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TYPES AND PROSPECTS OF NON-TRADITIONAL AND RENEWABLE ENERGY SOURCES IN UKRAINE

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ВИДИ І ПЕРСПЕКТИВИ НЕТРАДИЦІЙНИХ І ВІДНОВЛЮВАНИХ ДЖЕРЕЛ ЕНЕРГІЇ В УКРАЇНІ

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The article analyzes the current issues of the development of the alternative energy sector of Ukraine and possible further prospects of this sector, because in the context of European integration processes, significant attention is paid to the issues of the country's energy independence, taking into account the ecological purity and inexhaustibility of renewable energy sources. It is proved that the development of renewable energy will be an important step capable of improving the trade balance, creating new jobs, solving social issues, reducing dependence on natural gas imports, ensuring the country's energy independence and increasing the competitiveness of products in both domestic and foreign markets. It is proven that dependence on mineral extraction and outdated infrastructure have become a guarantee of the use of renewable energy sources, because boiler houses, diesel engines and coal-fired power plants emit small particles into the air that settle in the lungs and can cause serious diseases. It is noted that in order to strengthen the country's energy security, it is important for the state to make a choice between continuing to finance imported energy sources or developing the use of its own renewable energy sources, which will make it possible to reduce the cost of "green" electricity compared to thermal and even nuclear power plants.

Global processes in the modern world, the growth of world industrial production, lead to a significant increase in energy consumption and, as a result, significant environmental damage to the world environment. In recent years, this problem has become increasingly of concern to the world community, since a person needs the cleanest possible environment for his life. Therefore, at the moment there are reasons to consider environmental problems as one of the most important for ensuring the future sustainable development of humanity, it is these problems that pose the greatest threat to the world community.

In this paper, we discuss relevant background information on some unusual, yet renewable energy sources. We examine their current and potential uses, operational limitations, advantages and disadvantages, and the potential capacity of each fuel source for energy generation and fuel savings. The quantitative section analyzes the amount of power that unusual renewable energy sources can provide, according to the generation methods. In a separate section, we analyze the potential fuel savings through direct application in some industries. We explore these values with the help of several examples and show a financial analysis of selected alternative fuel projects. Finally, an overall analysis presents unusual alternative renewable energy sources and concludes that there is a great potential for fuel and cost savings, as well as for environmental protection.

Keywords: *alternative energy, unconventional energy, renewable energy sources, green energy.*

Introduction. Today, with energy prices at record highs, the need for non-conventional and renewable energy sources has skyrocketed. The market for alternative energy sources is extremely large because the cost of energy has increased so much. It is extremely important to find alternatives to coal and oil as a means of providing electricity and transportation to the population. Some non-conventional energy sources, such as wind and geothermal energy, have case studies that prove their value as an alternative energy source to provide electricity to the grid. In addition, biofuels and fuel cells have some significant results that demonstrate their potential to replace oil as a means of fueling transportation. The requirements for a

good alternative to traditional energy sources are that the energy source leaves little or no footprint on the environment, is economically feasible (good dollar-per-kilowatt ratio), and has the ability to support a large number of users. One of our goals is to study and determine which non-conventional energy sources can be part of the solution to the energy problem.

Due to the decrease in natural resources of traditional energy carriers (in particular, oil and natural gas), the increase in their cost, and concern about environmental problems, the world economy is increasingly focusing on the search and development of non-traditional and renewable energy sources (NRES).

The definition of "renewable" is rather conditional. The main features of renewable energy sources are inexhaustibility and high reproduction rate. This fully applies to the energy of the Sun, wind, ocean, hot dry rocks, molten magma. At the same time, the current level of economic development of civilization can significantly affect the reproduction of such types of renewable energy sources as biomass (BM), hydrothermal energy, therefore they are classified as renewable with a certain degree of convention. Modern world agro-industrial complex is a large consumer of fuel and energy resources (FER). The total cost of renewable energy for the production, processing and preparation of food products in most industrialized countries of the world is from 10 to 20%, and in developing countries - more than 30% in the structure of national energy balances. For the most part, this is the energy of steam and hydrothermal sources, biomass (biogas, fuel alcohols, fuel briquettes), the energy of small rivers, radiation and optical radiation of the Sun, as well as its derivative activity - wind. The main areas of use of renewable energy are heating residential and industrial premises, drying agricultural products, lifting and distributing water, lighting, providing car engines with liquid fuel.

The objective. To study the current state of the renewable energy industry, identify prospects for its further development and the investment attractiveness of alternative energy sources in Ukraine.

Research results. Non-traditional and renewable sources of energy have recently become one of the important criteria for the sustainable development of the world community. New and improved technologies are being searched for, their bringing to a cost-effective level and expanding the areas of use. The main reasons for such attention are the expected depletion of reserves of organic fuels, a sharp increase in their price, imperfection and low efficiency of technologies for their use, and harmful effects on the environment, the consequences of which are increasingly worrying the world community.

The use of traditional hydrocarbons by combustion is accompanied by total energy losses of up to 80-90%, and therefore, technologies for their electrochemical conversion have already been developed today, which reduce losses to 10% and are more environmentally friendly.

Alternative energy is becoming one of the basic directions of technological development in the world; together with information and nanotechnologies, it is becoming an important component of the new post-industrial technological order.

Solar energy. The direction of solar energy is promising, because owners installing solar batteries on their houses (on walls and roofs) with a capacity of up to 30 kW (this is the amount prescribed by legislation for private households), and selling surplus energy at the "green tariff", can expect a payback in 5-10 years. In addition, they can use the received electricity to heat their own homes, installing, for example, an electric boiler.

It is worth noting that the efficiency of a mini power plant depends on many factors:

• climatic zone (southern Ukraine or northern)

• season (in summer there is more sunlight, therefore the efficiency is higher, in winter – lower)

• angle of inclination of the panels (optimal 30º - 45º)

• weather (cloudiness and clarity)

• time of day

• quality of the manufacturer [2]

In addition to solar panels, owners of private households can also install solar collectors - devices for heating water with solar energy. However, their efficiency also depends very much on the above-mentioned factors for solar panels.

Advantages of using solar panels on the roof of a house:

• free and practically inexhaustible source of energy;

• work does not harm the environment;

• maintenance consists in periodic cleaning of the panels from dust;

• the possibility of obtaining electricity in places where there are no centralized electricity networks;

• the ability to combine different power sources, i.e. in clear weather you can turn on solar panels, and in bad weather use a conventional source of electricity;

Disadvantages:

• relatively high prices for equipment for generating energy;

• low efficiency;

• dependence on the activity of sunlight under different climatic conditions of use. Prospects:

• manufacturing of roofing elements (tiles) with built-in photovoltaic cells, which significantly reduces the cost of solar installations on the roof.

• constant global improvements in the field of solar energy [3].

Wind energy. Currently, about 70 countries around the world are operating in the wind energy sector. Among the countries with the largest wind energy capacities are Germany, the USA, Spain, India, China, Denmark. In the USA, it is planned to achieve 15% of electricity production from wind by 2020, turbines are being improved, and the range of wind speeds that can be used by wind turbines is being expanded. Ukraine has its own developments of wind energy installations (WEU) and its own industrial production, and there are also licensed WEUs. Eight wind power plants (WEPs) are operating in the Crimea, the Azov Sea, and the Carpathian region. Since 1997, when the Comprehensive Program for the Construction of WEPs was adopted, wind energy in Ukraine has received state support in the form of a surcharge to the electricity tariff and direct financing. Advantages:

• An environmentally friendly type of energy. Electricity generation using "windmills" is not accompanied by emissions of carbon dioxide or any other gas.

• Ergonomics. Wind power plants take up little space and easily fit into any landscape, and are also perfectly combined with other types of economic use of the territory.

• Renewable energy. Wind energy, unlike fossil fuels, is inexhaustible.

• The best solution for hard-to-reach places. For remote places, the installation of wind power generators can be the best and cheapest solution possible.

Disadvantages:

Instability. Instability lies in the lack of guarantees of obtaining the required amount of electricity. In some areas of land, wind power may not be enough to generate the required amount of electricity.

• Relatively low electricity output. Wind generators are significantly inferior in electricity generation to diesel generators, which leads to the need to install several turbines at once. In addition, wind turbines are inefficient during peak load periods.

• High cost. The cost of a 1 MW installation is $1 million. Although it is clear that smaller installations cost less.

• Danger to wildlife. The rotating elements of the turbine pose a potential danger to some species of living organisms. According to statistics, the blades of each installed turbine are the cause of the death of at least four birds per year.

• Noise pollution. The noise from "windmills" can cause concern for both wildlife and people living nearby.

Currently, the Ukrainian agro-industrial complex uses very limited amounts of solar, wind, and biomass energy. The development of renewable energy is mainly hindered by:

1) insufficient scientific research on this topic,

2) lack of material and technical base,

3) organizational and managerial reasons.

The Verkhovna Rada of Ukraine adopted the Laws of Ukraine "On Energy Saving" (1994) and "On Alternative Energy Sources" (2003). However, they do not actually function due to the lack of development and implementation of the necessary by-laws, standards, regulations, etc.

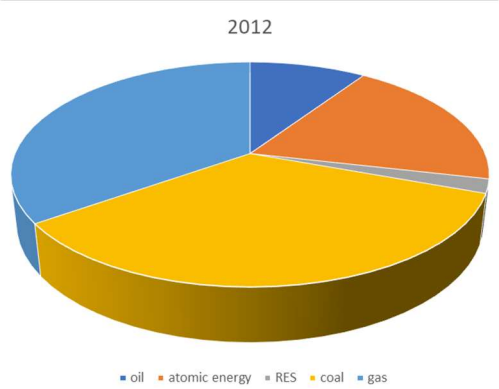

Fig. 1. Diagram of energy consumption in Ukraine in 2012

The share of non-traditional energy sources (RES) is less than 0.5% in the global energy balance, but a number of countries have achieved significant success in the use of non-traditional energy sources in the agro-industrial complex (AIC). Among the industrialized Western countries, it is necessary to note Germany (the leader in wind and solar energy), the USA (solar and wind energy), Japan, Belgium, France (solar energy), Denmark, Great Britain, the Netherlands (wind energy). Among the developing countries, it is necessary to mention China, Brazil, the Philippines, Cyprus and India. It is assumed that in 2025, RES will account

for 60% of all energy consumed on the planet. According to other sources, in the global energy balance in 2020, the share of RES may be from 5 to 10%.

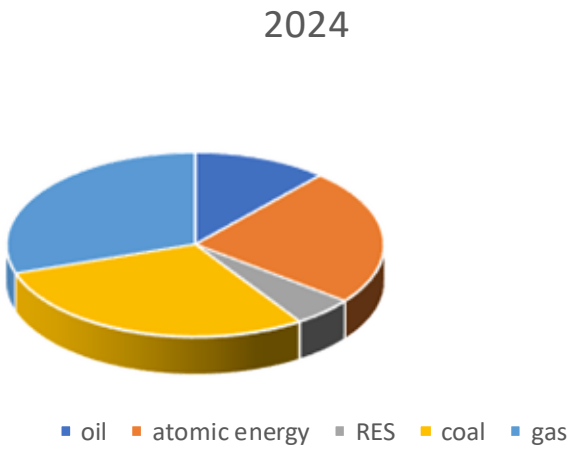

Fig. 2. Diagram of energy consumption in Ukraine in 2024

Conclusions. The purpose of the search for alternative energy sources is the need to obtain it from the energy of renewable or practically inexhaustible natural resources and phenomena, such as the sun and wind, which in turn will significantly improve the economic situation of the country, reduce the negative impact on the environment, and make private household owners more energy independent. Measures are being developed to support renewable energy sources: tax, credit and tariff benefits, legal support, and state development programs. Thus, in Germany, increased purchase prices have been established for electricity produced from non-traditional installations: 0.08 euros per 1 kWh for wind installations, 0.51 euros for solar installations. The state program “100,000 solar roofs” is being implemented, with a budget of 570 million euros, aimed at the use of solar energy. According to the forecast of the International Energy Congress, by 2020 the share of non-traditional energy sources in the total energy consumption of developed countries (USA, England, etc.) will reach 20%.

The main disadvantage of non-traditional energy sources is low energy density. Thus, for wind, solar, geothermal installations, the energy density is less than 1 kW/m2, while in modern boilers and nuclear reactors a thousand times higher heat flux density is achieved. Accordingly, non-traditional energy installations have large dimensions, metal-intensive, and occupy much larger areas compared to operating thermal power plants, nuclear power plants, and boiler plants.

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Брожко Р.М. Види і перспективи нетрадиційних і відновлюваних джерел енергії в Україні

У цій роботі ми розглядаємо поточну світову енергетичну проблему, надаючи деяке уявлення про використання незвичайні, але відновлювані джерела енергії. Сучасна світова залежність від нафти ще породжує проблеми невідомі наслідки. Країни Латинської Америки та Карибського басейну не позбавлені цих проблем і однієї з них його основні наслідки: глобальне потепління. Досліджені тут джерела наразі можуть мати вплив на суспільства, і головним чином у промисловості, яка в середньому використовує приблизно 35% енергії країн в регіоні. З іншого боку, посухи є постійною загрозою для енергопостачання, починаючи з Латинської Америки країни Карибського басейну значною мірою залежать від дощів, які, у свою чергу, мають більший вплив на сільське господарство та водопостачання міст і для споживання людьми в цілому. У цій роботі ми обговорюємо доречний фон інформація про деякі незвичайні, але водночас відновлювані джерела енергії. Ми досліджуємо їх поточний і потенціал використання, експлуатаційні обмеження, переваги та недоліки, а також потенційну потужність кожного джерела палива для отримання енергії генерація та економія палива. У кількісному розділі аналізується кількість потужності, яка є незвичайною відновлювані джерела енергії можуть забезпечити, відповідно до методів генерації. В окремому розділі розберемо потенційна економія палива завдяки прямому застосуванню в деяких галузях промисловості. Ми досліджуємо ці значення за допомогою кількох приклади та показати фінансовий аналіз вибраних проектів альтернативного палива. Нарешті, загальний аналіз представлено незвичайні альтернативні відновлювані джерела енергії та зроблено висновок про існування великого потенціалу для економії палива та витрат, а також для захисту навколишнього середовища. Альтернативна енергетика стає одним із базових напрямів розвитку технологій у світі, разом із інформаційними та нанотехнологіями вона стає важливою складовою нового постіндустріального технологічного укладу. Метою пошуку альтернативних джерел енергії є потреба отримувати її з енергії поновлюваних або практично невичерпних природних ресурсів і явищ, таких як сонце і вітер, що в свою чергу значно покращить економічний стан країни, зменшить негативний вплив на навколишнє середовище, зробить більш енергонезалежними власників приватних домогосподарств.

Ключові слова: *альтернативна енергетика, нетрадиційна енергетика, відновлювані джерела енергії, зелена енергетика.*

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