Modeling, Simulation and Optimization of Thermal Systems in Supercritical Thermal Power Plant Cycle

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Abstract

Modeling, Simulations and optimization are extensively used in thermal power plant industries to evaluate the dynamic output responses of various thermal systems. The choice of optimal simulation parameters can lead to improve operation and time, but configuring them to produce maximum power output is a challenging problem. In power plants, there are so many parameters like steam pressure, temperature and steam extraction pressures from various high pressure and low pressure steam turbines (HPT and LPT) affects the efficiency of a plant and need optimum values in order to get maximum power output. In this process Cycle Tempo 5.0 simulation software was used to analyze the efficiency of supercritical thermal power plant cycle with a capacity of 660 MW with and without optimization. Quasi-Newton optimization method is applied that would offer the maximum efficiency of a power plant cycle for certain standard following input parameters of industrial power plant. Eight stages of regenerative feed water heater arrangement with and without flue gas for heat recovery circuit are considered for the analysis and the results were compared shown in table 1. The obtained values are in good agreement with industrial power sector results. The considered power plant is also analyzed at various environmental perspectives like atmospheric temperature variations.

Key words: Quasi-Newton Optimization, Supercritical Cycle (SC), Lower heating value of coal (LHV).

Table 1: Important results of supercritical thermal power plant capacity of 660 MW at environmental temperature of 25 ^{0}C

	Capacity of the thermal power plant=660 MW			
Parameters	**Conventional steam cycle**	**Conventional steam cycle after optimization**	**Conventional steam cycle with flue gas heat recovery circuit**	**Conventional steam cycle with flue gas heat recovery circuit after optimization**
Energy efficiency (%)	43.78	43.90	43.78	44.31
Exergy Efficiency (%)	41.29	41.40	41.25	41.77
No. of iterations required for optimization	-	890	-	900

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