

Design Simplification – A Feasible Option for IGCC Plants with Carbon Capture?

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Abstract:

Utility companies worldwide are challenged by climate change concerns and raising demand for electricity. E.ON as one of the world's largest private energy services provider made a commitment to cut the companies' specific carbon emissions while having a significant share of hard coal fired power plants in the fleet. Therefore E.ON pursues the development of carbon capture technologies in a diversified R&D portfolio.

In the field of low carbon IGCC concept development a cooperation with the Institute of Energy Process Engineering and Chemical Engineering (IEC) of TU Bergakademie Freiberg was established in order to take advantage of IEC's expertise in gasification technology and in cycle modelling. The benchmarking study on several adapted IGCC concepts analyses the influence of the carbon capture level on plant efficiency and costs.

Despite their thermodynamic and technological advantages IGCC plants with carbon capture could not be established in the market by today. The presentation is supposed to make a contribution to discuss the main influences on IGCC economics from a technology point of view and to shed light on effects of a disintegrated IGCC layout on efficiency, investments and availability.

As the base case an adapted IGCC concept with a dry feed gasifier and a gas quench for gas cooling is discussed and the technical constraints are exposed. In order to analyse the influence of carbon capture technology on the plant three scenarios of capture (maximum, bulk, no capture) are considered for the concept. The thermodynamic figures of the example are discussed; in particular efficiency losses due to carbon capture are in the focus. Based on this analysis, the defined economic constraints are presented and the main cost drivers for Cost of Electricity (CoE) are quantified. The CoE sensitivity analysis emphasises that specific investment costs and availability are the key factors to improve IGCC plant economics while plant efficiency is of less importance.

Considering economical sensitivity a simplified IGCC concept is studied. The investigated simplifications include disintegration of water and steam interfaces between gasification plant and combined cycle, so that the scrubbed synthesis gas is the only interconnection. The

investigations show that efficiency of a carbon capture IGCC is only marginally reduced – despite the significant simplifications in plant design. Moreover, minimal integrated concepts will most likely offer an enhanced flexibility and availability. Finally, some savings of investments are expected, so that disintegrated concepts can help to bring carbon capture IGCC plants in the market.

Keywords: IGCC, Carbon Capture, Concept Simplification.

Proposed Topic: Plant integration