

Unified performance evaluation approach in competitive environment: Case study on power plants

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Abstract

Data envelopment analysis (DEA) evaluates the performance of decision making units (DMUs). This research proposes a new approach to evaluate thermal power plants. In this study, we define two categories of inputs (operational and non-operational) to measure performance of power plants. In real case study, it is necessary to explore how to combine two separated efficiency measures in a unified structure. The conventional data envelopment analysis (DEA) may fail to discriminate among decision making units (DMUs) and the resulting efficiency scores may not be meaningful, especially when the number of DMUs is insufficient. In this paper, a new approach is suggested based on DEA and game theory to evaluate DMUs by a large scale of measures. For this purpose, Nash bargaining game as a cooperative game model and the conventional DEA models are combined. The proposed approach regardless of the number of DMUs discriminates among the DMUs more effectively. Moreover,

DMUs can be compared by different categories of measures in the competitive environment. Furthermore, the case study of thermal power plants in Iran is presented to show the abilities of the proposed approach.

1. Introduction

Data envelopment analysis (DEA) is a methodology based on a linear programming for evaluating relative efficiencies of DMUs. Data envelopment analysis proposed by Cooper et al. (CCR model, 1978) and extended by Banker et al. (BCC model, 1984). DEA models scores for efficient DMUs are equal to one and less than one to inefficient DMUs. With using DEA, the relative efficiency of DMUs that produce multiple outputs by using multiple inputs, may be calculated. The relative efficiency of a DMU is calculated using a ratio definition of efficiency. If the relative efficiency of a set of DMUs performing the same type of function is to be evaluated, the DMUs must use the