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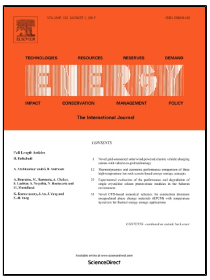

Modified exergoeconomic modeling and analysis of combined cooling heating and power system integrated with biomass-steam gasification

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Modified exergoeconomic modeling and analysis of combined cooling heating and power system integrated with biomass-steam gasification

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Abstract

Biomass-steam gasification is an efficient unitization technology of biomass to produce gas fuel for a combined cooling, heating and power (CCHP) system. The aim of this paper is to modify the exergoeconomic method and analyze the cost allocations of multi-products from CCHP system. Firstly, two integrated CCHP schemes with biomass-steam gasification are designed. The difference lies in the gasification endothermic process driven by electricity and thermal energy from the product gas, respectively. The thermodynamic models are presented and validated. Then, a modified exergoeconomic method based on energy level is proposed to accord with the principle of high quality and high price. Finally, a case study is presented to analyze the thermodynamic performances of two CCHP schemes and the production cost allocations including electricity, chilled water for cooling (hot water for heating) and domestic hot water in different operation modes. Compared with the previous exergoeconomic method, the unit exergy cost of electricity with higher energy level increases 0.09 Yuan/kWh while the cost of other products with lower energy level decrease. The results show that the modified exergoeconomic method is more reasonable and efficient.

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