

Combined cycle performance evaluation of a simple and adapted aeroderivative gas turbines.

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Abstract

A combined cycle performance analysis of an aeroderivative gas turbine model in simple, reheat, and recuperation modes respectively is presented. The combined cycle gas turbine (CCGT) was modeled with the CFM 56-5C2 aeroderivative gas turbine version. The investigation considered various heat recovery steam generator (HRSG) efficiencies and steam pressures between 80 to 90 % and 40 to 100 bar respectively in simple, reheat and recuperation gas turbine (GT) modes. Results showed that 58 % overall thermal efficiency (TE) and 26.8 MW power output (PO) were obtained at increasing HRSG efficiency and steam pressures respectively due to low exhaust gas temperature (EGT). Also owing to 1500 K reheating of the aeroderivative gas turbine, the EGT was enhanced by 64% (996.7 K). Overall PO and overall TE of 47.6 MW and 62.3 % respectively were achievable in the CCGT analysis with HRSG efficiency of 90% and increasing steam pressure from 40 to 100 bar. Conversely, a combination of reheat and recuperation had a much higher thermal efficiency of 63.4 % but a little lower exhaust gas temperature of 874.2 K. Therefore, aeroderivatives of the CFM 565-C2 gas turbine is recommended for CCGT applications due to its high thermal efficiency (> 60 %), higher power to weight ratios and high EGTs.

Keywords: Combined cycle, performance, aeroderivative, gas turbine, reheat, and recuperation.

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