

Effect of Deaerator Parameters on Simple and Reheat Gas/Steam Combined Cycle with Different Cooling Medium

Gas / steam combined cycle power plants have steam power plant as its integral component and the performance enhancement of combined cycle relies upon the performance exhibited by both gas based topping cycle and steam based bottoming cycle. Therefore, the measures for improving the performance of steam bottoming cycle eventually result into overall combined cycle performance enhancement. Amongst different parameters in steam bottoming cycle, the deaerator parameter also plays its role in cycle performance. Actually, the deaerator's deployment for removal of dissolved gases also offers an opportunity for utilizing the heat available with bled steam injected into it for deaeration purpose. The pressure at which steam is bled out from the steam turbine affects the work output of the bottoming cycle and thus the combined cycle output. The present study analyzes the effect of deaerator's operating pressure being varied from 1.6 bar to 2.2 bar in different configurations of simple and reheat gas/steam combined cycle with different cooling medium for fixed cycle pressure ratio of 40, turbine inlet temperature of 2000 K and ambient temperature of 303 K with varying ammonia mass fraction from 0.6 to 0.9. Analysis of the results obtained for different combined cycle configuration shows that for the simple gas turbine and reheat gas turbine based configurations, the maximum work output of 643.78 kJ/kg of air and 730.87 kJ/kg of air respectively for ammonia mass fraction of 0.6, cycle efficiency of 54.55% and 53.14% respectively at ammonia mass fraction of 0.7 and second law efficiency of 59.71% and 57.95% respectively at ammonia mass fraction of 0.7 is obtained for the configuration having triple pressure HRVG with ammonia-water turbine at high pressure and intermediate pressure and steam turbine operating at deaerator pressure of 1.6 bar.