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Abstract

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Performance Evaluation of Sawdust Co-Firing in a Pulverized Coal Boiler Power Plant

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Abstract

The study investigates sawdust as a biomass fuel in coal-fired power plants to support Indonesia's efforts to meet its renewable energy targets. By 2025, Indonesia aims for 23% of its energy mix to come from renewable sources, and co-firing biomass with coal is considered an effective, low-cost strategy to accelerate this transition. The study focuses on co-firing sawdust in a 300 MW pulverized coal boiler, examining the effects on plant performance, fuel efficiency, and emissions. Sawdust, chosen for its availability and lower sulfur content, was used at a 5% mass ratio in the fuel mix, alongside coal, which has a higher calorific value and different combustion characteristics.

The study's objective was to evaluate how adding sawdust to the fuel mix affects the power plant's equipment and operational parameters. It also analyzed emissions to determine whether co-firing could reduce harmful pollutants. The tests compared two scenarios: 100% coal combustion and a mix of 95% coal and 5% sawdust. Key operational data, such as mill performance, boiler temperature, steam production, and emissions, were collected during both tests.

The findings showed that the sawdust addition caused a slight increase in mill workload, as reflected in a 0.78-ampere rise in mill current and a 1.72°C increase in the mill outlet temperature. These changes were attributed to the lower grindability and calorific value of sawdust compared to coal. Despite these variations in mill performance, other key plant operations, including the air heater's performance and steam production, remained unaffected. This suggests that co-firing sawdust at the tested ratio can be implemented without significant modifications to the existing power plant infrastructure. This makes it a practical option for power plants looking to incorporate renewable energy.

In terms of environmental impact, the co-firing of sawdust led to a reduction in harmful emissions. Specifically, sulfur dioxide (SO_2) emissions decreased by 14.54 mg/Nm³, and nitrogen oxides (NOx) emissions dropped by 4.95 mg/Nm³ when compared to 100% coal combustion. These reductions indicate that biomass co-firing can contribute to meeting environmental standards and reducing air pollution from coal-fired power plants, making it an attractive option for reducing the negative environmental impacts of coal energy.

The study concludes that biomass co-firing with sawdust is a feasible and environmentally beneficial solution for Indonesia's coal-fired power plants. It requires minimal investment, leverages existing infrastructure, and supports the country's renewable energy goals. The authors also suggest future research to evaluate other biomass types, such as rice husks and wood pellets, to further optimize co-firing operations and ensure a sustainable supply of biomass.