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RENEWABLE ENERGY AND PUBLIC HEALTH: GLOBAL PRACTICES FOR SYNERGY PROVIDING

ВІДНОВЛЮВАНА ЕНЕРГЕТИКА ТА ОХОРОНА ГРОМАДСЬКОГО ЗДОРОВ'Я: СВІТОВІ ПРАКТИКИ ЗАБЕЗПЕЧЕННЯ СИНЕРГІЇ

Abstract. *One of the sustainable development goals the UN General Assembly developed in 2015 is the movement towards affordable and clean energy (Goal 7). It aims to modernise energy systems, increase energy efficiency, and ensure cheap, uninterrupted, and universally available electricity by 2030. Clean energy has a positive effect on the state of the environment and reduces the "carbon footprint" and negative human impact on the environment. Intermediate results from implementing renewable energy positively impact people's health and better access to medical services. The article examines global practices of preserving public health through renewable ("green") energy. The influence of fossil fuels and non-ecological energy sources on the population's health was analysed, and successful cases of implementing "green" energy to improve the population's health were studied. Methods of promotion of enterprises working in this field are analysed. The analysis showed that while there are challenges to implementing renewable energy sources, the benefits far outweigh the costs. Promising directions in this field include increasing the efficiency of existing energy sources and intensively implementing renewable and environmentally friendly ones. It is essential to develop and invest in the infrastructure of renewable energy sources and to inform communities about the benefits of switching to renewable energy sources to preserve the population's health. The paper emphasised that the large-scale development of the renewable energy sector of Ukraine will be possible based on the state of clear national strategies, setting ambitious goals, conducting international communication campaigns, the introduction of new market mechanisms for stimulating increasing the use of biomass in electricity and heat generation, promoting the development of local energy initiatives, etc.*

Keywords: *sustainable development, renewable energy, public health, marketing strategies, communications.*

Анотація. *Однією з цілей сталого розвитку, розроблених Генеральною Асамблеєю ООН у 2015 році, є рух до доступної та чистої енергії (ціль 7). Реалізація цілі спрямована на модернізацію енергетичних систем, підвищення енергоефективності та забезпечення дешевої, безперебійної та загальнодоступної електроенергії до 2030 року. Чиста енергія позитивно впливає на стан навколишнього середовища та зменшує «вуглецевий слід» і негативний вплив людини на навколишнє середовище. Проміжні результати від впровадження відновлюваної енергетики позитивно впливають на здоров'я людей і забезпечують кращий доступ до медичних послуг. У статті розглядаються світові практики збереження здоров'я на-*

селення з урахуванням впливу відновлюваної («зеленої») енергії. Проаналізовано вплив викопного палива та неекологічних джерел енергії на здоров'я населення, вивчено успішні практики впровадження «зеленої» енергетики для оздоровлення населення. Проаналізовано методи просування підприємств, що працюють у цій галузі. Аналіз показав, що незважаючи на те, що впровадження відновлюваних джерел енергії супроводжується низкою складнощів, переваги значно перевищують витрати. Перспективними напрямками в цій галузі є підвищення ефективності існуючих джерел енергії та інтенсивне впровадження відновлюваних та екологічно чистих. Важливо розвивати та інвестувати інфраструктуру відновлюваних джерел енергії та інформувати громади про переваги переходу на відновлювані джерела енергії для збереження здоров'я. У роботі наголошується, що масштабний розвиток сектору відновлюваної енергетики України стане можливим за наявності чітких національних стратегій, встановлення амбітних цілей, проведення міжнародних комунікаційних кампаній, впровадження нових ринкових механізмів стимулювання збільшення використання біомаси у виробництві електроенергії та тепла, сприяння розвитку місцевих енергетичних ініціатив тощо.

Ключові слова: *відновлювальна енергетика, вплив на здоров'я, маркетингові стратегії, сталий розвиток.*

Introduction. Recognising the effects of fossil fuels on the population's well-being is crucial. Non-renewable energy sources like coal and nuclear power plants have been linked to an increased risk of cancer, respiratory diseases, and other health issues [1]. Energy consumption is intertwined with every aspect of human economic activities, including heating homes, cooking meals and transportation [2]. Particularly, using fossil fuels can contribute to air pollution that seriously harms human health. Moreover, it is undeniable that preserving biodiversity and prioritising health is paramount when transitioning from traditional energy sources to sustainable alternatives. Finding energy sources that do not harm human well-being becomes imperative to enhance public health.

The health benefits of using renewable energy in the economy and society are undeniable. Renewable energy can access reliable and non-polluting sources in remote and underserved areas. This impact on local communities' health and overall well-being cannot be understated [3]. In addition, using renewable energy can reduce air pollution, which is an excellent advantage for those with respiratory complications [2]. Ensuring a sustainable future and promoting global health and well-being requires innovative interventions in communities worldwide and is extremely important today. Given this, studying the main impacts of the energy industry and renewable energy on public health is an important scientific task.

Problem statement. One of the key public health problems is air pollution, which negatively affects people and the environment. Thus, 7 million people die every year from the effects of pollution. Air pollution is a cause of respiratory, infectious and heart diseases, stroke, lung cancer and complications related to pregnancy. Experts call air pollution an "invisible killer" that kills 800 people every hour. According to estimates, if adequate measures are not taken immediately, by 2050, mortality from air pollution will increase by 50-100 per cent. The leading causes of atmospheric air pollution are electricity production, industrial processes, mining, etc. At the same time, the total expenses in connection with air pollution exceed 5 trillion dollars per year [4].

A modern and environmentally sustainable way to mitigate this problem is to switch to renewable energy sources, which, from an environmental point of view, are much safer than fossil fuels. International organisations and governments of many countries worldwide have recorded the movement to reduce air pollution and the transition to sustainable energy. Therefore, as the world begins to take stock of progress towards the Sustainable Development Goals and shape the post-2030 agenda, integrating health, air pollution and climate change mitigation goals into different policy areas is essential for ensuring sustainable development focused on preserving public health. This is where the question arises of creating green awareness and promoting renewable energy sources at the global level, taking into account the specifics of the development of individual countries.

The article aims to study the influence of renewable energy on the preservation of public health and to determine the ways and approaches of promoting the ideas and practices of implementing renewable energy that can be used to improve public health.

Methods. The study of the influence of renewable energy on the preservation of public health was carried out with the help of a scientific analysis of the literature and the systematisation of data from open sources.

Results of the research. A significant part of the world's population breathes polluted air, billions of people lack access to clean energy in their homes and healthcare facilities, and the importance of reducing air pollution to protect our vulnerable climate. Therefore, as the world begins to take stock of progress towards the Sustainable Development Goals and shape the post-2030 agenda, integrating health, air pollution and climate change mitigation goals into different policy areas is essential for ensuring sustainable development focused on healthcare.

The replacement of outdated power plants operating on fossil fuels and the gradual transition to renewable energy sources marks the reliable and significant development of the global energy industry. Today, world economies increasingly depend on these sustainable alternatives, and civilised countries are leading the way. This innovative and environmentally conscious energy use trend continues to grow and develop worldwide. The energy industry worldwide tends to use, develop and implement renewable energy. Promoting a renewable energy company involves demonstrating its value, authority, potential and other benefits to an audience. This marketing strategy supports a sustainable future and promotes global health and well-being by implementing such activities in communities worldwide.

Air pollution is the leading cause of non-communicable diseases. In 2018, the United Nations Organization recognised air pollution as one of the five major risk factors in response to the global epidemic of non-communicable diseases. Accordingly, she called on countries to intensify their efforts in the fight against air pollution. Unlike the other four risk factors for non-communicable diseases (tobacco smoking, salt intake, alcohol consumption and lack of physical activity), which primarily depend on individual behaviour, this fight requires a systemic policy that involves various economic sectors and stakeholders at different global levels.

Implementing waste management practices in households, promoting clean transportation, constructing of

energy-efficient housing, and adopting smart power generation methods can effectively address the root causes of air pollution leading to cleaner air. The unique characteristics of each region play a crucial role in determining the cost implications and public health outcomes associated with implementing various measures. It is renewable energy that can make a significant contribution to overcoming or mitigating this problem. Sustainable household waste management, clean transportation, energy-efficient housing, and smart power generation can help reduce the root causes of air pollution, contributing to cleaner air. The specific attributes of each region play a role in determining the costs and public health impacts associated with implementing these measures individually or in combination. Renewable energy is poised to contribute to overcoming or alleviating this challenge.

In the European Union (EU), energy is increasingly emphasised as member countries aim to reduce carbon emissions and achieve climate neutrality targets. The EU has established directives [5] that outline regulations for attaining a 32% target for energy by 2030 with an ambitious goal for Europe to become the first climate-neutral continent by 2050. In this context, renewable energy plays a role in fulfilling the EU objectives related to both energy production and addressing climate change. Renewable energy sources are widely available in the EU and are cost-competitive with fossil fuels. As a result, adopting energy can make energy systems more economically accessible and decrease the EU's reliance on imported fossil fuels. It also has the potential to provide many new jobs, create new industrial opportunities and contribute to economic growth.

Figure 1 illustrates the share of renewable energy in gross final energy consumption by sector. In European countries, the leaders are Iceland (80%) and Norway (74%). The anti-leaders are Luxembourg (11,7%) and Malta (12,1%). The average figure for EU member states was 21,75%.

Using renewable energy sources has numerous advantages for preserving the population's health. For example, renewable energy can reduce air pollution, a significant cause of respiratory diseases such as asthma and lung cancer. In addition, the United Nations Sustainable Development Goals include renewable energy as a critical component in achieving improved health and well-being for all [6]. Therefore, introducing renewable energy sources can have a significant positive impact on the population's health. According to the World Health Organization's draft strategy for air quality, "Energy Access and Health 2023", 7 million deaths are attributable to exposure to air pollution each year. These deaths are caused by heart disease, stroke, chronic obstructive pulmonary disease, lung cancer and pneumonia. In addition to years of breathing difficulty punctuated by asthma attacks or cataracts, there is growing evidence of important links between exposure to air pollution and other health outcomes, such as low birth weight, diabetes, cognitive impairment, and mental health.

With 2.4 billion people using polluting fuels and cooking technologies and 1 billion people worldwide lacking reliable electricity access to clean and renewable energy, this is holding back progress towards sustainable public health, universal coverage of medical services and emergency preparedness. High morbidity due to air pollution and lack of access to energy has significant economic consequences, burdening state and household budgets with costs for the health care system and treatment of diseases. As a result, there is a loss of income and a decrease in labour productivity, leading to further inequality and a negative impact on the population's well-being. After all, air pollution and the lack of access to clean, sustainable energy are significant contributors to climate change.

According to statistics on the level of fatalities from accidents and air pollution per unit of electricity in the world, by energy sources (Figure 2), the biggest threat is lignite and hard coal, with a ratio of 32.64 and 24.62 deaths per thousand terawatts hours respectively. This figure includes the direct threat caused by accidents and the impact of air pollution from burning coal on the human body and the environment. Air pollution from coal-fired power plants is a growing concern because it has been linked to asthma, cancer, and heart disease. Burning coal can release toxic pollutants such as mercury, sulphur dioxide, nitrogen oxides and particulate matter into the air. At the same time, renewable sources are the safest. Wind

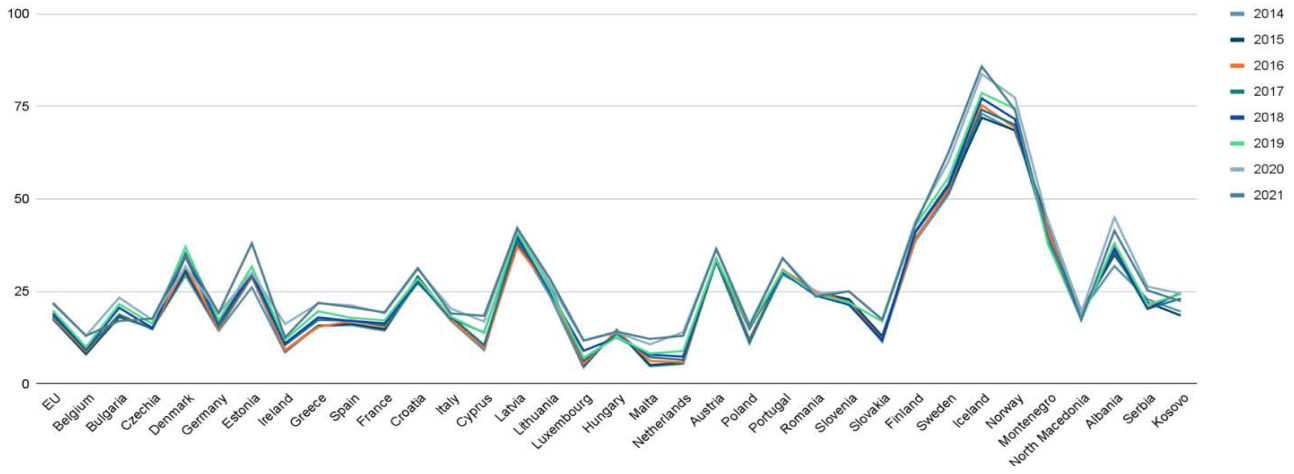

Figure 1 – Share of renewable energy in gross final energy consumption by sector (% of gross final energy consumption)

Source: developed by the authors based on Renewable Energy Targets

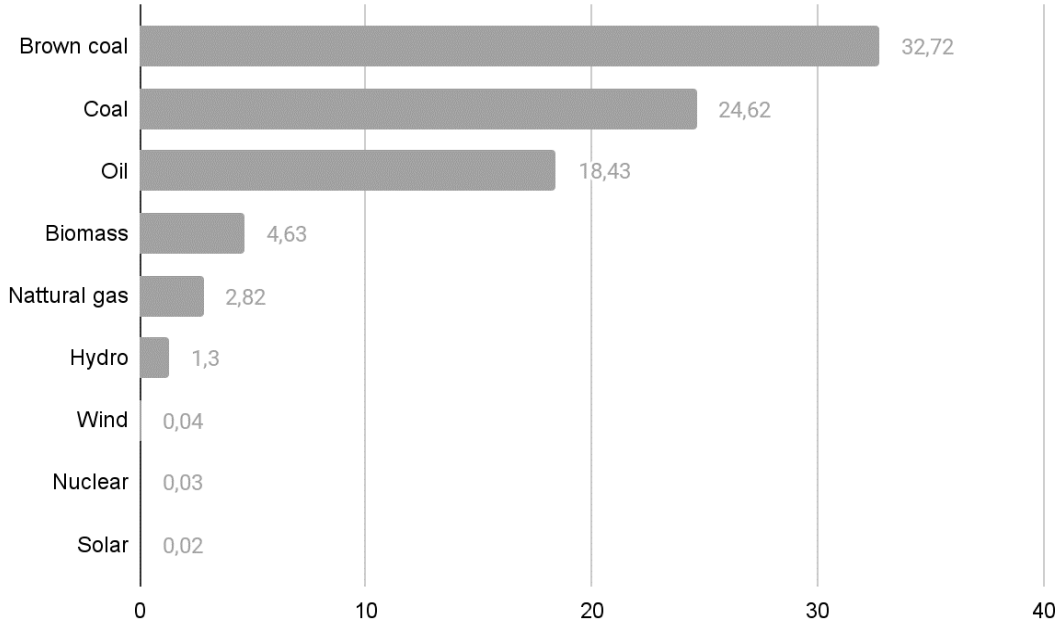

Figure 2 – The fatality rate from accidents and air pollution per unit of electricity in the world by energy source (in fatal cases per thousand terawatt-hours)

Source: developed by the authors based on [7]

and solar energy development analysis indicates 0,04 and 0,02 fatalities per unit of electricity, respectively.

They do not create carbon emissions or other "greenhouse" gases that retain heat during operation. This avoids environmental damage associated with the extraction or drilling of fossil fuels.

One of the successful implementation cases of using renewable energy to improve health is the experience of the "Solar for Health" program within the framework of the United Nations Development Program initiative in Africa. More than 70% of health facilities in sub-Saharan Africa lack reliable access to electricity, affecting the storage of medicines and vaccines. Solar for Health focuses on installing solar PV systems in medical clinics in the world's poorest and most remote regions, helping to ensure that no one is left behind [4].

As part of this program, solar panels are installed in medical facilities in Zimbabwe, Zambia, Libya, Namibia, Sudan and South Sudan. In Zimbabwe, over 2/3 of medical clinics have only 4 hours of power per day. Solar energy has powered 405 HIV clinics, and they can now provide medical services to the public 24 hours a day. This has made it possible to reduce electricity bills by up to 60%, safely store medicines and vaccines, and obtain clean water from solar-powered pumps.

The total installed capacity is 6.5 MWh, and more than 20 million people can access quality healthcare services. Healthcare facilities are estimated to receive a 100% return on investment in solar PV within 2-3,5 years, which can be reinvested in other healthcare sector priorities [4].

To enhance both the environment and residents' well-being, “green cities" aim to revolutionise city development. These cities adopt renewable energy systems, reducing environmental harm and improving residents' comfort. Solar power plays a role in achieving this objective. In " cities," buildings, streets and bus stops can integrate solar panels into their architecture seamlessly blending them with housing estates, office spaces and other infrastructure. By maximising energy utilisation on building facades and rooftops while saving space, cities can access cleaner and renewable energy sources while reducing dependency on hydrocarbon fuels. Educating citizens about energy and raising awareness is crucial for successfully implementing it within "green cities." This can be accomplished through workshops, educational programs, and awareness campaigns.

However, there are challenges when it comes to implementing energy in public healthcare systems. One obstacle is the cost associated with transitioning to renewable energy sources, which may pose a barrier for many communities and countries. Additionally, intermittency issues arise with renewable energy sources such as wind and solar power, making it challenging to ensure a consistent electricity supply. Furthermore, developing the energy sector necessitates substantial investment in infrastructure, which can prove challenging for nations with limited resources or facing political instability [8].

One of the practical tools for the implementation and promotion of sustainable energy is the feed-in tariff. It is a policy that supports the development of renewable energy sources by providing producers with a guaranteed price above the market price [9].

Since renewable energy is generally less competitive in price than energy from mineral sources, grid operators must buy power from renewable sources at a fixed price set separately for each renewable energy source. This fixed price covers the average cost to energy producers for each renewable source and allows for a profit margin. As a result, the demand for renewable energy is increasing at a higher price than in the unregulated market. As a result, more renewable energy is produced and consumed [10]. "Green" tariffs usually involve 15 to 20 years of long-term

contracts. Green tariffs are standard in the US and worldwide, especially in Germany and Japan [9].

Green tariff policies can also increase community ownership of energy resources, depending on their local operating rules. Project development is not limited to corporations, as standard contracts facilitate use among community groups. This type of ownership can contribute to government support for modern technologies such as wind turbines and solar panels.

Renewable energy marketing promotes green companies by demonstrating values, authority, potential, differences, safety, reliability, and other attributes essential to target audiences. This can mean highlighting the company's value for society or the environment and clarifying the potential for the transition of energy production and storage to new, more sustainable stages. It can also highlight technological breakthroughs that the company has achieved, building trust and ensuring customer satisfaction. Tools for creating awareness and a cheerful green image can be traditional and digital advertising, creation of unique content, SMM, favourable reviews of the media and much more. These approaches and tools may overlap with renewable or clean energy PR campaigns [11].

In addition, international organisations are powerful actors in promoting and advocating renewable energy. On their basis, informational materials, advertising campaigns, and recommendations for governments, households, public institutions, and enterprises are created regarding the advantages of using sustainable energy and methods of transition to it. One of the largest is the Health and Energy Platform of Action (HEPA), a multilateral platform created by the World Health Organization together with the United Nations Development Program, the United Nations Department of Economic and Social Affairs, the World Bank and in cooperation with the International Renewable Energy Agency. HEPA is a voluntary network of governments, international, non-governmental and civil society organisations, international business associations, philanthropic foundations and academic institutions working to ensure universal access to clean and sustainable energy to protect health. It aims to provide universal access to clean, sustainable energy to protect health.

Social marketing is another marketing approach used in global health practice and can be used in promoting renewable energy. This approach involves using marketing techniques to encourage health-related behaviours or products. Social marketing aims to satisfy the needs of consumers as well as to promote health and well-being [13]. It has been used to promote various health-related behaviours, such as smoking cessation, healthy eating, and physical activity. Social marketing can be an effective health promotion tool because it uses marketing techniques to reach a wider audience and influence behaviour change.

The urgent need to find a sustainable marketing partner or renewable energy PR partner for green energy companies has become apparent as consumers become more environmentally conscious. 85% of consumers today consider a company's impact on the environment when making a purchase decision, and a third are willing to pay significantly more for goods and services that meet the principles of sustainable development. This phenomenon also applies to companies working in the field of renewable energy. Marketing strategies that emphasise the company's high environmental friendliness, reputation and commitment to sustainable development will be attractive to private consumers and companies seeking to form partnerships that will provide them with a good ESG reputation. Informational messages should emphasise the benefits of switching to renewable energy sources, such as cost savings, environmental impact, and the health of current and future generations. Companies in the renewable energy industry must employ various marketing strategies, including content marketing, influencer marketing, and social media marketing.

Conclusions and prospects of further research. Using renewable energy sources has a significant potential to improve public health. The complete transition to 100% energy from renewable sources and its efficient and economical use is the only way for the further development of humanity, which will allow overcoming the problems of climate change environmental pollution and preserve the population's health.

Large-scale development of "green" generation and the creation of a new model of the energy sector of Ukraine will be possible on the condition that: 1) the adoption by the state of clear national strategies for the development of renewable energy and the increase in the volume of storage capacities (energy storage); 2) setting ambitious goals for the development of renewable energy that will correspond to the current energy policy of the EU; 3) conducting international communication campaigns to encourage international strategic and financial investors to enter the renewable energy market of Ukraine; 4) introduction of new market mechanisms for stimulating the development of renewable energy, including "green" auctions, corporate long-term contracts for the purchase and sale of electricity produced from renewable energy, contracts for difference, etc. 5) increasing the use of biomass in electricity and heat generation; 6) ensuring the development of the renewable hydrogen market, namely: 7) potential research and development of the appropriate legislative framework for the construction of hybrid power plants from renewable energy sources; 8) promoting the development of local energy initiatives, particularly energy cooperatives, small and medium-sized enterprises in the energy sector, generation and supply of electricity considering regional characteristics, and development of distributed generation.

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