

Energy Security of Ukraine: External Threats From the Russian Federation

by

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Abstract

A country's energy security is an important component of its overall national security, as energy supply is essential for the functioning of its national economy and the livelihoods of its population. The purpose of this research is to develop practical tools for analyzing the condition of Ukraine's energy sector, and to provide practical recommendations for potential development and integration into the single European energy system. The practical value of the research findings is that the SWOT-analysis (Strengths – Weakness – Opportunities – Troubles) of the energy sector of Ukraine which makes it possible to identify the most acute problems and threats that have

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a negative impact on the energy sector of Ukraine and its integration into the European common energy system. Based on the results of the conducted SWOT-analysis, three potential scenarios for the development of Ukraine's energy sector are proposed: a "no change" scenario (preservation of current trends and state of affairs); an "unfriendly influence" scenario (no systemic changes in energy policy combined with the escalation of aggression by the Russian Federation); and a "positive transformation" scenario (targeted efforts aimed at achieving the goals set out in this Strategy). The paper suggests the following possible ways of ensuring energy import substitution for Ukraine: development of renewable energy; development of energy efficiency; development of its own oil and gas industry; development of alternative energy sources; diversification of energy import sources; development of energy infrastructure; developing energy self-sufficiency in its individual regions.

Resumé

La sécurité énergétique d'un pays est une composante importante de sa sécurité nationale globale, car l'approvisionnement en énergie est essentiel au fonctionnement de son économie nationale et aux moyens de subsistance de sa population. L'objectif de cette recherche est de développer des outils pratiques pour analyser la situation du secteur énergétique ukrainien et de fournir des recommandations pratiques pour le développement potentiel et l'intégration dans le système énergétique européen unique. La valeur pratique des résultats de la recherche est que l'analyse SWOT (Strengths – Weakness – Opportunities – Troubles) du secteur énergétique de l'Ukraine permet d'identifier les problèmes les plus aigus et les menaces qui ont un impact négatif sur le secteur énergétique de l'Ukraine et son intégration dans le système énergétique européen commun. Sur la base des résultats de l'analyse SWOT, trois scénarios potentiels de développement du secteur énergétique ukrainien sont proposés : un scénario "sans changement" (maintien des tendances et de la situation actuelles) ; un scénario "influence inamicale" (pas de changements systémiques dans la politique énergétique combinés à l'escalade de l'agression par la Fédération de Russie) ; et un scénario "transformation positive" (efforts ciblés visant à atteindre les objectifs fixés dans cette stratégie). L'article propose les moyens suivants pour assurer la substitution des importations d'énergie pour l'Ukraine : développement des énergies renouvelables ; développement de l'efficacité énergétique ; développement de sa propre industrie pétrolière et gazière ; développement de sources d'énergie alternatives ; diversification des sources d'importation d'énergie ; développement de l'infrastructure énergétique ; développement de l'autosuffisance énergétique dans ses différentes régions.

Key words: foreign policy; military aggression; energy security; energy complex; traditional energy resources; decarbonization; synchronization of legislation; single energy market.

JEL: F510, F520, F590, K330

I. Introduction

Russia's full-scale invasion of Ukraine in February 2022 changed the political landscape in Europe and the world. The Kremlin has challenged international law, the world order and the norms of humanity. Moscow's actions threaten the Ukrainian State and nation with destruction, undermine democracy and freedom in the EU, and create conditions for a food and economic crisis in many regions of the world. Expecting to take over the whole of Ukraine in a few days, Russia hoped for a lukewarm reaction from Kyiv's international partners, including the European Union. This expectation was based on the system of hybrid influences that Moscow has been building and using in Europe over the past two decades.

Energy has played a key role in Russia's strategy of subduing EU Member States. By selling relatively cheap oil and gas to its Western partners, Moscow ensured their economic growth and guaranteed their loyalty, even during aggressive actions against third countries. In addition, having the status of a major supplier of hydrocarbons to some EU States, Russia could use it as a tool to influence the situation within the bloc. Thus, as of 2020, more than 40% of all-natural gas imported to the EU came from Gazprom. In addition, Russian suppliers provided almost a third of all crude oil, and more than half of all solid fuels, imported into the EU from outside the bloc.

A country's energy security is an important component of national security overall, as energy supply is essential for the functioning of its national economy and the livelihoods of its population. Insufficient or unstable energy supply can lead to an economic crisis, rising energy prices, reduced competitiveness of producers, and deterioration of the socio-economic situation in a country. In addition, insufficient energy supplies may lead to increased use of hazardous alternative energy sources, such as coal, which leads to environmental pollution and to the deterioration of public health. However, dependence on foreign energy suppliers can also pose a threat to national security, as it can be used as a political tool or even armed pressure. Therefore, ensuring national energy security aims to reduce dependence on foreign suppliers and developing domestic energy sources.

II. Research outline

1. Purpose

The purpose of this research project is to develop practical tools for analyzing the condition of Ukraine's energy sector and to provide practical recommendations for its potential development and integration into the single European energy system.

2. Methodology

The research methodology includes the following main steps: a review of current literature in the field of energy security, which will enable a comparison of existing approaches to understanding the concept of energy security; analysis of Ukrainian legal acts regulating the relationships in the energy sector, which will make it possible to analyze the improvement of Ukrainian legislation in this area. The next step is to conduct a SWOT-analysis of Ukraine's energy sector, which will identify the main problems and threats that have a negative impact on Ukraine's energy security, as well as offer a number of practical recommendations to improve the situation in Ukraine's energy sector in the context of its integration into the European energy system.

III. Literature review

Energy security is important for many aspects of modern life and geopolitics, and therefore it is the subject of research by many European scholars and research organizations. The energy sector is an important part of the economy of many European countries. Energy security research helps to understand what threats and opportunities exist for the energy market, and how this affects economic stability. The concept of energy security has been studied by many scientists, in particular, the three dimensions of availability, affordability and reliability.¹ Theoretical papers and international organizations have

¹ Nye, J. 'Energy and security in the 1980s' (1982) *World Politics*, 35(1), 121–134; Yergin, D. (1988). *Energy Security in the 1990s*. *Foreign Affairs*, 67, 110–132. <https://doi.org/10.2307/20043677>; Kendel, J. 'Energy security in APEC' (2018) <https://www.ief.org/_resources/files/events/ief16-ministerial/official-articles/james-kendell-article.pdf>.

added new elements to their analysis, especially, environmental acceptability.² Baldwin M. argues that the energy crisis has forged new linkages among national security, energy security, climate security and economic security.³ He considers that EU Members should strive to deepen collaboration in the realm of sustainable energy development, because progress here will reinforce collective security and contribute to global environmental health. Strojny, et al. presents a comprehensive review of the concept of energy security, in the context of new trends in the development of the energy sector.⁴ They identify the main differences in the perception of energy security, and point out that the “supply concept” of energy security is giving way to an approach whereby energy is a factor initiating deep transformations of social systems. It does so by changing consumption patterns, reducing energy consumption, and forcing changes in economic systems by imposing energy efficiency standards and environmental standards.

Bluszcz, Manowska, Tobór-Osadnik, Wyganowska (2023) et al. present the assessment of the level of energy independence of European Union countries, including Poland, based on selected indicators, such as: the level of final energy consumption in a household per capita, GDP per capita, GDP energy consumption, Net Import Dependency ratio (NID).⁵ Samson (2019) analyzes the Polish energy market with the share of individual sources, and examines the possibility to increase the share of those alternatives to coal in the near future. Pokhodenko (2023) focuses on the main aspects of energy security, such as ensuring energy independence, stability and sustainability of the supply of energy resources, the development of energy efficiency and the use of renewable energy sources, integration into a single energy space, as well as the challenges faced

² Neff, T. ‘Improving Energy Security in Pacific Asia: Diversification and Risk Reduction for Fossil and Nuclear Fuels’ (1997) Commissioned by the Pacific Asia Regional Energy Security (PARES) project, Center for International Studies, Massachusetts Institute of Technology, Cambridge, USA; World energy assessment (2000). <<https://www.undp.org/sites/g/files/zskgke326/files/publications/World%20Energy%20Assessment-2000.pdf>>; World energy assessment. Overview 2004 update (2004). <https://sustainabledevelopment.un.org/content/documents/2420World_Energy_Assessment_Overview_2004_Update.pdf>; ESMAP 2005–2007 business plan – securing energy for poverty reduction and economic growth (2005). <<https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/806051468175434798/esmap-2005-2007-business-plan-securing-energy-for-poverty-reduction-and-economic-growth>>.

³ Baldwin, M. ‘Energy priorities of the European Commission’ (2023). <<https://www.eolasmagazine.ie/energy-priorities-of-the-european-commission-2/>>.

⁴ Strojny, J., Krakowiak-Bal A., Knaga J., Kacorzyk P. ‘Energies’ (2023) 16(13), 5042. doi: <https://doi.org/10.3390/en16135042>.

⁵ Bluszcz, A. et al., ‘Poland’s energy security during the transformation process in comparison with the EU countries’ (2023) IOP Conf. Ser.: Earth Environ. Sci. 1132 012001. doi 10.1088/1755-1315/1132/1/012001.

by both sides.⁶ Suhodolia, et al. (2020) develop the methodology of a system analysis and strategic planning of energy security of Ukraine.⁷

There is thus no common consensus among scientists about the optimum model that can be used in analyzing energy security in a certain state. Consequently, every scientist presents their own vision and refers to the crucial components and indicators according to their point of view. In general, theoretical literature agrees on the controversial nature of the energy security concept, as it lies in an overlapping area between economics, politics, technical and environmental aspects, as well as the legal dimensions governing the circulation and energy transfer processes. Therefore, the analysis of current scientific papers has shown a certain fragmentation and disparity of views on the problem subject to this study. Hence, energy security is the provision of stable, reliable and uninterrupted energy supply to meet the needs of society in energy (oil, gas, coal, electricity, etc.), while ensuring economic efficiency, environmental safety and conservation of energy resources for future generations. Energy security is a key component of national security overall, and is of strategic importance for a country's development. The need to ensure energy security is becoming especially urgent due to the growing energy consumption and deteriorating environmental situation in the world.

The IEA (2023) defines “energy security as the uninterrupted availability of energy sources at an affordable price. Energy security has many aspects: long-term energy security mainly deals with timely investments to supply energy in line with economic developments and environmental needs. On the other hand, short-term energy security focuses on the ability of the energy system to react promptly to sudden changes in the supply-demand balance”.⁸ In accordance with the EC (2014), “energy security refers to ensuring uninterrupted energy supply within a country and between countries that are members of the European Union”.⁹ The American Office Of Energy Efficiency & Renewable Energy (2023) considers that “energy security means having enough energy to meet demand and having a power system and infrastructure that are protected

⁶ Pokhodenko, B. ‘Review and comparative analysis of energy security concepts of the European Union and Ukraine’ (2023) *The Journal of V. N. Karazin Kharkiv National University* (17), 56–79. <https://doi.org/10.26565/2310-9513-2023-17-06> (in Ukrainian).

⁷ Sukhodolia, O., Kharazishvili, Yu., Bobro, D. ‘Metodolohichni zasady identyfikatsii ta stratehuvannia rivnia enerhetychnoi bezpeky Ukrainy [Methodological principles of identification and strategizing the level of energy security of Ukraine]’ (2020) *Ekonomika Ukrainy – Economy of Ukraine*, 6 (703), 20–42. <https://doi.org/10.15407/economyukr.2020.06.020> [in Ukrainian].

⁸ IEA ‘Energy security. Reliable, affordable access to all fuels and energy sources’ (2023) <<https://www.iea.org/topics/energy-security>>.

⁹ Communication from Commission to the European Parliament and the Council. European energy security strategy (2014). Brussels, 28.5.2014. COM(2014) 330 final. <<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0330>>.

against physical and cyber threats. Together, energy independence and energy security enhance national security, American competitiveness, and economic standing”.¹⁰ The Strategy of Energy Security of Ukraine (2021) argues that energy security is understood as the protection of national interests in ensuring access to reliable, sustainable, affordable and modern energy sources, in a technically reliable, safe, cost-effective and environmentally acceptable manner, under normal conditions and in a state of emergency.¹¹ Different approaches to the definition of energy security lead us to the conclusion that the concept of energy security has different variations depending on the context and country. However, in all cases, energy security is an important component of national and global security overall, which aims to ensure a reliable and sustainable supply of energy to meet societal needs.

IV. Results of the study

A country's energy security is an important element of its national security that affects the economic, social and political development of the country. Ensuring reliable and sustainable energy supply, as well as reducing dependence on foreign suppliers, is thus an important task for ensuring national security.¹² As for Ukraine, it has the greatest need for these types of energy. Natural gas is the main source of energy for heating and domestic use. Gas is also used by industry, in particular for the production of chemicals, mineral fertilizers, steel, etc. Coal is an important source of energy for electricity and heat production in Ukraine. Most Ukrainian power plants are fired by coal. Electricity is an important energy carrier for various industrial sectors and for home use. Ukraine has also a large demand for transportation fuels, particularly gasoline and diesel. With the development of renewable energy and increased attention to environmental issues, the Ukrainian economy is increasingly relying on biofuels, including ethanol, biodiesel, as well as other biofuels.

Ukraine is a major producer of coal and natural gas, but its dependence on imports of these energy sources is significant. In addition, with the focus on reducing carbon emissions and increasing the use of renewable energy

¹⁰ American office of energy efficiency & renewable energy (2023). <<https://www.energy.gov/eere/office-energy-efficiency-renewable-energy>>.

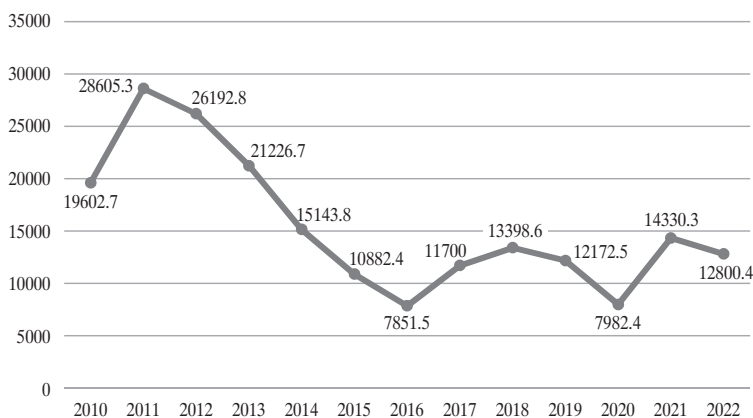
¹¹ Strategiiia enerhetychnoi bezpeky [Strategy of energy security] (2021). <<https://zakon.rada.gov.ua/laws/show/907-2021-%D1%80#Text>>.

¹² Lymar, V. 'Ukraine's economy after the Russian Federation war invasion: global scale' (2022) Ukrainian Economy in the Aftermath of the Russian Aggression – Selected Issues, 75–82.

sources, an important task for Ukraine is to develop appropriate energy technologies, infrastructure, and import substitution. Ukraine's dependence on energy imports, especially gas and oil, is one of the main problems for its energy security. In practice, dependence on external suppliers can lead to acute energy shortages and high energy prices, which threaten economic growth and national security.¹³ Import substitution of energy is important for ensuring the country's sustainable development and reducing its dependence on external suppliers. This can be achieved through the development of domestic renewable energy sources, such as solar and wind energy, as well as energy efficiency and reduction of energy consumption. It is also important to develop its own oil and gas industry and ensure diversification of supply sources.¹⁴ Reducing energy imports can also have a positive impact on the country's balance of payments, and increase its competitiveness in the international market. In addition, import substitution can create new jobs and support the development of the domestic energy market. Thus, energy import substitution is an important task for Ukraine to ensure energy security, sustainable development and economic growth.

The figure below shows the dynamics of imports of mineral fuels, oil and oil products to Ukraine (Fig. 1).

Figure 1. Imports of mineral fuels, oil and its distillation products to Ukraine in 2010–2022, UAH million



Source: compiled by the author. Based on Commodity structure of Ukraine's foreign trade in 2010–2022. <https://www.ukrstat.gov.ua/operativ/operativ2023/zd/tsztt/arh_tsztt2023_u.html>.

¹³ Lyamar, V., Zveriev, O. 'Mizhnarodna ekonomichna bezpeka Ukrainy v umovah posylnennia zovnishnih zagroz [International economic security of Ukraine in the context of growing external threats]' (2022) *Economics and organization of management*. № 1, 13–25 [in Ukrainian].

¹⁴ Lyamar, V., Zveriev, O. 'Naukovi pidhody do rozuminnia kontseptu globalnoi ekonomichnoi bezpeky [Scientific approaches to understanding the concept of global economic security]' (2023) *Business Inform*, № 3, 6–12 [in Ukrainian].

The data of the State Statistics Service of Ukraine on imports of mineral fuels, oil and its distillation products, demonstrate certain fluctuations in the analyzed indicator:

- in 2010–2011, Ukraine experienced a significant increase in imports (from 19602.7 to 28605.3 million UAH);
- in 2011–2016, a significant decrease in energy imports occurred (from 28605.3 to 7851.5 million UAH);
- in 2016–2018, Ukraine's imports again increased (from 7851.5 to 13398.6 million UAH);
- in 2018–2020, energy imports again showed a decrease (from 13398.6 to 7982.4 million UAH);
- in 2021, the numbers of energy imports into the Ukraine almost doubled (to 14330.3 million UAH); and,
- in 2022, imports again decreased (to 12800.4 million UAH).

Fluctuations in energy imports to Ukraine can be explained by several factors, including the following. Political factors: energy imports can be increased or decreased depending on the conditions of relations with exporting countries. For example, changes in the political course of the exporting country, conflicts on the territory of the exporting country, as well as relations with 3rd countries can all affect the volume of energy imports. Economic factors: changes in the economic situation in exporting countries, such as a decrease or increase in energy production, decrease or increase in energy prices, may all affect import volumes. Technical factors: the development of appropriate infrastructure (pipelines, terminals, ports, etc.) is an important factor in ensuring stable energy imports. Climatic factors: Changes in climate conditions, such as temperature variability, may affect the demand for certain types of energy, in particular natural gas and coal used for heating.¹⁵

Ukraine is a country that depends on imports of natural gas and other energy sources, which makes it vulnerable to changes in prices and supply volumes. Therefore, developing Ukraine's own renewable energy sources, as well as improving energy efficiency, is an important task to ensure the stability of the country's energy system, and reduce its dependence on imports. The largest energy demand in Ukraine is for natural gas, which is used for heating and electricity. Other important energy sources in Ukraine include oil, coal, nuclear fuel, and renewable energy.¹⁶

¹⁵ Sukhodolia, O., Kharazishvili, Yu., Bobro, D. 'Metodolohichni zasady identyfikatsii ta stratehuvannia rivnia enerhetychnoi bezpeky Ukrainy [Methodological principles of identification and strategizing the level of energy security of Ukraine]' (2020) *Ekonomika Ukrainy – Economy of Ukraine*, 6 (703), 20–42. <https://doi.org/10.15407/economyukr.2020.06.020> [in Ukrainian].

¹⁶ Kholod, N., Denysenko, A., Evans, M., Roshchanka, V. 'Improving Ukraine's Energy Security: the Role of Energy Efficiency. Pacific Northwest National Laboratory' (2018) Richland, Washington <<https://www.osti.gov/servlets/purl/1566786>> [in Ukrainian].

The dangers of Ukraine's energy security have become more acute with Russia's full-scale aggression against Ukraine. Russia's manipulation of energy resources has several aspects. One of them is the construction of the Nord Stream 2 pipeline by Russian Gazprom, which allows gas to be transported to Germany bypassing Ukraine. To date, this pipeline is awaiting certification by German regulators. In this context, Russia's goal is to reduce Ukraine's role in the European gas transportation system. This resulted in a decrease in gas supplies to Europe and, accordingly, a significant increase in prices for this energy source.¹⁷ In such circumstances, Ukraine is facing the task of reducing its energy dependence, in particular, our country is already buying gas for its own needs from Europe, and is also taking measures to further integrate the domestic energy grid into the European energy space.

The table 1 presents the main legal acts regulating relations in the energy sector, as well as certain aspects of the country's energy security. Of course, this is not the full range of relevant legal acts, but they are the main, priority ones that regulate the energy sector of Ukraine.

There may be certain conflicts or contradictions between different laws and regulations in the legal framework for Ukraine's energy security. Some of the potential conflicts include:

- dependence on energy imports – as Ukraine is dependent on imports of oil, natural gas and other energy resources. This may create a conflict between its energy security goals and foreign economic policy objectives;
- regulation of different energy sectors – Ukraine has separate laws and regulations concerning specific energy sectors, such as electricity, gas, alternative energy sources, etc. This can create conflicts in the interaction and coordination between different sectors;
- differences in strategic directions – different energy development strategies and programmes may have divergent or insufficiently coherent objectives, which can make it difficult to achieve overall energy security goals;
- energy source priorities – Ukraine faces a choice between different energy sources, such as coal, gas, nuclear, renewables, etc. Different legislative acts may set different priorities and approaches to the use of these sources, which may lead to conflicts.
- regulatory framework for energy efficiency – the introduction of energy efficient technologies and measures is an important aspect of energy security. However, there may be conflicts in regulatory provisions and in support for energy efficiency between different authorities and sectors of the economy.

¹⁷ Lymar, V. 'Ukraine's economy after the Russian Federation war invasion: global scale' (2022) *Ukrainian Economy in the Aftermath of the Russian Aggression – Selected Issues*, 75–82.

Table 1. Legal and regulatory acts governing relations in the energy sector of Ukraine

Legal act	Short characteristics
The Law of Ukraine “On Energy” of 22 September 2017 [24]	This law establishes the general principles and foundations of State policy in the energy sector, as well as the legal framework for ensuring Ukraine’s energy security
The Law of Ukraine “On the electricity market” of 13 June 2017 [25]	This law defines the legal framework for the functioning of the electricity sector of Ukraine, including energy security issues
the Law of Ukraine On the Principles of Functioning of the of the natural gas market of 9 April 2015[26]	This law establishes the legal framework for the extraction, transportation, supply and use of natural gas in Ukraine, in particular with a view to ensure energy security
The Law of Ukraine “On Atomic Energy” of 8 December 1995 [27]	This law establishes the legal framework for the use of nuclear energy, nuclear safety, and the protection against radiation exposure
Law of Ukraine “On Energy Efficiency of Buildings” of 22 March 2017 [28]	This law establishes requirements for energy efficiency of buildings, and contributes to reducing energy consumption, improving energy efficiency and ensuring energy security
The Law of Ukraine “On Heat Supply” of 2 June 2005 [29]	This law defines the legal framework for the organisation and operation of heating supply systems, including ensuring stable, reliable and efficient heat supply to households and industry
Law of Ukraine “On Energy Efficiency” of 21 October 2021 [30]	This Law defines the legal, economic and organisational framework for relations arising in the field of energy efficiency in the production, transportation, transmission, distribution, supply and consumption of energy

Source: developed by the author based on [24–30]. Based on Law of Ukraine On energy efficiency (2022). Bulletin of the Verkhovna Rada, 2022, № 2, ar. 8). <<https://zakon.rada.gov.ua/laws/show/1818-20#Text>> [in Ukrainian]; Law of Ukraine on Energy Efficiency Fund (2017). Bulletin of the Verkhovna Rada of Ukraine (BVR), 32, 344. <<https://eefund.org.ua/sites/default/files/legislation/1.%20Law%20on%20EEF.pdf>> [in Ukrainian]; Law of Ukraine On heat supply (2005). Bulletin of the Verkhovna Rada, № 28, ar. 373. <<https://zakon.rada.gov.ua/laws/show/2633-15#Text>> [in Ukrainian]; Law of Ukraine on the electricity market (2017). Bulletin of the Verkhovna Rada, № 27–28, ar. 312. <<https://zakon.rada.gov.ua/laws/show/2019-19#Text>> [in Ukrainian]; Law of Ukraine On the energy efficiency of buildings (2017). Bulletin of the Verkhovna Rada, № 33, ar. 359). <<https://zakon.rada.gov.ua/laws/show/2118-19#Text>> [in Ukrainian]; Law of Ukraine On the principles of the natural gas market functioning. <https://zakononline.com.ua/documents/show/305581__503060> [in Ukrainian]; Law of Ukraine On the use of nuclear energy and radiation safety (1995), Bulletin of the Verkhovna Rada, № 12, ar. 81. <<https://zakon.rada.gov.ua/laws/show/39/95-%D0%B2%D1%80#Text>> [in Ukrainian].

Resolving these conflicts and contradictions may require harmonization of legislation, increased coordination between different authorities, development of integrated strategies and policies, and consideration of the interests of different sectors and stakeholders in decision-making.

Ukraine should be a part of the mechanisms for overcoming the challenges mentioned in the previous section, as well as the EU's energy transformations. That is, as a candidate for accession to the European Union as a country with an extensive gas transmission network and numerous storage facilities, and as an additional power in ensuring the bloc's security. Joining the common European strategy of eliminating fuel dependence and decarbonization is also dictated by the need for Ukraine's post-war recovery. This process can become a framework for rapid reforms of the country's energy sector, which would be impossible to implement quickly under other conditions.

The return of Ukraine's production and generation capacities located in the territories temporarily occupied by Russia, was one of the country's biggest energy challenges until February 2022. Other challenges included maintaining the status of a transit country for Russian gas, in the face of the construction of gas pipelines bypassing Ukraine; the signing of a long-term agreement between Hungary and Gazprom; and a possible reduction in the volume of fuel transported from Russia to Romania, Slovakia, and Poland. The Kremlin's decision to launch a full-scale invasion has eliminated some of these problems, while adding new and more significant ones. In late 2021 and early 2022, Russian suppliers reduced gas transit through Ukraine by over 60%. After February 2022, these figures dropped by at least another third. At the same time, Gazprom stopped supplying fuel to Europe through Belarus and Poland. Finally, in early September, Russia shut down Nord Stream 1. Thus, the Turkish Stream and, to a lesser extent, pipelines on Ukrainian territory are now the only means of delivering Russian gas to Europe.¹⁸

The agreement between Gazprom and Ukraine on the transit of Russian gas is valid until 2024. The EU has decided to gradually sever its energy relations with the Kremlin, and Russia itself has reduced its share of foreign gas supplies to the European market to a record low. As for energy contacts between Kyiv and Moscow, the Ukrainian side cannot return to them for security, political and economic reasons. Any contacts in this context are not possible until Russian troops leave the territory of Ukraine, recognize the war crimes they have committed, and compensate for the damage they have caused. Therefore, the current gas transit agreement between Kyiv and

¹⁸ Drapak, M., Kraiev, O. 'Mictse Ukrainy e spilnii enerhetychnii politytsi EC: retsipient praktyk chy initsiatyvnyi partner [Ukraine's place in the EU common energy policy: a recipient or a practitioner, or an initiative partner]' (2022). <<http://prismua.org/560987654590-2/>> [in Ukrainian].

Moscow is likely to be the last one of its kind. The same is likely to be true for Russian oil, which is transported to Europe through Ukraine. Transportation through the Druzhba pipeline is now only a temporary exception for Central European countries, which must find alternative sources of supply by the end of 2023, according to the 6th EU sanctions package.. In addition, given the continuing hostilities, Russia's temporary occupation of part of Ukraine's territory and frequent provocations by the Kremlin, Kyiv is currently unable to guarantee the security of oil (or any other fuel) passing through its territory.

As a result, Ukraine will no longer be a transit country for Russian gas and, most likely, oil in the coming years. Under these circumstances, the country will have to find a new place in the EU energy system and find new sources of fuel supply. Ukraine's gas storage facilities are the largest on the continent. They can help our European partners survive the most difficult periods of the winter season. In addition, Ukraine is already discussing possible options for supplying natural gas and increasing oil imports from the western and southwestern directions. The Polish, Slovak, and Hungarian gas transmission networks may in the future open up opportunities for Liquid Natural Gas (LNG) supplies to Ukraine, from ports on the Adriatic and Baltic Seas. Representatives of the Gas Transmission System Operator of Ukraine have previously announced their intention to start importing gas from Azerbaijan, and this year the company discussed the possibility of receiving LNG from Greek and Turkish ports. However, this requires the restoration of the Trans-Balkan Corridor's full operation, which requires agreements between Kyiv, Chisinau, Bucharest, and Sofia, as well as interest in the project from respective capital.¹⁹

The biggest challenge in the energy sector for Ukraine today is the need to counter Russian attacks. The response to this challenge requires urgent action. The Russian army has temporarily occupied territories with significant electricity generation capacity as well as fossil fuel deposits. These include the largest nuclear power plant in Europe, Zaporizhzhia Nuclear Power Plant, thermal power plants in the Donetsk and Luhansk regions, and the Kakhovka Hydroelectric Power Plant. In addition, the largest alternative energy capacities in Ukraine are concentrated in the Dnipro, Mykolaiv, Kherson and Zaporizhzhia regions. Some of them are located in the temporarily occupied territory. This situation is worsened by the fact that 30-40% of renewable energy power plants in the southern and eastern regions of the country were damaged.

During the first stage of the war after February 2022, the invading forces often directed their rocket and artillery fire at oil and gas storage facilities and

¹⁹ Delivering the European Green Deal. <https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/delivering-european-green-deal_en>.

enterprises, in particular in Kremenchuk, Odesa, Zhytomyr, Lviv and other cities. This created shortages, particularly on the petrol market in Ukraine. Since September 2022, Russian troops have launched repeated massive attacks on the country's power plants and distribution networks. According to the Ukrainian authorities, as of the end of November 2022, about 50% of Ukraine's energy infrastructure was damaged. The head of Ukrenergo, Volodymyr Kudrytskyi, noted that almost every thermal power plant, hydroelectric power station and hub substation in the country sustained damage. The systematic attacks by Russian troops have exhausted their stock of spare parts and equipment for repairs. At the same time, the destruction of facilities by air strikes not only disrupts electricity supply to households and businesses, but also hampers the supply of water and heating as well as communications. In addition, all of Ukraine's nuclear power plants are in a dangerous situation, as they remain de-energized due to damage to the grid. This poses a threat not only to Ukraine but also to other countries. It should also be remembered that the Russian occupiers are using the seized Zaporizhzhya NPP to blackmail and terrorize the population of Ukraine and the whole of Europe.

V. SWOT-analysis of the energy sector of Ukraine

In 2021, the Cabinet of Ministers of Ukraine adopted the Energy Security Strategy of Ukraine until 2025 [16], which is closely linked to successful EU integration and synchronization of Ukrainian legislation with the European one. In addition, the strategy identifies the main threats to Ukraine's energy security, including the certification of Nord Stream 2, obsolete energy infrastructure, and a significant share of energy imports.

This Strategy is a component of the national security system, a strategic planning document. It contains an analysis of threats to energy security with the determination of their criticality, identifies priorities for ensuring energy security, describes strategic choices, goals and objectives aimed at preventing situations that could potentially pose threats to Ukraine's energy security.

The purpose of the State policy of Ukraine in the field of energy security is to ensure the protection of national interests in the field of 1) ensuring access to reliable, sustainable, affordable and modern energy sources for all consumers, 2) in a technically reliable, safe, cost-effective and environmentally acceptable manner, 3) under normal conditions and in crisis situations, 4) exclusively within the limits and in the manner prescribed by law. This Strategy has been developed in order to ensure a balance between the economic, social and environmental dimensions of Ukraine's sustainable development.

The current unsatisfactory technical condition of the fuel and energy sector, and the low level of energy efficiency, pose challenges to Ukraine's ability to fulfill its international obligations and adapt to ambitious EU initiatives, in particular the European Commission's European Green Deal.²⁰ The introduction of the carbon footprint concept by the EU will be a requirement for the Ukrainian economy to be included in the EU's overall production chain. In the future, mechanisms may be introduced to restrict access to credit financing for certain commercial projects if certain environmental requirements are not met.

Ukraine's nuclear industry is still critically dependent on resources, technologies and services from suppliers in the Russian Federation. Domestic uranium mining companies are in a financial crisis, and require significant investments to increase production. Nuclear power plants have to continue implementing measures to ensure their safe operation, and are in need of urgent upgrades, in particular to improve their technical characteristics. Decisions must also be made on the construction of new power units.

Uncoordinated actions of the entities in the energy sector management system pose a potential threat to the functioning of the management system and coordination of the State's actions to implement its energy policy. There are constant changes in the legal framework, functions and powers of the authorities when it comes to formulating energy policy. The adopted regulations are not always in line with the overall national security priorities. The State should play the role of an effective owner that sets clear and coherent tasks and directions for State-owned companies.

Structuring and analyzing the threats identified in the Energy Security Strategy make it possible to conduct a SWOT analysis of the energy sector of Ukraine (Table 2).

Taking into account the threats to Ukraine's energy sector, the Strategy sets the following tasks: to stop importing energy resources from Russia and Belarus, to physically separate Ukrainian power grids from Russian and Belarusian ones, and to synchronize the operation of the United Energy System of Ukraine and European operators.

The Strategy provides for: independence of the State in developing and implementing domestic and foreign policy in the energy sector; reducing Ukraine's dependence on energy imports; ensuring the diversification of energy resources and energy-saving technologies; stimulating the increase in domestic natural gas production; support for public-private partnership instruments to ensure national energy security.

²⁰ Delivering the European Green Deal. <https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/delivering-european-green-deal_en>.

Table 2. SWOT-analysis of the energy sector of Ukraine

<p style="text-align: center;">S – strengths:</p> <ul style="list-style-type: none"> • The presence of significant coal and gas reserves in Ukraine, which makes it possible to meet the country’s energy needs; • High potential for the development of renewable energy in Ukraine, in particular solar and wind energy; • Availability of nuclear energy production facilities that can be used to ensure sustainable energy security; • Availability of specialized companies that can provide services for the extraction, transportation and storage of energy resources 	<p style="text-align: center;">W – weaknesses:</p> <ul style="list-style-type: none"> • Outdated equipment and technologies in the energy sector, which leads to low production efficiency and increased energy costs; • Dependence on gas imports, which leads to higher import costs and reduced energy security of the country; • Lack of sufficient infrastructure for transportation of energy resources, which leads to low accessibility for consumers and increased transportation costs; • Insufficient regulatory framework and transparency of management in the energy sector, which leads to insufficient competition and inefficient use of resources
<p style="text-align: center;">O – opportunities:</p> <ul style="list-style-type: none"> • The development of renewable energy can help reduce dependence on imports and ensure the sustainability of the energy sector; • Increasing the efficiency of energy production and reducing energy costs through the use of modern technologies and infrastructure improvements; • Developing cooperation with energy producing countries to ensure stability of supply and reduce import costs; • Increasing transparency of management and regulation in the energy sector to ensure efficient use of resources and stimulate competition 	<p style="text-align: center;">T – threats:</p> <ul style="list-style-type: none"> • Full-scale military aggression of the Russian Federation against Ukraine, which led to the severance of diplomatic and foreign trade relations between the two countries; • Increase in prices for imported energy resources, which leads to higher costs and reduced competitiveness of the country; • Low level of investment in the energy sector, which leads to a decline in development and lagging behind modern technologies and trends; • Changes in climate conditions and environmental safety requirements, which may lead to restrictions on the use of traditional energy sources and the need to switch to more environmentally friendly energy solutions

Source: developed by the author (based on Strategiiia energetychnoi bezpeky [Strategy of energy security] (2021). <<https://zakon.rada.gov.ua/laws/show/907-2021-%D1%80#Text>>).

The Strategy also envisages: independence of the State in the formation and implementation of domestic and foreign energy policy; ensuring the realization of national interests, which in practice means, in particular, preventing Ukraine’s increasing dependence on external suppliers; ensuring an appropriate level of diversification of energy resources and technologies; increasing domestic production of natural gas and other types of energy

resources; introducing effective mechanisms of public-private partnership to ensure energy security.

Taking into account external and internal challenges and threats to energy security, the following likely forecast scenarios of changes in the energy sector were developed, and their impact on the implementation of strategic choices in the medium term identified namely: a “no change” scenario (preservation of current trends and state of affairs); an “unfriendly influence” scenario (no systemic changes in energy policy combined with escalation of aggression by the Russian Federation); and a “positive transformation” scenario (targeted efforts aimed at achieving the goals set out in this Strategy).

Below is a scheme showing the possible scenarios and events that could likely develop in the energy sector of Ukraine, according to the specific developed scenarios. The most likely events are shown in the respective blocks, albeit not all of them (Fig. 2).

The following main points were taken into account when developing these three scenarios: historical preconditions and potential for the development of the energy sector of Ukraine and the current condition of the energy sector and threats of physical destruction and political influence from the Russian Federation. Fluctuations in energy imports to Ukraine can have a serious impact on the country’s economy and national security. The following possible ways of energy import substitution for Ukraine are proposed.

Development of renewable energy: Ukraine has significant potential for wind, solar, and hydropower development that is not yet fully utilized. To achieve this goal, it is necessary to create favorable conditions for investors, ensure government support, and develop research and development in this area.

Development of energy efficiency: Ukraine is one of the countries with the highest energy consumption per unit of GDP, which means that much of the energy is used inefficiently. Fostering energy efficiency can reduce energy consumption and help replace it with wind and solar energy.

Development of the oil and gas industry: Ukraine has significant potential to develop its own oil and gas industry. In particular, it is possible to extract gas from shale deposits, which could help reduce dependence on gas imports.

Development of alternative energy sources: Ukraine has the potential to develop biomass energy, which can provide energy from agricultural and forestry waste. It is also possible to use geothermal energy, which is obtained from deep rocks.

Diversification of energy import sources: Ukraine could foster cooperation with other countries to diversify its energy imports. For example, it could consider cooperation with Central and Eastern European countries, as well as with countries with significant coal and oil reserves.

Development of energy infrastructure: Ukraine has the opportunity to develop its energy infrastructure, which can help ensure reliable energy supplies and reduce dependence on energy imports. For example, it is possible to develop electricity transmission networks, increase the number of energy storage facilities, and create new gas pipeline networks.

Developing energy self-sufficiency in the regions: Ukraine could encourage the development of internal region based energy self-sufficiency, which would help reduce dependence on centralized energy supplies and ensure an even distribution of energy resources. For example, local energy companies could be created to produce energy from wind and solar power plants or biomass plants.

Figure 2. Possible scenarios for the development of Ukraine’s energy sector, taking into account its current condition and external threats from the Russian Federation

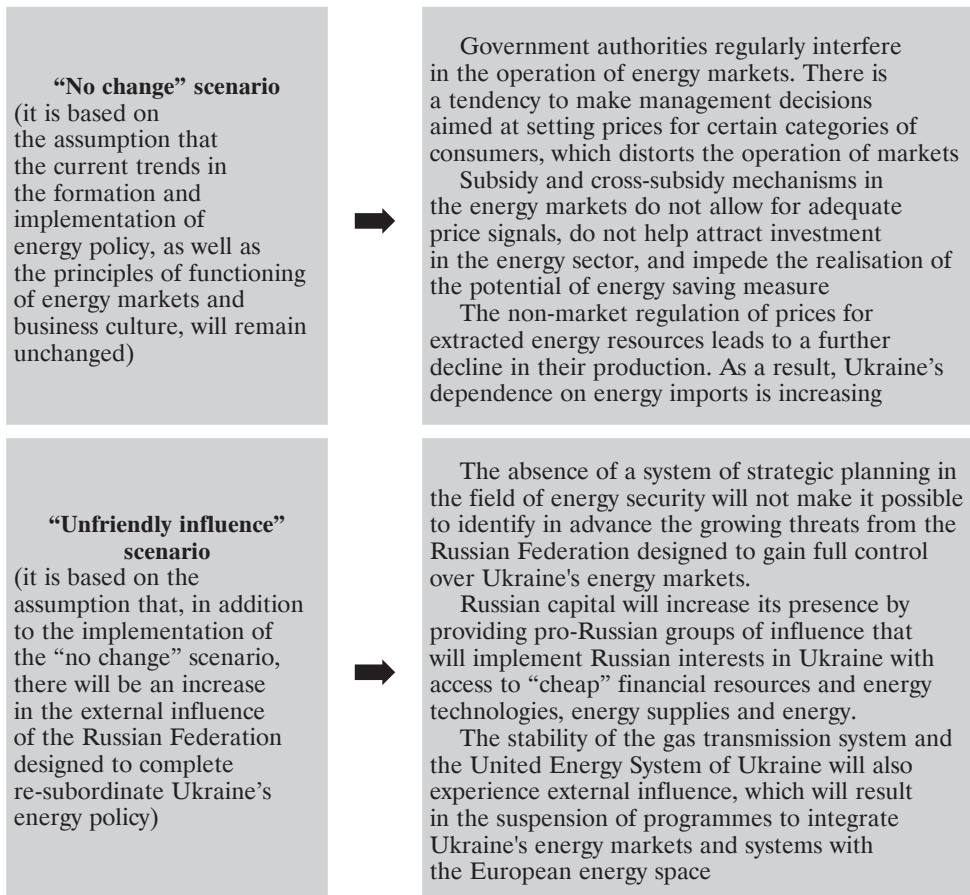
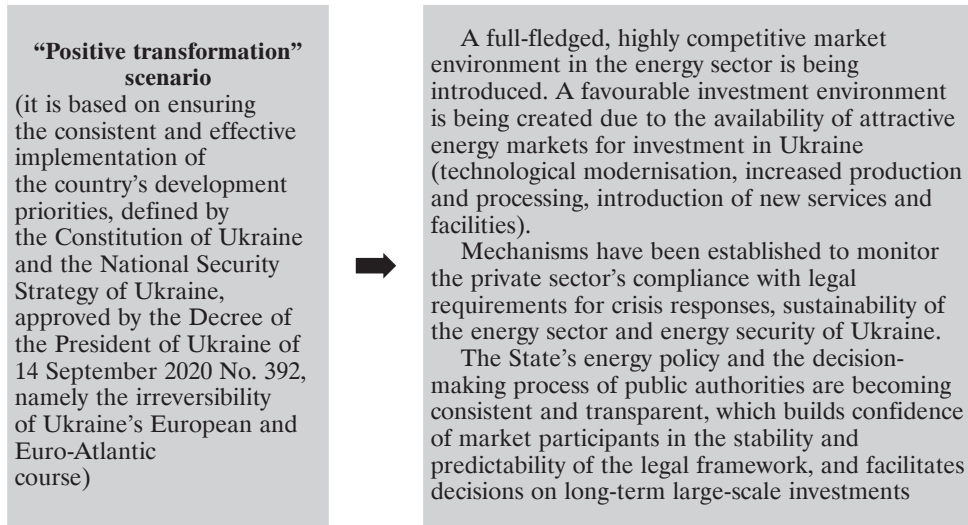


Figure 2 – cont.

Source: Author’s own elaboration.

Overall, energy import substitution is an important goal for Ukraine, given its dependence on energy imports. The development of renewable energy, energy efficiency, and diversification of import sources are key factors that can help Ukraine achieve this goal. The growing role of renewable energy and the reduction of energy consumption, which is responsible for a large share of imports, will allow Ukraine to reduce its dependence on foreign suppliers and ensure the stability of its energy system. Diversification of import sources, including cooperation with different countries and attracting the interest of new suppliers, will reduce political and economic risks. Finally, the development of energy infrastructure and regional energy self-sufficiency can help Ukraine ensure the sustainability of energy supplies and stimulate the development of local economies. The proposals under consideration, which include the development of renewable energy, energy efficiency, diversification of import sources, development of energy infrastructure and regional energy self-sufficiency, can help Ukraine achieve energy import substitution and ensure the country’s energy security.

VI. Practical value of the research

The practical value of the research findings is that the SWOT-analysis of the energy sector of Ukraine made it possible to identify the most acute problems and threats that have a negative impact on the energy sector of Ukraine, and its integration into the European common energy system. Based on the results of this SWOT-analysis, three potential scenarios for the development of Ukraine's energy sector are proposed: a "no change" scenario (continuation of current trends and state of affairs); an "unfriendly influence" scenario (no systemic changes in energy policy combined with the escalation of aggression by the Russian Federation); and a "positive transformation" scenario (targeted efforts aimed at achieving the goals set out in this Strategy). The following possible ways of energy import substitution for Ukraine are suggested: development of renewable energy; development of energy efficiency; development of the own oil and gas industry; development of alternative energy sources; diversification of energy import sources; development of energy infrastructure; developing energy self-sufficiency in the regions. Thus, the practical significance of this study lies in the development of practical tools for analyzing the energy sector of Ukraine, and providing a number of recommendations for its future development in the context of its integration into the single European energy system.

VII. Conclusions

Thus, energy security is crucial for Ukraine for several key reasons. Ukraine is located between Russia and Europe, and has an important transit corridor for transporting energy, particularly natural gas, from Russia to Europe. This gives Ukraine a strategic role in the supply of energy to Europe, but also makes it vulnerable to possible restrictions or cuts in this transit. Ukraine is heavily dependent on energy imports, particularly natural gas and oil. Imports of energy resources make the country vulnerable to changes in global energy markets and political decisions of suppliers. In the past, Ukraine has faced problems with some energy importers, in particular Russia. Political conflicts and disputes between these countries may result in restrictions on the supply of gas and other resources.

Ukraine has significant potential to improve energy efficiency and develop renewable energy sources. Ensuring its energy security requires developing these areas to reduce dependence on imports. Ensuring a sustainable and

reliable supply of energy is essential for the country's economic development. Lack of energy, or its high cost, can negatively affect the competitiveness of businesses and the lives of citizens. Energy security is also important for national defense. Providing the necessary resources for the army and other critical infrastructure is of vital importance in the event of a conflict or threat. All of these factors make energy security extremely important for Ukraine, and the country is actively working on various measures to improve its energy resilience and independence.

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