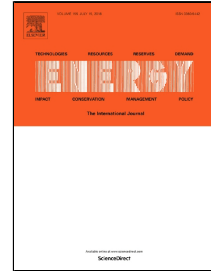


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# Energy level difference graphic analysis method of combined cooling, heating and power systems

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## 2 ABSTRACT

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

## 16 KEY WORDS

17 Off-design performance; CCHP systems; energy level difference

## 18 1. Introduction

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

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