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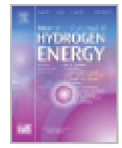

Employing a booster/ejector-assisted organic flash cycle to heat recovery of SOFC system; Exergy- and economic-based optimization

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Abstract

Integrating heat recovery units into modern power plants is a good way to improve their efficiency in the future. To address this challenge, this study aims to design and develop an electricity/cooling cogeneration system (ECCS) that uses a solid oxide fuel cell (SOFC), fed by CH_4, along with a booster/ejector-assisted organic flash cycle that recovers heat from the exhausted gasses. An extended evaluation of the output of the proposed ECCS is conducted based on energy-exergy, environmental, and exergoeconomic criteria, in which the SOFC's current density (J_{SOFC}), the SOFC operating temperature (T_{SOFC}), along with the flashing tank temperature (T_{FT}), are considered variables. Accordingly, the exergetic efficiency and cost of products as objective functions are optimized by the NSGA-II method. The optimum state is reachable at T_{FT}=370K, T_{SOFC}=895K, and J_{SOFC}=5000 A/m^2. Here, the exergetic efficiency and cost of products are calculated at 53.23% and 43.27 $/GJ. Accordingly, energetic efficiency and total exergoeconomic factor are enhanced by 1.33% and 1.96%, respectively, compared with the based case. Moreover, a variation in T_{FT} does not have any effect on the pollution damage cost (PDC) at all, in fact, the PDC remains at 3.066 $/h regardless of the variation in T_{FT}.