



دهمین کنفرانس بین المللی مهندسی صنایع

Tenth International Industrial Engineering Conference

۷ و ۸ بهمن ماه ۱۳۹۲

27-28 January, 2014



Performance Optimization of HSEE Factors in Generation Companies

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Abstract—A unique framework for performance optimization of generation companies (GENCO) based on human, safety, environment and ergonomics (HSEE) indicators is presented. In order to rank this sector of industry, the combination of data envelopment analysis (DEA), principle component analysis (PCA) and Taguchi are used for all branches of generation companies. The mentioned methods are applied in an integrated manner to measure the performance of GENCO. The preferred model between DEA, PCA and Taguchi is selected based on sensitivity analysis and maximum correlation between rankings. To achieve the stated objectives, noise is introduced into input data. The results show that Taguchi outperforms other methods. The developed algorithm of this study could be used for continuous assessment and improvement of GENCO performance in supplying energy with respect to HSEE factors. The results of such studies would help managers to have better understanding of weak and strong points in terms of HSEE factors.

Keywords- *Performance Optimization; Generation Companies (GENCO); Human, Safety, Environment and Ergonomics (HSEE); Data Envelopment Analysis (DEA); Principal Component Analysis (PCA); Taguchi Methods*

I. INTRODUCTION

Human, Safety and Environment (HSE) at the operational level will strive to eliminate injuries, adverse health effects and damage to the environment. Effective application of ergonomics in work system design can achieve a balance between worker characteristics and task demands. This can enhance worker productivity, provide improved worker safety (physical and mental) and job satisfaction [1]. Several studies have shown positive effects of applying ergonomics principles to the workplace including machine, job and environmental design [2-7].

There are a lot of factors in ergonomics design of workplace both in micro and macro parts, thus it seems inevitable to consider a model which includes all related factors. Micro-ergonomics consider those factors of machine design and work posture that affect the user interface and working conditions related to the job or task design. In a macro-ergonomics study, ergonomics factors considered in parallel to organizational and managerial aspects of working conditions in context of a total system design. Moreover, it attempts to create equilibrium between organization, operators and machines. It focuses on total “people-technology” systems and is concerned with the impact of technological systems on organizational, managerial and personnel sub-systems [8-9]. Studies in ergonomics have produced data and instructions for industrial applications [10-12]. Eklund [13] presented the relationships between ergonomics and several factors such as work conditions, product design, ISO 9000, continuous improvements and TQM. Azadeh et al. [9] described an integrated macroergonomics model for operation and maintenance of power plants.

By considering HSE, an organization manages its operations in a manner that places safety and health first. Champoux and Brun [14] gave an overview of the most characteristic OHS representations and practices in small firms. Singh et al. [15] considered the state of the art of understanding the hazards and risks to human health and the environment associated with the use of synthetic chemicals as a basis for developing a risk assessment procedure for the mining industry.

HSE and ergonomics have been considered from different points of view [16-18]. There are close relationship between health, safety, environment and ergonomics factors. Inappropriate design between human and machine could lead to decreased safety. Inappropriate design of system leads to management error. Management error and work environment injurious