

## THE IMPACTS OF RENEWABLE ENERGY LAW ON TURKISH WIND ENERGY SECTOR

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**Abstract-** Although the first wind turbine started operation in Turkey as early as 1998, virtually no significant progress has been achieved in the wind energy sector until 2006 due to the absence of a stable legal framework and an effective support mechanism. With the adoption of Renewable Energy Law into Turkish wind energy sector in May 2005 many foreign and local firms are interested in the developments of wind farms and applied to the Energy Market Regulatory Authority for a licence. Despite the fact the perspectives for the development of wind power in Turkey are becoming quite attractive, there are problems to be tackled. This paper provides an analysis of the technological background of Turkish wind energy sector and legislative framework.

**Keywords:** Wind, Wind Energy, Renewable Energy, Electricity Market.

### I. INTRODUCTION

Turkey has dynamic economic development and rapid population growth. The net effect of these factors is that Turkey's energy demand has grown rapidly almost every year and is expected to continue growing in the coming years. In Turkey electric power is mainly generated through thermal power plants, and the country is highly dependent on imported natural gas. Almost 45 percent of the overall electric energy produced in Turkey uses natural gas [1, 2]. To reduce the import of fossil fuels, while meeting the growing energy demand, the Turkish government is planning to diversify its energy mix by developing the renewable energy sources particularly wind in the coming years.

In the view of increasing global concerns such as reduction of emissions of greenhouse gases, and scarcity of water supplies, the utilization of renewable energy resources in Turkey as an alternative to fossil fuels has been promoted and encouraged by the Turkish government in recent years. The liberalisation process which was started in 1984 provided a large space for private wind energy developers. With an annual wind speed and power density of about 2.5 m/s and 25.8 W/m<sup>2</sup>, respectively, the western, northern and south-eastern coasts of Anatolia have been identified as the most favourable locations for wind power generation in

Turkey. It is estimated that Turkey's technical wind energy potential is 88,000 MW and economical potential is approximately 10,000 MW depending on the technical conditions [2-5].

Despite the fact the first wind turbine started operation in Turkey as early as 1998; actual progress in the market has started in 2006 after the adoption of Renewable Energy Law on 18 May 2005. Although the law is an important step towards the renewable energy implementations, it does not set a target for electricity generated from renewable sources. In 2006 in total of 56 MW capacity of wind turbines were erected, followed by a further 148 MW in 2007. In the end of the 2008 the installed wind capacity in Turkey has reached to 433 MW with an increase of 286 MW which was only 147 MW at the end of 2007. According to latest figures released from Turkish Wind Energy Association (TWEA) in January 2010 there are 29 wind farms with an installed capacity of 776.55 MW operating in Turkey [6, 7]. The current production status of wind energy projects in Turkey is around 1500 MW [8]. According to the projection of the Turkish Electricity Transmission Company (TEIAS), the energy demand is foreseen to increase by 6.3% per annum in the years 2006-2015 and the total installed capacity by 2015 is expected to reach about 59.000 MW. Wind industry will play a primary role to reach this target and the accumulated installed capacity by 2015 will reach more than 1400 MW, representing 2.5% of the total accumulated capacity [9].

### II. LEGAL FRAMEWORK

In the European Union (EU) the development of common rules for the promotion of renewable energy resources dates back to the late 1980's. The Council Recommendation to Promote Cooperation between Public Utilities and Auto-producers of Electricity of 1988 is the oldest piece of legislation on renewable energy in the EU. However, as stated above, the promotion of renewable energy resources in Turkey is subject to far more recent attention [10].

#### A. Electricity Market Law

In March 2001, the Turkish government enacted The Electricity Market Law (EML) with the law no. 4628 which sets the stage for liberalization of power generation

and distribution activities. The new law also created the Energy Market Regulatory Authority (EMRA) to take the necessary measures to promote the utilization of renewable energy resources, including the setting of tariffs, issuing licences and assuring competition. This legislation generated two policies related to renewable energy:

- Renewable energy facilities are only required to pay 1% of the total licence fee or the licence for construction and are exempted from the annual licence fee for the first eight years following the completion date of the facilities stated in their licences.
- The auto-producers which generate electricity from renewable energy resources may purchase electricity from private sector wholesale companies under certain conditions whereas the other auto-producers are not entitled to do so. Moreover it is stated in Article 38 of Electric Market Licensing Regulation (EMLR) that TEIAS and/or the distribution companies are required to give priority status to the facilities generating electricity from renewable energy resources in terms of their connection to the transmission and/or distribution systems [10-12].

### **B. Renewable Energy Law**

Since the incentives provided by EML and EMLR were not adequate, to achieve desired results in the utilization of renewable energy resources renewable energy law has been accepted. The law regarding the spread of the use of renewable energy sources for electric power generation, utilisation from these resources in a secure, economic and qualified way, the increase of the energy mix, the decrease of greenhouse gas emissions, the recycle of wastes, the protection of the environment and the development of the related manufacturing industries for realizing these targets was adopted in Turkish Parliament on 18 May 2005 with Law No. 5346 [1, 7, 10].

The renewable energy law provides that the facilities which generate electricity from renewable energy resources will be granted a renewable energy resources (RER) certificate which will entitle them to benefit from the incentives provided by the law. EMRA is the competent authority to grant the RER certificates of which the procedures and principles are specified by a regulation [10].

The Renewable Energy Law introduced a feed-in tariff scheme which licences power generation companies to generate and transact power from the renewable energy resources and imposes an obligation on companies with a retail licence to purchase a certain percentage of the amount of electricity that they sold in the previous year from the entities holding a RER certificate until 2011. The price of electricity produced by renewable energy sources will be equal to the average wholesale electricity price of the previous year which was approximately 4.6 Euro-cent/kWh for the year 2005 [1].

The Law provides a seven year price guarantee for entities generating electricity from renewable energy sources. After the end of year 2011, the above stated

price mechanism will not be applicable to the entities holding a RER certificate which are in operation for more than 7 years. However after the end of year 2011, the retail sale licence holders will be obliged to purchase energy under the Law from the RER certificate holders which are in operation for less than 7 years [1, 10, 12].

There are certain incentives concerning the investment periods of the projects. For example, the service fees will be waived from the individuals or legal entities willing to construct generation facilities to primarily meet their own energy needs from renewable energy resources. In the event the forests and the lands under private ownership of Treasury or under the disposal of the state are utilised for the generation of electricity from renewable energy resources, such lands can be rented or awarded access by the State to the relevant entities. During the investment period, the fees for the granting of such rights will be discounted by half and certain duties will be waived for lands in forestry areas [1, 10].

The introduction of average wholesale price of electricity generated from renewable energy resources was not welcomed by the wind turbine operators since it caused difficulties in the financing stage of wind farms. It is argued by the wind operators that, by the end of the year 2011, the price of electricity generated by renewable resources will be equal to the average wholesale price of the previous year. Since the electric power is mainly distributed by the state utilities, the price defined by TETAS (Turkish Electricity Trading and Contracting Joint Stock Company) is assumed as average wholesale price. Leaving aside the unrealistic billing procedures between the state enterprises, due to liberalisation of the electric market not only state companies but private investors will be in the energy sector. Upon the criticisms by the investors and operators in the renewable energy sector, in May 2007 the Turkish Parliament has carried out an amendment to the Renewable energy law and introduced following changes in order to improve the existing feed-in tariff scheme [13]:

- Legal entities with a retail sale licence are obliged to buy electrical energy from power plants generating electrical energy from renewable energy resources which are holding a RER certificate and have not completed 10 years of operation.
- The amount of RER-certified electrical energy available shall be published by the EMRA annually. The legal entities holding a retail sale licence shall purchase the amount of RER-certified electrical energy according to the proportion of the energy amount they sold within the previous calendar year to the total electrical energy amount they sold in the country.
- The price of the electrical energy generated from renewable energy resources, which is to be purchased in accordance with the provisions of the Law, shall be the average electricity wholesale price of the year to be determined by EMRA. However, such applicable price may not be less than the Turkish Lira equivalent of 5 Euro-cent/kWh and may not exceed the Turkish Lira equivalent of 5.5 Euro-cent/kWh. However, legal entities

that hold licences based on renewable energy resources and which have the opportunity to sell above the limit of 5.5 Euro-cent/kWh in the market may benefit from this opportunity.

- The implementations within the scope of this article shall cover the plants that are put into operation before 31st of December 2011. However, the council of Ministers may extend the expiration date to 2 years at the most, provided that such extension is published in the Official Gazette until 31 December 2009.

### III. DEVELOPMENT OF THE WIND MARKET

Figure 1 shows the development of total installed wind capacity in Turkey and the generated electricity respectively. It is clear from the figure that the development is directly related to the aforementioned evolution of legislative framework. Although this directly shows the effect of RER certificates in terms of feed-in tariffs and incentives to some extent, the complexity of the licensing procedure and the complicated bureaucratic procedure still imposes a heavy burden on investors. This is probably one of the main reasons why additional supportive measures have to be taken for the development of the wind market.

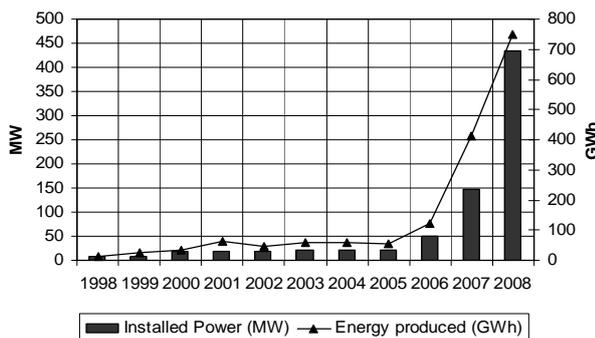


Figure 1. Development of installed wind power and energy produced in Turkey

It is also of important to analyse the installed wind energy parks and the projects with a turbine supply contract in relation to the generators' manufacturers. As can be seen from Figures 2 and 3, the company Enercon dominates the market closely followed by Nordex and Vestas. This can be explained with the fact that although Vestas Turkey office was officially established in early 2008 to handle sales, project management and service activities in the area, Enercon has established its headquarter and service centre in 1999 relatively earlier. Thanks to the stable legal framework and a quite attractive support mechanism in Turkey many foreign and local players are interested in wind development and have projects in the pipeline. There is a big demand for wind turbines and minimum 2 years of delivery times are pronounced as a deadline. Also the shortage of wind turbines has led to different manufacturers to enter into the Turkish wind market which offers relatively shorter delivery times. For example in 2007 Suzlon Energy which is one of the leading turbine manufacturers of India supplied 15 units to Ayen Energy with initial capacity of 31.5 MW.

The main difficulty faced in the installation of big wind turbines is the transport and construction of the systems in the mountainous areas, where the exploitable wind energy may be very appealing. Such locations very often necessitate infrastructure and access roads which very often does not exist. Another problem also pointed out by the investors that the existence of a misperception amongst the local citizens and land owners that wind turbines will cause environmental problems and degrade the quality of agricultural products in the fields.

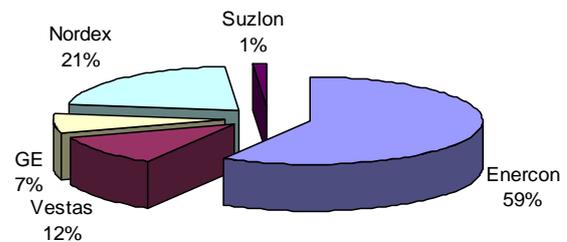


Figure 2. Market shares distribution with respect to installed units

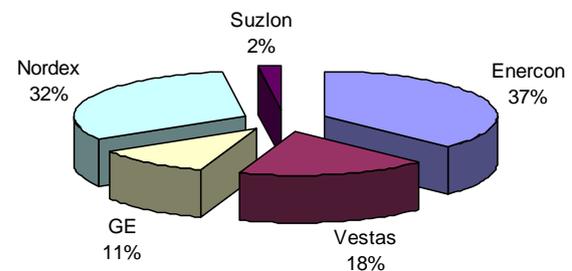


Figure 3. Market shares distribution with respect to installed capacity

Concerning the size of new installed wind power turbines, the average size of the turbines which was installed in 2009 came up to 1508.5 kW against 926.36 kW in the year 2000 as shown in Figure 4.

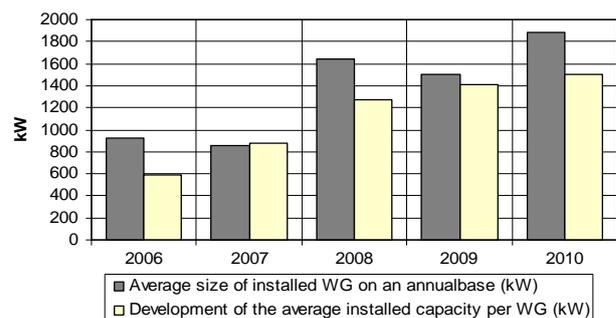


Figure 4. Average power of installed wind generators in Turkey and its annual development

In the first quarter of 2008 the first wind power turbines of 3 MW (Vestas N90) with an established power of 60 MW were made operational in Istanbul. From the projects under construction or with a turbine supply contract it can be observed that there is a tendency of using bigger and more powerful wind turbines. This can be explained with the fact that the incentives given by the state and the guaranteed purchase price of electrical energy generated from renewable energy resources had a positive effect on Turkish wind energy sector. As far as

future projects are concerned, this trend is likely to continue since the technology available is continuously improving while the costs of modern and powerful wind turbines has fallen substantially. As the number of wind turbines increase, the areas with high wind potential will be exploited and this will necessitate turbines with higher efficiency which can generate electricity in areas which have relatively lower wind conditions.

In respect to the system transmission infrastructure costs related to wind energy, in the Turkish situation, there is reasonable match between potentially attractive wind areas on the one hand and load areas as well as transmission infrastructure on the other hand [14].

**IV. IMPACT OF BALANCING AND SETTLEMENT SYSTEM**

Although the electrical energy produced from the renewable energy resources stated in the renewable energy law was officially guaranteed to be purchased for a period of 10 years for a minimum price of 5.5 Euro-cent/kWh, generation companies prefer to make spot sale arrangements in the balancing and settlement system (BSS), which was put into practice in November 2004, rather than committing themselves to a fixed and a lower price in bilateral agreements. The aim of BSS is to create a market where electricity generation without contract can be traded. The actual implementation of the BSS started on August, 1st 2006 following a 21-month virtual implementation period.

As a result of the actual implementation of BSS, the prices emerged in spot market have become higher than those determined between buyers and sellers and the daily electricity market has become more profitable for the investors. The system imbalance which was about 11-13 YKr/kWh in August 2006 when the BSS was initiated, in the course of time increased by more than 35% and exceeded 18 YKr/kWh. Therefore, most generation companies prefer to sell the electricity from renewable sources in spot market rather than to a private third party [8, 12].

With the implementation of BSS, the pay-back period of initial investment costs of wind parks have decreased to 5 years which was around 7-8 years. As a result of the incentives which went into effect with the legislation of renewable energy law and implementation of BSS the wind energy market became quite attractive for the investors. On the other hand, such high prices emerged in the BSS are not guaranteed to continue forever. In this case as a worst scenario the investors will have to rely on the state purchase guarantee rather than higher prices in spot market. Consequently the applications for the new wind power plant applications reached to 70 GW by the end of November 2007. Out of 722 new wind power plant applications with a capacity of 70 GW, 97 projects with an established capacity of 3060 MW have been granted licences by EMRA. Additionally 19 projects with a total capacity of 1022 MW have been accepted feasible while assessment of 44 wind projects with a total established capacity of 2480 MW still continues [8].

Table 1 shows the latest figures of regional distribution of operational wind plants at various stages in Turkey released by TWEA in January, 2010 [6]. As seen from the table the total capacity of the commissioned wind farms have reached to 776.6 MW. According to projections of TWEA including the projects under construction and the projects with a signed turbine delivery contract the operational wind capacity of Turkey is estimated to reach to 1.5 GW by the end of 2010.

Table 1. Regional distribution of operational plants at various stages

Region	Capacity under operation (MW)	Capacity under construction (MW)	Projects with a turbine supply contract (MW)
Western Marmara	28.8	0	15.0
Central Marmara	86.1	0	0
Southern Marmara	275.3	0	200.4
Central Aegean	264.3	95.8	265.5
Eastern Mediterranean	92.5	135.1	15.0
Southern Aegean	29.6	0	0
Total	776.6	230.9	495.9
Gross total			1503.4

**V. CONCLUSIONS**

In Turkey until the introduction of Renewable Energy Law, little importance has been given to wind power and the installed wind capacity was merely 27.2 MW until 2006. After the introduction of Renewable Energy Law which was put into force in 2005 and amendments carried out in 2007, in last two years there has been remarkable progress in Turkish wind sector. Although there are some complaints from the investors such as delays in turbine delivery times, relatively high interest rates, access to windy locations, etc. the wind power still seems profitable business in Turkey. From the progress, which has been achieved to date, it is anticipated that the targeted capacity of 1400 MW will easily be exceeded before 2015.

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## **BIOGRAPHY**



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