MHI Completes Development of the J-series Gas Turbine

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- Featuring the World's Largest 320 MW Power Generation Capacity and
- Enabling Over 60% Thermal Efficiency in GTCC Applications
- Delivery of Commercial Units to Begin in 2011

Tokyo, March 12, 2009 - Mitsubishi Heavy Industries, Ltd. (MHI) has completed development of the "J-series" gas turbine, featuring the world's largest power generation capacity and highest thermal efficiency. The unit is designed to operate at a very high temperature near 1,600 degrees Celsius (°C) at the turbine inlet. The company has also launched activities towards the turbine's commercial production.

The 60 hertz J-series gas turbine achieves a rated power output of about 320 megawatts (MW) (ISO basis) and 460 MW combined-cycle power generation – also the world's largest. In gas turbine combined-cycle (GTCC) applications, high-temperature exhaust gas from the gas turbine is used to generate power by a steam turbine. The company is aiming to achieve over 60% thermal efficiency in GTCC applications, the world's highest level. The company will soon begin marketing, with delivery to commence in 2011.

With the adoption of low-thermal-conductivity TBC (thermal barrier coating) technology and improvements in cooling efficiency, the J-series gas turbine is able to withstand 100 degrees higher temperatures than the existing 1,500 °C-class G-series gas turbine. The adoption of an enhanced 3-dimensional design contributed to improved aerodynamics. In the J-series gas turbine, the compressor is designed to provide a higher compression ratio, while the combustor carries on the steam-cooled technology originally developed for the G-series turbine. In addition to these G-series turbine technologies, the J-series also adopts new technologies derived from an ongoing national project that seeks to develop core technologies for a 1,700 °C-class gas turbine*. The nitrogen oxide (NOx) emission of the J-series is expected to be equivalent to the level of the existing series to address global environmental issues.

As a result of the foregoing developments, GTCCs featuring the J-series gas turbine are expected to achieve well above 60% power generation thermal efficiency (lower heating value). The power generation capacity with J-series GTCC will be about 1.2 times that of GTCC using a G-series gas turbine, the largest gas turbine commercially available until now.

MHI produces gas turbines on a vertically integrated basis, from conceptual and detail design to verification and manufacturing, at its Takasago Research & Development Center and Takasago Machinery Works in Takasago, Hyogo Prefecture. At the Takasago Works, MHI has a verification facility for GTCC. In commercializing the GTCC, the company conducted elaborate verification tests of the large-

size gas turbines and their core technologies. The G-series gas turbine was designed and developed through such meticulous verification processes. To date, 62 units of G-series gas turbines have been sold worldwide, including Japan, and their cumulative operating time exceeds 700,000 hours.

For the J-series gas turbine, MHI focused on the development of technology to enable higher temperatures and enhanced efficiency. In conjunction with this initiative, the company has been participating in a national project for a 1,700 °C-class gas turbine and is pursuing an opportunity to introduce a commercial model J-series gas turbine incorporating state-of-the-art technologies.

With GTCC type power generation, gas and steam turbines are used in combination to generate electricity in two stages, utilizing high-temperature exhaust gas from the gas turbine. This configuration enables GTCC power plants to achieve higher thermal efficiency than other plants with preceding technology such as conventional boiler steam turbine plants. Higher efficiency means that GTCC plants reduce fuel consumption relative to electricity output and emit less CO2, thus making them friendlier to the environment. J-series GTCC power generation will achieve CO2 emissions approximately 50% lower than with conventional coal-fired power generation (comparison with MHI's power plants). In this way, the newly developed turbine is expected to contribute significantly to worldwide efforts to reduce global warming.

*Based on Japan's Basic Act on Energy Policy enacted in 2002, the Basic Energy Plan was approved by the Cabinet in 2003. In response, the Ministry of Economy, Trade and Industry is promoting development of the technology for high-efficiency gas turbines for the power generation industry and conducting government-aided projects. Apropos a 1,700 °C-class gas turbine, these projects focused on core technology development through fiscal 2007 and on development of commercialization technology starting from fiscal 2008.