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**GREEN ENERGY TRANSITION IN THE CONCEPT OF POST-WAR
RECONSTRUCTION OF UKRAINE**

Zvarych, R., Masna, O. (2023). Zelenyy enerhetychnyy perekhid v kontseptsiyi pislyavoyennoyi vidbudovy Ukrayiny [Green energy transition in the concept of post-war reconstruction of Ukraine]. *Visnyk ekonomiky – Herald of Economics*, 3. P. 170–181. DOI: <https://doi.org/10.35774/visnyk2023.03.170>

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Abstract

Introduction. *Green energy is energy production technologies, the use of which minimizes environmental pollution, including emissions of greenhouse gases into the atmosphere. Green energy uses inexhaustible and renewable sources, which include wind energy, solar energy, and hydroelectricity. The Ukrainian-Russian war made adjustments to green energy and the green energy transition of Ukraine. The value of renewable energy shifted from ecology to security, and then to economy. Even half a year ago, renewable energy sources were considered by the international community primarily as a tool for combating inevitable climate change and reducing carbon emissions. Today, wind, solar, bio, small hydro and hydrogen energy are key to national energy security and independence and cost significantly less than fossil fuels, although as of 2021, Ukraine's renewable energy sector was fighting for the right to work under fair conditions guaranteed by the state, in*

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2023 it will become one of the foundations of the post-war reconstruction of Ukraine and is preparing for the further increase of the country's energy independence.

The purpose of the article is to research and find opportunities, proposals for a green energy transition in the concept of post-war reconstruction, taking into account the natural resource potential of Ukraine.

Methods. The methodological basis of the study is a theoretical generalization and comparison, analysis and synthesis, conducting scientific research with the aim of finding new opportunities for the green energy front of Ukraine in the post-war period. The statistical and factual basis of the research is official data, namely the Green Future Index published by the Massachusetts Institute of Technology.

Conclusions and prospects of further research. The challenges and possibilities of reconstruction and post-war development of Ukraine's green economy are analyzed, and a possible development path to the green economic transition of the country's energy sector is outlined. The Government of Ukraine has already announced an approach to the green recovery of the energy sector based on the principles of "build back better" and "build back greener" with an emphasis on renewable energy sources and energy-efficient technologies.

Prospects for further research are to develop clear principles for the implementation of green energy in Ukraine in the post-war period with the aim of decarbonizing key sectors of the economy, taking into account the consistency of state policy for the implementation of important environmental goals.

Keywords: green energy, renewable energy, green energy transition, concept, post-war reconstruction of Ukraine.

Formulas: 0, figure: 3, table: 1, bibl.: 15.

JEL classification:

Introduction. New technologies for the production of electricity from renewable sources (RES) are less than 50 years old. Green energy based on their use gained popularity in the 1970s. as part of the growing environmental movement. But only at the beginning of the 21st century. a real breakthrough was made in this field, which will eventually allow RES to replace fossil fuels as the main energy carrier [1].

The problem statement. Green energy can solve the problems of global climate change and reduce the negative impact of man on nature. Economic benefits include the creation of new jobs in the construction and maintenance of green energy facilities. However, with the beginning of the war in Ukraine, the value of RES was transformed. Green energy became one of the foundations of the reconstruction of our country in the post-war period and the main factor of its energy independence [2]. The conditions that arose due to a full-scale war with the aggressor country Russia became of urgent importance for further development in the Plan for the Recovery of Ukraine until 2032, which the government of Ukraine presented in July 2022 at the international donor conference in Lugano. In order to keep up with the times and maintain modernized trends, the post-war reconstruction of Ukraine's green economy will take place in accordance with the above-mentioned Plan, and the key sector without exception will be renewable energy sources.

Research results. In recent years, major changes have been made in the development and installation of renewable energy sources around the world, thereby improving the efficiency and reducing the cost of the energy received. Despite the rapid development of renewable energy sources in the world, the domestic energy sector of the economy has an actual rate of energy production from renewable energy sources of less than 5%. In the conditions of a constant increase in the number of solar and wind power plants, the issue of economic evaluation of the advantages and disadvantages of the consequences of using renewable energy sources, as well as including the prospects and possibilities of transition to green energy, is acute. Foreign and domestic scientists have paid attention to various aspects of the research problem, in particular, such as O. F. Balatskyi, V. V. Byba, O. V. Chmyr, S. V. Voitko, D. Dodmen, A. Evans, I. Zvarych [3], R. Zvarych [4], Eckhous B., Mathis W. and Mutaugh D. [5], Prishchepa Ya. and Bohdanyok O. [6], Zakiyanov D. [7], Omelchenko V. [8] and others.

The Ukrainian-Russian war caused huge losses to the Ukrainian power industry. First, electricity consumption dropped sharply by at least 30 % [9]. Secondly, enemy forces occupied some power generation facilities, and dozens of power plants of various types were destroyed by rockets, artillery shells, and bombs. Thirdly, the majority of thermal power plants operating on coal were left without this energy raw material due to the fact that the mines were located in the occupied territory. All this has a negative impact on the Ukrainian economy, leads to a drop in GDP, and leads to the impoverishment of the Ukrainian people.

Reconstruction of the energy infrastructure after the war will be an opportunity to reformat the Ukrainian energy industry and make Ukraine a successful example of the “green transition”. Energy efficiency is not only a matter of protecting the climate or saving money for households, but also is a part of energy independence, which is a key factor in national energy security and sustainable innovative development. From 2011 to 2021, the share of renewable energy in Ukraine increased from 4% to almost 14%. At the same time, 70% of Ukraine’s energy balance consists of clean energy generated by nuclear power generation and renewable energy sources.. In addition, Ukraine has significant potential for the production of hydrogen, in particular, green, and biomethane.

Green (or sustainable) revival of Ukraine must be considered as one of the possible concepts of reconstruction after the end of the war. The concept of green recovery is based on a holistic vision of the development of society, the economy and the state as a whole.

The challenges and opportunities of reconstruction and post-war development are a chance for systemic rethinking and transformation of Ukraine, [10] in particular regions and cities, based on the green principles of transformation of the economy and regions , which focuses on people, their interest in returning to a healthy, safe and viable environment.

As a result of Russia’s massive missile attacks since the beginning of the full-scale war, more than 50% of Ukraine’s energy infrastructure has been destroyed

In the second year of the war, taking into account the socio-economic problems faced by business and the population, the state of Ukraine’s economy looks like this:

- constant terrorist attacks by Russia on cities, villages, enterprises, infrastructure, etc.;
- the decline of Ukraine’s export potential, in particular, due to limited access to export logistics;

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- psychological and physical injuries of civilians and soldiers;
 - damage to critical infrastructure, in particular in the energy sector, man-made disaster at the Kakhovskaya HPP and risks of an explosion at the Zaporizhzhya NPP;
 - the dependence of the functionality of the Ukrainian army on the supply of weapons from other partner countries, the need for large-scale domestic production.

But there are many other negative factors caused by war. Of course, under such conditions, the priority of development for the state and society are industries that can solve urgent problems [11].

Consider this situation based on the Green Future Index published by the Massachusetts Institute of Technology. The Green Future Index 2023 explores climate uniformity while assessing geopolitical landscape change.

Now the focus is on Russia's war against Ukraine and its disruption in the natural gas markets. While Russia's war against Ukraine has had numerous negative climate and other consequences that have reverberated around the world, one consequence is that it sets a global price on carbon faster than multilateralism has so far achieved.

The Green Future Index ranks 76 leading countries and regions on their progress and commitment to building a low-carbon future. It measures the extent to which these countries' economies, industries, agriculture and societies are transitioning to clean energy through investments in renewable energy, innovation and green finance.

The research was conducted through in-depth secondary research and analysis and interviews with global experts on climate change, green energy and technologies that help decarbonise. The list included 76 countries, which were ranked by "progress and commitment to a green future through carbon reduction, clean energy development, innovation in green economic sectors, and the extent to which governments are implementing effective climate policies". According to this study, in 2021, Ukraine was in the last, fourth group in 63rd place, namely among 16 countries that will be left behind in the green future due to the lack of progress and commitment to the development of a modern, clean and innovative economy (see fig. 1).

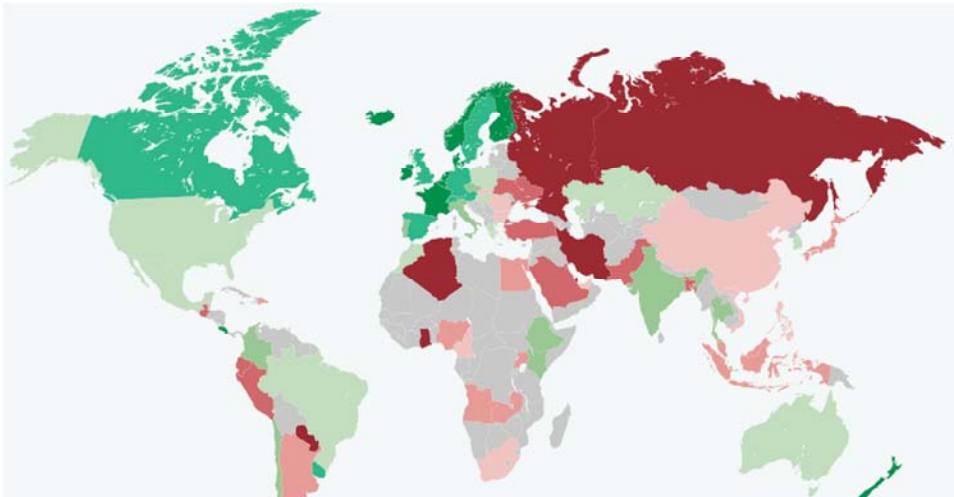


Fig. 1. The Green Future Index rankings world map in 2021.

Source: [12].

According to the Green Future Index in the period 2021 - 2023, an analysis was conducted and the obtained results showed, Ukraine is included in the rating the 20 countries that are making slow and uneven progress or commitment toward building a green future (see tabl. 1, see fig. 2).

Table 1

Comparison table The Green Future Index (score/rank)

	2021	2022	2023
The Green Future Index (score)	3,97	-	4,38
The Green Future Index (rank)	63	61	47

Source: authors according to [13].

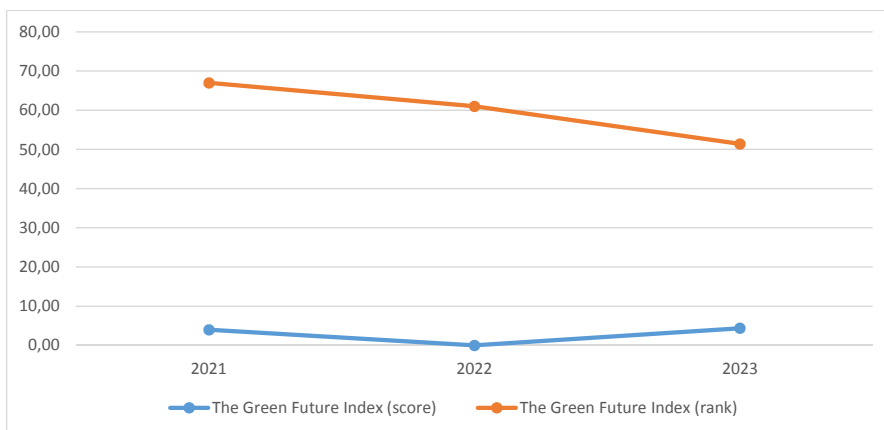


Fig. 2. For a more detailed study - the schedule for 2021-2023 The Green Future Index.

Source: authors according to [13].

The Green Future Index measures and ranks the degree to which countries and regions are building a green future in several key areas:

Carbon emissions: total emissions and the degree of change in emissions from transport, industry and the rural economy;

Energy transition: the share of renewable energy sources and their contribution, as well as their growth rates;

Green society: a number of indicators regarding the planting of clean forests, development of green construction, processing and consumption of livestock products;

“Clean” improved competitive technologies: a certain number of “green” patents, foreign investments in clean energy, investments in food technology;

Climate policy: political commitment to climate goals, carbon financing programs, sustainable agriculture, use of COVID incentives for environmental restoration.

The fundamental principles of post-war reconstruction emerge from the Report on the results of the International Expert Conference on Reconstruction, Reconstruction and Modernization of Ukraine [14] which was organized by Germany during its presidency of the G7 and the EU. Namely, (1) the consequences of crises, regardless of their type (economic crises, natural disasters, political upheavals or wars) are long-term in nature and

wide-ranging, which must be taken into account in recovery and reconstruction; (2) early recovery planning (even during conflict) and in conjunction with EU accession planning:

- can become a trigger for long-term sustainable development;
- it is expedient not to build on the foundations of restoration, as before, but to “build better than it was” and in accordance with the European Green Course (EGC). This will lead to increased investment in a future-oriented green transition;
- requires a thorough removal of the baggage of historical Soviet experiments in planning.

Even in pre-war times, the government and expert circles of Ukraine recognized the feasibility of a dual long-term development strategy in the context of the European Economic Community and accession to the EU, and the need for post-war reconstruction on the basis of the green transition is already being emphasized today.

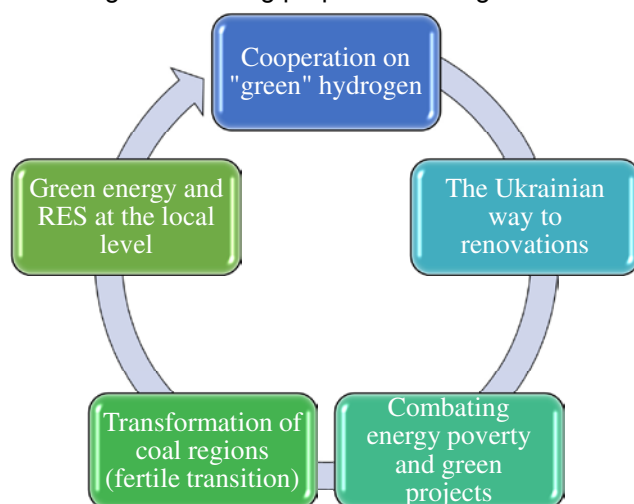
The Government of Ukraine has already announced an approach to the recovery of the energy sector based on the principles of “build back better” and “build back greener” with an emphasis on renewable energy sources and energy-efficient technologies.

It is appropriate to say that Ukraine is accelerating the development of the National Energy and Climate Plan and plans to present the first draft of the document by the end of November 2023.

NPEK needs a) supplementing with measures for the cyclical economy, energy efficiency and deployment of RES in all sectors of the economy/industry, reduction of methane emissions in land use, forestry and agriculture; b) reflecting investments in both energy and climate measures and recovery and sustainability reforms. It is important to draw attention to the fact that the current EU NAPs already contain measures to decarbonize key sectors of the economy and are not limited to the energy sector.

Consistency of public policy is crucial for the transition to green energy, as the realization of environmental goals is always the result of cooperation between the state and business. The energy sector is part of Ukraine’s obligations under the Association Agreement, in particular regarding the implementation of energy legislation.

We suggest considering the following proposals for a “green” transition for Ukraine



Source: authors according to [15].

“Green hydrogen”. Ukraine has announced that it plans to introduce the production of “green” hydrogen for the EU market, but the implementation of this plan is still ongoing. The production of “green” hydrogen requires “green” electricity, and so far too little is produced, because it is possible to use electricity to split water into hydrogen and oxygen - electrolysis. But with the help of nuclear energy, which Ukraine is still able to produce in sufficient quantities, conventionally “yellow hydrogen”, Europe does not need it. France, which also has many nuclear power plants, can provide its production by itself. Because of this, there is only demand for Ukrainian “green” hydrogen, which will be produced with RES.

The lack of adequate distribution channels is also a problem that may hinder the implementation of the new fuel supply plan to Europe. Ukrainian transportation of gas mixtures and hydrogen is almost impossible to withstand from the point of view of hydrology, because hydrogen is much more explosive than natural gas. It easily penetrates metal and quickly damages it, so the Ukrainian pipeline for transporting hydrogen is currently not adapted. On this way, there are losses of resources, as well as other phenomena related, for example, to the extraction of gas. The flow of the gas-hydrogen mixture is affected by the gas distribution network and groups of gas pipelines connected to the main gas pipeline system. The pressure drop in the exhaust gas pipeline must be compensated by the corresponding hydrogen injection pressure. These are very complex calculations that require constant optimization.

In the near future, hydrogen may no longer be needed as a fuel. Hydrogen technologies and carbon capture are currently actively discussed in our space, mostly in connection with the energy transition of our country, but together with other measures, they are only a component of the strategies of global companies.

“The Ukrainian “wave of renovations” is, in fact, already supported by the EU and is aimed at bringing the energy efficiency requirements of buildings closer to European standards, implementing building information modeling technologies, reducing waste, and introducing mandatory energy management systems for public buildings .

“Combating energy poverty” is an initiative aimed at involving Ukraine in European initiatives and policies regarding the definition of energy poverty criteria. “Green” projects. In Ukraine, the most problematic in the development of environmental projects is their development, which is at an insufficient stage of development. According to experts, that is why it is difficult to find financing for such projects. Difficulties in financing projects of energy transformation. These include the technical and economic uncertainty associated with innovative technologies, long planning periods, the need to involve various partners in the project, and difficulties in coordination between partners. The terms of equipment supply are also of decisive importance.

“Transformation of coal regions” (just transition) - such an initiative can include both the use of EU experience in the transformation of coal regions in EU countries and the use of the mechanism of a just transition, as well as concrete steps to transform coal regions into investment-attractive territories.

“Green” energy. In order to reduce carbon dioxide emissions, most industries need “green” energy. This will increase the demand for steel needed to build renewable energy facilities. According to GMK Centre’s estimates, 1.7 billion tons of steel will be needed for the “green” transition of world energy. This is equivalent to the current annual world

steel production. Ukraine's energy strategy envisages a more ambitious long-term goal. Construction of new renewable energy facilities would be impossible without investments in this sector. Transparent regulatory conditions, clear and equal rules, as well as the state's fulfillment of its obligations to investors are important for attracting investments.

The potential for Ukraine's involvement in the European Green Course in the field of energy efficiency and energy is very high given the same direction of the movement vectors, the ambition of the changes, the similarity of the agendas and coverage by the Association Agreement.

Conclusions and prospects of further research. Modern economic problems, increased requirements for environmental safety, as well as the depletion of large fossil fuel deposits determine the attitude of most countries to renewable energy sources (RES) as a possibility to replace classical energy sources. Reconstruction of the energy infrastructure after the war will be an opportunity to reform the Ukrainian energy industry and make Ukraine a successful example of the "green transition". Energy efficiency is not only a matter of protecting the climate or saving money for households, but also a matter of energy independence, a key component of the country's energy security and sustainable innovative development. The use of renewable energy sources is of great importance in ensuring Ukraine's energy independence. Before the war, the green energy sector was actively developing, increasing capacity and attracting foreign and domestic investors. However, with the onset of full-scale invasion, the RES sector faced serious challenges that threatened its existence. Among these problems are the damage, destruction and closure of "green" energy facilities, the financial crisis, the suspension of the construction of new power plants, the lack of state support, and the absence of a single strategic document that determines the direction of the development of green energy in Ukraine. Solving these problems requires the implementation of the following measures: restoration and improvement of damaged or destroyed renewable energy facilities, repayment of debt to renewable energy producers, support for the production of equipment on the domestic market for "green" energy facilities, state support, adoption of a single decisive document, which clearly directions for the development of green energy in Ukraine will be determined. The practical significance of the study lies in the possibility of using the obtained results by state authorities in the process of developing the legislative framework in the field of green energy.

References

1. The five different kinds of renewable energy sources. CHARIOT Energy. 2020. Retrieved from <https://chariotenergy.com/chariot-university/renewable-energy-sources/> [in English].
2. Mykhailova, L. M., Semenyshina, I. V., Shpatakova, O. L. (2023). Zelena enerhetyka yak chynnyk enerhetychnoi nezalezhnosti Ukrainy [Green energy as a factor of Ukraine's energy independence]. *Ekonomika ta suspilstvo – Economy and society*, 47. Retrieved from <https://economyandsociety.in.ua/index.php/journal/article/view/2090> [in Ukrainian].
3. Zvorych, I. Ya. (2016). Hlobalna tsyrkuliarna ekonomika yak zasib pobudovy novoho ekolohichno stiikoho suspilstva [Global circular economy as a means of building a

- new ecologically sustainable society]. *Svit finansiv – World of finance*, 4, 148-155 [in Ukrainian].
4. Zvarych, R., Masna, O., Rivilis, I. (2022). Metodolohichni zasady formuvannia kontseptsii zelenoi ekonomiky [Methodological principles of the formation the concept of green economy]. *Visnyk ekonomiky – Herald of Economics*, 4. P. 131-144 [in English].
 5. Eckhous, B., Mathis, W., Mutaugh, D. (2021). Ten renewable energy trends to watch in 2021. *World Oil*. Retrieved from <https://www.worldoil.com/news/2021/1/6/ten-renewableenergy-trends-to-watch-in-2021> [in English].
 6. Prishchepa, Ya., Bohdanyok, O. (2022). YeS ne mozhe pohodyty steliu tsin na haz cherez hlyboki rozbizhnosti [The EU cannot agree on a gas price ceiling due to deep differences]. *Suspilne. Media – Public. Media*. Retrieved from <https://suspilne.media/324586-es-ne-moze-pogoditi-stelu-cin-na-gaz-cerez-gliboki-rozbizhnosti-france-24> [in Ukrainian].
 7. Zakiyanov D. (2019). Khto «naizelenishyi»: yak peredovi krainy Yevropy rozvyvaiut alternatyvnu enerhetyku [Who is the “greenest”: how advanced European countries are developing alternative energy]. *Mind. Mind – Mind*. Retrieved from <https://mind.ua/publications/20194992-hto-najzelenishij-yak-peredovi-krayini-evropi-rozvivayut-alternativnu-energetiku> [in Ukrainian].
 8. Omelchenko, V. (2022). Sektor vidnovliuvanoi enerhetyky Ukrainy do, pid chas ta pislia viiny [The renewable energy sector of Ukraine before, during and after the war]. *Razumkov – Razumkov*. Retrieved from <https://razumkov.org.ua/statti/sektor-vidnovlyuvanoyi-energetyky-ukrayiny-do-pid-chas-ta-pislya-viyny> [in Ukrainian].
 9. Razumkov Center calculations based on the analysis of the structure of electricity consumption in Ukraine. This estimate is comparable to the EBRD statement. Retrieved from <https://www.ebrd.com/news/2022/war-in-ukraine-and-inflation-slow-growth-in-ebrd-regions.html> [in English].
 10. Green post-war recovery of Ukraine: vision and models. Analytical note (August 2022). Resource-analytical center “Society and Environment”. Retrieved from <https://www.rac.org.ua/priorytety/viyna-ta-zelena-vidbudova-ukrayiny/zelene-povoenne-vidnovlennya-ukrayiny--viziya-ta-modeli-2022> [in English].
 11. Vidbudova Ukrainy: 5 investytsiino pryvablyvykh sektoriv pid chas viiny ta pislia [Reconstruction of Ukraine: 5 investment-attractive sectors during the war and after]. Retrieved from <https://mind.ua/openmind/20262853-vidbudova-ukrayini-5-investicijno-privablivih-sektoriv-pid-chas-vijni-ta-pislya> [in Ukrainian].
 12. The Green Future Index Silver partners 2021. Retrieved from <https://mittrinsights.s3.amazonaws.com/GFI/Report2021.pdf> [in English].
 13. The Green Future Index Premier partner Gold partner Silver partner 2023. Retrieved from <https://www.finance-for-impact.com/uploads/publications/green-future-index/GFI23report.pdf> [in English].
 14. International Expert Conference on the Recovery, Reconstruction and Modernisation of Ukraine. Retrieved from <https://www.bundesregierung.de/resource/blob/992814/2153244/7b13a64361fe37cb52549a2d0dead9ea/2022-12-12-ukr-aufbaukonferenz-abschluss-data.pdf?download=> [in English].
-

-
15. Kartuvannia stratehichnykh tsilei. Ukrainy ta YeS u konteksti Yevropeiskoho zelenoho kursu: vektory rozvytku ta flahmanski initsiatyvy [Mapping of strategic goals. Ukraine and the EU in the context of the European Green Course: development vectors and flagship initiatives]. Retrieved from www.rac.org.ua [in Ukrainian].

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ЗЕЛЕНИЙ ЕНЕРГЕТИЧНИЙ ПЕРЕХІД В КОНЦЕПЦІЇ ПІСЛЯВОЄННОЇ ВІДБУДОВИ УКРАЇНИ

Анотація

Вступ. Зелена енергетика – це технологія виробництва енергії, використання якої сприяє зменшенню забруднення навколишнього середовища, в т. ч. викидів парникових газів в атмосферу. Зелена енергетика використовує відновлювані та невичерпні джерела енергії, у т. ч. енергію вітру, сонячну енергію, а також гідроелектроенергію. Українсько-російська війна внесла свої корективи в зелену енергетику та в зелений енергетичний перехід України. Цінність відновлюваної енергетики змістилася від екології до безпеки, а потім і до економіки. Ще пізніше тому міжнародна спільнота розглядала відновлювані джерела енергії, насамперед, як інструмент боротьби з неминучою зміною клімату та зменшенням викидів карбон IV оксиду. Сьогодні відновлювальна зелена енергетика основна для національної енергетичної безпеки та незалежності і коштує значно менше, ніж викопні види палива, хоча станом на 2021 р. сектор відновлюваної енергетики України боровся за право працювати за справедливих умов, гарантованих державою. У 2023 році він буде однією з основ післявоєнної відбудови України і готується до подальшого підвищення енергетичної незалежності країни.

Мета статті полягає в дослідженні та пошуку можливостей, вироблення пропозиції щодо зеленого енергетичного переходу в концепції післявоєнної відбудови відповідно до природно-ресурсного потенціалу України.

Методи. Методологічними засадами дослідження є теоретичне узагальнення і порівняння, аналіз і синтез, покрокове наукове осягнення з метою пошуку нових можливостей до зеленого енергетичного переходу України в післявоєнний період.

Статистичну та фактологічну базу дослідження становлять офіційні дані, а саме: the Green Future Index published by the Massachusetts Institute of Technology.

Результати. Проаналізовано виклики та можливості відбудови та післявоєнного розвитку зеленої економіки України, а також окреслено можливий шлях розвитку до зеленого економічного переходу енергетики держави. Уряд України вже оголосив підхід до зеленого відновлення енергетичного сектору за принципами «build back better» та «build back greener» з акцентом на відновлювальні джерела енергії та енергоефективні технології.

Перспективи. Перспективи подальших досліджень полягають у виробленні чітких принципів впровадження зеленої енергетики України в післявоєнний період з метою декарбонізації ключових секторів економіки, враховуючи послідовність державної політики для реалізації важливих екологічних цілей.

Ключові слова: зелена енергетика, відновлювальна енергетика, зелений енергетичний перехід, концепція, післявоєнна відбудова України.

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Література

1. The five different kinds of renewable energy sources. *CHARIOT Energy*. 2020. URL: <https://chariotenergy.com/chariot-university/renewable-energy-sources/>
2. Михайлова Л. М., Семенишина І. В., Шпатакова О. Л. Зелена енергетика як чинник енергетичної незалежності України. *Економіка та суспільство*. 2023. № 47. URL: <https://economyandsociety.in.ua/index.php/journal/article/view/2090>
3. Зварич І. Я. Глобальна циркулярна економіка як засіб побудови нового екологічно стійкого суспільства. *Світ фінансів*. 2016. Вип. 4. С. 148–155.
4. Zvarych R., Masna O., Rivilis I. (2022). Metodolohichni zasady formuvannia kontseptsii zelenoi ekonomiky [Methodological principles of the formation the concept of green economy]. *Visnyk ekonomiky – Herald of Economics*, 4, 131–144.
5. Eckhous, B., Mathis, W., Mutaugh, D. Ten renewable energy trends to watch in 2021. *World Oil*, 2021. URL: <https://www.worldoil.com/news/2021/1/6/ten-renewableenergy-trends-to-watch-in-2021>
6. Прищепя, Я., Богданьок, О. ЄС не може погодити стелю цін на газ через глибокі розбіжності. *Suspilne. media*, 2022. URL: <https://suspilne.media/324586-es-ne-moze-pogoditi-stelu-cin-na-gaz-cerez-gliboki-rozbiznosti-france-24>
7. Закіянов, Д. Хто «найзеленіший»: як передові країни Європи розвивають альтернативну енергетику. *Mind*, 2019. URL: <https://mind.ua/publications/20194992-hto-najzelenishij-yak-peredovi-krayini-evropi-rozvivayut-alternativnu-energetiku>
8. Омельченко В. Сектор відновлюваної енергетики України до, під час та після війни. *Razumkov*, 2022. URL: <https://razumkov.org.ua/statti/sector-vidnovlyuvanoyi-energetyky-ukrayiny-do-pid-chas-ta-pislya-viyny>
9. Razumkov Center calculations based on the analysis of the structure of electricity consumption in Ukraine. This estimate is comparable to the EBRD statement. URL: <https://www.ebrd.com/news/2022/war-in-ukraine-and-inflation-slow-growth-in-ebrd-regions.html>

-
10. Green post-war recovery of Ukraine: vision and models. Analytical note (August 2022). Resource-analytical center «Society and Environment» <https://www.rac.org.ua/priorytety/viy-na-ta-zelena-vidbudova-ukrayiny/zelene-povoenne-vidnovlennya-ukrayiny--viziya-ta-modeli-2022>
 11. Відбудова України: 5 інвестиційно привабливих секторів під час війни та після. URL: <https://mind.ua/openmind/20262853-vidbudova-ukrayini-5-investicijno-privablivih-sektoriv-pid-chas-vijni-ta-pislya>
 12. The Green Future Index Silver partners 2021 URL: <https://mittrinsights.s3.amazonaws.com/GFI/Report2021.pdf>
 13. The Green Future Index Premier partner Gold partner Silver partner 2023. URL: <https://www.finance-for-impact.com/uploads/publications/green-future-index/GFI23report.pdf>
 14. International Expert Conference on the Recovery, Reconstruction and Modernisation of Ukraine. URL: <https://www.bundesregierung.de/resource/blob/992814/2153244/7b13a64361fe37cb52549a2d0dead9ea/2022-12-12-ukr-aufbaukonferenz-abschluss-data.pdf?download=>
 15. Картування стратегічних цілей. України та ЄС у контексті Європейського зеленого курсу: вектори розвитку та флагманські ініціативи. URL: www.rac.org.ua

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