

Technical and economical analysis of a zero-emissions power generation plant integrated with a sub-bituminous coal mine in South-West Sardinia

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Abstract

The implementation of Kyoto protocol, the subsequent introduction of the International Emissions Trading and the increasing interest on the environmental protection are making more and more interesting the development of the “zero emissions” power generation technologies, in particular from coal.

This study evaluates the feasibility to introduce a 1500 MWth near zero-emissions plant which operates in close integration with a sub-bituminous coal mine located in the Sulcis area, in South-West Sardinia. The plant will be fed by a mixture of a local high-sulphur coal (which is characterized by a sulphur content of about 6-7%) and an imported low-sulphur coal. In particular, a comparative technical and economical analysis has been carried out considering three different technologies: USPC (ultra-supercritical pulverized coal combustion), PFBC (pressurized fluidized bed combustion) and IGCC (integrated gasification combined cycle).

Moreover, for each kind of power generation technology, the effect of the introduction of a carbon capture and sequestration system (in order to have a CO₂-free plant) has been considered. In fact, carbon dioxide can be captured from flue gas through an absorption system based on chemical solvents, and the CO₂-rich stream can be injected, without significant costs for transport, in the deep and unmineable coal seams, with a methane production through ECBM (Enhanced Coal-Bed Methane) technology.

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