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## **Modeling and Performance Assessment of a New Integrated Gasification Combined Cycle with a Water Gas Shift Membrane Reactor for Hydrogen Production**

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### **Highlights:**

- A Gibbs free energy based model of the gasification process is developed and validated.
- Effects are investigated of various gasification parameters on the energy efficiency.
- Effects are assessed of various gasification parameters on the hydrogen production rate.
- Low grade coal is preferable in terms of energy efficiency to gasifying high grade coal.

### **Abstract**

This paper investigates the effects of flow rate of gasification oxidant, gasification agent and coal type on the energy efficiency and hydrogen production rate of a proposed system. The proposed system consists of a pressurized entrained flow gasifier integrated with a cryogenic air separation unit, a water gas shift membrane reactor and a combined cycle. Aspen Plus software is used to develop and simulate the integrated system. Three different types of coal are fed to the gasifier. A Gibbs free energy based model of the gasification process is developed and validated. The Gibbs free energy based model is then used to assess the effect of gasification parameters since it is more straightforward regarding changing input flow rates. It was found that gasifying low grade coal is preferable in terms of energy efficiency to gasifying high grade coals, which are more advantageous for combustion regarding energy efficiency.

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