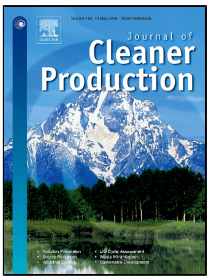
# Accepted Manuscript




$CO_2$ capture in existing power plants using second generation Ca-Looping systems firing biomass in the calciner

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# $CO_2$ capture in existing power plants using second generation Ca-Looping systems firing biomass in the calciner

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**Abstract**

Calcium looping (CaL) is an emerging $CO_2$ capture technology that uses high temperature circulating fluidized beds, CFB, using CaO particles as functional material and can be retrofitted to existing power plants and. Its similarity to existing CFB combustion technology has made it possible to demonstrate its feasibility at MW scale and to obtain an accurate estimation of its energy efficiency and cost. This work analyzes a novel CaL system that incorporates recent developments tested at large pilot scale, where the calciner operates under an oxygen-rich atmosphere and the sorbent is reactivated by recarbonation allowing a reduction in the thermal input needed in the calciner. It has been shown that, when this 2nd generation CaL system is coupled to existing large sources of flue gases and biomass is used as fuel in the calciner, the full system becomes carbon-negative, with $CO_2$ emissions failing to as low as -245.3 $kg_{CO2}$/MWhe since the biomass source is carbon-neutral. The net electric efficiencies achieved for the entire system including capture are more than 33%. Moreover, the total investment required for this CaL system can be reduced by more than 30% compared to conventional CaL systems due to the reduced footprint of the calciner-related equipment when the calciner is fired with pure oxygen.

**Keywords**

$CO_2$ capture, Calcium looping, biomass, sorbent recarbonation, second generation