

Thesis Title	Optimization of Combustion Processes in a Fuel-Oil-Fired Steam Boiler Using Cost Estimation Approach
Thesis Credits	6
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### Abstract

The method that is used for optimization of excess air in steam boiler based on the cost estimation approach has been proposed. The method is based on accounting of the "internal" costs (associated with the heat losses of the boiler), "external" costs (associated with the boiler impact on the environmental) under various operating conditions. The total sum of these costs will be minimum at a certain excess air value. At this point, the best result in terms of harmful oxides emissions and thermal efficiency will be obtained.

In this research, the proposed method was applied to the furnace of steam boiler firing fuel-oil 310 MW capacity. The predicted and experimental data have been obtained for rated load at various values of excess air and gas recirculation.

With the proposed method, it was found that excess air ratio between 1.03 to 1.06 corresponds to the minimum of total costs. When the excess air ratio was less than 1.04, the concentration of carbon monoxide was present in flue gases and the amount of heat loss due to incomplete combustion also increased with excess air decrease. In this study, the fraction of flue gas recirculation (varied from 0.10 to 0.15) had insignificant influence on  $\text{NO}_x$  emission.

The other effect of excess air increase was associated with the increase in the heat loss due to waste gases and  $\text{SO}_2$  emission in the boiler. Using cost estimation method, the excess air ratio for the considered boiler was found to be 1.04 which is the "optimal excess air", that leads to minimum total cost

Keywords: Steam boiler/  $\text{NO}_x$ /  $\text{SO}_2$ / carbon monoxide/ excess air/ flue gas recirculation/  
"internal" cost/ "external" cost/