

# World's Best Power Plants



The 3800 ton HRSGs were designed and built with a modular approach to reduce assembly at site; they're shown here being moved by barge from the MHI shipyard in Nagasaki, Japan.



Aerial view of the TEPCO Kawasaki Combined Cycle Thermal Power Station.

## FIRST COMMERCIAL APPLICATION OF THE M701G2 GAS TURBINE

### mitsubishi heavy industries

The Tokyo Electric Power Co.'s (TEPCO) Kawasaki Combined Cycle Thermal Power Station is one of the most advanced 50 Hz combined-cycle plants in operation, with demonstrated 59.1% combined-cycle efficiency. This combined-cycle thermal power station will eventually replace an existing 1050 MW six-unit conventional power station that has supplied power to the Tokyo metropolitan area for more than 40 years. The new high-efficiency combined cycle consists of three 500 MW single-shaft blocks based on Mitsubishi Heavy Industries M701G2 gas turbines.

This is the first commercial application of the 334 MW M701G2 — one of the largest gas turbines currently in commercial operation. The M701G2 is the latest 50 Hz version of the MHI steam-cooled large frame gas turbines. It incorporates a high-efficiency 21:1 pressure ratio compressor and proven steam-cooled technology for the combustion liners, row 1 and row 2 blade rings. This blade ring cooling scheme is designed to provide turbine tip clearance control for better efficiency.

The original 1050 MW plant was converted from Naphtha to LNG over 20 years ago. The Naphtha tanks were demolished to open space for the new combined-cycle plant. Located in a heavy traffic zone in the heart of Kawasaki city, this new plant occupies only one-third of the existing plant's total area. Construction involved engineering and logistic challenges to minimize traffic disruption while mobilizing large and heavy equipment. Vertical HRSGs, used to minimize the footprint of the plant, were designed and built with a modular approach to reduce the assembly at site, and were

mobilized by barges from MHI shipyard in Nagasaki. Construction took place with the existing plant in operation.

In addition to generating power, this new plant is configured to supply steam from the HRSGs to 10 neighboring industries. This higher efficiency steam supply allows the elimination of the currently used lower efficiency old boilers and a CO<sub>2</sub> reduction of 25 000 tons per year.

The power output from two of the three new blocks roughly match the output of the existing 43% efficiency (LHV) plant with a fuel consumption reduction of 17.1 million MBTU per year and 892 000 ton of CO<sub>2</sub> per year. The NO<sub>x</sub> emissions from the final power plant with Group 1 and 2 in operation will be lower than the existing plant. The ultra dry-low NO<sub>x</sub> combustion system installed in the M701G2 will achieve a 24 Nm<sup>3</sup>/h NO<sub>x</sub> reduction despite a power output increase from 1050 to 3000 MW.

In addition to fuel consumption and emission reductions, this ecology-friendly plant will reduce the direct impact on the Kawasaki Bay ecosystem. Two-thirds of the total power from the new plant will be generated by the gas turbines, considerably reducing usage of seawater for the steam cycle condensers. This results in a considerable reduction of warm water discharge to Kawasaki Bay, greatly reducing the impact on its ecosystem.

Performance tests conducted at TEPCO's Kawasaki Combined Cycle Thermal Power Station have demonstrated 59.1% single-shaft combined-cycle efficiency. While full commercial operation of the entire plant will occur in early 2009, all three units were operating at full capacity on June 25, 2008. 🐦