology in the form of the only third-generation-plus reactor in the world to be in actual operation. Cooperation on human resource development is also taking place, with nuclear power scholarships and the running of satellite courses at the Hanoi University of Science and Technology (HUST), and the Electric Power University (EPU) in collaboration with the Tokyo Institute of Technology (see Fig. 3).

Malaysia

Japan and Malaysia signed a bilateral cooperation agreement in 2010 aimed at establishing the basis for Malaysia's nuclear power generation plans. Following on from this agreement, a nuclear technology seminar was hosted later the same year by the Malaysian Nuclear Agency, and this was followed up with ongoing activities such as a presentation on safety improvement to local interested parties, including the Malaysia Nuclear Power Corporation (see Fig. 4). Meanwhile, Hitachi is taking advantage of the work done with Vietnam to promote cooperation on human resource development in Asia in the field of nuclear power, with programs being run for that country to be extended to Malaysia from 2013. This will involve the invitation of Malaysian students and researchers to Japan under a Hitachi nuclear power scholarship program and the hosting of satellite courses in collaboration with the Tokyo Institute of Technology.



Fig. 4—Scene from First Malaysian Nuclear Agency ABWR Seminar.

A seminar on ABWR technology in December 2010 was hosted by the Malaysian Nuclear Agency and attended by more than 120 people, including many Malaysian university academics.



Fig. 5—Construction Site Visit.

To promote understanding of nuclear power generation, relevant people from the Thai government and EGAT were shown construction technology and work in progress at the latest ABWR plant.

Kingdom of Thailand

With objectives that include meeting growing demand for electric power and reducing dependence on natural gas, the Kingdom of Thailand is planning to introduce nuclear power generation from the early 2020s. Since 2008, HGNE has been inviting interested parties, including the Electricity Generating Authority of Thailand (EGAT), to visit its factories and nuclear power plants in Japan, and also running a vigorous program of local seminars and other technology presentations (see Fig. 5). A feasibility study conducted in 2009 and 2010 selected the ABWR proposed by HGNE as one of the preferred reactor designs. Cooperation on achieving public acceptance is also ongoing, along with investigations into establishing the important underpinnings for the plans for Thailand's first nuclear power plant, including assistance with arranging an inspection of Japanese nuclear power facilities by relevant people from the Thai government in response to a request from EGAT to participate in public relations.

ACTIVITIES IN UK

Plans for New Nuclear Power Plants

The UK shifted to a policy of favoring nuclear power during the period when Gordon Brown was prime minister, with the publication by the government of an energy white paper in 2008 that included a policy of pursuing nuclear power. This was in response to the fact that, with the exception of one pressurized water reactor (PWR), all 16 nuclear power plants currently in operation in the UK are due to be shut down by

2023. Accordingly, the government selected eight sites for new plants in 2011 and awarded construction of new plants to EDF Energy, the national electric power company of France, and the Horizon Nuclear Power Limited consortium, which was owned by two German electric power companies, RWE npower plc and E.ON UK plc. The two organizations are proceeding with plans for construction, at two sites adjacent to the existing Hinkley Point and Sizewell nuclear power stations in the case of EDF Energy, and at two sites adjacent to the existing Wylfa and Oldbury nuclear power stations in the case of Horizon Nuclear Power. Since then, the owners of Horizon Nuclear Power decided for domestic reasons to sell their stakes to Hitachi, Ltd., with the sale completed in November 2012. Meanwhile, NuGeneration Limited, a joint venture between the French electric power company GDF Suez S.A. and Spanish electric power company Iberdrola, S.A., owns the Moorside site. For the remaining three sites, it is understood that they are to be sold to third parties by the current owner, EDF Energy, in accordance with the UK government's strategy, with work on new nuclear power plant construction to proceed within the UK.

Electricity Market Reform

The UK government recognizes nuclear power as a low-carbon energy source and is proceeding with laws to establish a Feed-in Tariff with Contract for Difference scheme for low-carbon electric power as part of its electricity market reform policies. The Energy Bill containing measures for electricity market reform was introduced to parliament in November 2012. If passed, it is anticipated that this bill will encourage investment by reducing the risks for investors in nuclear power.

Purchase by Hitachi, Ltd. of Horizon Nuclear Power Limited

By purchasing Horizon Nuclear Power Limited, Hitachi has acquired two sites for plant construction, at Wylfa and Oldbury. Horizon Nuclear Power Limited has plans to construct two or three 1,300-MW-class nuclear power plants at each of these sites. The target is for the first plant to commence operation in the early 2020s.

To prepare for this project, HGNE initiated discussions with the UK Office for Nuclear Regulation in December 2012 with the aim of obtaining approval for the ABWR through the UK's Generic Design Assessment (GDA) process. Hitachi has also

embarked on consultations with relevant organizations to set up a UK supply chain, and plans to form an EPC consortium in the near future.

COLLABORATIVE ARRANGEMENTS WITH GEH

HGNE and GEH, the joint-venture nuclear power companies established by Hitachi, Ltd. and General Electric Company (GE) in 2007, have been sharing resources in their nuclear power business activities. They have also strengthened their collaborative arrangements on a range of projects, with the aims of expanding their businesses in the global market and boosting competitiveness by taking advantage of synergies. In the Lithuania contract being sought by HGNE, for example, Hitachi is utilizing GEH resources such as their approvals and licensing engineering. Elsewhere, HGNE and GEH are adopting common strategies to building a marketing organization that can target specific projects in ways that draw on the respective strengths of each company.

As the two companies have based their business operations around boiling water reactor (BWR) technology, a variety of opportunities exist for exploiting synergies beyond those already quoted. Examples include utilization of the naturally circulated reactor technology from the Economic and Simplified Boiling Water Reactor (ESBWR) in the development of small BWRs, sharing of design resources, and encouraging the shared use of test facilities.

CONCLUSIONS

This article has described Hitachi's involvement in the nuclear power business in major markets, focusing in particular on the activities of Hitachi-GE Nuclear Energy, Ltd.

HGNE and GEH are pursuing a common strategy for their nuclear power businesses. By adapting to changing global markets and exploiting synergies to boost competitiveness, they intend to contribute to overcoming international challenges, such as global environmental problems and energy security.

ABOUT THE AUTHORS



Masahiko Nakane

Joined Hitachi, Ltd. in 1981, and now works at the UK Project Department. He is currently engaged in development work for overseas nuclear power business.



Takashi Masui

Joined Hitachi, Ltd. in 1987, and now works at the Business Development Department, Hitachi-GE Nuclear Energy, Ltd. He is currently engaged in development work for overseas nuclear power business.



Masahiro Hamamoto

Joined Hitachi, Ltd. in 1979, and now works at the Business Development Department, Hitachi-GE Nuclear Energy, Ltd. He is currently engaged in sales of nuclear power generation equipment, primarily for Asian markets. Mr. Hamamoto is a member of the Atomic Energy Society of Japan.



Mizuki Igarashi

Joined Hitachi, Ltd. in 2002, and now works at the Business Development Department, Hitachi-GE Nuclear Energy, Ltd. She is currently engaged in development work for overseas nuclear power business.