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A MULTI-OBJECTIVE ENERGY RESOURCE ALLOCATION MODEL FOR TURKISH MANUFACTURING INDUSTRY USING LINEAR PHYSICAL PROGRAMMING

Semih Onut, Umut Rifat Tuzkaya, Gülfem Tuzkaya and Bahadir Gülsün

Department of Industrial Engineering, Faculty of Mechanical Engineering
Yildiz Technical University
Barbaros Street, Yildiz, Istanbul 34349, Turkey
{ onut; tuzkaya; gtuzkaya; bahadir }@yildiz.edu.tr

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Abstract. *The efficient use of the available resources is very important for a country's economical and political development. Energy is the main component of the natural resources of industrialized and developing countries. Since Turkey is not an oil or a natural gas producing country, her current energy resources should be allocated to the appropriate energy consuming sectors considering the various objectives and constraints. The main objective of this study is to devise a model to allocate the current energy resources to the Turkish Manufacturing Industry sub-groups by using Linear Physical Programming (LPP), which is a multi-objective optimization technique. The most widely used energy resources in the Turkish Manufacturing Industry, namely, fuel-oil, lignite, hard coal, electricity, LPG and natural gas are taken into consideration in this study. Furthermore, several scenarios are generated on the probable risks of price fluctuations, energy shortages in relation to specific resources, and on the influences of energy emission targets to measure the robustness of allocation preferences.*
Keywords: Energy resource allocation (ERA), Turkish manufacturing industry, Linear physical programming, Multi-objective optimization

1. **Introduction.** Due to the economic and social developments in Turkey, the demand for energy in general and for electricity in particular has increased considerably. Turkey's primary energy consumption has increased from 72.30 mtoe (million tons of oil equivalents) in 1998 to 83.94 mtoe in 2003 [1]. According to the development plans, Turkey's primary energy consumption is estimated to be 171 mtoe in 2010 and 298 mtoe in 2020 [2]. Sadly enough, the domestic energy production has dramatically declined from 28.86 mtoe in 1998 to 23.96 mtoe in 2003 [1]. In other words, while the domestic energy production secured 39.92% of the total primary energy demand in 1998, this proportion fell down to 28.54% in 2003. It will probably secure as low as 24% of the demand in 2020 [2]. The domestic energy output has mostly been from hydro and lignite generators. Almost all oil and natural gas are imported. The share of the imported energy in total energy consumption has continued to increase in time. In 2000, oil had the biggest share of 41.89% in total energy consumption followed by natural gas with 16.20%, lignite with 15.15% and hard coal with 11.02% [3]. More than half of the primary energy consumption was met by imports [4].

In 2001, 36.6% of Turkey's primary energy consumption occurred in the industrial sector, 34.5% in the residential sector, 20.9% in the transportation sector, 5.1% in the agricultural sector and 2.9% in other sectors [2-5]. Likewise, Turkey's electricity consumption occurred mainly in the industrial sector by 52%. The share of the industrial sector in total consumption is expected to grow at approximately 9% per year [6]. Hence, as