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- EXERGOENVIRONOMIC MODELLING AND PERFORMANCE ASSESSMENT OF SELECTED GAS TURBINE POWER PLANTS

Exergoenvironomic modelling and performance assessment of selected gas turbine power plants

Author(s):

[Sunday Olayinka Oyedepo](#) , (Mechanical Engineering Department, Covenant University, Ota, Nigeria)

[Richard Olayiwola Fagbenle](#) , (Department of Mechanical Engineering, Obafemi Awolowo University, Ile Ife, Nigeria)

[Samuel Sunday Adefila](#) , (Department of Chemical Engineering, Covenant University, Ota, Nigeria)

[Md Mahbub Alam](#) , (Institute for Turbulence-Noise-Vibration Interaction and Con, Harbin Institute of Technology, Shenzhen, China)

...Show less authors

Abstract:

Purpose

This study aims to use an environomics method to assess the environmental impacts of selected gas turbine power plants in Nigeria.

Design/methodology/approach

In this study, exergoenvironomic analysis has been carried out to investigate the environmental impact of selected gas turbine power plants in Nigeria from an exergetic point of view.

Findings

The exergy analysis reveals that the combustion chamber is the most exergy destructive component compared to other cycle components. The exergy destruction of this component can be reduced by increasing gas turbine inlet temperature (GTIT). The results of the study show that thermodynamic inefficiency is responsible for the environmental impact associated with gas turbine components. The study further shows that CO₂ emissions and cost of environmental impact decrease with increasing GTIT.

Originality/value

The exergo-environmental parameters computed in this study are CO₂ emission in kg per MWh of electricity generated, depletion number, sustainability index, cost flow rate of environmental impacts (\dot{C}_{env}) in \$/h and total cost rates of products (\dot{C}_{Tot}) in \$/hr. For the period considered, the CO₂ emissions for the selected plants vary from 100.18 to 408.78 kgCO₂/MWhm, while cost flow rate of environmental impacts varies from \$40.18 /h to \$276.97 /h and the total cost rates of products vary from \$2935.69/h to \$12,232.84/h. The depletion number and sustainability index vary from 0.69 to 0.84 and 1.20 to 1.44, respectively.

Keywords:

[Exergy](#), [Exergo-environmental analysis](#), [Sustainability index](#), [GTIT](#), [Carbon dioxide emissions](#)

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