

volatility, does allow increasing the performance of asset allocation process and to surpass both naïve and index portfolio.

### References

1. List of the PFTS Index constituent stocks (2016). Retrieved from <http://pfts.ua/trade-info/indexes/shares-indexes> (in Ukr.)
2. Sharpe, W. F. (1966). Mutual fund performance. *The Journal of business*, Vol. 39, No. 1, pp. 119-138.
3. Van der Weider, R. (2002). GO-GARCH: a multivariate generalized orthogonal GARCH model. *Journal of Applied Econometrics*, Vol. 17, No. 5, pp. 549-564.
4. JP Morgan Chase (1996). *RiskMetrics<sup>TM</sup> - Technical Document. Fourth Edition*. 296 p. Available at: <https://www.msci.com/documents/10199/5915b101-4206-4ba0-ae2-3449d5c7e95a>

**УДК 338.36**

## **FINANCING RENEWABLE ENERGY PROJECTS IN TURKEY**

*Zeki KILIÇ*

*YTL Energy and Engineering*

*e.mail: zekikilic63@gmail.com*

### Introduction

Rapid increase of population and industrialization in the 20th century resulted in a huge energy demand across the world. According to the United States Energy Information Administration (EIA), total world consumption of marketed energy is projected to increase by 49% from 2007 to 2035 in International Energy Outlook 2010 reference case.

Energy is the most important input of economic sustainability but it is not possible to provide sustainable development without protecting the environment and taking economic conditions into account (Fig. 1).

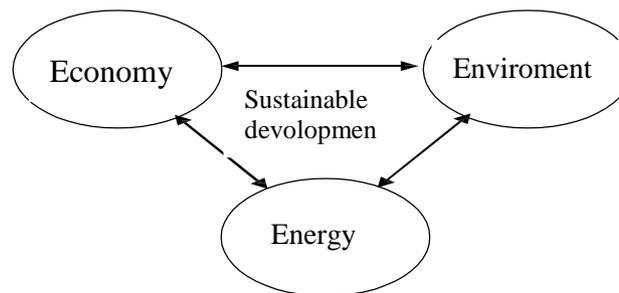
Energy is considered to be a significant factor in economic development and prime agent in generation of wealth.

Much of the world's energy, however, is currently produced and consumed in ways that could not be sustained if technology were to remain constant and if overall consumption were to increase substantially. Electricity supply infrastructures in many developing countries are being rapidly expanded as policy makers and investors around the world increasingly recognize the pivotal role of electricity in improving living standards and sustaining economic growth. The renewable energy sources have become more important than ever due to the increase in oil and natural gas prices by 500% in the last 15 years and corresponding political situation of the world.

Nowadays, new energy investments are directed towards clean energy. Accordingly, the EU has adopted an energy policy aiming to maximize the use of renewable energy sources to reduce the dependence on fuel from non-member countries, to minimize emissions from carbon sources, and to decouple energy costs from oil prices. Energy (E) is one of Turkey's most important development priorities. Hence, utilization of indigenous renewable energy sources is of vital importance for Turkey to reduce its dependence on foreign energy supplies, provide supply security and prevent the increase in greenhouse gas emission. Turkey's energy policy targets to increase the current share of renewable energy from 20% to 30% in coming years.

Turkey has a quite diverse energy resources, including hard coal, lignite, oil, hydropower, natural gas, geothermal, wood, animal and plant waste, solar and wind power. However, utilization of these resources is not at desired levels to meet the demand of the country. The energy demand of Turkey has been growing more rapidly than the energy production since it is a socially and economically developing country.

In Turkey, natural gas and electricity prices for residential and industrial use have increased by almost 8 and 7 times, respectively, between 1999 and 2010. Thus, the renewable energy sources have become a challenging alternative to fossil fuels for the country.

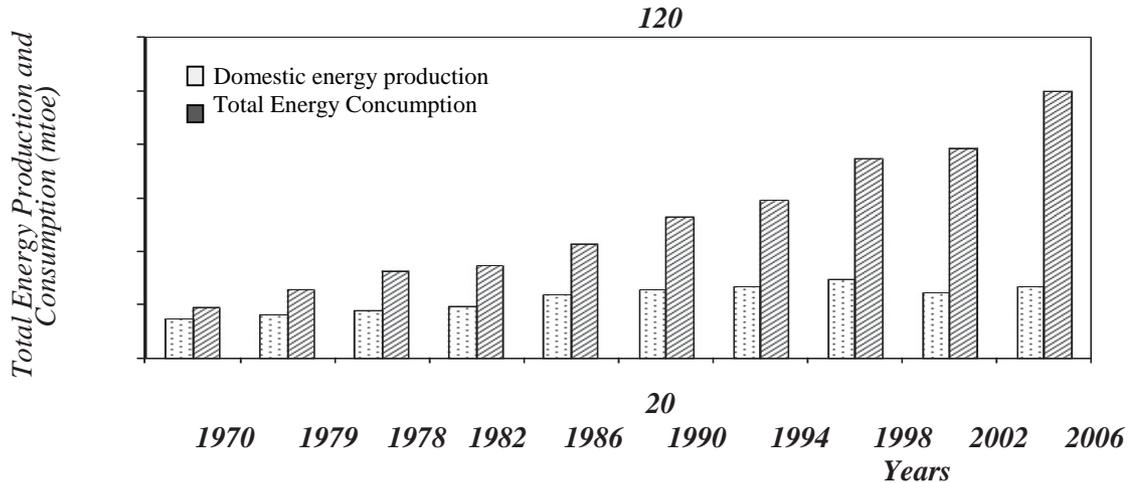


**Fig. 1. Three main elements of sustainable development**

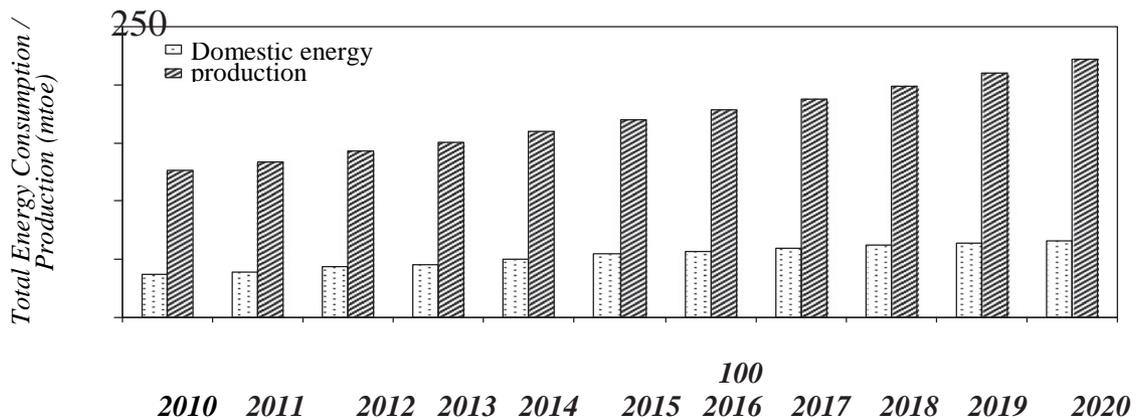
### 1. Current energy trends and economic profile of Turkey

In Turkey, the public sector monopoly was ended in 1982 and the private sector was allowed to build power plants and sell the electricity generated to Turkish Electricity Administration. The first law (Law No. 3096) that formed the framework for the participation of private sector in electricity industry was enacted in 1984. This law constituted the legal basis for private entrepreneurs to build new generation plants by means of build-operate-transfer (BOT) contracts. The law on Building and Operating of Electricity Generation Plants by BOT Model and Regulation of Energy Marketing (Law No. 4283) enacted in 1997 and provided the participation of private sector in building and operating of energy plants. Turkey has become one of the biggest economies around Europe and in the world over the last 30 years with rapid increase in its population and

industrialization. According to According to OECD, Turkey was the 11th largest economy of the world with a gross domestic product (GDP) of 960.1 billion USD in 2007



**Fig. 2. Trends in total energy production and consumption of Turkey between 1970 and 2006**



**Fig. 3. Projections on domestic energy production and total energy consumption of Turkey between 2010 and 2020**

## 2. Financing of renewable energy projects in Turkey

Turkey is the 6th largest electricity market in Europe and it is also one of the fastest growing markets globally. In early 2000s, in order to meet the growing energy demand, the Turkish government initiated an ambitious reform program which was intense in the most important segments of Turkey's energy market.

This reform program has brought restructuring of the market together with privatization, liberalization and enhancement of competition. Moreover, by enacting the Renewable Energy Law, the Turkish government provided a strong support towards

increasing electricity generation from renewable energy sources. The Industrial Development Bank of Turkey (TSKB) and the Development Bank of Turkey (TKB) have been providing loan opportunities for the utilization of renewable energy sources for electricity generation.

TSKB has provided loans for 43 hydropower plants, 2 wind power plants and geothermal energy projects having a total installed capacity of 1328, 53 and 57.2 MW, respectively. Turkey has also benefited from international grants to finance energy projects in the last five years. As a result of the application executed mutually by the World Bank and Turkey to finance the exploitation of renewable energy sources, a loan of nearly 200 million USD has been provided by TSKB and TKB for a total of 21 projects including 1 wind, 4 geothermal and 16 hydropower plant projects. Total installed capacity of these projects is 585 MW.

Furthermore, the World Bank granted 600 million USD for a renewable energy and energy efficiency project in Turkey in May 2009. 500 million USD of this credit will be provided by the World Bank and the rest by the Clean Technology Fund (CTF). In this project, it is aimed to provide supply security through increasing the share of renewable energy sources, particularly SHPs, in energy production and supporting energy efficiency investments

### **References**

1. Balat, H., 2008. Contribution of green energy sources to electrical power production of Turkey: a review. *Renewable and Sustainable Energy Reviews* 12, 1652–1666.
2. Beccali, M., Cellura, M., Mistretta, M., 2003. Decision-making in energy planning. Application of the Electre method at regional level for the diffusion of renewable energy technology. *Renewable Energy* 28, 2063–2087.
3. Boyle, G., 2004. *Renewable Energy: Power for a Sustainable Future*. Oxford University Press.
4. Branche, E. 2010. Impact of carbon credits on hydropower project financing. In: *Proc., Hydro 2010 Conf., Lisbon, Portugal*.
5. CIA, 2009. *World Factbook 2008*, Central Intelligence Agency, /www.cia.gov.