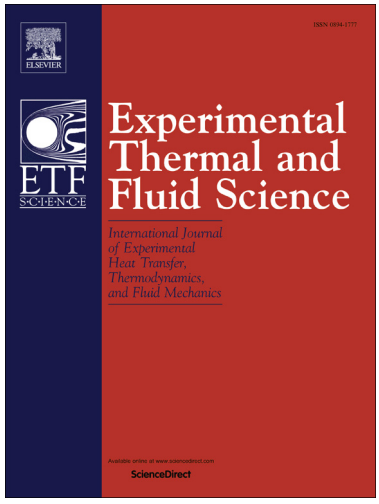

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Power generation enhancement with hybrid thermoelectric generator using biomass waste heat energy

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Abstract

The performance of (Bi_2Te_3-$PbTe$) hybrid thermoelectric generator (*TEG*) at diverse operating conditions using the "syngas" (biomass waste heat) obtained from the gasification of Pongamia de-oiled cake is experimentally investigated. On combustion of the "syngas", a real time temperature of about 250 to 300 ^oC is obtained. For this purpose, an experimental rig is fabricated and tested under various operating temperature and load conditions. The heat energy obtained from biomass gasified and burnt "syngas" is mimicked by an electrical heater. The hot side of hybrid *TEG* was varied from 150 ^oC to 250 ^oC and load resistance upto 2 Ω respectively, while the coolant temperature was kept constant at 26 ^oC. The effect of flow rate of coolant, temperature difference and number of modules in series on the performance of hybrid *TEG* has been studied. The experimental results showed that the use of single hybrid *TEG* gave a maximum power output of 8.94 W with an efficiency of 2.5% and a dimensionless figure of merit, $Z\bar{T}$ of 0.86 for a temperature difference of 200 ^oC. Further, three hybrid *TEG* modules connected in series gave a maximum power output of 27.38 W at the same temperature difference. The use of hybrid *TEG* gave about 53.4%, 21.7% and 39.6% average enhancements in power, voltage and current respectively, when compared with that of an ordinary Bismuth-Telluride (Bi_2Te_3) module.

Keywords: Pongamia, Syngas, Hybrid, Thermoelectric generator, Renewable energy, Power generation