EXPERIMENTAL STUDY ON COFIRING HIGH SHARES OF TORREFIED FUELS IN A 500kW PULVERIZED COAL BOILER

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Abstract:
Cofiring biomass with coal potentially decreases the carbon intensity of coal-fired power plants. The market and demand for biomass pellets continues to grow across Europe. European demand comes also from large power producers which are motivated by a variety of incentives across Europe to cofire. Pellets are now imported into Europe from places such as the US, Canada, Australia, South Africa etc. The torrefaction process involves pre-heating biomass in the absence of O₂ to a temperature of 200°C to 320°C thereby reducing the moisture and volatile content of biomass. This leaves behind a dry, hydrophobic, brittle and carbonized solid, similar to coals. Torrefied biomasses have energy densities approaching those of coals. For torrefied biomasses, the transport and logistics costs are reduced and significant investments on separate storage facilities, milling and feeding equipment required for non-thermally treated biomass materials can be minimized. Torrefied biomasses can be potentially cofired with coal at higher percentages in conventional coal boilers with minimal modifications.

The tests performed at the 500kW combustion rig investigated the cofiring of torrefied biomass with bituminous coal (El Cerrejón coal from Colombia). The tests cover 50% thermal share of the torrefied fuels in the cofiring mix as well 100% dedicated torrefied biomass and coal combustion cases. The measurements performed include flame stability, burn-out, gas temperature profiles and emissions characteristics (CO₂, NOₓ and SO₂). An important aspect was the investigation of the impact of air staging on NOₓ reduction. Results for the torrefied fuel combustion and co-combustion cases were compared to the coal test case as well as a biomass reference.

The comparative study aims to comprehensively demonstrate the feasibility of cofiring at higher shares while also showing in a structured way, the avenues for efficiency gain for the utility providers. One way to improve the efficiency is cost savings from flue gas cleaning. The tests therefore explore the limits of managing emissions by cofiring and primary measures (air-staging) without using expensive secondary flue gas cleaning measures.

Keywords: Cofiring, co-combustion, torrefaction, air-staging

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