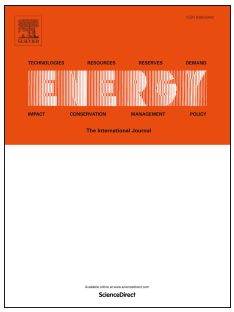
Accepted Manuscript



Investigation on co-firing of coal mine waste residues in pulverized coal combustion systems

Javier Pallarés, Carlos Herce, Carmen Bartolomé, Begoña Peña

PII: S0360-5442(17)31368-3

DOI: 10.1016/j.energy.2017.07.174

Reference: EGY 11362

To appear in: *Energy*

Received Date: 11 May 2017

Revised Date: 10 July 2017

Accepted Date: 30 July 2017

Please cite this article as: Pallarés J, Herce C, Bartolomé C, Peña Begoñ, Investigation on co-firing of coal mine waste residues in pulverized coal combustion systems, *Energy* (2017), doi: 10.1016/j.energy.2017.07.174.

Title: Investigation on co-firing of coal mine waste residues in pulverized coal combustion systems

Authors: Javier Pallarés [a b]*, Carlos Herce [b], Carmen Bartolomé [b], Begoña Peña [a]

[a] University of Zaragoza, María de Luna 5, 50018 Zaragoza, Spain

[b] Research Centre for Energy Resources and Consumption (CIRCE), CIRCE Building – Campus Río Ebro, Mariano Esquillor Gómez 15, 50018 Zaragoza, Spain

* Corresponding author: E-mail address: jpallare@unizar.es (Javier Pallarés).

Abstract

Millions of tonnes of coal mine waste residues are piled up in dumping sites, causing serious environmental problems. Co-combustion in fluidized bed facilities is the most widespread alternative for the energy utilization of these by-products. However, no experiences have been so far reported of coal mine waste residues co-firing under pulverized fuel combustion technology. This work proves the technical feasibility of co-firing coal with up to 20% coal mine waste residues and investigates the impacts of transferring this co-firing alternative into a commercial unit. Experimental co-firing tests of coal mine waste residues were conducted on a 500 kWth pulverized fuel pilot plant. Regulated emissions (CO, CO2, SO2 and NOx) and visible flame radiation were monitored, obtaining regular and stable flicker and acceptable emissions levels for CO (200 mg/m^{3}N) and NOx (700 - 800 mg/m^{3}N). Finally, the impact analysis of co-firing coal mine waste residues in a full-scale pulverized fuel plant was performed by simulating the power cycle and combustion process in a 160 MWe pulverized coal combustion unit. Simulation results show the viability of this alternative in terms of plant efficiency, increase in power consumptions of auxiliary equipment and pollutant emissions for co-firing ratios under 10 % in energy basis.

Highlights

- Experimental co-firing tests of CMWR and coal were conducted in a PCC pilot plant
- Lower combustion efficiency but stable conditions as CMWR share increases
- An impact analysis of co-firing CMWR in a full scale PCC plant was performed
- Plant efficiency reduction and emissions levels for CMWR co-firing are acceptable

Keywords: Coal mine waste residues, co-firing, pulverized coal combustion

Abbreviations

CCD – Charge coupled device