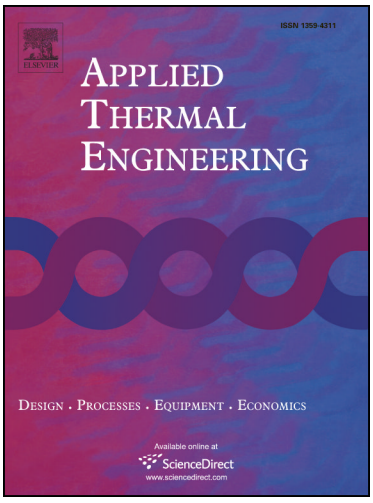

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Energy, exergy and sustainability assessments of a cogeneration system for ceramic industry

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Abstract

In this study, energy, exergy and sustainability analyses are applied in the ceramic sector to simulate gas turbine based cogeneration plant model. The cogeneration system mainly consists of a proposed gas turbine unit, a wall tile dryer and a ground tile dryer. The energy analysis is performed, and then the exergy and sustainability analyses are applied for the five different dead state (environment) temperatures varying from 10°C to 30°C (interval of 5°C). It is found that the most energy efficient components are determined as the air compressor and combustion chamber, while the minimum one is obtained to be wall tile dryer (7.98%). The maximum sustainability and exergy efficiency (89.46%) are determined for the air compressor as 89.46% at 10°C dead state temperature. The cogeneration (overall) system has 17.51% energy efficiency; while its maximum exergy efficiency is found to be 29.94% at 10°C environment temperature. The sustainabilities of the components are also directly proportional to their exergy efficiencies. Furthermore, the utilization of the gas turbine unit included cogeneration system can provide 0.1115 m^3/s and 0.0732 m^3/s natural gas saving for the ground and wall tile dryers, respectively.

Keywords: Cogeneration; Efficiency; Energy; Exergy; Gas turbine; Spray dryer.

1. Introduction

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