

## THE TRENDS OF UKRAINE ENERGY STRATEGY DEVELOPMENT IN THE CONTEXT OF ENERGY SECURITY

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**Abstract.** *Developing an energy policy is a long term challenge. This needs a clear but flexible framework: clear in that it represents an approach endorsed at the highest level, flexible in that it needs periodic updating. This allows stocktaking, monitoring progress and identifying new challenges and responses on all aspects of energy policy. The purpose of the research is to investigate the current trends of Ukraine energy strategy development in the context of energy security and identify promising development directions. This paper is based on the traditional methods of scientific knowledge: analysis and synthesis – in identifying energy strategy development in the context of energy security; comparison and compilation – to analyze the experience of Ukraine energy strategy development; statistical method – trends of Ukraine energy strategy development; scientific support methods – to summarize and to formulate conclusions on priority of the Ukrainian state energy policy for providing energy security. These approaches allow to allocate the challenges and opportunities for Ukraine to develop energy sector, to achieve the goals of Energy Strategy of Ukraine until 2035. The article provides the current development trends of the energy strategy of Ukraine in the situation of integration into the European energy environment. Based on the study, measures are proposed in Ukraine's energy policy to ensure energy security, which implies diversification of routes and sources of energy resources and technology, a sharp improvement in the effective use of resources, development of renewable energy, a new model for the functioning of the coal industry, integration of energy markets of Ukraine and the European Union, sustainable development of the energy sector.*

**Keywords:** *energy strategy, energy security, energy resources.*

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**Introduction.** Ukrainian energy sector is the base of the national economy. In terms of taxes paid, this industry is a real locomotive. In 2019, the state budget received from the energy sector about UAH191.6 billion in tax payments, which is 21.7% of the total volume [1]. The national joint-stock company “Naftogaz of Ukraine” alone has a share of 8% in Ukrainian GDP, while the electricity market takes up about 6%. Ukraine's United Energy Grid is Europe's sixth largest following Germany, France, Italy, Spain and the UK. Near 450,000 specialists work in Ukraine's energy sector, accounting 3% of the employed population, and that's excluding related industries. Today this foundation needs a very serious modernization. And, of course, Ukrainian energy sector is a driver for the development of different branches of industries, just like the development of different branches of industries is something that affects the energy sector. Modern and competitive energy sector is an integral part of the developed national economy of Ukraine.

The energy intensity of the Ukrainian economy is one of the highest among the European countries. If this is not changed, Ukraine's economy will not be able to become effective in the modern world. Therefore, it is extremely important that country works towards reducing energy consumption. In addition to the global impact

on the economy, energy efficiency has a significant multiplier effect: the development of various sectors of national economy and science, spread of new technologies, and creation of new jobs and specialties. According to preliminary calculations, each hryvnia invested in energy efficiency creates another four in the economy.

It is extremely important for Ukraine to finally get rid of the status of natural gas importer. Ukraine has colossal potential in this regard. Ukraine has a strong agrarian sector, so biomass that is amassing can be used as a source of energy. In this case, economy will use Ukrainian resource without needing to spend foreign currency on imported natural gas. The search and development of the use of new energy sources alternative to natural gas are among the key tasks for achieving energy independence. It is worth mentioning that Ukraine was one of the pioneers and world leaders in hydrocarbon production: in the 1970s, the record natural gas output in Ukraine was at 68.7 billion cubic meters (bcm). Since then, gas and oil production has been constantly decreasing, until 2016, when the trend finally reversed. In order to promote self-sufficiency in natural gas production in Ukraine, it is necessary to approve the bill amending certain legislative acts of Ukraine on the facilitation of some aspects of the oil and gas industry, which should reduce a number of duplicated bureaucratic procedures, accelerate the acquisition of land for oil and gas extraction, will reduce rental rates for new wells down to 12%. A revolutionary boost in the production of Ukrainian hydrocarbons is a key issue not only for Ukraine's energy independence, but also for the country's national security and strategic development.

The current reform of the Ukrainian energy sector allows to talk about following European trends. If we talk about specific things, then these are reforms in the field of electric power industry and primary energy resources – natural gas and thermal coal. Reform of the gas sector began in early 2015. A fundamental reform was the introduction of secondary legislation on the natural gas market, which is recognized throughout the world. Also a regulatory framework was created that allows to attract investment and improve the quality of service for consumers. At the same time, in 2018, reforms in the gas sector have slowed. It has not yet been decided to conduct an anbanding of National joint-stock company “Naftogaz of Ukraine”. The government-approved search plan for the partner company to manage the gas transportation system is not being implemented. The deadline for starting the daily balancing was postponed due to disagreements between the the National Commission, which performs state regulation in the energy sector and utilities (regulator) and Public Joint Stock Company “Ukrtransgaz”.

Talking about the production of electricity – it is a systematically prepared base of by-laws under the new law “On the Electricity Market of Ukraine”. At the same time, the market reform of the European model was carried out in 2019. The problem of debt restructuring and the problem of cross subsidizing have not yet been resolved at the legislative level. Without this, the full functioning of the electricity market is impossible.

In the direction of electrical networks, a regulatory framework was developed for the introduction of incentive tariff formation (RAB, Regulatory Asset Base),

purchase and sale agreements (PPA, Power Purchase Agreement) were approved, which meet international standards and significantly increase the interest in the alternative energy sector, investment in renewable energy. Introduction of guaranteed power quality standards is also noteworthy. These standards today give consumers the right to material compensation in case of poor quality services.

**Literature review.** Energy security is one of the most important components of the economic security of any country and affects the phenomena and processes of not only the energy system, but also the economy. It is defined as the protection of citizens and the state as a whole from the threats of the deficit of all types of energy and energy arising from the influence of negative natural and man-made, managerial, socio-economic, internal and foreign factors.

In accordance with the Yergin [2], the current model of energy security, which was born out of the 1973 crisis, focused primarily on how to handle any disruption of oil supply from producing countries. Today, the concept of energy security is expanded to include the protection of the entire energy supply chain and infrastructure.

Kalicki and Goldwyn [3] define energy security as “ensuring access to energy resources necessary for the progressive development of national power”.

Energy security as one of the most important components of economic security manifests itself, firstly, as a state of ensuring the state of fuel and energy resources that guarantee its full functioning and, secondly, as the state of security of the energy complex, first of all – nuclear energy, and the ability energy to ensure the normal functioning of the economy, energy independence of the country. Political and energy independence are interdependent [4].

Different approaches characterize attempts to develop analytical tools for assessing the level of threats and the state of energy security, which prevents the precise definition of the subject field and the scope of the use of the concept of energy security.

The European Commission gives a definition to energy security as security of energy supply, an integral part of the Energy Union strategy. Energy supplies are exposed to risks that include disruption from countries from which the EU import fuel but also extreme weather events, industrial hazards and terrorism and hybrid threats. By working together to prevent and to manage potential crises, the EU and its member countries can make the European energy system more resilient. Solidarity and regional cooperation, as well as speaking with one voice internationally when dealing with supplier countries, are key to this [5-9].

According to Khatib et al. [10], energy security is the continuous availability of energy in varied forms, in sufficient quantities, and at reasonable prices.

International Energy Agency's website [11] defined 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.

Unfortunately, in these definitions one can notice a certain narrowing and blurring of the concept of "energy security", because, firstly, in this formulation does not specify the object and subject of energy security, that does not allow to determine the objectives of the strategy of ensuring energy security and to work out concrete means to achieve these goals. Secondly, there is no indication of the cause of threats to energy security, which can have economic and political, social, natural, technological, technological character. Thirdly, such interpretations do not include additional inclusion in the concept of energy security factors that take into account the role of fuel and energy complex in the country's economy.

Denchev [12] notes that there is a difference in the priorities of different groups of countries in the field of energy security. For importing countries, this is first of all ensuring the reliability of their energy supply, diversifying sources of energy supply, ensuring the security of energy infrastructure, introducing new technologies for reducing dependence on energy imports. For exporting countries, this is to consolidate strategic markets at economically advantageous prices, secure capital and finance investment in infrastructure and resource development.

In summary, the author point out that all these approaches complement each other and are based on several approaches in which energy security is seen as:

- state of protection of citizens, society, economy from the threats of unsatisfactory energy supply;
- the state of protection of interests (national, state, public) in the energy sector;
- state of power supply systems (in particular, fuel and energy) in different conditions.

There are various approaches to the definition of interconnection, interdependence of basic and specific concepts of safety, and energy security, in particular in the scientific literature. In our opinion, it is necessary to investigate the problem of developing its own Ukrainian model of an active strategy for ensuring energy security that actualizes the problem of comprehension of its systemic, structural, functional properties and hierarchical characteristics.

It is necessary to recognize the lack of a common understanding of the concept of "energy security" in Ukraine and abroad. Only in our country today there are a number of fundamentally different interpretations of the concept of "energy security". This circumstance greatly complicates the unification of efforts of national science, higher education, business entities and state administration bodies to form an effective strategy for ensuring Ukraine's energy security. The most possible reason for such diverse voices is the insufficient development of the theory of energy security, the methodology of its study and provision. The explanation of the intrinsic properties and specific characteristics of energy security is greatly complicated by pluralism in understanding and understanding the scientific apparatus through which they express themselves.

Aspects of energy strategy development in the context of energy security were thoroughly researched by numerous scientists who comprehensively covered the trends in energy strategy. So, Gonzalez and Bobrov [13] compared EU and Ukraine Security of Energy Supply. Lyubashenko [14] identified integration problems of

energy markets of Ukraine and the European Union. Sukhodolia and Bobro [15, 16] investigated the part of Ukrainian energy security police, in particular, system of physical protection of critical infrastructure. Sendich [17], Zachmann [18], Jason and Cantos [19] explored the various issues of energy security. Pirani [20] noted issues of gas market reforms. Logatskiy [21] noted the new challenges, market conditions of Ukrainian energy sector. Radeke and Naumenko [22] noted the regulation and ways promoting energy efficiency improvements. Lakyda and Geletukha [23] identified the energy potential of biomass in Ukraine.

**Aims.** The purpose of the research is to investigate the current trends of Ukraine energy strategy development in the context of energy security and identify promising development directions.

**Methods.** This paper is based on the traditional methods of scientific knowledge: analysis and synthesis – in identifying energy strategy development in the context of energy security; comparison and compilation – to analyze the experience of Ukraine energy strategy development; statistical method – trends of Ukraine energy strategy development; scientific support methods – to summarize and to formulate conclusions on priority of the Ukrainian state energy policy for providing energy security. These approaches allow to allocate the challenges and opportunities for Ukraine to develop energy sector, to achieve the goals of Energy Strategy of Ukraine until 2035.

**Results.** The strategic importance of the Ukrainian energy sector is due to the volume of attracted resources and their decisive influence on the country's economic and political system. Over the past 29 years, several attempts have been made to reform the Ukrainian energy sector in accordance with the requirements of the times and political priorities. But, despite the length of the processes, they have not yet the expected results.

The weaknesses of Ukraine's energy sector since independence in 1991 shine a spotlight on the foundational link between energy security and national security. Talking about energy efficiency, Ukraine has one of the last place in Europe.

By that time, Ukraine rejected all logically consistent options for reforming the energy sector, which are market liberalization with the transition to market pricing for all categories of consumers; opening markets and attracting investors' financial resources while maintaining strong state-owned energy companies; maintaining a centralized management system and energy assets under state control.

In this case, a model of partial privatization was chosen, while preserving the possibilities of state regulation. The solution was based on the following:

- the state establishes subsidized prices for the population and compensates for the difference in prices, offsetting the losses of energy suppliers;
- the state controls the expenditure of energy companies by limiting their ability to invest in the development of new energy infrastructure and to modernize the existing one;
- the state introduces a “cost-based” methodology (actual costs plus an allowable level of profitability) in tariff and pricing.

Such a model, firstly, stimulated energy suppliers to overstate costs, expenditures and losses as it increased the amount of compensation received from the state, secondly, leveled the interest of companies in implementing energy saving measures and improving the energy efficiency of technological processes as it guaranteed the receipt of resources depending on actual costs.

The situation was complicated by continuous state interference in the functioning of markets and multilevel tariffs established for various categories of consumers and energy producers, which provided unfair suppliers with an additional opportunity to manipulate, especially given the lack of accounting.

The long time absence of positive shifts in the development of competitive markets, the increase in the energy efficiency of the economy, the use of its own energy potential, and diversification of sources and routes of energy supplies predetermined the critical vulnerability of the Ukrainian energy sector in the face of external and internal risks. Political changes in 2014 turned these risks into threats to the stable functioning of the national economy and the existence of Ukraine as a state. A direct consequence of this was the need to create a new vision of the energy security policy.

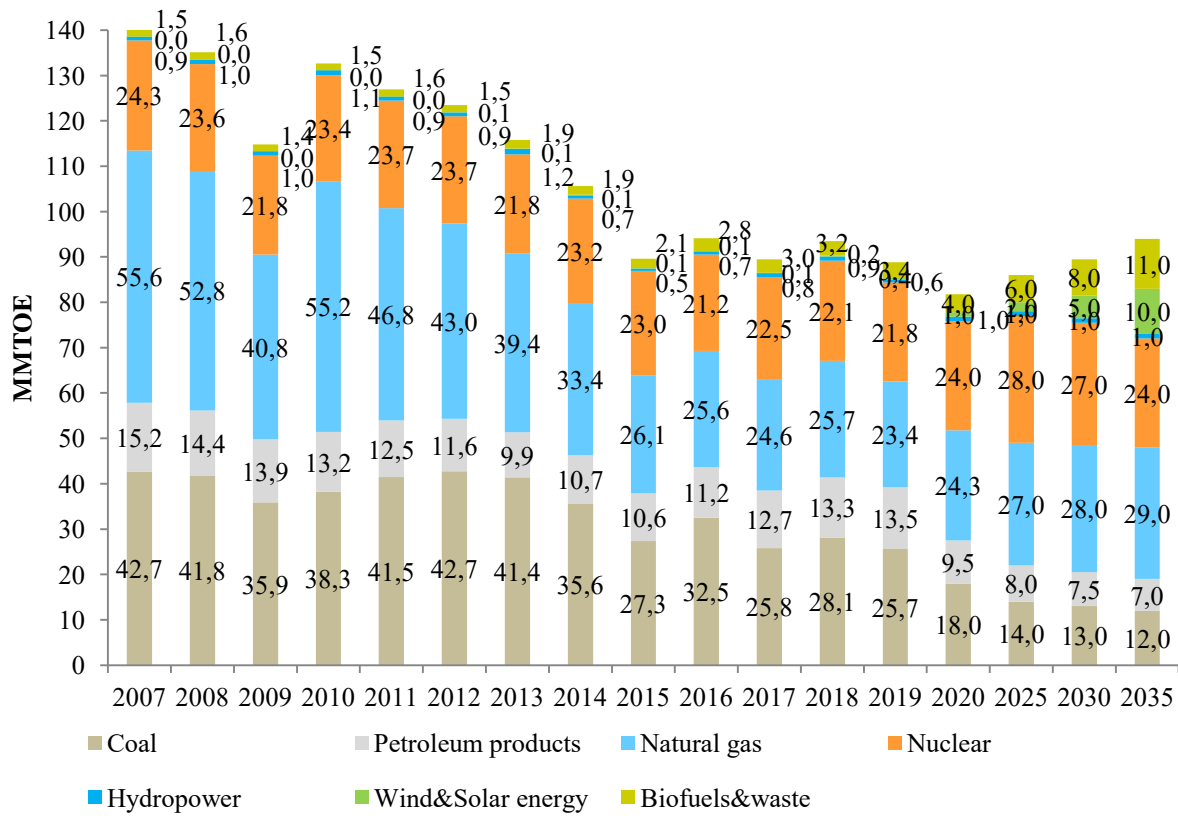
The transforming Ukraine's energy sector from being a drag on its economy and national security into a positive enabling force will require both well-designed plans and sound implementation pathways that can be sustained. Proceeding without due planning and preparation poses risks of creating ill-conceived market structures or regulations and negative unintended consequences. Proceeding after excessive deliberation, however, allows opponents of reform to marshal their political forces and obstruct needed change. The challenge for Ukraine is to navigate between these counterposed hazards.

In 2017 the Cabinet of Ministers of Ukraine adopted Energy Strategy of Ukraine for the period until 2035 [24]. This updated document was much needed. The document defining the state's main strategic goals in the energy sector is one of the cornerstones of the clear setting of state priorities in energy policy in general. Intensive reform of the energy sector is long overdue and, if compared with previous energy strategies of Ukraine, is rather progressive and outlines a number of positive changes.

The main goals declared in the Energy Strategy were: liberalization of markets, establishing effective regulation and, as a result, attracting investors to the economy's energy sector.

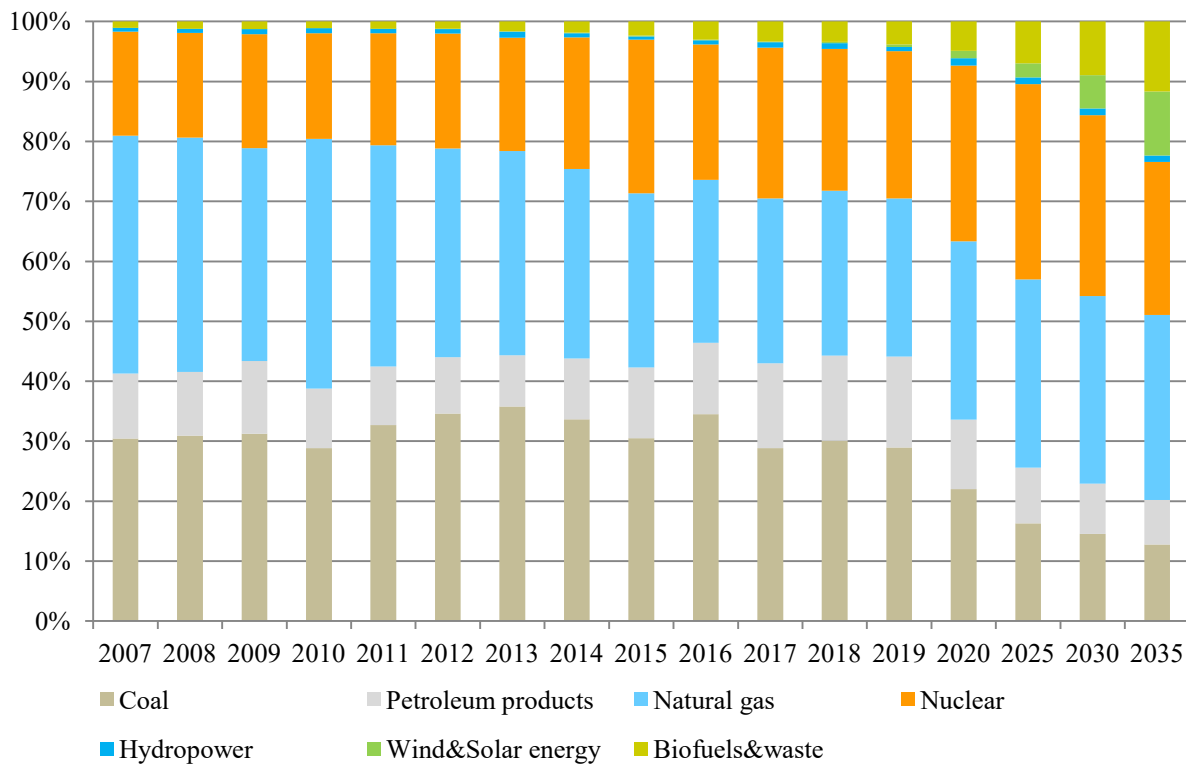
Figures that's situated below, present the current structure of the primary energy supply according to the energy balances of Ukraine from 2007 to 2019 and the forecast till 2035. Figure 1 shows the general structure of primary energy supply in actual terms, in million tons of oil equivalent. Figure 2 shows the percentage of each source of primary energy supply in percent.

Sustainable development of the national economy requires reliable and stable energy supplies at affordable prices. The fulfillment of this task requires responding to challenges that threaten of current energy security.



**Fig. 1. General structure of primary energy supply in actual terms (2020-2035 - forecast)**

Source: Compiled by author based on information from State Statistics Service of Ukraine.



**Fig. 2. Percentage of each source of primary energy supply**

Source: Compiled by author based on information from State Statistics Service of Ukraine.

The key is the unsatisfactory state of Ukraine's energy sector, which is constantly deteriorating due to the moral and physical aging of fixed assets. Most of the power generation assets and networks are worn out and ineffective. The overwhelming majority of thermal power plants' units require modernization or replacement, a significant part of the trunk and distribution networks have worn out their resources. Emissions of dust, sulfur oxides and nitrogen by thermal power stations exceed the corresponding norms of developed countries.

Current models of energy markets do not allow to solve even the modern problems. Despite the adoption of the laws of Ukraine "On the Electricity Market of Ukraine" and "On the Natural Gas Market" both markets remain disorganized.

None of the remaining oil and gas refineries in Ukraine is able to compete with enterprises in the neighboring countries and has the resources for large-scale reconstruction. The share of imported oil products is close to 80%, while the share of motor fuel produced in Russia and from Russian raw materials in the Republic of Belarus, Lithuania, and Poland exceeds 80% (\$4,5billions in money terms) in the import structure.

The problem of a single nuclear fuel supplier for nuclear power plants is particularly solved. The current model of tariff formation does not allow to form a sufficient investment resource. The extension of the life of nuclear power plants, the management of spent fuel and radioactive waste also require the significant financial injections.

The occupation of part of Ukrainian territory led to the dependence of coal imports. The deficit of coal had a negative impact on the economy, proving the imperfection of the national energy security system. Given the excess of the installed capacity in Ukraine, the deficit of the maneuvering capacity continues to grow. The lack of energy during the peak periods of consumption reaches 3 GW. The gap between consumption and production of electricity increases, in this way dependence in the balancing increases too.

Despite significant problems with energy security, the tasks of increasing energy efficiency have not become sufficiently important. There are stereotypes in society about the presence of an excess of cheap energy. The population expects that the state will subsidize all energy costs in the future. At the same time, business entities do not see the need to introduce high energy conversion technology, since they use the "cost-based" methodology of pricing and tariffs. This violates the market balance between different types of energy resources and sources of energy supplies, weakening the competitiveness of national producers in the world market.

These challenges require the state to ensure sustainability of energy supplies without switching to manual regulation in the event of the slightest problems. Situations where the normal functioning of markets is interrupted for a long time after the announcement of the next emergency measures in the energy sector should not become common practice.

Proceeding from the foregoing, Ukraine requires the transition to a new model for ensuring energy security and developing the energy sector.



Ukraine continues to demonstrate the movement towards integration into the European energy environment. Thus, most of the systemic issues were subject to legislative approval – laws were adopted on the electricity market, on environmental impact assessments, and on a package of energy-efficiency measures. The issue of the minimum reserves of oil and oil products, the issue of transparency in extractive industries, a strategic environmental assessment, as well as the new wording of the Subsoil Code were unchanged with regards to legislation.

The international structures, primarily the European Commission, the IMF, the EBRD and the World Bank, as well as the Energy Community Secretariat, act in a coordinated manner and retain their influence. Despite talk of “Ukraine fatigue” key partners have maintained a high level of attention and interest in the transformation of energy markets in Ukraine.

The trend of the last years was the disclosure of more information and data – both proactively disclosed by certain state bodies (the Ministry of Energy, the NEURC), and in such fundamental issues as budget transactions, public procurement, and the management of state-owned enterprises. New rules harmonized with European accounting and financial reporting rules, implemented.

There is an attempt to systemize and improve the process of European integration. Thus, the Government Office for the Coordination of European and Euro-Atlantic Integration has actually been re-established, a new plan for the implementation of the Association Agreement has been adopted, and a new procedure for its monitoring by means of so-called “scorecards” has been developed.

In the understanding of the author, during the process of implementing the Association Agreement in the areas of energy and environment, the old challenges became apparent and a number of new ones appeared.

Manipulations within the already-adopted framework laws became a serious problem, when the principles and norms introduced by them were distorted at the regulatory level. In 2018 for more than a year the President, the Verkhovna Rada and the Cabinet of Ministers had been unable to create a committee for the selection of new NEURC members, as a result the work of the Regulator has been paralyzed for 1.5 months. Several “attacks” were made on the ProZorro system involving the parliament under cover of the fight against cyber-threats or in the interests of the “national producer”. Also, a package of energy-efficiency laws, the legislation in heat metering, lacks high-quality by-laws.

Obstacles in the discovery of information and the lack of transparency in the early stages of documents’ development became another challenge.

On the other hand, the sophisticated navigation on official government web resources may also conceal important details about energy markets for engaged domestic consumers. For an example, updates on the site of the Cabinet of Ministers led to the disappearance of information about certain implementation plans.

There are significant delays with the publication of adopted documents. Acting of individual regulatory legal acts sometimes continues even after their formal adoption. This is what happened with the Plan for the implementation of the Association Agreement, the National Plan for Reducing Emissions from Large

Combustion Plants, and the Action Plan for the Implementation of Energy Management Systems at Budgetary Institutions.

Similar violations of procedures for the adoption of Government documents, or a failure to comply in practice with the provisions of the law, are the consequences of “frozen conflicts” inside the executive branch. Such conflicts occur because of the various interests of the agencies or individuals involved, conflicts which may be personal in nature, or through the lack of communication between the apparatus and advisory groups that are empowered to develop draft decisions.

The system of coordination of European reforms, despite attempts to change it, has made little progress. The presence of parallel structures for preparing decisions has been preserved, while resources are not invested in raising the level of professionalism, deepening knowledge and, in general, creating a substantially higher capacity for ministries and the Regulator.

**Discussion.** On the basis of the conducted research, author identified that priority of the Ukrainian state energy policy for providing energy security should be the diversification of routes and sources of energy resources and technology, a sharp improvement in the effective use of resources, development of renewable energy, a new model for the functioning of the coal industry, integration of energy markets of Ukraine and the European Union, sustainable development of the energy sector.

**Conclusion.** It is necessary to promote the following directions:

1. Diversification of supplies of resources and technology. Domestic energy was an element of fuel and energy complex of the Soviet Union. Therefore, even having obtained sovereignty, Ukraine is still struggling for its resource, technological and managerial independence.

2. Improving energy efficiency. Although the need for the efficient use of fuel and energy resources is recognized as a priority for sustainable development, there has not been a breakthrough in this direction (in 1990 the level of energy efficiency of the national economy was about 61 % lower than the global one, in 2019 the gap narrowed to about 56%). Thus, no conditions for the formation of conscious energy-efficient society have been created in Ukraine. Since the increase in the efficiency of fuel and energy use is extremely fragmented and almost not stimulated, it does not reflect in the costs of households. As a consequence, the population does not see any sense in changing the habitual way of life. And since consumers are not ready to pay much today for the sake of receiving an uncertain benefit tomorrow, the producers are also not interested in developing, promoting and implementing energy efficient technology and devices.

3. Development of renewable energy. As of January 1, 2020, the total installed capacity of facilities operating under the feed-in tariff was 6.8 GW (excluding those in the temporarily occupied territories). In 2019, they produced 5.5 billion kWh of electricity. Despite this, the share of renewable energy sources in the production structure did not exceed 3.6%.

4. The current political situation stressed the need to rethink the place and role of the coal industry in the national economy. The practice of understating the cost of coal through budgetary subsidies to keep the industry afloat has reached a dead end.

State policy should focus on restructuring the industry, creating viable economic entities and their privatization in the short term. Ukraine has no alternative of the formation of a new model for the functioning of the coal industry based on market conditions of the economy, and the introduction of a competitive market for coal products.

5. Integration of energy markets of Ukraine and the European Union. Having concluded the Association Agreement with the EU, Ukraine has made a decision on the priorities of its development. The principle choice of Ukraine in terms of its full integration into the group of the European nations predetermines the need to form an energy policy that must comply with the EU principles and practices, Ukrainian energy industry should become an integral part of the European energy markets and the system of ensuring the EU's energy security. Systemic work and coordination of efforts of the whole system of public authorities are necessary.

6. Ensuring the sustainable functioning of the energy sector. Taking into account modern challenges, more and more countries call their political priority the ensuring of energy sustainability, which is guaranteed by the systems of strategic reserves, primarily oil reserves; crisis prevention; and critical infrastructure protection. Having concluded the Association Agreement with the EU, Ukraine has undertaken to provide itself with this toolkit.

### References:

1. Rating. Business in official figures. The structure of tax payments in the fuel and energy sector. 02/27/2020. Available at: <https://rating.zone/struktura-podatkovykh-platezhiv-u-palyvno-enerhetychnomu-kompleksi-2/> [in Ukrainian].
2. Yergin D. (2006). Ensuring Energy Security. *Foreign Affairs*. Volume 85, #2, 69-82. Available at: [http://www.un.org/ga/61/second/daniel\\_yergin\\_energysecurity.pdf](http://www.un.org/ga/61/second/daniel_yergin_energysecurity.pdf)
3. Kalicki J., Goldwyn D. (2005). *Energy and Security: Toward a New Foreign Policy Strategy* 604 p. Washington–Baltimore: Woodrow Wilson Center Press, Johns Hopkins University Press.
4. Shidlovsky A. (Ed.) (2001). *Fuel and energy complex of Ukraine on the threshold of the third millennium*. Kyiv, UES [in Ukrainian].
5. European Commission (2014). *Communication from the Commission to the European Parliament and the Council. European Energy Security Strategy*. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0330&from=EN>
6. European Commission (2011). *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on security of energy supply and international cooperation - "The EU Energy Policy: Engaging with Partners beyond Our Borders"*. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52011DC0539&from=EN>
7. European Commission (2014). *Commission staff working document. In-depth study of European Energy Security Accompanying the document Communication from the Commission to the Council and the European Parliament: European energy security strategy*. Available at: [https://ec.europa.eu/energy/sites/ener/files/documents/20140528\\_energy\\_security\\_study.pdf](https://ec.europa.eu/energy/sites/ener/files/documents/20140528_energy_security_study.pdf)
8. European Commission (2018). *Imports and secure supplies*. Available at: <https://ec.europa.eu/energy/en/topics/imports-and-secure-supplies>
9. European Commission (2013). *Report from the Commission to the European Parliament, the Council and the European Economic and Social Committee Implementation of the Communication on Security of Energy Supply and International Cooperation and of the Energy Council Conclusions of November 2011*. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52013DC0638&from=EN>
10. Khatib H., Barnes A., Chalabi I., Steeg H., Yokobori K. (2000). *World energy assessment: energy and the challenge of sustainability*, 111-134. Available at: <http://www.undp.org/content/dam/aplaws/publication/en/publications/environment-energy/www-ee->

library/sustainable-energy/world-energy-assessment-energy-and-the-challenge-of-sustainability/World%20Energy%20Assessment-2000.pdf

11. International Energy Agency (2018). *Energy security*. Available at: <https://www.iea.org/topics/energysecurity>
12. Denchev K. (2010). World energy security: history and prospects. *New and recent history*. #2. 34-77. Available at: [http://www.hist.msu.ru/Journals/NNI/pdfs/Denchev\\_2010.pdf](http://www.hist.msu.ru/Journals/NNI/pdfs/Denchev_2010.pdf) [in Russian].
13. González Arencibia I., Bobrov Y. (2007). *EU and Ukraine Security of Energy Supply. Comparative Analysis*. UNDP Blue Ribbon Analytical and Advisory Centre. Energy Policy Team.
14. Lyubashenko I. (2012). *Ukraine's First Year in the Energy Community: Restart Needed*. Polish Institute of International Affairs. Available at: [https://www.pism.pl/files/?id\\_plik=10131](https://www.pism.pl/files/?id_plik=10131)
15. Sukhodolia O., Bobro D., Butrimas V., Hajek J., Karasov S. (2018). *Hybrid Warfare Against Critical Energy Infrastructure: The Case of Ukraine*. NATO Energy Security Centre of Excellence.
16. Kondratov S., Bobro D., Horbulin V. (2017). *Developing the critical infrastructure protection system in Ukraine*. National Institute for Strategic Studies [in Ukrainian].
17. Sendich E. (2014). *Comparison of International Energy Intensities Across the G7 and Other Parts of Europe, Including Ukraine*. U.S. Energy Information Administration. Available at: [https://www.eia.gov/workingpapers/pdf/international\\_energy\\_Intensity.pdf](https://www.eia.gov/workingpapers/pdf/international_energy_Intensity.pdf)
18. Zachmann G. (2018). *The Clock Is Ticking: Ukraine's Last Chance to Prevent Nord Stream 2*. Bruegel. Available at: <http://bruegel.org/2018/01/the-clock-is-ticking-ukraines-last-chance-to-prevent-nord-stream-2>
19. Healey J., Cantos M. (2015). *What's next for Putin in Ukraine: Cyber escalation?* NATO Cooperative Cyber Defense Centre of Excellence, 153-158. Available at: [https://ccdcoc.org/uploads/2018/10/Ch17\\_CyberWarinPerspective\\_Healey\\_Cantos.pdf](https://ccdcoc.org/uploads/2018/10/Ch17_CyberWarinPerspective_Healey_Cantos.pdf)
20. Pirani S. (2017). *Adversity and reform: Ukrainian gas market prospects*. The Oxford Institute for Energy Studies. Available at: <https://www.oxfordenergy.org/wpcms/wp-content/uploads/2017/03/Adversity-and-reform-Ukrainian-gas-market-prospects-OIES-Energy-Insight.pdf>
21. Logatskiy V. (2017). *New Energy Strategy of Ukraine Till 2035: Security, Energy Efficiency, Competitive Ability*. Razumkov Center. Available at: [http://razumkov.org.ua/uploads/article/2017\\_NES%202035\\_RazumkovCentre\\_Ukraine\\_September%202017\\_description.pdf](http://razumkov.org.ua/uploads/article/2017_NES%202035_RazumkovCentre_Ukraine_September%202017_description.pdf)
22. Radeke, M., Naumenko, D. (2012). *Towards Higher Energy Efficiency in Ukraine: Reducing Regulation and Promoting Energy Efficiency Improvements*. German Advisory Group, Institute for Economic Research and Policy Consulting.
23. Lakyda P., Geletukha G., Vasylyshyn R. et al. (2011). *Energy Potential of Biomass in Ukraine*. Institute of Forestry and Landscape Park Management of the National University of Life and Environmental Sciences of Ukraine.
24. Verkhovna Rada of Ukraine. *Energy Strategy of Ukraine until 2035 "Safety, Energy Efficiency, Competitiveness"*. Available at: <http://zakon.rada.gov.ua/laws/show/605-2017-%D1%80> [in Ukrainian].
25. State Statistics Service of Ukraine (n.d.). *Energy balance of Ukraine 2007–2016*. Available at: <http://www.ukrstat.gov.ua/> [in Ukrainian].

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