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Review of Innovative Approaches for Sustainable Use of Ukraine's Natural Resources

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Abstract

Actualisation of the global trend of sustainable development in Ukraine in the context of efficient use of natural resources and minimisation of dependence on traditional energy sources is a logical stage of society's progress. The article aims to analyse sustainable development strategies for Ukraine in managing its natural resource potential. The research employed a set of complementary general scientific theoretical methods, including analysis, synthesis, and abstraction. A comparative analysis of the efficiency levels of integrating green energy principles in Ukraine and European Union countries was conducted. Institutional and economic tools underpinning the "green" concept of resource use, which have proven effective in international practice, are highlighted. As a result of the research, the potential for economic incentives and motivation of the business sector to develop renewable energy, reduce emissions, enhance resilience to climate change, and efficiently use resources has been substantiated. Furthermore, the need to intensify the share of renewable resources in the national energy sector has been demonstrated. Principles for integrating sustainable development strategies into the socio-economic recovery process of Ukraine during the post-war reconstruction period have been identified. The practical significance of the research findings lies in the prospect of reducing the use of non-renewable resources in Ukraine for sustainable societal development, consistent decarbonisation, and the preservation of the natural potential of ecosystems.

Keywords

Sustainable development; Resource use; Green energy; Climate dynamics; Decarbonisation; Natural resource potential

Introduction

Optimising traditional approaches to using natural resource potential in Ukraine is seen as a crucial aspect of the country's European integration and socio-economic development. This approach encompasses the adoption of circular economy principles, energy efficiency, active decarbonisation of production, and maximum environmental protection. Currently, the potential of 'green' resource use is being actively studied at the level of international organizations and national governments. For example, the general principles of using renewable energy sources are reflected in the policy documents of the United Nations (UN), world-renowned energy organisations (WEO, IEA, CIGRE, Energy Charter Secretariat), and OECD and European Union member states.

This issue receives significant attention in Ukraine, particularly in the context of European integration and sustainable development. Numerous scientific studies have reflected certain aspects of the issue (Khan *et al.*, 2020a; Pakhnenko and Kolomiiets, 2021; Parkhomets, Putsenteilo and Uniiat, 2020). In particular, Pakhnenko and Kolomiiets (2021) analyse the development of Green FinTech globally, identifying the functionality of this tool in achieving sustainable development goals. The researchers propose their classification of application areas, namely the use of FinTech in image-building and charitable eco-projects, FinTech solutions in "green" investing, as well as infrastructure projects and the management of Green FinTech.

Parkhomets, Putsenteilo and Uniiat (2020) highlight the urgency of increasing the use of renewable energy sources in the production of agro-industrial products. The researchers argue that an effective strategy will contribute to reducing the use of non-renewable energy resources and improving natural and living conditions in Ukraine.

A significant problem is posed by fossil resources. As researchers argue (Kostakis, 2024), the combustion of fossil fuels for energy production emits harmful greenhouse gases, such as carbon dioxide, which significantly contribute to environmental degradation and climate change. According to the Climate Protection Strategy 2050 developed by the European Commission, greenhouse gas emissions in EU countries can be reduced to zero over the next 30 years by abandoning the use of fossil energy resources (Marsh, 2023). In Europe, considerable attention is given to minimizing air emissions by increasing the share of alternative sources in the energy production structure, improving energy efficiency, and ensuring the sustainable use of natural resources (Li *et al.*, 2022; Twidell, 2021).

The prospects for grant funding within the framework of Ukraine's Eurointegration development strategy open up significant practical opportunities for the use of renewable energy sources in business (Radmehr *et al.*, 2022). Despite the relevance of the issue, several research gaps exist regarding the discussed aspects in the context of Ukraine. Among these gaps are the role of environmental taxes in promoting the transition to renewable energy sources, the potential for increasing environmental taxes, and their impact on sustainable development.

At the same time, the issue of developing and implementing an effective strategy to motivate businesses and society remains insufficiently explored. Additionally, it is

essential to develop a concept for the sustainable use of natural resource potential in modern conditions. Practical concepts of implementing a sustainable development strategy are fragmented, which makes the research issue relevant.

The article aims to analyze Ukraine's sustainable development strategy in managing its natural resource potential. This is particularly relevant in light of the opportunities arising from active international support during the war and the prospects for post-war reconstruction. Ukraine's energy development in the pre-war period featured active advancement of "green" resource consumption and the integration of innovative solutions in renewable energy, supported by government programmes and financial-economic incentives. The current situation necessitates in-depth analysis and the search for ways to bring Ukraine's development strategy back onto the path of "green" energy.

The main aim of the article is to analyze the strategies for sustainable development of Ukraine in the management of its natural resource potential, with a focus on the development of renewable energy.

Literature Review

An analysis of current research by domestic and foreign scholars shows a growing interest in the conservation of natural resources, their competent management, and the transition to renewable energy sources. This issue has become particularly relevant during Ukraine's socio-economic transformation.

Khan *et al.* (2020a) studied the impact of renewable energy on international trade, using a dynamic common correlated effects model for reliability. The researchers conclude that renewable energy is positively associated with international trade and the optimisation of environmental quality. The national scientific field studies the specifics of the use of renewable energy sources as an objective need to improve resource conservation, analyses the possibilities of using alternative energy as part of the circular economy (Iakovenko, 2023; Khotian and Rozen, 2022), and analyses the potential for optimising the national energy sector (Lunov, 2023; Yatsenko and Mohylna, 2023). In particular, Iakovenko (2023) explores modern forms of business organisation and operations within the framework of the circular economy concept. The author argues that business structures operating at both local and global levels, alongside the public sector, should implement the principles of the circular economy to reduce pressure on natural resources and transition towards sustainable use. At the same time, Yatsenko and Mohylna (2023) highlight the potential of energy district autonomy in integrating innovative solutions. The researchers propose a forward-looking vision for the development of Ukraine's regional energy systems to minimise the country's dependence on fossil fuel imports, enhance energy efficiency, and strengthen Ukraine's energy security. Alpatova *et al.* (2022), Horbal and Plish (2021), and Kofanov, Zozulov and Kofanova (2023) highlight the experiences of countries with notable achievements in the efficient use of natural resources within the context of sustainable development and decarbonization. While some studies highlight relevant opportunities for adapting these successful international practices in Ukraine (Kireitseva *et al.*, 2024; Tsyhanenko-Dziubenko *et al.*, 2023a; 2023b).

The fundamentals of business models in the alternative electricity market are being studied (Lu *et al.*, 2020), and sustainable solutions for green financing and investment in renewable energy projects are being explored (Taghizadeh-Hesary and Yoshino, 2020). All these developments significantly contribute to the formation of an effective resource management strategy. At the same time, some studies have summarised the issues of convergent sustainable entrepreneurship, innovation, and business models towards sustainable development (Lüdeke-Freund, 2020) and achieving high decarbonisation rates shortly (Khan *et al.*, 2020b).

Most studies focus on reducing emissions and increasing resilience to climate change, ensuring sustainable development within circular economic processes. At the same time, the issues of full or partial replacement of traditional energy sources with renewable ones, analysis of relevant tools, and opportunities to improve motivation and incentive approaches have been studied in a fragmented manner, which makes it important to conduct an extended study of the issue. The analysis of contemporary scholarly works highlights significant gaps in research on the potential for revitalizing the active development of "green" energy during periods of societal and political crises, as well as during the regeneration of the economic system in the post-crisis period. The financial and economic tools for stimulating the development of renewable energy during times of instability and crises remain poorly studied.

Methodology

The design and scope of the study. The study analyzed the experience of developed countries in implementing "green" resource use, economic tools, and investments in renewable energy sources, which help to reduce their negative impact on the environment. A comparative analysis of the levels of efficiency in implementing the principles of "green" energy in Ukraine and EU countries was conducted. Institutional and economic instruments that underpin the "green" resource use concept and have proven effective in international practice were identified.

Data collection and sources. The sample consisted of information as of 2024, as well as the dynamics of the development of the studied processes and phenomena during 2010–2023. The following methods of processing statistical data were used: classification of indicators by categories, analysis of the dynamics of "green" energy development in Ukraine from 2018–2022, capital investment measurements in energy greening from 2010–2022, and comparative-legal analysis to identify differences in environmental taxation among countries. Trend analysis was used to substantiate conclusions.

Analytical frameworks and methods. The main methods for establishing causal relationships included analytical approaches such as analysis, synthesis, generalization, comparison, and abstraction. Induction was also applied—a scientific research method aimed at identifying cause-and-effect relationships between phenomena and generalizing empirical data based on logical assumptions, moving from specific to general and from known to unknown.

Statistical methods in the context of achieving the study's objectives enabled the systematization and generalization of all information about the studied objects and

phenomena, including both positive aspects and shortcomings. These methods also facilitated drawing parallels between the essence and purpose of the studied object or phenomenon and its functional outcomes.

To determine specific parameters for assessing the impact of "green" economic tools on sustainable growth, a comprehensive analysis of academic articles published in various scholarly sources was conducted. To ensure the reliability and validity of conclusions, literature from influential journals indexed in well-known databases such as Web of Science, Scopus, and Google Scholar was selected. The works focused on recent developments and trends in "green" taxation and its impact on sustainable growth, covering the period from 2019 to 2024.

The article examines strategic documents, including the European Commission's (2020) 2050 Climate Protection Strategy, which shapes the climate leadership of EU countries. Special attention was paid to government programmes promoting clean technology development and fostering ecological innovations.

Evaluation criteria. A limitation of the study is the lack of access to complete and up-to-date official data and the difficulty of experimentally verifying theoretical conclusions.

To study approaches to "green" resource use, the authors analyzed scientific works dedicated to the impact of environmental management measures on sustainable development. Particular attention was paid to research examining the role of economic mechanisms in ensuring environmental sustainability at the regional level and their influence on transitioning to renewable energy sources. Criteria for selecting literature included several factors, such as journal quality, relevance to core industry topics like "sustainable resource use" and "environmental policy," and the availability of peer-reviewed content. The selected works predominantly cover the period from 2019 to 2024. Additionally, the methodology employed a systematic review approach with elements of meta-analysis, where appropriate, for the quantitative determination and comprehensive assessment of the effects of these policies.

Results

Key global trends in greening resource use

The main principles of sustainable development with significant practical value include greening the energy sector and production, reducing environmental impact, a rigorous system of monitoring and control in the environmental sphere, and appropriate optimisation of the management system in the context of resource efficiency. It is worth noting that the principles of energy efficiency and resource conservation are crucial in greening the economy (Sumets *et al.*, 2022).

The European Commission's 2050 Climate Protection Strategy (2020) aims to reduce greenhouse gas emissions in the European Union to virtually zero, which is seen as possible by replacing fossil energy resources, which emit large amounts of carbon dioxide, with renewable energy resources. The EU aims to be climate neutral by 2050 –

an economy with zero greenhouse gas emissions. The transition to a climate-neutral society is an opportunity to build a better future for all, leaving no one behind.

Given the strong support from the European community, Ukraine has significant potential in this area. Renewable energy technologies are being integrated to reduce the intensity of carbonisation and effectively manage fossil resources. According to the Climate Protection Strategy for 2050 (2020), greenhouse gas emissions can be reduced to zero over the next 30 years, which is planned to be achieved by abandoning the use of fossil energy resources, as their combustion releases large amounts of carbon dioxide. According to the report, by 2050, more than half of the EU countries' energy needs should be met by electricity. For citizens, this means the use of electric vehicles and partial heating of homes with electricity.

The Situation with the Sustainable Use of Ukraine's Natural Resources

Among the priority indicators for EU countries, aimed at reducing environmental and social pressures across Europe and measuring resource efficiency and emission levels, one of the most important is the intensity of carbonisation (Kofanov, Zozulov and Kofanova, 2023). In Ukraine, carbon dioxide emissions remain high, which is considered a negative phenomenon in light of European integration processes towards sustainable development and decarbonisation. At the same time, recent emission declines are identified as resulting from a reduction in production volumes rather than qualitative transformations in the production sector (Artyushok *et al.,* 2023). Ukraine has significant potential for renewable energy development. Solar and wind power plants are already being successfully integrated into the national energy system. The potential for hydrogen production and eco-friendly steel production is also substantial. Ukraine possesses strategic resources, including lithium, essential for manufacturing electric vehicles and electronic devices. All these unique advantages can make a significant contribution to implementing the European Green Deal (Iakovenko, 2023).

Development of renewable energy in Ukraine

EU membership opens new opportunities and advantages for Ukraine in developing renewable energy for several reasons. Firstly, it provides access to funding, investment, and the creation of a common market. This will enable the free export and import of hydrogen and hydrogen technologies, fostering competition, lowering prices, and stimulating innovation (Artyushok *et al.,* 2023). The common market will also facilitate cooperation with European partners, potentially leading to joint projects and knowledge exchange, along with access to advanced technologies. Secondly, an essential reason is the harmonisation of regulatory and standardisation processes, which will enhance energy security. This is expected to result in the diversification of energy supplies and reduced dependence on imported fossil fuels (Parkhomets, Putsenteilo and Uniiat, 2020). Thirdly, new opportunities will arise for investors and businesses, including an improved investment climate, market expansion, and strengthened cooperation with European companies (Kofanov, Zozulov and Kofanova, 2023). Additionally, Ukrainian businesses will gain access to European financial instruments and grants for developing initiatives. Compliance with EU environmental standards will further encourage Ukrainian companies to integrate innovative technologies and practices, enhancing their

competitiveness in the global market. Significant progress was made on the eve of Russia's war against Ukraine when a steady positive trend was observed (Figure 1).

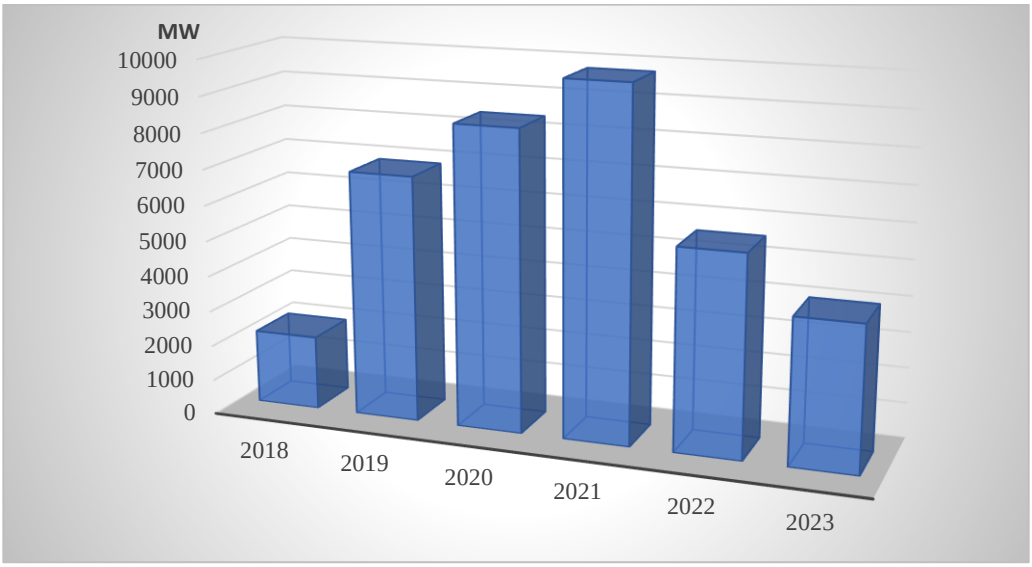

Figure 1**.** Dynamics of "Green" Energy Development in Ukraine, MW
Source: compiled by the author based on (NEURC, 2024)

The full-scale war has made adjustments to the resource use strategy in the energy sector, and many alternative energy facilities were destroyed or damaged in the first year. To restore sustainable growth in the share of renewable energy sources in the energy sector during the post-war recovery period, Ukraine should rely on the practical developments and experience of leading European countries (Artyushok *et al.*, 2023; Nikonenko *et al.*, 2022;). The experiences of Germany, Sweden, Romania, and Poland are particularly illustrative in this regard. Nikonenko *et al.* (2022) assess the impact of global commodity prices on the dynamics of investment in resource-exporting countries using a methodology developed under the influence of Industry 4.0 aspects. The researchers analysed the close interdependence between natural resource utilisation, economic processes, and environmental impact. In contrast, Artyushok *et al.* (2023) define the ecological-economic problems of property relations, which, unlike existing definitions, focus on issues related to attracting capital investments and the state's current expenditures on environmental protection. The researchers propose the principles for forming an institutional property system in resource management, taking into account international experience.

Green resource use policies in developed countries

The increase in green energy production in developed European countries demonstrates effective management policies in the sector. For example, in Germany, renewable energy sources have been identified as the main component of the country's future energy supply structure. In Eastern Germany, the "green transformation" is intensifying, with an increasing share of not only wind but also solar energy. Among the largest solar power plants in the country is the facility in Brandenburg, as well as the innovative energy park in Witznitz near Leipzig, currently the largest solar power station in Europe. This

experience could be particularly useful in the context of Ukraine's Bessarabia. The experience of integrating "green" certificates is beneficial for Ukraine's management practices, as they are currently recognised as securities that can be freely traded, irrespective of the sale of generated energy on the sectoral market.

One of the key factors that contributed to the rapid advancement of wind energy technologies in Romania was the official system of financial incentives for green energy producers, which stimulates investment growth in the Romanian energy sector (Østergaard *et al.*, 2020). Two Romanian projects (solar and wind) plan to cover Poland, Italy, Romania, and Croatia. Their goal is to achieve 5 GW of installed capacity in the EU by 2030. Together, they will produce approximately 225,000 MWh of electricity annually, allowing for a reduction in carbon emissions by 58,000 tonnes per year. In Sweden, energy policy is guided by an individualised action plan to stimulate renewable energy development, including ambitious targets for the green certificate system. Currently, Sweden generates over 60% of its electricity from renewable sources and is almost independent of fossil fuels. At the same time, efforts continue to reduce energy consumption in the country. In Poland, maximum emphasis is placed on the use of biofuels. Management mechanisms and instruments that promote the use of renewable energy sources in business are based on a legal and regulatory framework. Strengthening institutional support is viewed as a prerequisite for optimising natural resource management. In 2023, renewable energy covered 20.6% of Poland's needs, ranking second after coal. Raising environmental awareness among society and businesses about sustainable development is particularly important. A survey conducted by the FAMA sociological agency in 2023 and 2024 shows a significant shift in results, indicating progress in understanding the inevitability of environmental consequences and the need for active implementation of sustainable development principles in resource management strategies. All these aspects are directly related to the anthropogenic use of natural resource potential and can be successfully regulated through optimal management strategies.

The general concept of implementing Ukraine's sustainable development strategy

Table 1 presents the general concept of implementing Ukraine's sustainable development strategy in terms of natural resource potential management, as defined by the draft Law of Ukraine 'On the Strategy of Sustainabldee Development of Ukraine until 2030' (2018). The main goal of the process is to identify internal and external risks promptly by monitoring, analysing, and controlling indicators of the state of its main components.

Table 1**.** Concept of Implementing the Sustainable Development Strategy of Ukraine in terms of Natural Resource Management

Vector	*Approaches and tools*	*Expected results*
Level of natural resource use	Integral index, cluster analysis, neural network modelling	Identification of the levels of sufficiency and efficiency of natural resources use in the sectoral context, determination of security zones of territorial resource provision in the context of functional subsystems

Vector	*Approaches and tools*	*Expected results*
Sustainability of resource potential	Trend analysis	Prompt determination of fluctuations in resource security zones in the dynamics, which allows for optimisation of management decisions
Sustainability of the natural resource sector	Sensitivity analysis, qualitative and quantitative balance analysis, graph analytical method	Timely identification of existing risks, threats and imbalances, and their ranking by the strength of impact, to determine the priority and severity of management measures

Source: Artyushok *et al.* (2023); Kofanov, Zozulov and Kofanova (2023)

An important aspect is the process of investment in the energy sector. Regarding Ukraine, the pre-war period was characterised by the dynamics illustrated in figure 2.

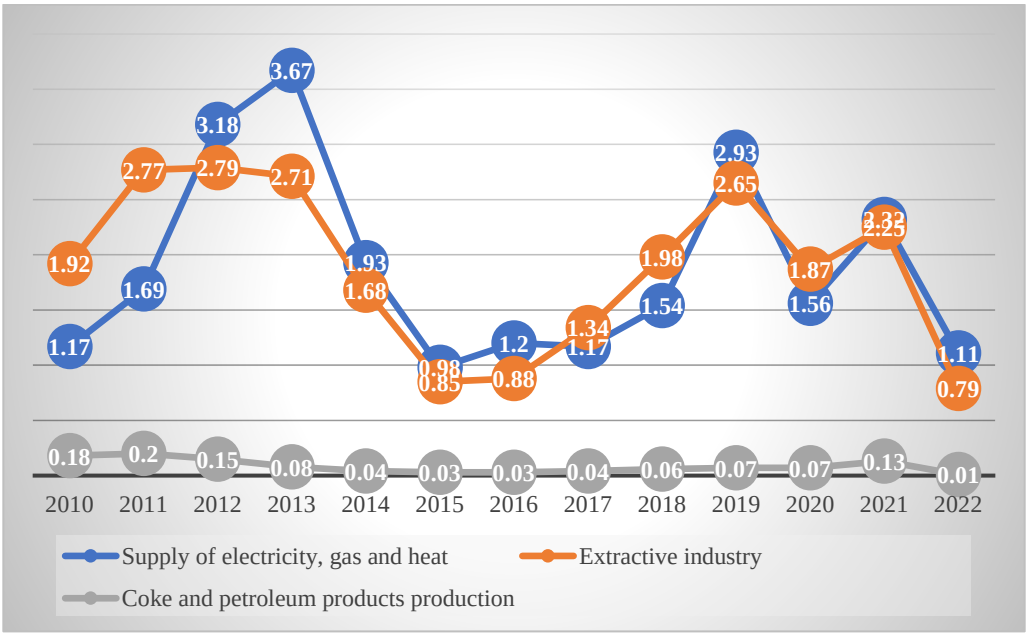

Figure 2: Capital Investments in the Energy Sector from 2010 to 2022, billion USD (Energy Map, 2023)

At the same time, investment in Ukraine's energy sector after the war should focus on renewable vectors and efficient resource use.

Recommendations for implementing an effective green resource use policy in Ukraine

Among the priority areas for integrating practical international experience in implementing a sustainable development strategy in terms of natural resource management, it is advisable to highlight the following areas:

1) Intensification of the use of "green" energy resources by stimulating and motivating market participants to minimise the share of traditional sources, resulting in a significant

reduction in the use of fossil fuel resources; in the context of Ukraine, this will help to develop the weak renewable energy sector;

2) Development and implementation of a unified national energy strategy and conceptual specific goals within its framework, with a variety of technical, organisational and economic instruments and mechanisms for achieving them; in particular, the provisions of Directive 2009/28/EC established mandatory national renewable energy targets in the European environment to provide certain guarantees to investors and encourage the development of new technologies and innovations in this area; in the context of Ukraine, this will mean integration into the single European energy space;

3) Targeted subsidies, "green" taxation, the introduction of sectoral codes of responsibility, and centralised regulation of prices for traditional fuels; introducing a system of subsidies and grants for practical testing of pilot business projects on the use of renewable energy sources, resource-saving technologies and circular production; the price of "green" certificates is determined on the market for these certificates; in Finland, investment grants and subsidies are the only types of incentives for the use of alternative energy sources; in the Netherlands, electricity generation from alternative sources is stimulated by redirecting corporate tax towards investment in alternative energy projects, and so on; in the context of Ukraine, this experience can be integrated in synergy with the transformation of tax policy;

4) Introducing a mechanism to prevent excessive profits of energy producers and a significant increase in tariffs for households and industry, the largest consumers of energy resources; in the context of Ukraine, this will help control the risks of corruption;

5) Raising awareness of the public and business formations on resource management, implementing productive interaction between public authorities, the public and the business community, particularly in green contracts; in the context of Ukraine, this is especially important against the background of active development of public administration.

Discussion

Our findings demonstrate a significant interest in the issue in modern society and differences in approaches to structuring their functionality and the level of prospective feasibility. Special attention is paid to the development of alternative energy. Studies have proposed expanding the possibilities for integrating energy storage technologies and their use in convergence with renewable energy sources (Tan *et al.*, 2021). Tan *et al.* (2021) explored different structures of energy storage systems and proposed to counteract problems in power grid networks, maintain the reliability and quality of electricity, and meet energy demand. Some studies also consider the possibilities of stationary energy storage for large-scale integration with the renewable energy network (Kebede *et al.*, 2022).

Instead, representatives of another school of thought (Cantarero, 2020) focus on renewable energy to accelerate the energy transition in developing countries. According to some studies, the integration of the innovative city energy system is positioned as a

forward-looking strategy on the way to a clean and sustainable development process (Kireitseva *et al.*, 2023; Tsyhanenko-Dziubenko *et al.*, 2024; Zamula, Shavurska and Kireitseva, 2024). In particular, Zamula, Shavurska and Kireitseva (2024) have a strong belief that for the post-war recovery of Ukraine, it is важливо to create conditions for attracting investment. To do this, it is necessary to regulate impact investing at the legislative level, promote disclosure of information on social and environmental activities by enterprises in corporate reporting, and create intermediary platforms for investors willing to invest in sustainable development.

The experience highlighted in the publications of contemporary researchers encompasses a globally integrated environment. Behera *et al.* (2024) demonstrate the link between energy consumption and economic growth in India and illustrate how broader utilization of both types of energy can benefit the economy. In the article by Dam, Işık and Ongan (2023), the authors examine the impact of renewable energy and institutional quality on environmental stability, proposing a new perspective on the coefficient of inverted throughput capacity. Noor *et al.* (2024) focus on the South Asia region and the impact of renewable and non-renewable energy sources on sustainable development. Kirikkaleli and Adebayo (2022) explore Brazil to assess the influence of the green financial system and innovations on improving environmental quality, as well as the capacity of institutional and financial measures to mitigate environmental impact. These challenges enrich the idea that less economically developed regions require specific financially and politically oriented measures. The findings of the current research also suggest that financial incentives are effective; however, they must be reinforced with financial mechanisms that align with the economic and environmental conditions of the region.

Sethi, Behera and Sethi (2023) examine economic growth and energy consumption, emphasizing that a balanced approach to resource utilization is crucial for environmental preservation. Conversely, the work by Dhillon and Kaur (2023) focuses on the interrelation between sustainable development, energy use, and economic growth.

Anton and Nucu (2020) have shown the significant role of green finance. The study proposed reconsidering FinTech's potential and the parameters of financial accessibility, in particular, green bonds, to achieve energy efficiency in the shortest possible time and reduce the consumption of non-renewable resources. Their findings convincingly show that financial development increases demand for clean energy sources. To achieve the goals of sustainable development, the researchers believe that governments should introduce incentives and tax policies that increase corporate demand for renewable energy sources and investment opportunities through public-private cooperation. Ahmad *et al.* (2021) emphasise that the development of digital technologies and artificial intelligence can radically change the system of resource consumption. The researchers examine aspects of the use of artificial intelligence in solar and hydrogen energy production, as well as in supply and demand management. Ahmad *et al.* (2021) argue that machine learning and artificial intelligence will play an essential role in the energy market of the future, allowing for the greening of energy production and consumption processes. Their findings and the analysis of scientific approaches highlight that exploring the possibilities of switching to renewable energy sources to reduce emissions and increase resilience to climate change should be positioned as one of the priority

shaping factors of socio-economic development towards the implementation of a sustainability strategy.

Given the stable international support for Ukraine's transformation processes, it seems advisable to use the maximum potential of the opportunities for businesses to switch to renewable energy sources to reduce emissions and increase climate change resilience during the post-war recovery period. The prospects for subsidised financing within the framework of the European integration strategy open up significant practical opportunities in terms of the use of renewable energy sources in business.

Our research aligns with previous conclusions that renewable energy has environmental advantages. However, it is also evident that its implementation varies significantly depending on the region and economy. There is a substantial gap in research on small-scale renewable energy projects, as large-scale projects raise issues of development adjustment and increase initial risks associated with renewable energy projects.

Conclusion

The primary objective of the article was to analyze Ukraine's sustainable development strategy in managing its natural resource potential, with a focus on the development of renewable energy.

The analysis of the problem under study has revealed the specifics of the use of renewable energy sources. The article has identified the priority need to intensify the share of renewable resources in the national energy sector. To do this, it is necessary to use the potential of the system of economic incentives and the motivation of the business sector to use resources economically. Timely identification of existing risks, threats and imbalances, and their ranking by the strength of their impact is important for determining the priority and severity of management measures. The implementation of Ukraine's sustainable development strategy in terms of natural resource management should synergise the aspects of the level of natural resource use, sustainability of resource potential, and balance of the natural resource sector. This approach will allow us to quickly identify fluctuations in resource security zones in the dynamics, timely identify existing risks, threats and imbalances, and rank them by the strength of their impact, which will allow us to make optimised management decisions. A promising area for future research in the field of sustainable environmental management is a detailed study of the potential of economic incentives and business motivation for sustainable development.

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Authors' Declarations and Essential Ethical Compliances

Authors' Contributions (in accordance with ICMJE criteria for authorship)

Contribution	*Author 1*	*Author 2*	*Author 3*	*Author 4*	*Author 5*
Conceived and designed the research or analysis	Yes	No	Yes	Yes	No
Collected the data	Yes	No	Yes	No	Yes
Contributed to data analysis & interpretation	Yes	Yes	No	Yes	No
Wrote the article/paper	Yes	Yes	Yes	Yes	Yes
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