

Accepted Manuscript

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PII: S0960-8524(18)30107-X
DOI: <https://doi.org/10.1016/j.biortech.2018.01.093>
Reference: BITE 19450

To appear in: *Bioresource Technology*

Received Date: 28 November 2017
Revised Date: 18 January 2018
Accepted Date: 19 January 2018

Please cite this article as: Zang, G., Tejasvi, S., Ratner, A., Silva Lora, E., A Comparative Study of Biomass Integrated Gasification Combined Cycle Power Systems: Performance Analysis, *Bioresource Technology* (2018), doi: <https://doi.org/10.1016/j.biortech.2018.01.093>

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A Comparative Study of Biomass Integrated Gasification Combined Cycle Power Systems: Performance Analysis

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ABSTRACT

The Biomass Integrated Gasification Combined Cycle (BIGCC) power system is believed to potentially be a highly efficient way to utilize biomass to generate power. However, there is no comparative study of BIGCC systems that examines all the latest improvements for gasification agents, gas turbine combustion methods, and CO₂ Capture and Storage options. This study examines the impact of recent advancements on BIGCC performance through exergy analysis using Aspen Plus. Results show that the exergy efficiency of these systems is ranged from 22.3% to 37.1%. Furthermore, exergy analysis indicates that the gas turbine with external combustion has relatively high exergy efficiency, and Selexol CO₂ removal method has low exergy destruction. Moreover, the sensitivity analysis shows that the system exergy efficiency is more sensitive to the initial temperature and pressure ratio of the gas turbine, whereas has a relatively weak dependence on the initial temperature and initial pressure of the steam turbine.

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