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Techno-economic comparison between different technologies for a CCS power generation plant integrated with a sub-bituminous coal mine in Italy

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Abstract

The increasing interest in the development of carbon capture and storage (CCS) technologies requires a great effort to reduce capital and operating costs and to demonstrate the potential application of these kind of systems on the commercial power generation plants.

This paper shortly describes the main results of a technical and economical comparison between different CO_2-free power generation plant configurations, with a particular reference to ultra supercritical (USC) pulverised coal combustion plant, atmospheric fluidized bed combustion (AFBC), integrated gasification combined cycle (IGCC) and a potential projection for the application of oxy-combustion technologies.

The comparative analysis is based on the typical economic indicators such as net present value, internal rate of return, payback time and cost of electricity; all these parameters have been calculated on the basis of the annual cash flow during the plant operating life. Due to the impossibility to estimate with accuracy the future trend of some parameters, a sensitivity analysis has been also carried out in order to evaluate the effects of these assumptions, with a subsequent risk reduction for the potential investment.

As reference case, a 660MW_e (referred to the hypothetical ''basis'' configuration, without CCS system) operating in close integration with the Sulcis coal mine (South–West Sardinia island, Italy) has been considered. As a matter of fact, the Sulcis sub-bituminous coal basin, in which the only Italian coal mine is located, represents a key point for the increasing of the Sardinian energy security, by raising the power generation capacity and partially releasing energy production from imported primary sources; in parallel, the economy in the Sulcis area has to be re-launched through the strengthening of the local industry.

Keywords: Clean coal technologies; Carbon capture and storage; Ultra-supercritical plant; Coal gasification; Oxy-combustion

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