

## **The use of the DEA method for simultaneous analysis of the interrelationships among economic growth, environmental pollution and energy consumption**

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### **Abstract**

*In this study Data Envelopment Analysis (DEA) is used not only to develop an efficiency index which combines economic activity, CO2 emissions and energy consumption of the production process in the 31 countries of Europe for the year 2004, but also to make estimates about the margins of long term increase or decrease in the consumption levels of exhaustible energy resources of a selected sample (Switzerland, Greece, United Kingdom, and Luxembourg) of European countries (out of 31) which belong to the high income group of OECD members. As shown, each country can achieve better TE when its increased economic activity is combined with improved ecological performance. It can be noticed from the analysis that the developed economies that tend to stabilize their environmental degradation through time (Switzerland), as the GDP (per capita GDP) increases, ensure satisfactory margins for the increase in the consumption of the 'dirty' energy index (DEI) in the long term, and thus contribute to sustainable economic development. This fact is significantly different in countries showing either intense deterioration (Greece) or temporary improvement (United Kingdom, Luxembourg) in the pollution levels without any indications of a temperate stabilization of environmental degradation.*

**Keywords:** Technical Efficiency index, Sustainability, Energy Consumption, Environmental Pollution, Economic Development, DEA, Future Estimations.

**JEL classification:** Q01, Q32.

### **1. Introduction**

The Data Envelopment Analysis (DEA) developed by (Charnes *et al* in 1978, is one of the most established methods for assessing efficiency and comparative analysis of Decision Making Units (DMUs) which function in a system that consists of uniform units.

The (DEA) method is based on a model of linear programming in order to define the TE levels, in cases of constant or variable returns to scale. The DEA in particular can be carried out either with the assumption of Constant Returns to Scale

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