

Heavy Industrial & Marine (I&M) Gas Turbines: Design and Development

A number of the heavy industrial and marine gas turbine engines and machines in design and development did not until recently warrant inclusion as full reports. (Heavy engines/machines have a power output of 15,000 hp [11,185 kW] or more.) These gas turbine engines are summarized below.

A parallel report is provided in this book for light gas turbine engines, with a power output up to 15,000 hp.

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MHI M501J, M701J. Mitsubishi has been working on two advanced models, the M501J and the M701J. The M501J is available solely for combined-cycle applications. Rated at 403 MW, it has a combined-cycle efficiency of 60 percent. That model has steam cooling in stages 1-2 of the turbine.

The 60-Hz M501J gas turbine was developed in the spring of 2009 incorporating MHI's proprietary technologies. It claims the world's highest efficiency and power generation capacity in a system of this type, having achieved the world's highest turbine inlet temperature of 1,600°C. MHI has already received an order for six units from Kansai Electric Power Co Inc and delivered the first unit to its Himeji No. 2 Power Station, currently under construction. The six units will sequentially go on-stream from 2013. The order for 10 units from the Republic of Korea marks the first for the J-Series gas turbine from outside Japan. The turbines to be delivered to Korea are slated to begin GTCC operation sequentially in 2014.

Another model is the M701J for the 50-Hz market. Forecast International estimates the machine's combined-cycle output will be 675 MW. Compared with the M701G and M501H, the M701J has an elevated turbine inlet temperature.

Siemens SGT5-8000H. Siemens is currently testing a very powerful and efficient H-class gas turbine for the 50-Hz market. The 50-Hz SGT5-8000H gas turbine is the primary driver of the SCC5-8000H combined-cycle power plant, which will have an output of 530+ MW and an efficiency level exceeding 60 percent. Built by Siemens Power Generation (PG) at its manufacturing plant in Huttenstrasse in Berlin, it is 13 meters long and 5 meters high, and weighs more than 440 metric tons.

The new SGT5-8000H gas turbine and SCC5-8000H plant are the result of years of research and development

in the quest to develop a plant that offers operational flexibility at lower life-cycle costs than competitors' comparable units. The 8000H is the first new frame developed after the merger of Siemens and Westinghouse, combining the best features of the existing product lines and technology advancements, according to Siemens.

To test the prototype turbine, Siemens, in cooperation with E.ON, is building an experimental power plant in Irsching, in the vicinity of Ingolstadt. The new gas turbine will set benchmarks in terms of output, efficiency, life-cycle costs, emissions, and operational flexibility. Its capacity of 340 MW is reported to be approximately equivalent to that of 1,100 Porsche 911 auto or 13 jumbo jet engines. Following the test phase, the gas turbine plant will be extended to form a high-efficiency combined-cycle power plant, where it will maximize overall plant performance: 530 MW and a maximum efficiency of more than 60 percent – the previous best was 58 percent. The 2-percentage-point-higher efficiency will save fuel and, at the same time, reduce CO₂ emissions in Irsching by approximately 40,000 metric tons per annum.

"The output of this turbine is sufficient to provide electricity for the entire population of a city the size of Hamburg," said Dr. Wolf-Dietrich Krüger, head of the Gas Turbines subdivision at PG. Approximately 250 Siemens technicians and engineers worked on this latest development. An additional 500 employees were involved in production of the prototype of the new machine. Siemens is investing approximately EUR550 million in machine development and construction, as well as financing and validation of the power plant. First firing of the new turbine in Irsching was performed in December 2007. Following successful trial operation, the plant was taken over by E.ON Kraftwerke in 2011.

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