Assessment of Coal Import Prices and Import Years in Turkey

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Abstract: Statistical analysis techniques are one of the important analysis techniques for the energy issues. In this paper, coal import prices ($) and coal import years (2000-2010) in Turkey are assessed by using the statistical analysis techniques including cluster analysis and block diagram. Through the results from the cluster analysis, it was determined that three different groups of coal import years and two different groups of coal import prices. After, the results of cluster analysis supported the block diagram. Finally, this study shows that the beneficial to statistical analysis techniques such as cluster analysis and block diagram for grouping in the coal import prices ($) and coal import years (2000-2010).

Keywords: energy; coal, import prices, cluster analysis, block diagram, turkey.

1. INTRODUCTION

Energy is a significant factor for economic development and social prosperity of countries. Modern society would have not been possible without energy (Capik, Yilmaz & Cavusoglu; 2012).

Coal is the altered remains of prehistoric vegetation that had originally accumulated in swamps and peat bogs. The most significant uses of coal are in electricity generation, steel production, cement manufacturing and other industrial processes, and as a liquid fuel (Jorjani, Mesroghli & Chelgani, 2008; Yerel & Ankara, 2011). Turkey is situated at the meeting point of three continents (Asia, Europe and Africa) and stand as a bridge between Asia and Europe. The country is located in
southeastern Europe and southwestern Asia. Its size is 779,452 km². Turkey’s population was about 73 million in 2007 (DIE, 2007). Because of social and economic development of the country, the demand for energy is growing rapidly. The main indigenous energy resources are hydro, mainly in the eastern part of the country, and lignite (MEF, 2007; (Toklu, Guney, Isik, Comakli & Kaygusuz, 2010).

Turkish coal and lignite are largely inappropriate for the purpose of sustainable development as their usage is cost ineffective and responsible for air pollution in urban centers during the 1970s and 1980s. This is because Turkish lignite has low calorific value and high sulfur, dust and ash content whereas Turkish hard coal is low grade (Yuksel, 2010; Yarbay, Guler & Yaman, 2011).

Turkey imports significant amounts of hard coal, mainly from Australia, The United States, South Africa and Russia (Balat, 2006; Yerel & Ersen, 2012). In this article coal import prices and coal import years assessed by using the statistical analysis techniques such as cluster analysis and block diagram.

2. MATERIALS AND METHODS

2.1. Cluster analysis

Cluster analysis is a multivariate technique, whose primary purpose is to classify the objects of the system into categories or clusters based on their similarities, and the objective is to find an optimal grouping for which the observations or objects within each cluster are similar, but the clusters are dissimilar to each other. Hierarchical clustering is the most common approach in which clusters are formed sequentially. The most similar objects are first grouped, and these initial groups are merged according to their similarities. Eventually as the similarity decreases all subgroups are merged into a single cluster.

Cluster analysis was applied to surface water quality data using a single linkage method. In the single linkage method, the distances or similarities between two clusters A and B are defined as the minimum distance between a point in A and a point in B:

$$D(A,B) = \min \{ d(x_i,x_j), \text{ for } x_i \text{ in A and } x_j \text{ in B} \}$$ (1)
where \( d(x_i, x_j) \) is the Euclidean distance (Johnson and Wichern, 2002; Alvin, 2002; Yerel, 2010).

### 2.2. Database

The dataset are composed, four different type coal import prices ($) such as briquettes, solid fuel from coal (A), lignite and turba from coal and retards (B), oil and other product from coal (C) and charcoal (D). The dataset is obtained from 2000 - 2010.

The dataset is assessed using the statistical analysis techniques such as cluster analysis and block diagram. All statistical computation is made using statistical software.

### 3. RESULTS AND DISCUSSION

In this paper, cluster analysis is used to determine similarity groups among the coal import prices ($) and coal import years (2000-2010). The dataset were used to graphed dendrogram (Fig. 1-2).

Fig. 1 show that the coal import years are composed three different groups. Group 1 is formed 2000, 2006, 2005 and 2007; group 2 is composed 2001, 2002, 2003 and 2004 and group 3 is formed 2008, 2009 and 2010.

Fig. 2 presents that the coal import prices are formed two different type prices in Turkey. Group 1 is formed B, C and D; group 2 is composed A.
The coal import years and coal import prices in Turkey were compared in Fig. 3-4. The Fig. 3 presented that the three different groups are composed according to years. Group 1 is composed 2000, 2006, 2005 and 2007; group 2 is formed 2001, 2002, 2003 and 2004 and group 3 is generated 2008, 2009 and 2010. The block diagrams show that the coal import prices are increased last three years.

The Fig. 4 shows that the two different groups are composed according to coal import prices. Group 1 is generated B, C and D; group 2 is composed A.
4. CONCLUSION

In this paper, the coal import prices and the coal import years in Turkey were investigated statistical analysis techniques. Cluster analysis was applied to determine similarity groups among the coal import prices ($) and the coal import years (2000-2010). Coal import prices are determined two different groups and coal import years are determined three different groups. After, the coal import prices and the coal import years were using the constructed block diagram. The results of cluster analysis are back up the block diagram. Finally, the analysis presents that the coal import prices are increased last three years.
REFERENCES