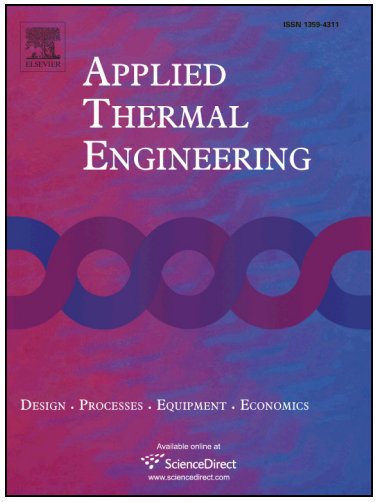

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Thermo-economic optimization of heat recovery steam generator for a range of gas turbine exhaust temperatures

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Abstract

This paper illustrates the effect of selling price on the optimum design parameters of a heat recovery steam generator and selection of its ideal configuration for an outlet temperature range of 350°C - 650°C. The Particle Swarm Optimization (PSO) method was used, considering the steam cycle specific work as an objective to be maximized, the net present value as another objective to be maximized for the economic optimization and a combination of both of them. Three configurations of heat recovery steam generators are considered with one, two and three pressure levels with reheat. The results show that, the three pressure level system is the best configuration from a thermodynamic point of view, but with respect to the economical aspect the two pressure levels is the best configuration for the low and medium selling prices (0.04$/kWh, 0.08$/kWh and 0.2$/kWh), whereas the three pressure level configuration would only be interesting for a high selling price of 0.3$/kWh and a temperature range 450-600°C. For a temperature of 650°C, the high cost of the three level system leads to net present value decrease. As the selling price increases the optimized design parameters of the three pressure level HRSG based on an economic or a thermodynamic optimization are similar. The obtained results are used to elaborate a new correlation relating the net present value with the gas turbine outlet temperature, gas mass flow rate, number of levels of HRSG and the selling price.

Keywords: Combined cycle; HRSG; Exhaust gas temperature; Net present value; Thermo-economic optimization

Highlights

- Thermo-economic optimization of HRSG configurations
- The maximum value of the net present value was targeted for the economic optimization
- Three level HRSG is the best option in respect of power output and high priced medium
- Two level HRSG is the best for net benefit in low and intermediate priced mediums