

THE STATE OF USE AND WAYS TO INCREASE THE EFFICIENCY OF RENEWABLE RESOURCES AND ALTERNATIVE ENERGY SOURCES

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Abstract: This article analyzes the current state of the use of renewable resources and alternative energy sources, as well as ways to improve their efficiency.

Keywords: renewable energy, alternative energy, ecological efficiency, energy saving.

Introduction. Today, the use of renewable energy sources plays a crucial role in addressing global problems. The depletion of conventional energy sources, ecological issues, and the need to enhance economic efficiency are increasing the demand for alternative energy sources. This, in turn, requires energy conservation.

Energy conservation is the process of preventing the wasteful use of resources by utilizing electricity, heat, or fuel efficiently. This term is applied in industries, transport, residential and municipal services, and other sectors. The main goal of energy conservation is to save natural resources and prevent their depletion, reduce harmful emissions to the environment, and improve economic efficiency while cutting costs. In this regard, renewable energy sources play a significant role.

Renewable resources are natural resources that are constantly replenished through natural processes and do not deplete due to human activities. These resources are widely used in energy production, industry, agriculture, and other sectors.

Renewable resources play an important role in maintaining ecological sustainability and reducing issues like global warming. Moreover, using these resources ensures energy independence, improves economic efficiency, and helps protect the natural environment.

Alternative energy sources are those that can replace conventional fuels (oil, gas, coal) and are renewable and environmentally safe. These energy sources allow for usage without harming the environment or depleting natural resources.

The importance of alternative energy sources is growing against the backdrop of global warming, ecological pollution, and the depletion of natural resources. These energy types do not emit harmful gases into the atmosphere, ensure sustainable development, and play a significant role in achieving energy independence.

Methodology. This research applied scientific and technical approaches and research methods aimed at improving the economic and ecological efficiency of renewable energy sources. During the study, methods such as the analysis of scientific and technical literature, the study of statistical data, practical research techniques, and the analysis of best practices were employed.

Results. In recent years, the use of renewable energy sources has significantly increased worldwide. This process is linked to the need to protect the environment, achieve energy independence, and ensure sustainable development. According to reports by the International Energy Agency (IEA) and the United Nations (UN), as of 2023, the global installed capacity of renewable energy exceeds 3,400 gigawatts.

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Currently, technologies for utilizing solar, wind, and biogas energy are among the fastest-growing sectors. The reduction in the cost of solar photovoltaic panels, increased efficiency of wind turbines, and improvements in biogas production technologies have contributed to the rapid development of these sectors. For instance, countries such as China, the United States, Germany, and Denmark are leading in this field by attracting new technologies and large investments.

The widespread adoption and increased efficiency of renewable energy sources are influenced by a number of factors, including:

- **Technological innovations:** The appearance of new generation models of solar panels and wind turbines has increased their production capacity and reduced their costs. For example, modern solar panels have the ability to produce 25-30% more energy than previous models.
- **Government support and legislative framework:** In several countries, subsidies, favorable loans, and tax incentives are provided to encourage renewable energy projects.
- **Development of energy storage and distribution systems:** The improvement of modern battery technologies and energy storage methods has increased the efficiency of using renewable energy sources. For example, the size of lithium-ion batteries has decreased, and their capacity has increased, leading to an 80% reduction in their cost over the past decade.
- **Climate and geographical factors:** The efficiency of renewable energy sources depends on the natural resources of a specific region. For instance, solar energy is more efficient in countries such as Uzbekistan, Saudi Arabia, and Australia, which receive a large amount of sunlight, while wind energy is more dominant in areas with higher wind speeds, such as Denmark, the Netherlands, and the UK.

The Republic of Uzbekistan is carrying out consistent reforms in the use of renewable energy sources. Specifically, the government has set a goal to increase the share of renewable energy in the country's energy system to 30% by 2030.

- **Solar energy:** Uzbekistan has significant potential in solar energy, with an average of 300 sunny days per year. Since 2021, large-scale solar power plant projects have been implemented in the country. For example, in 2022, large solar photovoltaic plants were commissioned in the Kashkadarya and Navoi regions.
- **Wind energy:** Several projects are underway in the country to develop wind energy. Specifically, wind power plants with a total capacity of 1.5 gigawatts are planned to be built in Bukhara, Navoi, and Karakalpakstan by 2025.
- **Biogas and biomass energy:** Uzbekistan has the potential to produce biogas using agricultural waste and organic materials. Currently, biogas technologies are being implemented in some farms, improving energy supply in rural areas.

The development of renewable energy sources in Uzbekistan is supported by the government. In 2019, the "Renewable Energy Sources Law" was adopted, and mechanisms were developed to attract foreign investments into projects in this sector.

Discussion. The effective use of renewable energy sources is a pressing issue globally, playing a crucial role in achieving sustainable development, environmental security, and energy independence. To enhance efficiency in this area, a range of measures needs to be implemented. In particular, the introduction of innovative technologies and the development of modern energy storage and transmission systems are key factors for the continuous and efficient use of renewable energy sources. Since solar and wind energy are dependent on natural conditions, advanced energy storage technologies must be applied to ensure their constant supply.

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Moreover, cooperation between the public and private sectors is of great importance in developing renewable energy projects. The collaboration between government and private sector entities will significantly contribute to advancing this field.

Furthermore, expanding scientific research is necessary to improve the efficiency of renewable energy sources. Scientific innovations, through the development of new materials and technologies, can increase energy production and reduce costs. Based on the results of scientific research, the implementation of innovative technologies that are tailored to local conditions will positively impact the development of renewable energy in our country.

Most importantly, promoting ecological culture among the population and business entities, as well as raising awareness about the benefits of renewable energy sources, are also critical factors. Increasing public awareness not only fosters an energy-saving culture but also contributes to ensuring ecological sustainability. For example, in developed countries, programs aimed at improving energy efficiency have led to a significant reduction in electricity consumption.

Conclusion. A comprehensive approach is required for the effective use of renewable energy sources. The development of innovative technologies, strengthening cooperation between the public and private sectors, focusing on scientific research, and fostering ecological awareness in society will positively contribute to the growth of this sector. Uzbekistan is also actively implementing reforms in this direction and aims to significantly increase the share of renewable energy sources in the future. This will play a crucial role in ensuring sustainable development and energy security.

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