Oil Consumption Forecasting in Turkey using Artificial Neural Network

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ABSTRACT

Oil and energy markets have experienced dramatic changes over the past three decades. Due to these changes, it may be difficult to model and forecast the oil consumption with traditional methods such as regression. Artificial Neural Networks (ANNs) are the strong rival of regression and time series in forecasting. ANNs provide good accuracy along with more reliable and precise forecasting for policy makers, in this regard, ANNs can establish the foundation for oil consumption management by providing good model results. This paper tries to unfold the oil consumption forecasting in Turkey using ANN through some predetermined inputs, which is data for population, GDP, import and export of Turkey from 1965 to 2010, with the aim of finding the essential structure of the data to forecast future oil consumption in Turkey with less error.

Keywords: Artificial Neural Network (ANN), Forecasting, Least-Squares Method, Oil Consumption, Regression

1. INTRODUCTION

Amount of energy consumed in a process or system, or by an organization or society is called energy consumption. Worldwide energy consumption is rising sharply, owing to increasing human population, continuing pressures for better living standards and emphasis on large-scale industrialization in developing countries, thus sustaining positive economic growth rates. For this reason, the importance of forecasting primary energy production and consumption sources cannot be overlooked or underestimated. Accurate forecasts provide the foundation for daily operations, market planning and risk management. A well forecasting technique is a must for accurate investment planning in energy production/generation and distribution.

Traditional forecasting models can be classified as time series or regression models. Various techniques for forecasting energy con-
Artificial neural networks (ANNs) are a tool of forecasting and modeling used widely in recent years. ANNs have received increasing interest in corporate business, promising superior performance, reduced forecasting errors and consequently enhanced decisions in strategic, tactical and operational planning.

The utility of ANN models lies in the fact that they can be used to infer a function from observations. This is particularly useful in applications where the complexity of the data or task makes the design of such a function by hand impractical. The tasks ANNs are applied to tend to fall within the following broad categories:

- Function approximation, or regression analysis, including time series prediction, fitness approximation and modeling.
- Classification, including pattern and sequence recognition, novelty detection and sequential decision making.
- Data processing including filtering, clustering, blind source separation and compression.
- Robotics including directing manipulators, computer numerical control.

Turkey is a crucial bridge between energy-rich regions and Europe, which spends a huge amount of money for the imported energy resources. Turkey has become one of the large growing energy markets in the world in the last 20 years since its young and growing population and rapid economic developments cause the increment of energy consumption. Turkey became a candidate for European Union (EU) membership in the near future. Turkey reorganizes her energy policy in order to meet EU membership criteria.

In this study, the oil consumption of Turkey is aimed at forecasting through some predetermined inputs using an ANN model. The rest of the paper is organized as follows. Section 2 gives the information on oil consumption in Turkey. Section 3 introduces the fundamentals of ANN. Section 4 gives a literature review on ANNs in energy forecasting. In Section 5, an ANN model to forecast oil consumption and an application in Turkey is presented. Finally future directions and conclusion are given in Section 6.

2. OIL CONSUMPTION IN TURKEY

Turkey’s primary energy sources include hard coal, lignite, asphaltite, bituminous schist, hydroelectricity, oil, natural gas, nuclear, geothermal, solar, wood, animal, and plant wastes. But, the level of primary energy production in Turkey is very low. Due to the very limited indigenous energy resources, Turkey has to import nearly 52% of the energy from abroad to meet her needs (Ogulata, 2002).

Turkish oil fields are generally small, and scattered around the country. Oil fields in the southeast (specifically the Hakkari Basin, Turkey’s main oil producing area) are old and expensive to exploit. Most of Turkey’s 270 million barrels of oil reserves are located in the Hakkari Basin, which is also where most of Turkey’s oil production occurs with additional deposits found in Thrace in the northwest. In addition to the Hakkari Basin, Turkey contains oil prospects in its European provinces, in the Black Sea shelf region, and in other oil basins in southern and southeastern Turkey. Turkish Petroleum Company (TPAO) has increased its exploration activities in the Black Sea, which according to the company could hold 10 billion barrels of oil.

Turkey’s oil consumption has increased in recent years, and this trend is expected to continue, with growth of 2–3% annually in the coming years. Half of Turkey’s energy usage is currently oil, but this proportion is expected to decrease somewhat as natural gas usage increases. Oil now constitutes a critical factor in sustaining the well-being the Turkey’s as well as the nation’s economic growth. Production in industries such as manufacturing, transportation, and electricity generation demands a substantial amount of oil.
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