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Techno-economic assessments of oxy-fuel technology for South African coal-fired power stations

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Abstract

Oxy-fuel technology is one of the potential solutions to reduce CO_2 emissions from coal-fired power plants. Although vendors offer a "retrofit package," to the best of our knowledge there has not been a study undertaken that looks at the technical and economic viability of oxy-fuel technology for CO_2 capture for South African coal-fired power stations. This study presents a techno-economic analysis for six coal fired power stations in South Africa. Each of these power stations has a total capacity of about 3600 MW. The analysis was done using the oxy-fuel model developed by Carnegie Mellon University in the USA. The model was used to define the performance and costs of retrofitting the boilers. The results obtained showed that the CO_2 emission rate was reduced by a factor of 10 for all the plants when retrofitted to oxy-fuel combustion. Between 27 and 29% of the energy generated was used to capture CO_2. The energy loss was correlated to the coal properties. Sulphur content in the coal samples affects the energy used for flue gas cooling but did not affect the energy used for CO_2 purification and compression. The study also showed there is a need for the flue gas to be treated for NO(subx) and SO(subx) control. The total capital costs and cost of electricity for the six plants were different, resulting with the cost of electricity varying from 101$/MWh to124$/MWh.