Environmental Engineering and Management Journal

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DESIGN AND ENERGY ANALYSIS OF A MODIFIED ECO-FRIENDLY COMBINED CYCLE FOR ENHANCED WASTE HEAT RECOVERY UTILIZATION

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Abstract

One of the primary challenges in energy engineering is the development of sustainable and high-efficiency systems. This study investigates the design and performance of a novel combined cycle (engine-cooler) aimed at converting thermal energy from waste heat recovery (WHR) below 100 °C into useful energy outputs, either electrical or thermal. To assess the system's effectiveness, a simulation code was developed using MATLAB to compare the energy performance of conventional and novel combined cycle under identical operating conditions.
Simulation results show that for exit temperatures of 100 °C (boiler), 30 °C (condenser), and 15 °C (evaporator), the novel combined cycle yields coefficient of performance improvements of 59.74 %, 67.34 %, and 70.27 % respectively, over the conventional system. These findings suggest that the proposed configuration offers significant energy performance advantages and has the potential as a replacement for existing systems.

Keywords: combined cycle (engine-cooler), eco-friendly R602, energy efficiency, useful energy, waste heat recovery

Received: October, 2024; Revised final: June, 2025; Accepted: June, 2025

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