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An innovative approach for utilizing waste heat of a triple-pressure cogeneration combined cycle power plant by employing TRR method and thermodynamic analysis

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ABSTRACT

The aim of this study is to examine the possible locations where heat recovery can occur in a triple-pressure cogeneration combined cycle power plant and calculate the amount of waste heat that can be recovered. To complete this objective, an adjusted cycle layout is created and the energy system is analyzed from both thermodynamic and exergetic viewpoints. Furthermore, the Total Revenue Requirement (TRR) method and thermoeconomic analysis are used to determine the price of products produced. The optimization results are displayed in a Pareto chart diagram, utilizing a new model with two objective functions - power cost and product heat. This method allows for identifying the best operating point for these types of power plants, accounting for electricity and heat prices across various regions. The implications of this study for the energy sector are significant as it highlights how waste heat recovery plays a crucial role in cogeneration combined cycle power plants. By pinpointing potential heat recovery locations and determining how much waste heat can be recovered, valuable insights are gained that can inform both design and operation decisions for these power plants. Additionally, using the TRR method and thermoeconomic analysis provides a comprehensive framework for evaluating the economic feasibility of this type of system.

1. Introduction

The utilization of waste heat can improve the efficacy of power plants by decreasing their fuel demand; additionally, it can be used to reduce the demand for fuel or create a supplementary product besides electricity [1]. Wasted heat from power plants is generally harnessed in its direct form as steam, hot water, and other forms such as industrial desalination, energy-enhancing systems, and regional heating and cooling systems. The utilization of a trigeneration system is the most promising technology integration practice,

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