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Ensuring Environmental Safety: The Global Experience and Ukrainian Perspectives

Zapewnienie bezpieczeństwa środowiska naturalnego: globalne doświadczenia i ukraińskie perspektywy

Abstract

This article presents the environmental component as one of the extremely important components of national security, which is a state of natural objects protection, as well as the protection of human life and health from environmental threats, where all components of the natural environment are optimal for the normal functioning and development of human civilization. One of the important tasks of ensuring environmental safety is to guarantee a population's livelihood in a technologically safe and ecologically clean world.

This is why concern about the state of the environment grows every year, and the need to integrate environmental policy with security measures remains a priority for world leaders. In the leading states of the world, such as the USA, Germany, Great Britain and France, environmental safety is considered as one of the main areas of environmental policy implementation. In particular, a "Green Deal" is cur-

rently being implemented in the European Union which will help the EU become the world's first climate-neutral continent by 2050.

It is important that the Ukrainian state faces not the simple, but the obvious and important task of ensuring and restoring its environmental security. In order to transform environmental safety to high standards and become an example of a country that can rebuild its environmental sector in a post-war period, Ukraine needs to develop the following priority directions in the environmental sector: reforming state management in the field of environmental protection, compliance with climate policy, effective waste management, reasonable use of natural resources, and conservation of natural ecosystems and biodiversity.

With the introduction of such reforms as part of a comprehensive climate policy, including ecological safety, reform of the regulation of industrial pollution, effective waste management, the rational use of natural resources, ecological management so as to preserve the landscape and biological diversity, effective state management in the field of environmental protection, environmental control and establishing legal responsibility thereof, and comprehensive environmental monitoring, Ukraine will be able to transform its environmental safety to high standards and become an example of a country that was able to rebuild its environmental sector in a post-war period.

Key words: *environmental security, national security, environmental policy, climate policy, the environment, the nature protection industry, natural resources.*

Abstrakt

W artykule omówione zostało zagadnienie bezpieczeństwa ekologicznego jako elementu bezpieczeństwa narodowego.

Dbłość o środowisko naturalne (w tym m. in. próba łączenia rozwoju społeczno-gospodarczego i ochrony przyrody) jest jednym z priorytetów polityki realizowanej przez światowych liderów, tj. państw, takich jak USA, Niemcy, Wielka Brytania czy Francja. Ponadto w Unii Europejskiej wdrażany jest obecnie Zielony Ład będący pakietem inicjatyw politycznych, które sprawią, że do 2050 r. Europa stanie się pierwszym na świecie kontynentem neutralnym klimatycznie.

Podobne wyzwania stoją również przed Ukrainą, która po wojnie musi zadbać o bezpieczeństwo ekologiczne. Aby tak się stało, należy podjąć szereg działań w zakresie zarządzania sektorem ochrony środowiska, transformacji polityki klimatycznej, gospodarowania odpadami, racjonalnego korzystania z zasobów naturalnych, ochrony ekosystemów oraz bioróżnorodności. Dzięki temu Ukraina ma szansę nie tylko odbudować po wojnie swój potencjał ekologiczny, ale też znaleźć się w czołówce państw najbardziej przyjaznych środowisku.

Słowa kluczowe: *bezpieczeństwo ekologiczne, bezpieczeństwo narodowe, polityka środowiskowa, polityka klimatyczna, środowisko naturalne, przemysł dla ochrony przyrody, zasoby naturalne.*

Introduction

The environmental security component is an extremely important element of national security, which guarantees the protection of vital interests not only of persons, but also of the state and the environment, from potential or real threats. Such a topic remains unpopular in academia and not fully comprehensible.

In today's globalized world, the challenges posed by the dynamic process of industrialization have led to and continue to pose a number of global environmental threats that have been convincingly on international agendas. The destructive actions of anthropogenic activities require the creation of effective levers of influence and the search for immediate possible solutions to environmental problems that exist in the economic, political, spiritual, social, information, and military spheres, as well as care for the environment at large. This is why environmental security should be seen not just as a component of national security, but as a fundamental issue, or even as a kind of integrator capable of uniting society and ensuring its progressive development.

It is very important for the state to develop a correct and reasonable strategy to ensure environmental safety at all levels of life, with this being a strategy aimed at achieving maximum results. It is especially important for Ukraine to adhere to the greening of its political course in accordance with the European Green Agreement (2019.) and thus ensure its national security as a candidate for EU accession.

Determining the place and role of environmental security in the system of national security at the global and domestic level is relevant. Comprehensive disclosure of this issue is facilitated by the study of the global experience of becoming an environmental security system and the search for tools and mechanisms for its provision in the system of domestic national security.

Methods and materials

The article was researched by means of the comparative method, the structural-component method, SWOT analysis, the extrapolation method, and the interpolation method.

With the growing problem of resource scarcity to date, environmental security is facing quite serious challenges. Almost all countries are actively looking for new ways to develop and address the various problems caused by the environmental component. Concerns about the environment are growing every year, so the need to integrate environmental policies with security measures remains a priority for world leaders.

There are now a number of international organizations in the world, such as the United Nations, UNIDO, UNESCO, OSCE, NATO, and others that pay attention to global environmental security issues. Since 2003, the Organization for Security and Cooperation in Europe (OSCE) and the United Nations Environment Program (UNEP) have taken an important step in helping to address environmental issues, launching the United Nations Development Program (UNDP) during the launch of the joint initiative “Environmental Agenda for Security and Cooperation in South-Eastern Europe and Central Asia” (ENVSEC). (*Програма НАТО “Наука...”*) Subsequently, NATO joined the ENVSEC initiative and coordinates its environmental security teams with the OSCE, UNEP, and UNDP.

NATO’s facilities are part of the NATO Program “Science for Peace and Security” and the work of the Committee on the Challenges of Modern Society (CDSM). This serves as a kind of forum where member countries and partner countries can share their knowledge and experience on the technical, scientific and political aspects of social and environmental issues in both the civilian and military sectors. Its main goal is to address the environment and environmental issues. (*Політика vs. Зміна клімату...*)

In September 2015, as part of the 70th session of the UN General Assembly in New York, the UN Summit was held, wherein the Paris Climate Agreement was signed. The Paris Agreement aims to prevent the global average annual temperature on the planet from exceeding 2 degrees relative to the pre-industrial level by 2100. The parties also intend to do everything possible to keep warming within 1.5 degrees Celsius. During this meeting, the leaders of 193 countries adopted 17 global sustainable development goals for 2016-2030. (*Our response to environmental...*) Among them, 7 concern environmental safety issues, in particular:

- clean water and sanitation;
- renewable and inexpensive energy;
- environmentally friendly cities and communities;
- responsible use of resources;
- combating climate change;

- safe use of oceans;
- safe use of land.

Preventing environmental crimes at the international level is also an important element of ensuring environmental safety. An illustrative example of the implementation of such a policy is the Interpol Environmental Security Division (ENS) established in 2009 and which actively supports partnerships with other international organizations and 190 member countries to better implement environmental standards and treaties. (*Notre réponse à la criminalité...*) Environmental crimes is a growing, organized, and sophisticated form of international crime, including the poaching of wildlife, smuggling and trade of illicit goods, disposal of electronic and toxic waste, illegal logging, illegal fishing, and the illegal extraction of natural resources. (*The federal emergency...*) The experience of Member States that have already joined the ENS shows that they are helping to bring together the national departments responsible for compliance with environmental standards, including departments dealing with wildlife, pollution, forestry and fisheries, policing, customs, and financial and tax services. Combined within the NEST, these departments communicate and cooperate at all levels, making it easier to take stronger, more coordinated, and more effective interagency action against environmental damage.

In the most developed countries of the world, for example in the United States, environmental security is seen as one of the main areas of implementation of national security policy. The most famous security system in this regard is the US Federal Emergency Management Agency (FEMA), which is directly subordinate to the head of state. It was created in accordance with the decrees of the President of the United States № 12127 of March 31, 1979 and № 12478 of July 20, 1979 on the basis of the Civil Readiness Agency of the US Department of Defense and other structures, to focus in one department the authority to coordinate efforts to manage the preparation of the country's economy for emergency work. (Obama, 2016) It should be noted that until the present century, the US security sector has paid little attention to environmental safety issues. It was not until 2010 that the Obama administration recognized environmental issues, including climate change, as a serious threat to human security. In 2015, the United States led the Paris Climate Agreement to set a target for restricting the increase of global temperatures on Earth within 2°C by 2100. (Biden, 2021) In 2016, President Trump changed the course of the United States, essentially starting the desecuritization of the environmental component. He declared economic security through energy independence a security priority. In parti-

cular, he described the Paris Agreement as a threat to security and withdrew the United States from the agreement in November 2020. President Joe Biden has campaigned to restore climate change security. After taking office, he called environmental security a deep crisis, rejoined the United States in the Paris Agreement, and announced the return of US global leadership in addressing environmental issues. (*Environmental performance review...*)

In Germany, for example, in addressing all environmental security issues and, above all, the organization of protection of the population and territories from natural, man-made, and military emergencies in general, entrusted such endeavours to the central body of the state executive branch within the Ministry of Internal Affairs. At the same time, Germany makes extensive use of economic tools to ensure its environmental safety. In particular, the country actively applies environmental fees, licenses “for interaction with the environment”, direct state protection of natural resources and human habitats through environmental taxes, contributions, fees, and other such initiatives. (*The UK Environment Act...*) Significant financial resources are allocated by the state on a grant basis for research and development of environmental technologies.

Similarly, the overall management of the environmental, technological, and civil security system in the UK is carried out by the Home Office through its relevant department and the Interministerial Planning Committee, coordinating the activities of other ministries and agencies. At the local level, key activities are carried out by the councils of districts, administrative regions, and municipalities through specially established committees. (*France’s environmental policies...*)

In France, environmental security is an integral part of a system of preventing and eliminating natural, man-made, and military emergencies, built in a similar way. Currently in France, the general management of its system of protection of the environment of the population and territories is carried out by the Minister of the Interior through the Directorate of Civil Defense and Security. As in a number of other advanced countries, French public administration is successfully combined with market regulation mechanisms based on the concept of “environmental risk”. This concept establishes a fee which benefits researching potential environmental threats that is taken from the operation of industrial complexes or enterprises and the direct sale to such entities of “pollution rights” which is itself a paid amount of permissible harmful emissions to the environment. (*European External Action...*)

In general, it should be noted that the European Union is the most coordinated mechanism to maintaining environmental safety in the world.

The European Commission was one of the first organizations in the world to identify climate change as a major environmental security issue. In 2013, the Foreign Affairs Council developed conclusions that promised to include climate security in all foreign policies and dialogues (*Що має Європейський...*) Today, the European Union is expressing its goal of introducing high-level environmental safety. Under pressure to achieve zero greenhouse gas emissions by 2050, the European Union has launched a “green agreement” aimed at cleaning up its economy. In an effort to slow the rising of the planet’s heat, the European Union in 2019 promised to become the world’s first climate-neutral continent by 2050. If the European Union manages to clean up its economy, it would serve as a model for the world’s leading powers, such as the United States or China, and would demonstrate to countries in Africa and Asia that one of the richest emission regions in the world is serious about climate change.

The first climate initiatives under the Green Deal include:

- European climate legislation enshrining the goal of climate neutrality by 2050 in EU legislation;
- A European Climate Pact to involve citizens and all parts of society in climate action;
- A target climate plan of 2030, which envisages a further reduction of net greenhouse gas emissions by at least 55% by 2030.

A new EU strategy on climate adaptation aims to make Europe a climate-resilient society by 2050, fully adapted to the inevitable effects of climate change and environmental safety. (*The EU Green...*)

The European Union receives 22% of its energy from renewable sources. Last year, the organization put forward a plan to reach 40% by the end of the decade. Then, after Russia invaded Ukraine in February 2022, the European Commission said it wanted to increase that share to 45% again. This goal is a quick and powerful push to electrify polluting activity and clean up the continent’s electricity grid. The proposal passed two rounds of legal bureaucracy, but still needs to be agreed upon by states-members who lobby to keep the target at 40%. The European Commission intends to reduce the average CO2 emissions of new cars by 55% by 2030 before reaching zero in 2035. This would be one of the easiest solutions for cleaning up transport, the only sector where pollution is constantly growing. In 2021, greenhouse gas emissions were 15% higher than in 1990. In addition, in April 2023, US President Joe Biden and European Commission President Ursula von der Laue agreed to begin negotiations which would allow the use of European raw materials in the framework of American clean energy costs. (*Українська Кліматична Мережа...*)

Despite the efforts of the world governments to prevent environmental catastrophes that pose a danger to humanity, it is unfortunate to note the fact that not all countries in the world support and implement environmental security policies. For example, the implementation of the Paris Agreement, which aims to prevent the temperature on the planet from exceeding more than 2 degrees celsius, is unsatisfactory. It is significant that the current development of the agreement after 2015 shows a significant deviation from the trajectory towards accelerating warming. The world market, in turn, does not regulate the problem of warming, and market prices do not “reflect” social losses from carbon emissions. Emissions reduction is not treated as a public good by all parties to the agreement. (*Why are dupont...*) According to the UN Environment Program, global CO₂ emissions reached a maximum of 36 billion metric. tons in 2018, in 2019 they decreased by only 1% mainly due to warm winters, and in 2020 decreased by another 4% due to the COVID pandemic (figure 1)

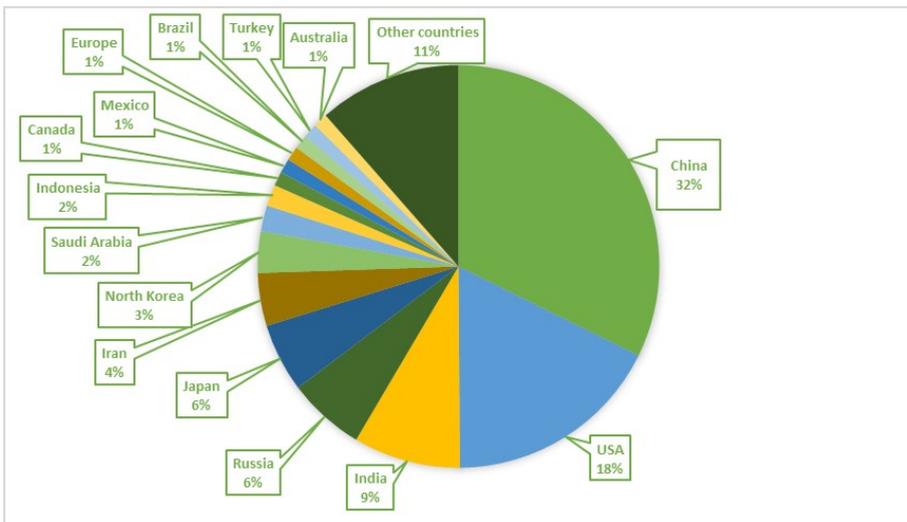


Figure 1: Carbon dioxide (CO₂) emissions from burning resources in 2020

As we can see, the largest polluters of CO₂ emissions in the world are the United States and China. With this, in 2022 the highest rate of a company with a negative impact on a country's environmental security was recorded in the United States. In this case, a great example is the American chemical company DuPont, which since 1951 has been using the chemical

C8, also known as PFOA perfluorinated carboxylic acid, in its products, with this chemical being extremely dangerous to the human body. Studies by the Working Group on Environmental Protection (EWG) and other community groups found that the blood of almost all Americans was contaminated with PFOA, which is easily passed from mother to child and continues to do so. In 2006, the Federal Environmental Protection Agency confirmed that PFOA is a likely human carcinogen and has been spread to 91% of the earth's population. (*Top 10 most...*) According to official sources, PFOA has not been used in the United States since 2015, but DuPont and other companies use other chemicals which may not be much safer. DuPont currently uses GenX, which is even more dangerous to health than the previous chemical. Despite the terrible consequences of the company's activities, the US Federal Emergency Management Agency has so far failed to prevent the activities of not only DuPont but dozens of other such companies that pose a threat to human security.

In addition, as of the end of 2022, according to AQI (air quality index), the countries of Bangladesh, Kuwait, Chad, the United Arab Emirates, India, Iraq, Pakistan, Sudan, Bahrain, and Nepal are the ten most polluted countries in the world, with this being a national security issue for these resective countries' citizens. (*Environmental performance Index*)

At the international level, a number of step-by-step measures need to be developed to ensure environmental security at the highest level not only in individual states but also around the world. The first and most important thing to pay attention to is the development of a mechanism for a single system to combat environmental problems. If not all states are involved in such a process, the result will be reduced to zero in the future. Leading countries such as the United States, France, Germany, Canada, the United Kingdom, and especially China must launch a new "Environmental Union" to help countries with economies in transitional and low incomes join the agreement. Of course, it will not be possible to fully cover and control the entire earth at first, but leading countries in their respective regions need to implement so-called environmental initiatives. For example, China, Singapore, Japan, or Australia may act as sponsors in the implementation of facilities for less developed countries in the Asia-Pacific region. The United States and Canada in their region of influence can do the same. On the African continent, Western, European, and Asian partners must work together to introduce environmental actors to the mainland.

Initiatives themselves should include the introduction of new laws and services that will monitor the implementation of environmental agreements

in regions. The use of alternative energy sources to replace fossil fuels is a key step in solving environmental problems. Here it is also necessary to include recycling and the sorting of waste, landscaping, the banning of cars with DVR, and banning plastic and polyethylene products.

Summing up the above, environmental safety in the modern world faces quite serious problems. Almost all countries are actively looking for new ways to develop and address the various problems caused by the environmental component. Today, there are a number of international organizations in the world, such as the UN, UNIDO, UNESCO, the OSCE, NATO, and others that pay attention to environmental security issues in the world, creating a number of traffic jams in the environmental field. Although a number of countries are trying to pursue successful environmental security policies in the state space, in the international dimension the level of environmental security is unsatisfactory and needs more attention from world leaders to improve the situation.

Undoubtedly, an important part of environmental safety is its relationship to energy security. Energy and environmental issues are closely linked, as it is almost impossible to produce, transport, or consume energy without a significant environmental impact. One of the main components of energy security, in addition to the energy supply of an economy and population with the fuel and energy resources necessary for development and energy independence, is environmental friendliness when considering production and energy consumption. As global energy demand grows every year, the use of fossil fuels such as oil, coal, and natural gas, and nuclear fuel such as uranium, thorium, and plutonium still meet most global energy needs, creating serious consequences for the environment. The combustion of fossil fuels for energy production is certainly the main source of anthropogenic greenhouse gas emissions, namely CO₂ emissions – with this being the main cause of global warming. Fuel waste storage at nuclear power plants is fairly radiation-hazardous and dangerous for all living effects, as it needs a millennial isolation for final decay. The operation of thermal and nuclear power plants can possibly create accidents at power plants, accompanied by the release of radioactive materials into the environment. Therefore, it is advisable to consider environmental and energy security in the concerned complex, linking their elements in one.

Ukraine is considered a high-energy, developed country. In 2014, Ukraine ranked only 95th out of 178 countries in the Environmental Performance Index. (Евѳенсен, Совакул, 2022) With a predominant share of resource and energy-intensive industries, the anthropogenic burden on the environment

of Ukraine is several times higher than that of most developed countries. Energy production is one of the main causes of air pollution in Ukraine. The energy sector relies heavily on fossil and nuclear fuels. More than 70% of primary energy is consumed by various fossil fuels and most of them are used in large combustion plants.

34% of the country's electricity is generated by a large-scale park consisting of 20 coal-fired power plants. Thermal stations in Ukraine have a catastrophic impact on the environment because they use low-grade fuel, do not have proper environmental systems (in particular treatment plants and reverse water supply systems), have a low level of operation in existing environmental facilities, there is no proper control over environmental protection, and production and equipment technologies are outdated. (*European energy security...*)

Nuclear energy in Ukraine results from the emissions of about 250 radioactive isotopes, which as a result of the operation of nuclear reactors enter the environment, with this also having a negative impact on the environment.

Plutonium biosphere pollution and radioactive waste are the most important causes of environmental danger which remain unresolved.

Russia's military aggression against Ukraine has had a devastating effect on Ukraine's energy sector. A year after Russia's invasion of Ukraine, the global energy landscape changed dramatically. This has resulted in mass attacks on energy infrastructure, nuclear terrorism, and damage or destruction of about 50% of the power system, including substations and high-voltage power lines.

At the same time, Ukraine is already developing a plan for post-war recovery, including in the field of safe renewable energy. It is also known that more than 2,300 cases of environmental damage were caused by the war, including shell explosions, fuel leaks to soil and groundwater, mining, forest fires, and more. In addition, a study was presented at the UN International Conference on Climate Change this year which demonstrated that Russia's military action in seven months of full-scale invasion has already led to the release of 49 million tons of CO₂. (*Russia's war on Ukraine...*)

The key danger that the energy industry of Ukraine, in particular nuclear power plants, can carry is that no nuclear power plant is designed with combat conditions in mind. With 4 nuclear power plants, Ukraine now faces the issue of reforming its energy complex, taking into account the specifics of hostilities, the scale of damage to energy infrastructure, and a number of commitments as a candidate country of the EU.

In the context of the transformation of the energy sector, Ukraine needs to take the following steps to achieve its goals:

- increase energy efficiency – technological improvements can increase the efficiency of power plants and energy-consuming equipment; similar institutional actions and reforms are envisaged and embodied in the framework of the Sustainable Development Strategy “Ukraine-2020”, approved by the Decree of the President of Ukraine of January 12, 2015 No. 5/2015, in particular within the framework of the Energy Independence and Energy Reform Program. In Ukraine, the incentives and sanctions for the transition to resource-saving energy policy are still not enshrined at the legislative level. The roles of the state, energy services, and consumers are not defined;
- transition to fossil fuels with a lower carbon content: It is necessary to change Ukraine’s behavior towards more economical use of fuel and the introduction of carbon-neutral fuel. The more such fuel is used for targeted activities, the more emissions will be reduced. Coal is the greatest carbon fuel with an emissions factor of about 26 tons/TJ, while crude oil has a carbon emissions of about 20 tons/TJ, and natural gas – 15 tons/TJ. Thus, the transition to lower carbon fuels reduces emissions per unit of energy produced;
- transition to alternative energy sources without emissions: Solar, wind, and hydropower do not pose a danger to the environment, but rather have economic benefits and are inexhaustible, to say nothing of their lack of CO₂ emissions. With the help of energy sources, we can overcome the problems of a lack of resources, the pollution of the planet with mineral processing products, and global warming;
- capture and storage of CO₂ emissions: Carbon can be caught before or after burning fossil fuels. Thanks to this approach, the process of energy production does not change directly because an additional component is installed instead. Carbon can then be stored in geological formations, such as oil and gas fields, exhausted coal mines and deep salt formations, in the oceans, and by industrial fixing of CO₂ into inorganic carbonates. This removes emissions that would otherwise be released into the atmosphere.

Environmental security processes should also include decarbonisation and decentralization in the state’s new energy policy. Ukraine should set to the task of switching to 100% renewable energy sources by 2050 and gradually abandon its use of nuclear energy for power generation. Any investment in energy should be based on the need to abandon fossil fuels. (*Chernobyl. Chernobyl accident...*) This issue first and foremost requires solidarity and support from partners in the European Union. The first year of Russia’s full-

scale war against Ukraine highlighted the effects of dependence on Russian oil, gas, and coal, and demonstrated the benefits of energy efficiency and decentralization. It has also shown what a threat to the whole of Europe dependence on Russian resources is.

In addition, it is important to properly allocate the funds that Ukraine will receive for reconstruction. Ukraine must demonstrate with its decisions at the governmental level and through legislative processes that it is interested in a new energy transition. Ukraine must work to reform legislation and adapt it to European standards. In addition, it is important to examine the practices implemented in the European Union, including approaches to the most efficient integration of renewable energy production systems into the grid.

In order to prevent the risks associated with the use of nuclear energy in the future, decommissioning plans need to be developed for each unit of all existing nuclear power plants to ensure their phasing out by 2040. Funding for new nuclear power plants would be economically unjustified and risky during the post-war recovery period, as international experience shows significant delays in construction and an increase in the final cost of building power units. Instead, it is more appropriate to focus on building decentralized renewable energy facilities and smart grids that can supply electricity and heat even in critical conditions.

The risks and harmful effects of the use of nuclear energy are evidenced by the 1986 accident at the Chernobyl nuclear power plant. The accident was the result of an incorrect reactor design that was operated with insufficiently trained personnel. As the result of a steam explosion and fires, at least 5% of the reactor's radioactive zone was released into the environment, with there being subsequent deposition of radioactive materials in many parts of Europe. (*Додатковий протокол до Женевських...*) Several organizations reported the aftermath of the Chernobyl accident, but all had trouble assessing the significance of their observations due to the lack of reliable information on public health in 1986. According to the latest assessment provided by the UN Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), the average radiation dose due to the accident which was received by the residents of affected districts "strict radiation control" from 1986 to 2005 was 31 mSv.

After the disaster, Chernobyl unit 4 was enclosed in a large concrete shelter, which was quickly erected to allow other reactors to continue their operation at the station. However, the design of this dome was neither strong nor durable. About 200 tons of highly radioactive material remained inside the reactor and posed a danger to the environment until the construction of

a new frame began in 2012, which was finally built in 2017. It is an arch 110 meters high, 165 meters long, and 260 meters wide, and covers both block 4 and the 1986 built building.

In addition to the above consequences, the February 24, 2022 Russian military seizure of all Chernobyl nuclear power plants is a risk to Ukraine and the whole of Europe. It is important to note that the Russian Federation signed on September 14, 2005 and ratified on January 29, 2007 the International Convention for the Suppression of Acts of Nuclear Terrorism of April 13, 2005. Based on this, it is worth noting two norms of international law which explicitly prohibit the use of armed forces of any state to attack and seize nuclear power plants:

- The first paragraph of Article 56 of the Additional Protocol to the Geneva Conventions of August 12, 1949, which concerns the protection of victims of international armed conflicts (*International Atomic Energy...*) and states that dams and nuclear power plants should not become objects of attack. Therefore, Russia's activity is classified as a violation of the IAEA Charter, the norms of international law, and principles laid down in the UN Charter.
- Statement GC(53)/DEC/13, adopted on September 18, 2009 by the General Conference of the International Atomic Energy Agency (IAEA) during its eleventh plenary session, which includes the prohibition of armed attack on nuclear installations during operation or construction. (*Зона ЧАЕС пережилла...*) Violation of this statement by any state is classified as a violation of the principles of the United Nations, its Charter, international law, and the Agency's Charter.

Exceeding control levels of gamma radiation doses were found in the Chernobyl exclusion zone. The increase in radiation levels was associated with topsoil disturbance due to the movement of large amounts of heavy military equipment through the exclusion zone and increased air pollution. In March, the Chernobyl NPP lost its connection to the grid. Luckily, backup diesel generators were working and had a 48-hour supply of fuel. Subsequently, the power transmission line needed to restore Chernobyl's external power supply was repaired, and on March 31, the Ukrainian military was returned control of the site. It is difficult to imagine the scale of the possible disaster if the station were to be disconnected from the power grid for a long period of time or if it were to come under fire from the Russian side. The actions of Russian troops at the Chornobyl NPP fall under the classification of the first paragraph of Article 2 of the Geneva Convention, as they led to the de-energization of responsible nuclear facilities and prevented

the planned rotation of service personnel, which created a threat of release of radioactive material.

Currently the largest in Europe, Zaporizhzhia NPP is in the danger zone due to its occupation and constant shelling from the Russian side. The situation with the Ukrainian nuclear power plant is completely unprecedented. In total, one turbine oil tank, the building housing fresh nuclear fuel and solid radioactive waste storage, the new training building, the building housing the physical protection system's central alarm station, and the radiation control container in the dry storage area were damaged by spent nuclear fuel. In addition, the station was disconnected from its power supply several times. (Чабанюк, 2020)

Therefore, there is a need to transform energy security in Ukraine, especially in the post-war period. The Government of Ukraine and international partners are already working on a common vision for the post-war reconstruction of Ukraine, which involves not only overcoming the direct consequences of the war, but also building a medium-term development strategy for the country. In particular, this should include decentralization of the energy system, increasing the share of renewable energy sources, reconstruction of infrastructure taking into account energy efficiency, and other initiatives. A zero-pollution strategy, including zero waste, for post-war cities should be a cross-cutting element of environmental recovery. Also, in order to ensure environmental security, the Ukrainian government needs to reconstruct nuclear and power plants for military operations and start their transition to renewable energy sources to replace nuclear energy.

Therefore, the relationship between energy and environmental security is a very important component in the system of national security. The combustion of fossil fuels for energy production is by far the main source of greenhouse gas emissions, and storage of fuel waste at nuclear power plants has dangerous radiation consequences for all living things. The issue of Ukraine's energy security became especially acute with the beginning of Russian hybrid aggression against Ukraine. In the security space, the energy security of Ukraine must go through a certain number of processes for its improvement, so as not to pose a threat to the ecological paradigm not only of a specific state, but of the whole world.

Ukrainian environmental policy is aimed at solving modern environmental problems and their timely prevention, which ultimately ensures the environmental security of the state. Now, more than ever, it is important at the state level to attach great importance to issues of ecological direction and to define environmental protection as one of the key provisions of national security policy. This whole system requires the creation of a certain

legislative frameworks, executive bodies, systems for preventing the negative consequences of environmental and man-made disasters, the support of law enforcement agencies at the required level, and the participation of public organizations and independent experts in the development of environmental security. In 2020, Ukraine ranked 4th in the world in terms of its level of economic losses from atmospheric air pollution, the main polluters of which are the enterprises linked to the mining and processing industry, the energy and agricultural sector, and the emissions of pollutants from which accounted for more than 90% of the total volume. (*Сучасна екологічна ситуація...*) The resource intensity of Ukraine's economy is also the reason for the depletion and deterioration of natural resources, and especially agricultural land as the basic basis of the country's food security. The specific indicator of the use of natural resources per unit of production in Ukraine is much higher than in Western Europe. Total water resources in this regard are at 94.1 cubic km, which makes Ukraine one of the countries with an insufficient water supply, where more than 30% of water bodies have high and extremely high levels of chemical pollution. The forest cover of Ukraine is 15.9% of the total area, while a similar indicator in Germany rests at 32%. Territories and objects of the natural reserve fund, of which there are 8,633 in Ukraine, occupy 6.8% of the country's area. From 2012 to 2018, as a result of the destruction of meadow-steppe ecosystems and forests, the reduction area increased from 53.8 to 56.8% of the country's territory. For comparison, in the EU arable land is about 25%. (*Про виклики і загрози...*)

The lack of effective systems of state management, environmental control and monitoring and the ineffective integration of environmental policy into the socio-economic development of Ukraine before the full-scale war has prevented the achievement of the goals of environmental security, the rational use of natural resources, and European integration. The signing of the Association Agreement between Ukraine and the European Union in 2014 gave an impetus to solving environmental problems and initiated key reforms in the fields of ecology and climate. Progress in these reforms gave Ukraine a chance to be one of the first to support the European Green Deal and start a dialogue with the European Union regarding Ukraine's participation in the organization.

Currently, Ukraine faces the following challenges in the ecological dimension:

- The high carbon intensity of the economy, the low adaptive capacity of social, economic, and natural systems to climate change, and the lack of an effective system of green financing;

- The high environmental risks caused by industrial pollution and the alarming state of chemical, nuclear, and radiation safety;
- The depletion and deterioration of natural resources due to their irrational use and inefficient management, which is exacerbated by the consequences of climate change and the destructive impact of Russian aggression;
- The reduction and degradation of natural ecosystems, the critical loss of biodiversity, and the insufficient share of protected areas to balance the landscape structure. (Овчинников, 2023)

The requirement to improve the legal and institutional mechanisms for ensuring effective state management in the field of environmental protection must be taken seriously, including in the fields of state environmental supervision and environmental responsibility.

As a result of the full-scale war, environmental problems that previously existed in Ukraine have become much more complicated. A lack of access to territories and objects of nature the use, loss, and destruction of infrastructure, the loss of personnel and limitation of work opportunities, and the suspension of environmental inspections for the period of martial law negatively affected the effectiveness of state administration in the field of environmental protection. According to the Ministry of Environmental Protection and Natural Resources of Ukraine, the amount of damage to the environment caused by Russian armed aggression already exceeds 46 billion euros. (Стрілець, 2022)

The scale of the environmental crimes of the Russian invaders is astounding. Some ecosystems and unique natural objects cannot be restored. Although damage to the environment is evident, new approaches are needed to assess it, and the full amount of damage and environmental damage remains unclear as environmental monitoring systems have been damaged or destroyed, and access to forests and other natural areas is limited.

Environmental and security risks are increasing, creating hazardous waste from the destruction of military waste. 160 thousand square kilometers of the territory of Ukraine are contaminated with explosive objects. Because of the war, more than 4.6 million people in Ukraine have access problems. As a result of the destruction of buildings, a large amount of construction waste containing ozone-depleting substances has been formed, in particular from heat-insulating materials such as insulating foam. Pollution is also caused by the destruction of transport and industrial infrastructure, which leads to the mass release of petroleum products and other hazardous substances. More than 227 enterprises and factories, including chemical ones, were damaged

or destroyed during the war. The activity of a number of mining enterprises was suspended, which led to a shortage of salt, coal, and other minerals.

There are significant threats to nuclear and radiation safety due to damage to nuclear and hazardous radiation facilities, in particular due to the temporary occupation of the Zaporizhzhia NPP and the Chernobyl Exclusion Zone. The consequences of the armed invasion will have a long-term negative impact on the ability of national economies to prevent and adapt to climate change.

In this regard, the state level needs to implement a step-by-step plan for restoring Ukraine's environmental security:

1. The first stage concerns 2023-2025 and includes:
 - Determining the mechanisms of compensation for environmental damage and the costs necessary for the restoration of damaged nature protection objects as a result of the war.
 - Strengthening the institutional capacity of state administration in the fields of environmental protection and the sustainable use of natural resources, in particular environmental monitoring and control.
 - Implementation of a new permit system for prevention, reduction, and control of industrial pollution.
 - Introduction of a system of extended responsibility for manufacturers and their decommissioned waste such as: packaging, batteries, accumulators, and the electronic equipment of vehicles.
 - Helping to prevent the formation and increase of the volume of recycled and reused mining industry waste.
 - Restoration and development of the network of nature conservation areas, which correspond to the best practices of the EU.
2. The second stage concerns 2026-2032 and includes:
 - Development of an environmental monitoring system.
 - The launch of a national emissions trading system.
 - Development of a waste management infrastructure.
 - Implementation of the findings of the best available technologies and management methods in accordance with EU norms on industrial pollution.
 - Achieving a “good” ecological status of water bodies for Ukraine's 9 regions of river basins.
 - Restoration of ecosystems, including within all territories and objects of the nature reserve fund, which suffered as a result of Russian military aggression.

Conclusion

Thus the Ukrainian state is currently faced with a number of challenges and tasks that need to be addressed at all levels of the state. As a result of the full-scale war, the environmental problems that existed in Ukraine before have become much more complicated and now require a fundamental transformation and solution. With the implementation of new effective reforms, Ukraine will be able to transform its environmental security to a high standard and become an example of a country that was able to rebuild its environmental sector in a post-war period.

An important component of environmental security is its relationship with energy security. The combustion of fossil fuels for energy production is by far the main source of anthropogenic greenhouse gas emissions, namely CO₂ emissions.

The storage of fuel waste at nuclear power plants has quite dangerous radioactive consequences for all living things. The operation of thermal and nuclear power plants may involve possible accidents at power plants accompanied by the release of radioactive materials into the environment.

Thermal plants in Ukraine lead to the catastrophic state of the environment due to the fact that they use low-grade fuel. Nuclear energy in Ukraine also has a negative impact due to the emission of about 250 radioactive isotopes into the environment as a result of the operation of nuclear reactors.

The key danger that the energy industry in Ukraine carries is that no nuclear power plant is designed to take into account the conditions of hostilities. Having 4 nuclear power plants, today Ukraine faces the issue of reforming its energy complex, taking into account the specifics of military operations, the extent of damage to its energy infrastructure, and, its obligations as a candidate country of the EU.

In the context of the transformation of the energy sector, Ukraine needs to take the following steps to realize its goals: increase energy efficiency, switch to fossil fuels with a lower carbon content, switch to alternative sources of energy without emissions, capture and store CO₂ emissions, and pursue decarbonization.

The Ukrainian state faces not a simple, but quite complex task of ensuring and restoring its environmental security. In order to transform its environmental safety to high standards and become an example of a country that was able to rebuild its environmental sector in a post-war period, Ukraine needs to follow 5 priority directions in the environmental field such as reforming state management in the field of environmental protection, compliance with climate po-

licy, effective waste management, the reasonable use of natural resources resources, and the preservation of natural ecosystems and biodiversity.

In addition, great attention should be paid to the step-by-step plan for restoring environmental safety, which includes 2 stages. At the first stage it is necessary to determine the mechanisms of compensation for environmental damage, implement new permit systems for industrial pollution control, and introduce systems of extended producer responsibility for decommissioned waste. At the second stage, there should be the development of environmental monitoring systems, the launch of a national emissions trading system, and the development of a waste management infrastructure.

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