

## ALTERNATIVE ENERGY: TYPES OF WIND POWER PLANTS AND THEIR IMPACT ON THE ENVIRONMENT

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### Abstract

This article provides answers to basic questions regarding wind energy. The main parameters of wind are considered, a brief description of the use of wind energy in the world is given and the types of wind power plants are described and the impact of wind energy on various components and parameters of the environment is shown.

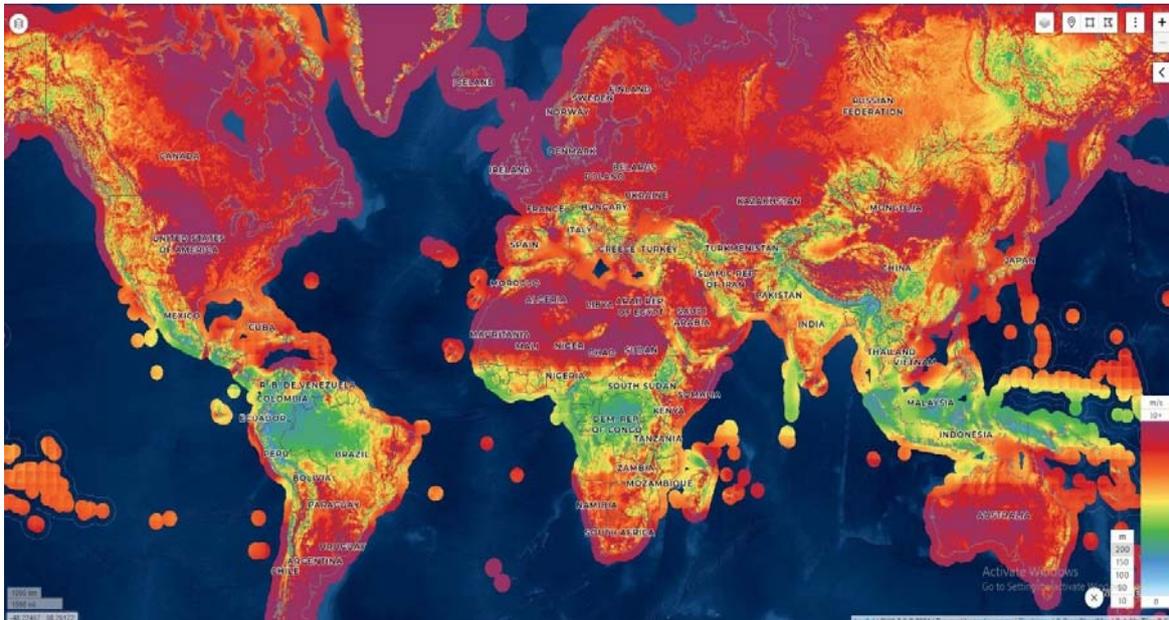
**Key words:** environment, types of wind power plants, wind farms, wind turbines, energetic potential of wind.

### Introduction

Wind – “the movement of air relative to the earth's surface...”. Usually they mean horizontal movement averaged over a time interval of about 1-3 minutes. Thanks to this averaging, micro scale pulsations with a period of several seconds are excluded. The occurrence of wind is associated with uneven heating of the Earth due to cloudiness, heat accumulation by water bodies, relief and a number of other reasons. Wind is closely related to pressure and is directed from high pressure to low pressure. On a global scale, air circulation has the character of convective transport from one pressure belt to another. The most important characteristics of wind are direction and speed. A smoothed value is an average value over a period of time. The instantaneous value gives the indicator directly at the time of measurement, it can significantly fluctuate around the smoothed value. For wind energy, smoothed wind speed is important. The direction of the wind is the direction from which it blows [1]. To indicate the direction, 8 main rhombs of the horizon are usually used: north, northeast, east, etc. and 8 intermediate rhombs between them. Wind speed is usually measured in meters per second. Zoning of the globe by wind speed is shown in Pic. 1 [2].

Wind energy is inherently the energy of the Sun converted into the kinetic energy of moving air masses. Wind energy was widely used in ancient Egypt and the Middle East to drive mills and water-lifting devices. Currently, the use of wind for grinding grain is practically stopped and in some places the preserved windmills are only monuments of the era. Wind farms are built in places with a high average wind speed - from 4.5 m/s and above. Conventional meteorological information for the choice of the construction site of wind farms is not suitable, because it contains information about surface wind speeds. To select a construction site, a preliminary study of the wind potential of the area is carried out. At an altitude of 30 to 100 meters, anemometers are installed and within one to two years they collect information about the speed and direction of the wind.

Since the wind speed increases with altitude, it is preferable to build wind farms on hills. Items that can affect the wind are taken into account: trees, large structures, etc. In general, the wind energy potential is quite large. Wind farms convert wind energy into electrical energy. They consist of several wind turbines assembled in one place.



**Pic. 1 Average annual wind velocity map from global wind atlas**

### **Conflict setting**

There are four types of wind power plants – Land-based (wind turbines are installed on the hills), coastal (at a short distance from the seashore), offshore (they are built in the sea 10-12 kilometers from the coast) and floating. Land-based is the most common type of wind farms at present. To install a wind turbine, places are being sreed on the hills and heights. The Gansu Wind Farm in China is the largest land-based wind farm in the world with a target capacity of 20,000 MW by 2020. Largest coastal power plant is Horse Hollow station located at state of Texas, USA. It consists of 421 wind farms turbine and has a capacity of 735 megawatts. A coastal wind farm in the Philippines is shown in Pic. 2. The largest offshore station is Hornesa power plant in England (Pic.3), with an installed capacity of 40 MW, built in January 2021. The United Kingdom has the world's largest potential for offshore stations. The first prototype of a floating wind turbine was built in December 2007. The 80 kW wind turbine is installed on a floating platform 10.6 nautical miles off the coast of Southern Italy on a 108 meters deep sea. Thus, wind power plants have their advantages and disadvantages. Therefore, for the purpose of further research and applied work, it is necessary to study the characteristics of wind plants and their impact on the environment to carry out their analysis. Despite all of the above, the main disadvantage of a wind farm is its impact on the environment.



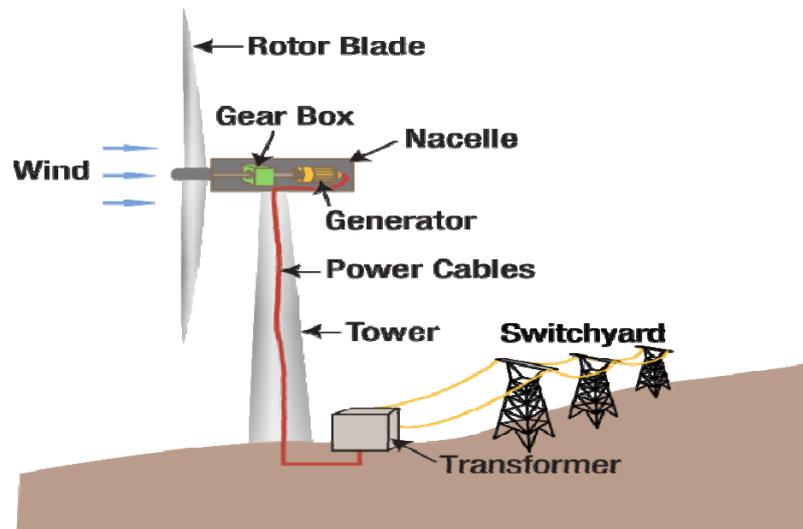
**Pic. 2 A coastal wind farm in the Philippines**



**Pic. 3 Hornesa offshore power plant in England**

### Research results

Wind currents rotate the blades of the wind generator: they pass through the turbine, drive it, and it begins to rotate. Energy is generated on the shaft which will generate the turbine to the wind flow. The stronger the wind, the more energy is generated. Further, the energy is transferred along the shaft to the rotor to the multiplier (if any), which generates it (Pic.4).



**Pic. 4 The structure of the wind power plant**

Wind power has advantages and disadvantages. The advantages of wind power systems are as follows:

- wind energy is inexhaustible; electricity production with the help of wind power plants is not accompanied by hazardous emissions into the atmosphere;
- possibility of placement in hard-to-reach places;
- require a small area and fit into any landscape; obtaining free electricity in the long term, no costs for fuel and its delivery;
- autonomy - independence from the state and operation of external electrical networks.

However, wind power plants have their disadvantages, including:

- noise;
- high price;
- long payback period;
- inconstancy and unregulated wind flow.

Adverse effects of wind energy expressed in the following:

alienation of land;

- alienation of land;
- influence on the animal world;
- noise impact;
- visual impact;
- electrical, radio and television interference [3].

Wind generators cannot be close to each other, since due to the interference of their power will be reduced. Therefore, their placement requires significant land acquisition. Wind farms require approximately 0.1 km<sup>2</sup> of free space per megawatt of rated power. Accordingly, a power plant with a capacity of 100 megawatts will need about 10 km<sup>2</sup>.

The impact on the animal world is expressed in the danger to aquatic organisms, birds and insects. The impact on the fauna is most dangerous during the construction of the wind farm:

disturbances in the habitat lead to migration and death of fish. During operation, the impact of noise and vibration is small, and the termination of navigation and fishing between turbine supports may even have positive effects. The impact on marine mammals (dolphins, seals, whales) is also small.

During the construction period, bottom sediments and the structure of turbulent flows change, which adversely affects, first of all, bottom organisms. The magnitude of the impact depends on the nature of the substrate, it is minimal in the case of rocky bottom soils. During the period of operation when transmitting electricity through a submarine cable when the permissible voltage values are exceeded electric and magnetic fields in fish and bottom animals can have a persistent reaction scaring away, and then the cable line will become an obstacle to the migration of fish.

As for the impact on birds, according to the data of European bird watchers, it is minimal. Birds feel wind turbines at a distance of more than 1 km and fly around them. The death of birds is 0,3-0,4 birds per 1 Gigawattis/ hour of electricity generated which corresponds to about 70 thousand birds per year for the United States.

Noise generated by wind turbines impact can be divided into mechanical and aerodynamic. Components that produce the greatest noise level are the generator, swing drive that unfolds the upper part of the wind turbine towards the wind, gearbox and blades. The noise from some of these components occurs constantly, from others - from time to time, but all the noises only happen when the turbine is running. At the same time, the noise of working wind turbines in comparison with other industrial sources is relatively small.

There is also visual impact, but it is ambiguous. Many people think that wind farms improve the aesthetic perception of the landscape, but there are also people who dislike them. There is a known case when the implementation of a wind farm project in the United States was postponed for several years precisely for reasons of landscape aesthetics.

Wind farms are the source of radio and television interference. In particular, due to reflections of USW (ultra short waves) and microwaves from moving blades of wind power plants, the normal operation of the navigation aircraft equipment and it is difficult to receive television broadcasts [4].

### **Conclusion**

Natural contamination and the emissions of CO<sub>2</sub> and other gasses from the utilization of fossil fuels constitute a risk to wellbeing, the environment and economical financial development. The foremost risk comes from quickening climate alter as the coordinated result of the greenhouse effect. Wind turbines cause for all intents and purposes no emissions during their operation and exceptionally small noise during their establishment, support and evacuation. The wind as a “fuel” is free and endless and the innovation is developing and competitive. Consequently, the wind vitality can shape the premise of a long-term feasible vitality supply framework and is basic in the event that the fundamental decreases in CO<sub>2</sub> and other emissions from power era are to be met and economic advancement and feasible development are to be accomplished. In spite of the fact that there are numerous positive angles of wind vitality, the negative impacts of the wind power plants on the environment have to be considered moreover. The most concerns are clamor and visual interruption, as well as the feathered creature and bat mortality at wind turbines. In any case, the scale of the biological affect may or may not be noteworthy, depending on particular circumstances and each conceivable negative affect must be considered and managed with when arranging wind power plants.

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## ԱՅԼԸՆՏՐԱՆՔԱՅԻՆ ԷՆԵՐԳԵՏԻԿԱ: ՀՈՂՄԱՅԻՆ ԷԼԵԿՏՐԱԿԱՅԱՆՆԵՐԻ ՏԵՍԱԿՆԵՐԸ ԵՎ ՆՐԱՆՑ ԱԶԴԵՑՈՒԹՅՈՒՆԸ ՇՐՋԱԿԱ ՄԻՋԱՎԱՅՐԻ ՎՐԱ

**Ռ.Հ. Ավոյան**

*Հայաստանի ազգային պոլիտեխնիկական համալսարան*

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Տրվում է քանու էներգիայի վերաբերյալ որոշ հիմնական հարցերի պատասխաններ: Դիտարկված են քանու հիմնական պարամետրերը, տրված է աշխարհում քանու էներգիայի օգտագործման համառոտ նկարագրությունը, նկարագրված են հողմային էլեկտրակայանների տեսակները, քանու էներգիայի ազդեցությունը շրջակա միջավայրի տարբեր բաղադրիչների և պարամետրերի վրա:

**Բանալի բառեր.** շրջակա միջավայր, հողմային էլեկտրակայանների տեսակները, հողմակայան, հողմային էներգիայի ներուժ:

## АЛЬТЕРНАТИВНАЯ ЭНЕРГЕТИКА: ВИДЫ ВЕТРОВЫХ ЭЛЕКТРОСТАНЦИЙ И ИХ ВЛИЯНИЕ НА ОКРУЖАЮЩУЮ СРЕДУ

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Даются ответы на некоторые основные вопросы, касающиеся ветроэнергетики. Рассмотрены основные параметры ветра, дано краткое описание использования энергии ветра в мире, описаны виды ветровых электростанций, показано влияние энергии ветра на различные компоненты и параметры окружающей среды.

**Ключевые слова:** окружающая среда, типы ветровых электростанций, ветряная электростанция, потенциал ветровой энергии.

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