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## WIND ENERGY, WORLD AND TURKEY

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Increased energy consumption has led manufacturers and users to search for new and environmentally friendly energy sources in line with the energy needs of technology and the development of the industry. Renewable energy sources include wind energy; clean, reliable and low operating costs, it is regarded as a valuable and clear source of energy. In this study, both in the world and in Turkey the development of electricity generation from wind energy, wind turbine use, was presented the production process and energy production status. In addition, manufacturers and consumers, and to increase the use of wind energy production rate in Turkey has made some suggestions and recommendations.

**Keywords:** Clean energy, wind energy, wind turbine, energy production.

### *The introduction*

When the developments of the countries in the world and their relations with each other and their problems are examined, ENERGY is very foreground. The most important problem in the world for the last 200 years is to reach and control the energy.

Increased production, the development of technology and the expectation of comfort; per capita energy consumption. The first thing that comes to mind when energy is mentioned is «Electricity Energy».

Due to environmental awareness, which has gained importance in the last 50 years; it is important that the energy produced is environment friendly as well as being uninterrupted, reliable and affordable. A serious environmental and energy knowledge has developed in society. Instead of polluting the environment, environmentally friendly «renewable energy sources» are adopted. These include; Wind, solar and biogas investments have increased significantly.

The desire of all the countries of the world to have energy has caused the century we have been called «energy century». Millions of years of fossil fuel reserves are rapidly consumed.

As a result of serious investments and researches on renewable energy sources; the energy unit prices produced with these instruments have fallen to very economic levels. Wind energy has shown further improvement in this regard. Wind energy investments have increased all over the world, especially with the development of composite materials and wing aerodynamics.

The wind is caused by the different heat of the

solar radiation on the ground surface. The different warmth of the surface of the earth, the temperature of the air, the nature of the nest and the pressure are different, which causes the air to move. Approximately 2% of the world's solar energy is converted to wind energy.

### *The main part of research*

Wind power; It is a natural, renewable, clean and endless power source. A small amount, 1-2% of the energy that the sun sends to the earth is transformed into wind energy. Air flow occurs because of the difference of temperature and pressure, which is the result of the sun, the surface and the homogeneous heating of the atmosphere. If an air mass is more heated than it exists, it rises up the atmosphere and by the increase of this air mass, the cold air mass of the same volume is settled at the vacant position. The winds are called the displacement of these air masses. In other words, the wind; is a stream of air flowing from the high pressure center toward the low pressure center due to the pressure differences between the two adjacent pressure zones. While winds flow from high pressure areas to low pressure areas; the earth's rotation around its axis, surface rubbing, local heat spread, different atmospheric phenomena in front of the wind, and the topographic structure of the land. The characteristics of the wind vary temporally and locally, depending on local geographical differences and the inhomogeneous warming of the earth. Wind speed and direction are expressed by two parameters. The wind speed increases with height and the theoretical power varies with the speed of the cube. In addition to the disadvantages of wind energy applications such as high initial investment cost, low

capacity factors and variable energy production, their advantages can be summarized as follows:

1. Abundant and free in the atmosphere.
2. Renewable and clean energy source, environment friendly.
3. The source is reliable, there is no risk of exhaustion and increase in price over time.
4. The cost has reached a level where it can compete with power plants of today.
5. Maintenance and operating costs are low.
6. Create employment.
7. Hammaddesi is completely located, does not create external dependency.
8. The installation and operation of the technology is relatively simple.
9. Taking into operation can take place in a short time.

Wind turbines are manufactured with horizontal axis or vertical axis according to the direction of rotation axis. The most common types of these types are horizontal axis wind turbines. Such wind turbines are constructed with one, two, three or many wings. Horizontal axis wind turbines; they take the name of up-wind, down-wind turbine.

The axes of the vertical axis wind turbines are vertical and vertical to the wind direction and their wings are vertical. Modern wind turbines with grid connection for electricity production are mostly 3-wing, horizontal-axis and up-wind type wind turbines.

Today, in parallel with technological developments, wind turbines with horizontal axis are used in large strong wind power plants at 1.0–7.5 MW power. The blade diameters of the three-bladed wind turbines reached 100 m and above. The rotor hubs of modern wind turbines are located on a tower 60–120 m above ground level. The amount of energy to be obtained from a wind turbine depends on the

wind speed at the turbine hub height from the first order. Increasing the hub height will ensure maximum benefit from the current wind power.

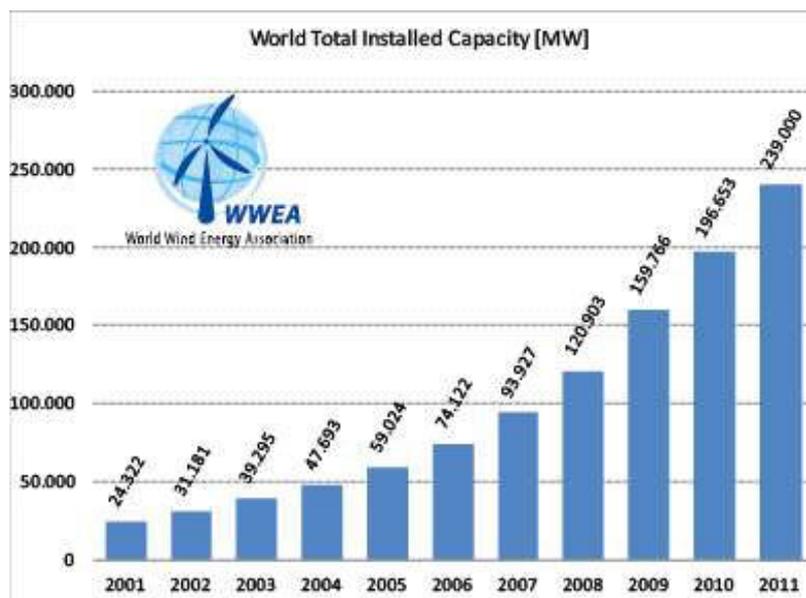
Wind turbines can start to produce electric energy only at a certain wind speed. A wind turbine performs energy production between cut-in and cut-out wind speeds. Modern wind turbines have cut-in speeds of 2–4 m/s, nominal speeds of 10–15 m/s and cut-out speeds of 25–35 m/s. At a given wind speed for each wind turbine, the power from the system reaches the greatest value. This is the greatest nominal power and this wind speed is called nominal speed. In order not to damage the system, the wind turbines are automatically switched to the stop position after a certain speed of wind. This maximum speed is called the cut-out speed of the system.

The body is sound insulated to prevent noise pollution. Towers are built in cage or pipe form. As the height of the tower can be too high, the constructions outside the cage towers can be two or three pieces.

The wind energy is developing rapidly in the world. Turbines are called «small turbines» under 300 kW in, and «big turbines» at the top.

As stated at the New Energy Fair in Husum (Bonn, Germany) on 15 March 2012, the number of small wind turbines reached 460000 at the end of 2008, 521000 at the end of 2009 and 656000 at the end of 2010. Large wind turbine capacity is 240 GW compared to small wind turbines with a total capacity of 440 MW.

The two countries with the smallest wind turbines are China (450000 units/166 MW) and USA (144000 units/179 MW). It is estimated that in 2020 the total capacity of small turbines will reach 3800 MW. Countries where medium-sized turbines are commonly found; England, Canada, Germany, Spain, Poland, Japan and Italy [1].



[1]

Position 2010	Country	Total Offshore Capacity 2010 [MW]	Added Offshore Capacity 2010 [MW]	Rate of Growth 2010 [%]	Total Offshore Capacity 2009 [MW]	Total Offshore Capacity 2008 [MW]
1	United Kingdom	1341	653	94,9	688	574
2	Denmark	854	190,4	28,7	663,6	426,6
3	Netherlands	249	2	0,8	247	247
4	Belgium	195	165	550,0	30	30
5	Sweden	164	0	0,0	164	134
6	China	123	100	434,8	23	2
7	Germany	108,3	36,3	50,4	72	12
8	Finland	30	0	0,0	30	30
9	Ireland	25	0	0,0	25	25
10	Japan	16	15	1500,0	1	1
11	Spain	10	0	0,0	10	10
12	Norway	2,3	0	0,0	2,3	0
<b>TOTAL</b>		<b>3117,6</b>	<b>1161,7</b>	<b>59,4</b>	<b>1955,9</b>	<b>1491,6</b>

[2]

Today, there are more than 330 small wind turbine manufacturers in 40 countries. Also; It is estimated that 300 firms also produce equipment for these producers. Most of the producers are small and medium sized companies. There are more than half of these producers in more than 5 countries. These; China, USA, Germany, Canada and the United Kingdom [1].

Although this sector has revived in many countries, only a few countries offer special support policies for small turbine production. A few countries give guarantees for purchases. There is very little support in developed countries, especially where there are no electricity zones. In China alone, the energy generated by small wind turbines is supported by affordable policies in rural areas.

Small turbines are at a very low level in the energy market. But; Market potential is very high. Given the recent growth rates, it is expected that small wind turbines will significantly increase their market share in the near future and will be an important sector in terms of energy security and healthy environment.

The price of small turbines is as follows on the basis of countries. In more than 50 countries around the world, legal regulations exist for supporting the renewable industry (especially wind and solar).

Offshore wind capacity continued to increase in 2010 as well. Like previous years, wind farms built on the sea have occurred in 12 countries. Ten of them are in Europe and the other two are in Asia. Total capacity is 3117 MW. In 2010 the newly added capacity ratio is 59%.

As can be understood from the following table, in terms of Turkey it is a country dependent on foreign energy. It supplies close to half of energy from abroad, and therefore gives importance to local energy production.

In 2001, «Energy Market Regulatory Board» was established and electricity, natural gas, oil and LPG market was regulated by this committee.

According to the projections made by the International Energy Agency, the world's primary energy demand will increase by 40% between 2007–2030. This means that the equivalent of 12 billion tons of oil (TEP) will rise to 16.8 billion TOE in 2030. Turkey is important for energy security. For this reason, significant investments have been made in the identification of new and renewable energy resources, nuclear power plant investments, energy efficiency and new energy technologies. The following laws have been enacted for this purpose. (2007), Energy Efficiency Law (2007), Geothermal Resources Law (2007), Law on Electricity Market (12001), Natural Gas Market Law (2001), Petroleum Market Law (2003), LPG Market Law , Nuclear Plant Law (2007).

Turkey's economic wind potential of 48000 MW. 8000 MW is very efficient (>8.5 m/s) and 40000 MW is medium efficiency (>7 m/s). The wind power of 18 MW in 2004 exceeded 800 MW in 2010. By the end of 2017, the total installed power of 178 (161 licensed, 17 non-licensed) wind power plants reached 6.504 MW. After the enactment of the Renewable Energy Law, 93 licenses were granted with a total capacity of 3363 MW.

As can be seen from Turkey's Wind Atlas, the western region is highly advantageous for the wind. For this reason, a significant portion of the investments have been realized in this region. The wind sells the turbine businesses with the energy purchase government guaranteed purchase. This guarantee is 5.5 cents for the first 10 years. Turkey, which already provide enough incentives for entrepreneurs who want to invest in wind energy [3].

### Conclusion

A summary of the present and future status of wind energy can be said as follows.

– In 2010, it was 197 GW and increased by 37 GW compared to 2009.

– The 2010 growth rate was 23.6%.

– More than the total electricity need of the UK, the 6th largest economy in the world, was provided by wind turbines installed in 2010. (4300 Terawattsat/year, 2.5% of total energy)

– The wind sector has 40 billion euro turnover and 670,000 employees in 2010.

– China as a total installed capacity has become number one. (50% of new investments in the world market with a capacity increase of 19 GW per year)

– In Europe, Germany maintains its first place with 27215 MW, followed by Spain with 20676 MW.

– Share of wind energy in total energy output in Europe; Denmark is 21%, Portugal 18% and Spain 16%.

– With new capacity growth, Asia is the first with 54.6%, Europe second with 27% and North America third with 16.7%.

– Due to nuclear accidents in Japan and oil spills in the Gulf of Mexico, wind power has increased in importance. Countries have had to evaluate wind energy policies.

– Global capacity is estimated at 600,000 MW in 2015 and 1500,000 MW in 2020 [2].

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## ВІТРОВА ЕНЕРГІЯ В ТУРЕЧЧИНІ

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*Збільшення споживання енергії привело виробників і користувачів до пошуку нових і екологічно чистих джерел енергії відповідно до потреб технології та розвитку галузі. Поновлювані джерела енергії включають енергію вітру, що характеризується чистотою, надійністю і низькими експлуатаційними витратами, він вважається цінним і ясним джерелом енергії. У цьому дослідженні розглянуті як енергія вітру, так і вітряна турбіна, виробничий процес і статус виробництва енергії. Крім того, виробники і споживачі, а також збільшення використання виробництва енергії вітру в Туреччині, були внесені деякі пропозиції і рекомендації.*

**Ключові слова:** чиста енергія, енергія вітру, вітряна турбіна, виробництво енергії.

## ВЕТРОВАЯ ЭНЕРГИЯ В ТУРЦИИ

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*Увеличение потребления энергии привело производителей и пользователей к поиску новых и экологически чистых источников энергии в соответствии с потребностями технологии и развития отрасли. Возобновляемые источники энергии включают энергию ветра, которая характеризуется чистотой, надежностью и низкими эксплуатационных расходов, ветер считается ценным и ясным источником энергии. В этом исследовании рассматривалась как энергия ветра, так и ветряная турбина, производственный процесс и статус производства энергии. Кроме того, производители и потребители, а также увеличение использования производства энергии ветра в Турции. Также были внесены некоторые предложения и рекомендации.*

**Ключевые слова:** чистая энергия, энергия ветра, ветряная турбина, производство энергии.