



SCIENTIFIC & RESEARCH PROJECTS

Project No.: 01 Year: 2013

Project Field: GHG Emission Reduction

Publisher: Chemical Engineering Research and Design, Part A, Vol. 91, No. 8, pp. 1403-1410, Aug. 2013

Project Title:

Techno-Economic Optimization of IGCC Integrated with Utility System for CO2 Emission Reduction - Part 1, Maximum Power Production in IGCC

Abstract:

Environmental legislation, with its increasing pressure on the energy sector to control greenhouse gases, is a driving force to reduce CO₂ emissions. In this paper, pre-combustion CO₂ capture through integration of a site utility system with an integrated gasification combined cycle (IGCC) is investigated as an option to provide a compressed CO₂-rich stream from a process site for sequestration. This work presents a two-step procedure for integration and optimization of a site utility system with an IGCC plant: (i) screening and optimization of IGCC plant performance parameters; (ii) integration and optimization of the utility system of the site with the IGCC plant. In the first step, an optimization approach applies the results of screening studies based on rigorous simulation of the IGCC. Having fixed the inlet fuel flow rate, the IGCC design parameters (including oxygen consumption, diluent flow rate and turbine exit pressure) are optimized for maximum power generation. Energy flows between the IGCC and CO₂ compression train are considered. In the second step, the economic and operating performance of the utility system integrated with the IGCC plant are modeled and optimized for minimum operating cost to find the most appropriate level of integration. In a case study illustrating the approach, 94% of the fuel is gasified; additional power generation offsets the operating costs of pre-combustion CO₂ capture.