Hitachi's Electric Power and Energy Systems

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THE use of energy is the basis of our prosperous way of life. The expansion of energy use during the 20th century was particularly remarkable, growing to such an extent that the resulting rise in the concentration of CO_2 (carbon dioxide) in the Earth's atmosphere has begun to have an influence on average temperatures. Consequently, electric power and energy systems have a major role to play in preventing global warming. Hitachi, Ltd. has developed both nuclear and renewable power generation technologies that do not release CO_2 as well as thermal power generation technology with world-leading efficiency.

In the field of thermal power generation, we have developed the A-USC (advanced ultra super critical) and AHAT (advanced humid air turbine) technologies which achieve significant improvements in generation efficiency. In the field of CCS (carbon capture and storage), we have been developing post-combustion capture and oxyfuel combustion boiler technologies in cooperation with several European universities and electric companies. As a pilot project, an integrated gasification combined cycle plant using carbon capture equipment has been constructed in Japan as part of a national project. This issue describes the latest technologies for CCS and includes a case study of a gas turbine replacement project aimed at improving efficiency.

In the field of nuclear power, General Electric Company (GE) and Hitachi have cooperatively developed highly reliable boiling water reactors [the ABWR (advanced boiling water reactor) and ESBWR (economic simplified boiling water reactor)]. We can provide our customers worldwide with choices that best fit their individual needs. This issue reports on the development of next-generation BWRs for the coming era of large-scale nuclear power plant construction, nuclear fuel cycle technologies for a future low-carbon society, and advanced inspection technologies for energy infrastructure.

Renewable energy such as hydroelectric, wind and photovoltaic power are expected to play a major role in mitigating global warming. Pumped-storage hydroelectric power plants are another valuable tool, but these require stable operation over a wide range of conditions. Using computational flow simulation, Hitachi has developed a pump-turbine that achieves a wide operating range in generating mode. Also, Fuji Heavy Industries Ltd. and Hitachi have jointly developed a 2-MW downwind turbine tailored to Japanese conditions such as updrafts and higher wind speeds on mountain slopes. A potential problem with connecting significant numbers of large wind and solar power generation systems to the electricity grid is that they may cause voltage and frequency fluctuations. In response, Hitachi has been involved in a project run by New Energy and Industrial Technology Development Organization (NEDO) that has developed a high-capacity power conditioning system for use with large scale power generation systems that can help maintain the stability of the power grid. This issue includes articles describing technologies for adjustable-speed pumped-storage systems and power stabilization for next-generation transmission and distribution networks.

Overall, this issue of the Hitachi Review covers technology development at Hitachi and its future outlook in the field of electric power and energy systems. We hope that you find this issue useful and that it may serve as a reference.