PROBLEMS AND PROSPECTS FOR THE DEVELOPMENT OF RENEWABLE ENERGY SOURCES

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The development of humanity, the creation of new technologies and the general improvement of living conditions lead to an increase in annual energy consumption. Energy resources are the basis of the functioning of the modern economy. The demand for energy remains high. Analysis of the structure of consumption of various types of energy in the world demonstrates the important role of traditional fuels, in particular oil, coal and natural gas (Putsenteilo, 2024). At the same time, there is a tendency to reduce the impact of traditional energy sources on the environment and reduce dependence on fossil fuels.

Research by the International Renewable Energy Agency (IRENA) indicates the need for an urgent transition to renewable energy sources (RES). Such a transition in the long term by 2050 will allow to reduce CO_2 emissions into the environment by 90% and ensure the production of more than 55% of energy due to solar and wind power plants. Therefore, the role of renewable sources is a priority and has a significant energy potential of a practically inexhaustible and environmentally friendly RES resource (IRENA, 2018). For Ukraine, the relevance of the introduction of RES is also due to the critical state of the energy sector. This was especially evident since 2022 during the armed aggression of the Russian Federation against Ukraine and initiated a further search for new technical solutions using innovative RES. Therefore, the search for the most effective RES and their use in the energy system is an important task for our country.

In general, RES can be classified into radiant energy of the Sun, wind energy, hydropower of water flows, waves and tides, thermal energy of the environment (Earth, air, seas and oceans), biomass energy and geothermal energy (Kudri, 2024).

The oldest RES used by mankind is hydropower. Its advantages are cleanliness

of use, reliability of generation, low maintenance costs, control of water resources. The main disadvantages are due to the need for an appropriate landscape, high construction costs and negative impact on the environment. That is, not all countries can use this method of energy production. According to open sources, the leaders in hydropower are China, Brazil, the USA, and Canada. Hydropower is important for the countries of Central Africa. Although the amount of electricity produced there is much less than in China, some countries are completely dependent on hydropower. Dams also store water, which is used for water supply, drinking, and land irrigation. According to experts, hydropower will develop in the future to replace fossil fuels.

The next renewable energy source in terms of the amount of electricity produced is wind. The advantages of wind energy are cheapness in production, availability in many regions, and environmental friendliness. Wind power plants also take up little space, in particular, a windmill can be placed in the backyard of a private house. The main disadvantage is instability due to changing weather conditions. The disadvantages of using wind as a renewable energy source are significant noise during operation, high cost of equipment and delivery to destinations, and collisions of birds with blades. Wind power plants also change the speed of the wind. This affects local changes in temperature, humidity and is a prerequisite for changes in flora and fauna. The leaders in wind energy production are China, the USA, Brazil, Germany, Great Britain. Wind turbines are most often located far from residential areas, in the seas. These technologies tend to be constantly developing. However, they should be considered as additional energy sources due to instability.

Solar power is also actively developing. Its main advantages are cheapness in obtaining and maintaining, efficiency throughout the year, but in certain regions, and environmental friendliness. Another advantage of solar batteries and panels is the ability to install them not only on an industrial scale, but for their own use. In hot and sunny regions, this is very popular in private homes. In this case, the advantage is partial independence from the general power grid or even the option to sell excess energy. The disadvantages are expensive installation and storage, the need for large

areas for placement. A negative factor is the variability of the weather, although the sun is more stable compared to the wind. Leaders in solar energy are traditionally China, the USA and developed warm countries such as Spain, Australia, India, Japan. At the same time, the production volumes of solar energy are much smaller than from wind. Despite this, solar energy also has a great future. Technologies are being improved, their popularity is constantly growing.

Bioenergy is also a renewable energy, but not as clean as the already considered energies of water, wind and sun. This is explained by the use of the process of burning biofuels to obtain energy, which leads to emissions of carbon dioxide into the atmosphere and damage to the Earth's ozone layer. This is a promising renewable energy sector that is actively developing with the creation of new environmentally friendly types of biofuels such as biodiesel and bioethanol, etc.

In general, the use of renewable energy sources in energy systems is determined by climatic and landscape conditions, the structure of power supply systems, environmental and economic factors. Therefore, an integrated approach is used for their implementation. It consists in the possibility of fully meeting local needs only at the expense of renewable energy sources. For large areas and facilities, to achieve the required capacity, it would be advisable to combine renewable energy sources and traditional energy sources. Thus, the review of types of renewable energy sources made it possible to identify the advantages and problematic issues in their use for the needs of ensuring the world’s energy industry.

References:

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