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Article

A Comparative Exergoeconomic Analysis of Waste Heat Recovery from a GT-MHR using Organic Rankine Cycles

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Abstract: A comparative exergoeconomic analysis is reported of waste heat recovery from a Gas Turbine-Modular Helium Reactor (GT-MHR) using different arrangements of Organic Rankine Cycles (ORCs) for electrical power production. The considered organic Rankine cycles are: Simple Organic Rankine Cycle (SORC), ORC with internal heat exchanger (HORC) and Regenerative Organic Rankine Cycle (RORC). The exergoeconomic analysis is performed based on the specific exergy costing (SPECOC) approach. For this purpose, the combined cycles are first thermodynamically analyzed through energy and exergy. Then cost balances and auxiliary equations are applied to subsystems and exergoeconomic parameters are calculated for the components and entire combined cycles. Based on fixed operating conditions for the GT-MHR cycle, the three combined cycles are compared. Finally a parametric study is performed to reveal the effects on the exergoeconomic performance of the combined cycles of such significant parameters as compressor pressure ratio, turbine inlet temperature and evaporator temperature. The results show that the GT-MHR/RORC has the lowest unit cost of electricity produced by the