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## **ESTABLISHMENT OF ALTERNATIVE ENERGY IN UKRAINE**

The fuel and energy complex (FEC) of Ukraine was formed in the 70s and 80s of the last century and reached its peak in 1990 [1] – production of traditional fuels was: coal – 164.8 million tons, oil – 5.2 million t, of natural gas – 28.1 billion m<sup>3</sup>, and electricity production – 298.5 billion kWh. Alternative energy was in its infancy due to the current prices for traditional energy carriers (for example, cost for households was 10 ruble/1000 m<sup>3</sup> and for industry – 28 ruble/1000 m<sup>3</sup>), as well as the social orientation of state policy.

During the years of independence, the structure of fuel and energy resources (FER) consumption, underwent drastic changes associated with the decline in production, industry restructuring based on market principles, etc. Solving these problems required finding new tools. One of these was the theory of "sustainable development" [2], which is considered one of the most promising ideologies of the 21st century.

The concept of sustainable development counts 17 Global Goals, among which two can be noted, namely: "7. Affordable and clean energy", the purpose of which is to ensure the access of mankind to affordable, reliable, sustainable and modern, environmentally friendly sources of energy" and "13. Mitigation of the consequences of climate change", which involves the development and implementation of urgent measures to combat climate change and its consequences.

Currently, most climatologists expect that the global temperature increase will exceed the thresholds of the Paris Agreement – 1.5-2 °C by 2100, which could lead to catastrophic consequences for the planet. The average forecast of scientists is 2.7 °C [3]. Data from the Ukrainian Hydrometeorological Center indicate that over the past thirty years, the average temperature in our country has increased by 1.2 °C [4]. The rate of increase in air temperature in some regions of Ukraine reaches 0.82 °C over the last 10 years, while in neighboring countries – 0.47-0.59 °C/10 years, and in the Northern Hemisphere and Europe – 0.34 and 0.47 °C/10 years, respectively.

Fundamental studies on reducing thermal pollution of the environment, reducing energy consumption, etc. have highlighted FEC, housing and communal services as sectors of the economy with the most undiscovered, economically beneficial long-term potential for energy resource conservation and energy efficiency improvement, environmental improvement. At the same time, they directly affect ensuring the harmonious development of society.

The reform of the energy sector, which began with the signing of the Association Agreement with the EU, continues today: from the adoption of legislative and regulatory acts, harmonized with the relevant documents of the European Union, to the implementation of technical solutions that contribute to the reduction of traditional fuels and, accordingly, "thermal" pollution of the environment. Significant changes are also taking place in the pricing policy. However, a detailed analysis of the structure of renewable energy sources (RES) [5] shows existing distortions, especially in comparison with the current situation in the EU countries. With the planned, almost equal, capacity indicators of wind (WPP) and solar (SPP), respectively, 2,280 and 2,300 MW, according to the results of the implementation of the National Renewable Energy Action Plan until 2020, 1203.7 (52.9) and 5576.3 MW (242.4% of the planned) were established, respectively. However, from the point of view of balancing the electricity market, preference should be given to the construction of wind power plants, as is done, for example, in Germany. The dynamics of changes and additions to the Laws of Ukraine "On the Electric Energy Market" [6], "On Alternative Energy Sources" [7] clearly testify to the above. Since their adoption, in 2017 and 2003, these documents have undergone 34 and 19 changes, respectively.

Before the start of full-scale war with the Russian Federation in 2022, renewable energy sources were one of the factors that threatened the energy, financial and, ultimately, national security of the state. Non-payments to the owners, as a rule, of private "green" power plants reached tens of billions of UAHS, and the cost of generated energy exceeded the tariffs for the population by 5 times.

Since 2019, the Ukrainian electricity market has been operating according to the European model. The National Commission, which carries out state regulation in the spheres of energy and communal services, takes care of the Ukrainian consumer. In 2019, Ukraine entered the TOP-10 countries in the world in terms of the rate of development of renewable energy. In the same 2019, in the Climates cope rating by Bloomberg New Energy Finance (Bloomberg NEF), Ukraine took honorable 8th place,

rising from 63rd among 104 countries in the world in terms of the country's investment attractiveness, specifically in terms of low-carbon energy sources development and construction of "green" economy.

In 2021, the production of electricity in Ukraine amounted to 158.4 billion kWh, and the share of RES was 7.9% of the total volume of generation. At the same time, 26% of all energy market funds should have been spent on settlements with them.

A positive achievement for the market in 2021 was the debut issue of 5-year Green and Sustainability-linked bonds by NEC Ukrenergo in the amount of US\$825 million with a yield of 6.875% with targeted allocation of funds to all producers of electricity from renewable sources. Analysis of world experience showed that during, for example, 2010-2016, after the introduction of auctions, the price of RES electricity decreased by 5 times. For Ukrainian realities, this will correspond to a price comparable with the prices of NPP generation. However, just now the State Enterprise "Guaranteed Buyer" announced the first pilot auction for the distribution of the support quota for the construction of a new capacity from alternative energy sources. The planned capacity of the SES is 11,000 kW. The maximum price offer of the auction participant is 9 euro cents per 1 kWh, against 15 according to the "green" tariff. That is, the generation discount is 40%, and the price is currently commensurate with the electricity tariff for household consumers – 10 eurocents/kWh.

Among European consumers, electricity is the most expensive in Germany, where the cost of 1 kWh, currently is 0.39 EUR. In Sweden and Finland – 0.17, and in Moldova – 0.14 EUR. The cheapest electricity in Serbia and Hungary is 0.10 EUR, cheapest: in Bulgaria – 0.09 EUR, Norway – 0.07 EUR.

In the near future, only power plants based on renewable energy sources will be able to compensate amount of electricity that was lost both for domestic consumption and for export, due to the wear and tear of fossil fuel infrastructure and its destruction. Receiving electricity from the wind and the sun, consumers do not depend on the quantity and finiteness of traditional fuels, the time of their extraction or delivery, availability of places for storage and disposal of waste.

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