FOR IMMEDIATE RELEASE

40MW rated output achieved in highly efficient, low-environmental load medium-class gas turbine test facility using humid air

Tokyo, February 14, 2013 - Hitachi, Ltd. (TSE:6501, "Hitachi") today announced the achievement of rated output at the 40MW-class test facility with the new gas turbine, AHAT (Advanced Humid Air Turbine) system(1), being co-developed with the Central Research Institute of Electric Power Industry ("CRIEPI") and Sumitomo Precision Products Co., Ltd. ("SPP"). Through operations at this facility, it has been verified for the first time that the key components of the AHAT system can be applied to medium-class gas turbines. Further tests to confirm operating characteristics under various conditions and component reliability will be conducted while developing scale-up technology for application in a demonstration plant, to realize small-medium class (~ 200MW-class) highly efficient gas turbine generation systems.

There is a growing demand in recent years for highly efficient gas turbines to achieve economic efficiency and low environmental impact. Further, increased efficiency in operating rate to improve stable operations, environmental consideration, and optimization of operating costs are being required of thermal power generation. Gas Turbine Combined Cycle ("GTCC") generation(2) is used widely as a highly efficient power generation technology in gas thermal power generation but further development to increase efficiency and reduce costs is being anticipated. Also, as the mass introduction of renewable energy systems such as wind and solar is also taking place, a power adjustment system excelling in a fast start-up speed and load following capability, is becoming increasingly important.

To respond to these needs, Hitachi, CRIEPI and SPP have proceeded with the development of key technology for AHAT cycle power generation and its system verification since 2004, in a project supported by the Ministry of Economy, Trade and Industry, Japan. Feasibility tests of the AHAT principle were completed in 2010 with a 3MW-class small gas turbine however as the system components such as the centrifugal compressor and a can-type combustor were

configured for a small-class turbine, feasibility tests in a medium-class gas turbine with multi-stage axial-flow compressors and multi can-type combustors were required. Further, to contribute to lower environmental load, the reduction of NOx emissions was also an issue. Hitachi therefore developed a 40MW-class test facility to apply the AHAT technology developed to a medium-class gas turbine used in industry and combustor technology to achieve a reduction in NOx emission, and verified operation.

Features of the technology developed in the 40MW-class test facility are as below:

(1) System configured for a medium-class gas turbine used in power utilities

In order to conduct Water Atomization Cooling[3] ("WAC") in axial compressors for medium-class gas turbines, changes in the blade loadings and flow angles inside the compressor need to be considered. In relation to this issue, a droplet evaporation model was developed and incorporated in a fluid simulation, to optimize the compressor blade angles. Further, to address the increased thermal stress caused by the high humidity combustion gas, it is necessary to improve the cooling performance of the turbine component. In relation to this issue, a hybrid cooling nozzle was developed using the highly humid air and the discharged air from the compressor, enabling the nozzle to be cooled to below target temperature.

When verification tests were conducted at the facility equipped with the above, a power generation efficiency equivalent to or better than an equivalent medium-class GTCC system was achieved based on calculations assuming equipment specifications for a commercial system. It was also confirmed that the start-up time from ignition to rated power could be achieved in a short period of approximately 60 minutes. This start-up time is approximately one-third that of a GTCC cold start[4] (Hitachi performance: approximately 180 minutes).

(2) Contributing to a reduction in environmental load

In this 40MW-class test facility, stable combustion with reduced NOx emission under higher temperature and pressure conditions (Gas temperature 1,270°C, Pressure 1.7MPa) than the previous 3MW-

class test facility (1,180°C, 0.8MPa) was required. In order to further reduce NOx, a fuel nozzle with lateral pores was developed to enhance mixing of fuel and air, optimizing it for a cluster nozzle burner which is a high humidity combustor. As a result, a NOx concentration of 24ppm (at 16% O2) was confirmed for the humidity of the pilot equipment (approx. 10 weight%), and an outlook of achieving a NOx concentration of less than 10ppm for the humidity in commercial equipment (approx. 18 weight%) was achieved.

Through continued operations at this facility, further tests to confirm operating characteristics under various conditions and component reliability will be conducted to assess system characteristics of commercial AHAT equipment, while developing scale-up technology for application in a demonstration plant, to realize small-medium class (~ 200MW-class) highly efficient gas turbine generation systems.

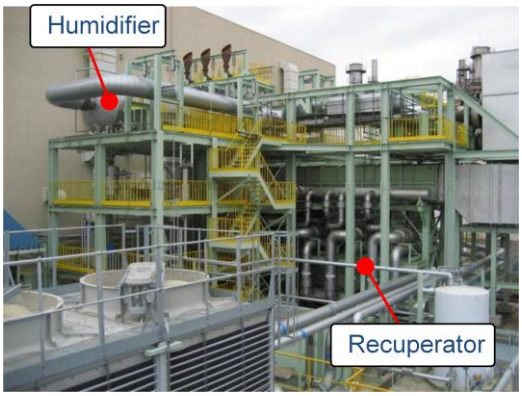

Fig. 1 Full view of the 40MW test facility

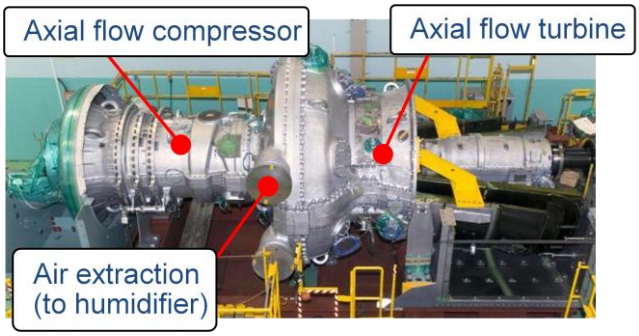

Fig. 2. 40MW test facility gas turbine

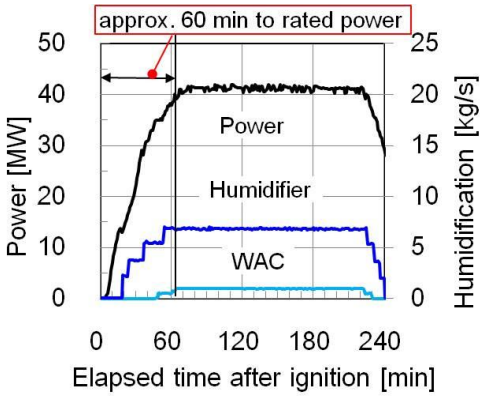

Fig. 3 Example of start-up time in the 40MW test facility

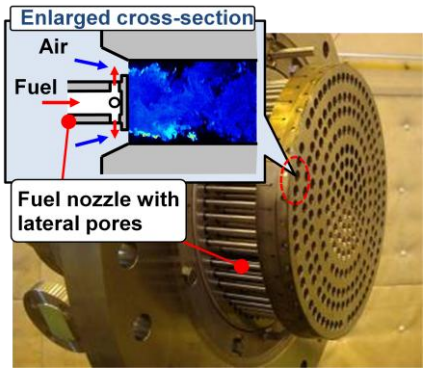

Fig. 4. Combustor (Cluster nozzle burner)

■ Technical terms

*1AHAT system: A new type of gas turbine power generating system with improved power generating method and cooling method based on high humidity air. In this system, the air compressed in the compressor is humidified in the humidification tower to create highly humid compressed air, which is then preheated by the heat from the exhaust gas from the gas turbine recovered using a recuperator before injecting the air into the combustor. By controlling humidity, the air flow for combustion is increased to raise output, and through pre-heating the air, efficiency is also increased.

*2GTCC power generation: A system which uses fuel such as natural gas to run a gas turbine, and also uses the exhaust heat from the gas turbine to generate steam to run a steam turbine to generate electricity, thereby improving power performance.

*3WAC: A function to lower the temperature within the compressor by injecting a small droplet of water into the inlet duct of the compressor, and evaporating it within the duct and the compressor. By suppressing the rise of air temperature within the compressor, the power consumed by the compressor can be reduced, thus having the effect of raising the output of the gas turbine.

*4Cold start: Starting-up plant equipment such as a gas or steam turbine from ambient temperature.

About Hitachi, Ltd.

Hitachi, Ltd. (TSE: 6501), headquartered in Tokyo, Japan, is a leading global electronics company with approximately 320,000 employees worldwide. Fiscal 2011 (ended March 31, 2012) consolidated revenues totalled 9,665 billion yen. Hitachi is focusing more than ever on the Social Innovation Business, which includes information and telecommunication systems, power systems, industrial, transportation and urban development systems, as well as the sophisticated materials and key devices that support them. For more information on Hitachi, please visit the company's website at http://www.hitachi.com.For more information on Hitachi, please visit the company's website at http://www.hitachi.com.

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