

Development and Practical Application of Combined Cycle Power Generation
Facility with a High-Efficiency and Large-Capacity Gas Turbine

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With the set-in of the 21st century, energy and environmental problems such as energy security and global warming are sparking much greater controversy as burning issues that sways the fate of human beings.

One of technologies presently available to deal with these issues is combined cycle power generation facility that can enhance the efficiency of power generation.

The combined cycle power generation facility can increase thermal efficiency to a significant degree by raising gas turbine inlet gas temperature (TIT). Combined cycle power generation is not only cost-efficient but it is also the technology that can contribute greatly to reducing the emission of carbon dioxide, which is believed to be one of the causes of global warming.

At Tohoku Electric Power Company, we successfully developed and introduced Japan's first large-capacity combined cycle power plant (Higashi Niigata Thermal Power Plant Unit 3series) in 1985. Going through experience in the operation and maintenance of this plant, we set about R&D on a high-efficiency gas turbine in 1987.

This plant attained the highest level of 1150°C gas turbine in those days. We raised this TIT target a step higher to over 1450°C, with the aim of developing a gas turbine attaining a hoped-for 50 % in plant thermal efficiency. We launched the high-efficiency gas turbine R&D program designed to develop following elemental technologies necessary for making the technology fit for practical use.

- High-performance cooling blades
- Heat resisting materials for moving and stationary blades
- High-temperature and low-NOx combustors

The unit output of this gas turbine reached the world's highest level of 270 MW, making it possible to increase the output of one single series of the multi-shaft type combined cycle power generation facility to 805 MW.

The Unit 4-1 series of our Higashi Niigata Thermal Power Station was constructed by applying the results of this high-efficiency gas turbine R&D program, and by applying expertise we gained from the planning, construction, operation and maintenance of the Unit 3 series.

In April 1996, we started the construction of the plant. In October 1998, the gas turbine was started up for test operation. In May 1999, we attained the world's highest plant thermal efficiency of 50.6% (HHV).

Since the Unit 4-1 series went into commercial operation in July 1999, it has been operating stably without shutdown and have achieved actual yearly thermal efficiency of 49.85%(HHV)in FY2001.