

Simulation of oxy-combustion power plants with CO₂ capture

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Coal is widely used in energy industries such as power plants and carbon capture and storage (CCS) technologies have been needed to reduce the burden of the CO₂ emission. This study evaluated the economic feasibility of three 500 MWe ultra-supercritical (USC) power generation plants: (1) air-combustion without CCS (AC), (2) air-combustion with amine absorber unit (AC-AAU), (3) oxy-combustion with CO₂ processing unit (OC-CPU). It was found that the OC-CPU process was more efficient than that of AC-AAU in terms of the energy penalty (EP), return on investment (ROI), and payback period (PBP). The EPs were 21.7% and 18.8% for AC-AAU and OC-CPU, respectively. The ROI and PBP of AC-AAU were 11.4%/yr and 7.2 yr, respectively, while those of OC-CPU were 12.1%/yr and 6.6 yr, respectively. Sensitive studies were also performed to evaluate the influence of several economic parameters such as electricity and coal prices on the ROI and PBP.