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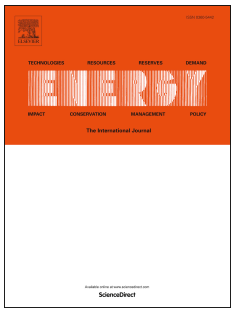

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Thermodynamic assessment of a novel SOFC based CCHP system in a wastewater treatment plant

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Abstract

Wastewater Treatment Plants (WWTP) have a significant role in both processing wastewaters to return to the water cycle and in transforming between 40% and 60% of the dissolved organic matter into a non-fossil combustible gas (biogas) with a methane content of around 50–70 vol. %. Significant energy cost savings can be achieved using combined cooling, heat and power (CCHP) systems in small-scale distributed power system wastewater treatment plants. In this study, feasibility of a trigeneration system in a real wastewater treatment plant is studied. A mathematical model has been developed to evaluate system prformance from the thermodynamics point of view. Based on the simulation results, fuel consumption, power production, and thermal efficiency of the system were analyzed. For the proposed configuration, the electricity coverage is increased by 27% and the produced cooling load of around 20 kW in summer season is obtained. The results also reveal that integration of the trilateral cycle (TLC) and the absorption chiller system in the reference WWTP offers a 17.2% more efficient plant from the viewpoint of first law efficiency.

Keywords: *Solid Oxide Fuel Cell, CCHP, wastewater treatment plant, biogas, trilateral cycle*

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