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PR.A.T.O.: a project to optimize pre-combustion technology for CO_2 capture

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Abstract

Fossil fuels cover the majority of the world's energy requirements, generating increase in greenhouse gas emissions and raising concern over global warming and climate change. Greenhouse gas emissions in general, and CO_2 emissions in particular, have become a major issue and Carbon dioxide Capture and Storage (CCS) is considered one of the options for reducing the greenhouse effect. The capture step involves separating CO_2 from other gaseous products. In fossil fuel fired power plants, one of the strategies to capture CO_2 is fuel decarbonisation before combustion (pre-combustion). A R&D project, called PR.A.T.O. (PRecombustion Absorption Technology Optimization), with the aim to build a pilot plant in the Sulcis coal mines region, Southwest Sardinia, has been designed to develop and optimize CO_2 pre-combustion capture technology using an existing air-blown coal gasification station.

The project also envisages additional development for CO_2 sequestration via ECBM (Enhanced Coal Bed Methane) technology. The pilot plant will treat the syngas from the existing gasifier in a series of downstream units: compression, hydrogenation and desulphurisation, high and low-temperature CO shift, CO_2 absorption and solvent regeneration.

This paper provides an overview of the pilot plant process units and their key characteristics. The following features are also described: possibility of operating with hot or cold sweetening in a wide range of CO_2 concentrations, water-gas shift reactors with catalysts operating with sour gases, selection of physical solvent for absorption of H_2S and CO_2. The expected correlations between CO_2 removal efficiency and energy consumption versus solvent design flowrate, based on the results of the pilot plant simulation, are then presented.

Finally, the paper illustrates the project phases and cost evaluation of PR.A.T.O. project.