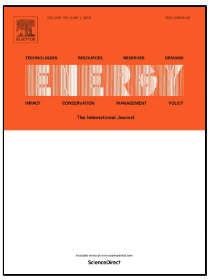
# Accepted Manuscript



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# Exergoeconomic and Exergoenvironmental Analysis of an Integrated Solar Gas Turbine/Combined Cycle Power Plant

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*Abstract*

Integration of solar power to Combined Cycle Power Plants is a solution attracting increasing interest, bridging solar thermal technology to a well-proven energy conversion solution. The integration is attractive for countries aiming to pass to natural gas as an energy feedstock and it could improve the environmental performance. In order to identify the performance and potential environmental benefits, a model of the plant was applied. It covered an annual operation period and included the effects of surroundings variables. The model allows to predict the power plant performance, and calculates a complete exergy balance for all the components of the complex plant. The calculations are repeated for referential CCGT and for the Integrated Solar CCGT.

A complete exergoeconomic and exergoenvironmental model was applied at the design conditions after evaluating the cost of equipment and their environmental score using a detailed Life Cycle Assessment (LCA) modelling tool. The results, applied to a power plant in Southern Poland, show that the solution can be attractive for improving the environmental performance of a CCGT ($CO_2$ emission factor decreased by 9%), and that the capital cost is only slightly increased so that the rate of return of the investment is only marginally affected.

**Keywords**

Combined-Cycle Power Plants, Solar Thermal Integration, Economics, Exergoenvironmental Analysis, Life Cycle Analysis.

## 1. Introduction

One of the greatest challenges of the 21st Century is to provide a dependable energy supply, limiting climate change issues connected to greenhouse gas emissions and considering economic aspects

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