Generation and Transmission Technologies for Satisfying Global Energy Demand

Takashi Ikeguchi
CTO
Power Systems Company
Hitachi, Ltd.

THIS March will see the end of the second year since the 2011 Great East Japan Earthquake. While a major power crisis has been averted thanks to actions led by electric power companies to restore generation capacity as quickly as possible, and a collective effort by industry and the public to conserve power, debate continues on what constitutes the best energy mix for Japan in the post 3.11 environment.

Meanwhile, despite being beset by a range of uncertainties that extend from instability in the Middle East to the economic crisis in Europe, and changes in the energy policies of a number of countries following the disaster in Japan, the global energy market is looking forward to considerable growth in demand for energy infrastructure in the medium to long term. This will include the construction of new nuclear and thermal power plants, primarily in emerging economies; the acceleration of plans for adopting renewable energy; and the provision of electric power distribution networks.

This issue of Hitachi Review looks at the latest developments in power generation and transmission technologies for satisfying this growing, and increasingly diverse, global demand.

In the field of thermal power generation, articles describe new technologies for improving the efficiency of gas and steam turbines and measures for reducing the load placed on the environment by coal-fired power generation systems. Advanced ultra-supercritical (A-USC) generation with steam temperatures in the 700°C range and integrated coal gasification combined cycle (IGCC) technologies improve generation efficiency, and their use in combination with carbon capture and storage (CCS) radically reduces the environmental load associated with use of coal as a fuel. New technologies under development by Hitachi that open up possibilities for the future include materials capable of withstanding temperatures up to 800°C for use in A-USC, and both solid adsorption agents and chemical solvents for carbon dioxide (CO_2) absorption in CCS. These new technologies are being trialed not only in Japan, but also in collaboration with research institutions and power companies in Canada, the USA, and Europe.

Gas turbine development is all about ensuring reliability and improving performance. Hitachi's H80 features world-leading capacity and efficiency for a two-shaft gas turbine, making it suitable for upgrading aging generation systems to reduce the load on the environment. Demonstrational testing of the advanced humid air turbine (AHAT), a new type of power generation system developed in Japan, is now complete, and the innovation and effectiveness of the technology have been recognized through awards (including prizes for technical papers) from bodies such as the Gas Turbine Society of Japan and the American Society of Mechanical Engineers.

From the field of electric power distribution, articles describe the latest grid interconnection technologies and how Hitachi is establishing the production capabilities to deliver strong and smart power grids throughout the world. Other articles dealing with renewable energy focus on the development and application of a downwind wind power generation system and a highly efficient power conditioning system (PCS) for large-scale photovoltaic power generation.

Articles on nuclear power generation describe the measures being taken to enhance safety by drawing on the lessons from the accident at the Fukushima Daiichi Nuclear Power Station, and an integrated construction coordination system that adopts new methods to enhance plant construction. This system won the "Best of the Best" Award at the Be Inspired Awards 2012 run by Bentley Systems, Inc. in the USA. Meanwhile, Hitachi is continuing its work on the development of the next generation of nuclear reactors with world-leading levels of safety and economic efficiency. Developments for the future include reactor technology that incorporates inherent safety to ensure that meltdowns cannot occur.

We hope that these articles will prove useful, and will help inform you about what Hitachi is doing in the fields of electric power and energy, and where it is going with its technology.