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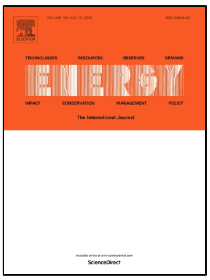

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# Energy level difference graphic analysis method of combined cooling, heating and power systems

*Zefeng Wang[a, b], Wei Han[a, b *], Na Zhang [a, b], Zhongxue Gan [c], Jie Sun [d], Hongguang Jin [a, b]*

[a] *Institute of Engineering Thermophysics, Chinese Academy of Sciences, Beijing, China*
[b] *University of Chinese Academy of Sciences, Beijing, China*
[c] *ENN Science and Technology Development Co., Ltd., Langfang, China*
[d] *Xi'an Jiaotong University, Xi'an, China*

## ABSTRACT

In this research, an energy level difference graphic analysis method that describes the variation of the driving force for a thermodynamic process is proposed. This method is based on the average energy level difference, in which the contrastive analysis among energy transfer and conversion processes especially for off-design conditions is presented. The graphic analysis using this method is conducted on a combined cooling, heating and power (CCHP) system. At the design conditions, because the high energy level difference occurs in the combustor (COMB), the exergy destruction accounts for approximately 40% of the input fuel exergy, followed by the high-pressure generator (HPG). Moreover, this proposed method is introduced to evaluate the off-design performance of the CCHP system with the different operation method for the gas turbine. The energy level difference $\Delta A_{\mathrm{COMB}}$ under the inlet air throttling (IAT) operation method is decreased, which makes the less exergy destruction in the COMB compared with the reducing turbine inlet temperature (TIT) operation method. However, the opposite results are presented in the HPG. The proposed method may provide a new approach to reveal the energy- saving potential of the energy system.

## KEY WORDS

Off-design performance; CCHP systems; energy level difference

## 1. Introduction

Beginning with the enactment of the American Public Utility Regulatory Policies Act in 1978, distributed energy systems (DES) have attracted increased attention from all over the world [1]. The typical DES technology consists of a power subsystem and surplus heat recovery subsystems

*Corresponding author. Tel: + 86 10 82543030 fax: +86 10 82543151
*E-mail address:* hanwei @ iet.cn