

ABSTRAK

ANALISIS KELAYAKAN ENERGI PROSES *CO-FIRING* BATU BARA DAN *WOODCHIP* PADA PEMBANGKIT LISTRIK TENAGA UAP (PLTU) (Studi kasus : PT. XYZ)

Oleh

FERTA JAYA SAPUTRA

Batu bara masih menjadi sumber energi utama pada pembangkit listrik tenaga uap (PLTU), namun penggunaannya menimbulkan permasalahan lingkungan akibat emisi gas rumah kaca. Peningkatan pemanfaatan energi terbarukan mendorong penerapan teknologi *co-firing* biomassa pada *boiler* berbahan bakar batu bara. Penelitian ini bertujuan untuk menganalisis pengaruh variasi rasio *co-firing woodchip* terhadap kinerja *boiler*, khususnya ditinjau dari efisiensi *boiler*, *specific fuel consumption* (SFC), dan *heat rate*. Penelitian dilakukan pada *boiler* bertipe *circulating fluidized bed* (CFB) berkapasitas 45 ton uap per jam dengan variasi rasio bahan bakar 100% BB, 95% BB : 5% WC, dan 90% BB : 10% WC. Metode penelitian meliputi pengujian laboratorium untuk analisis *proximate* dan nilai kalor bahan bakar, serta analisis data operasional *boiler*.

Hasil penelitian menunjukkan bahwa peningkatan rasio *woodchip* menyebabkan penurunan nilai kalor bahan bakar dari 4.259 kkal/kg pada kondisi 100% BB menjadi 3.654 kkal/kg pada rasio 95% BB : 5% WC dan 3.496 kkal/kg pada rasio 90% BB : 10% WC. Rata-rata efisiensi *boiler* tertinggi diperoleh pada rasio 95% BB : 5% WC sebesar 75%, dibandingkan 73% pada kondisi 100% BB dan menurun menjadi 68% pada rasio 90% BB : 10% WC. Nilai SFC dan *heat rate* cenderung meningkat seiring bertambahnya rasio *woodchip*, yang menunjukkan peningkatan konsumsi bahan bakar untuk menghasilkan jumlah uap yang sama. Berdasarkan temuan ini, disimpulkan bahwa penerapan *co-firing* dengan rasio *woodchip* 5% merupakan rasio yang layak dan optimal untuk mengurangi konsumsi batu bara tanpa mengorbankan efisiensi termal *boiler*.

Kata kunci: *co-firing*, *woodchip*, efisiensi *boiler*, *heat rate*, SFC, PLTU.

ABSTRACT

ENERGY FEASIBILITY ANALYSIS OF CO-FIRING COAL AND WOODCHIP PROCESS IN A STEAM POWER PLANT (Case Study: PT. XYZ)

By

FERTA JAYA SAPUTRA

Coal remains the primary energy source in steam power plants (PLTU); however, its utilization causes environmental issues due to greenhouse gas emissions. The increasing use of renewable energy has encouraged the implementation of biomass co-firing technology in coal-fired boilers. This study aims to analyze the effect of variations in woodchip co-firing ratios on boiler performance, particularly in terms of boiler efficiency, specific fuel consumption (SFC), and heat rate. The research was conducted on a circulating fluidized bed (CFB) boiler with a capacity of 45 tons of steam per hour, using fuel ratio variations of 100% coal, 95% coal : 5% woodchip, and 90% coal : 10% woodchip. The research methods included laboratory testing for proximate analysis and fuel calorific value, as well as analysis of boiler operational data.

The results indicate that an increase in the woodchip ratio leads to a decrease in fuel calorific value, from 4,259 kcal/kg under the 100% coal condition to 3,654 kcal/kg at a ratio of 95% coal : 5% woodchip, and further to 3,496 kcal/kg at a ratio of 90% coal : 10% woodchip. The highest average boiler efficiency was achieved at the ratio of 95% coal : 5% woodchip, reaching 75%, compared to 73% at the 100% coal condition, and decreasing to 68% at the ratio of 90% coal : 10% woodchip. The SFC and heat rate values tended to increase with higher woodchip ratios, indicating increased fuel consumption to produce the same amount of steam. Based on these findings, it can be concluded that the application of co-firing with a 5% woodchip ratio is a feasible and optimal option to reduce coal consumption without compromising the thermal efficiency of the boiler.

Key words: co-firing, woodchip, boiler efficiency, heat rate, SFC, steam power plant.