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STRUCTURAL FEATURES AND POTENTIAL RISKS FOR THE FUNCTIONING OF THE ENERGY SECURITY SYSTEM OF UKRAINE

СТРУКТУРНІ ОСОБЛИВОСТІ ТА ПОТЕНЦІЙНІ РИЗИКИ ДЛЯ ФУНКЦІОНУВАННЯ СИСТЕМИ ЕНЕРГЕТИЧНОЇ БЕЗПЕКИ УКРАЇНИ

Energy security is one of the essential foundations for the formation of the national energy security system of Ukraine. At the same time, it should also be noted that each state is characterized by a different range of features, needs and prospects in the energy sector, including the specifics of implementation mechanisms, institutional structure, and ways of guaranteeing and implementing them. This diversity is caused by the need to consider a significant number of mandatory needs of the state and its society. Energy security, in essence, involves protecting the state's interests in terms of constant provision of free access to energy resources on the conditions of stability, reliability, economic efficiency, environmental friendliness, and safety. In its turn, the energy security system summarizes these aspects. It systematizes them regarding their overall practical functioning, the role of their participants and management entities, and practical implementation. Taking into account the fact that today Ukraine and the world are undergoing quite intensive changes in terms of economic, technological, social development, political planes, models of formation, and further existence of energy markets of regional, national, and European importance, energy security requires consideration through the prism of systematicity. Thus, the systemic vision of the Strategy of ensuring the energy security of the state allows studying energy security directly as an object for management. According to the study results, it can be concluded that to prevent possible risks to the SSE (security system energy) resulting from the impact of potential threats, it is necessary to organize and ensure the possibility of timely detection of several potential threats. There is a need for an objective risk assessment to prevent deterioration or, if necessary, to restore the energy security system's proper state and the trajectory to improve its condition. From the point of view of the actors of the energy security system, which is an integral part of national security, it is worth focusing on potential threats in general. At the same time, at the level of state authorities, the national policy in the energy and fuel complex should be formed, and attention should be focused on the systemic components of the SSE while identifying potential risks and threats to the processes taking place in the SSE.

Key words: *security, energy security, features of energy security, risks to energy security, the energy crisis in Ukraine.*

Енергетична безпека являє собою одну з найбільш значущих підвалин для формування національної системи енергетичної безпеки України. В цей же час, також слід зауважити і те, що кожна з держав, характеризується різним спектром особливостей, потреб та перспектив в енергетичній сфері. Дане різноманіття, на сам перед викликане потребою взяття до уваги значної кількості обов'язкових потреб як самої держави, так і її суспільства загалом. Відомо, що енергетична безпека за своїм змістом передбачає в першу чергу захист інтересів держави в частині постійного забезпечення вільного доступу до енергетичних ресурсів на умовах стабільності, надійності, економічної ефективності, екологічності та безпеки. В свою чергу система енергетичної безпеки (СЕБ) – узагальнює зазначені аспекти та систематизує їх в частині сукупного практичного функціонування, ролі її учасників та суб'єктів управління, практичної реалізації. Взявши до уваги, той

факт, що на сьогодні в Україні та світі перетікають досить інтенсивні зміни в частині економічного, технологічного, соціального розвитку, в політичних площинах, моделях формування та подальшого існування енергетичних ринків як регіонального, національного та загальноєвропейського значення енергетична безпека вимагає реалізації розгляду крізь призму системності. За результатами дослідження, можна зробити висновок що з метою попередження можливих ризиків для СЕБ, що є слідством впливу потенційних загроз слід організувати та забезпечити можливість для вчасного виявлення ряду потенційних загроз. Є потреба в об'єктивній оцінці ризиків, для недопущення погіршення, або ж за потреби відновлення належного стану системи енергетичної безпеки, а також траєкторії до покращення її стану. Загалом, вважаємо, що з позиції суб'єктів системи енергетичної безпеки, що є невід'ємною складовою загальнодержавної безпеки, варто акцентувати свою увагу та потенційних загрозах в цілому. В цей же час, на рівні державних владних органів слід формувати національну політику в енергетичному та паливному комплексі, варто акцентувати увагу на системоутворюючих складових СЕБ ідентифікуючи при цьому потенційні ризики, загрози відносно процесів, що відбуваються в СЕБ.

Ключові слова: *безпека, енергетична безпека, особливості енергетичної безпеки, ризики для енергетичної безпеки, енергетична криза в Україні.*

Introduction. Analyzing the figure above, one can see that the prism of "systemic" in implementing energy security creates the proper conditions for harmonizing the foundations of its integrity and level of security.

Let us talk about the security of the energy security system. We should also mention the state of its security, which in its content determines a particular set of characteristics that, in their total volume, clearly outline the links with the external environment in which the energy security system of the state functions [6].

Thus, in our opinion, the energy security system should be viewed as a management object independent of external factors which directly affect the position of national security and sustainability [9].

Analysis of modern foreign and domestic research and publications. Many studies at both the theoretical and practical levels were devoted to the study of issues related to energy policy.

In a certain way, most of them reveal the main provisions that have already been highlighted in the Ukrainian Energy Strategy. Among the research scientists in this field, it is worth noting Sukhodolia O.M., Kharazishvili Y.M., Bobro D.G., Ryabtsev G.L. and others [6; 7].

Among the scientists who support the opinion regarding the consolidation and socialization of energy security goals, it is worth highlighting Pavlova O.M., Pavlov K.V., Pysanko S.V., Romaniuk R.V., Shabala O., and others [2; 4; 5; 9].

This article aims to identify structural features and potential risks for the functioning of the energy security system of Ukraine.

Coverage of the primary material. It is worth remembering that energy security entities, the totality of which forms the national energy security system, including local governments, state authorities, enterprises, and organizations of the energy and fuel complexes, practically implement their professional activities in the related energy and economic spheres aimed at preventing risks arising in the course of the energy sector [6].

In implementing this study, among the various points of view of the authors who paid attention to the study of the concepts of "challenge" and "threat" in the energy sector, we chose the formulation of O. Sukhodola [7].

Thus, a challenge is a set of circumstances that, in their content, form challenges about the operating conditions of a particular management object. Today, the challenge for our country is the implementation of the so-called "energy" transition, which is focused on a full-scale approach to the use of distributed energy capacities, infrastructure regulation, and the creation of regional energy markets operating based on competition and decentralization [3].

In turn, a challenge to energy security is a set of circumstances that, in their entirety, create specific requirements for implementing the conditions for the functioning and further deve-

lopment of the energy sector, which may, in the future, cause threats to it. At the same time, by its very nature, a threat implies events that occur spontaneously (including inaction on the part of relevant regulators). Threats to the energy security system can be potential and current, long-term and instantaneous. They can directly affect the uninterrupted functioning of the state energy security system and lead to emergency disconnections from energy distribution systems. Sukhodola O.M. is correct in his opinion that the threat, by its very definition, affects both the system of energy security of the state and the sources of its management [7].

In general, the threat is a precursor to a crisis in the energy security system because any failure in the process (sequence) of functioning of the state energy security system inevitably entails a failure or even a complete cessation of energy supply to the consumer sector. Below is a list of threats most likely affecting the national energy security system.

Terrorism (including military actions) – the use of weapons, arson, and explosions (including the threat of their occurrence), which together form a possible danger to critical energy infrastructure, which in one way or another affects the processes of managing human life and social order.

Cyber hazards are deliberate and targeted hostile actions implemented in cyber networks to violate the principles of stable operation and integrity and gain unauthorized access to energy systems and their information space.

Technological hazards – a complete disruption of the normal functioning of energy (including industrial) facilities caused by explosions, fires, and radioactive impact, which in combination creates obstacles to the proper functioning of the state's energy sector and poses threats to the environment and the lives of its citizens.

Crisis in the resource potential – a shortage of investment, financial, energy, water, food resources, etc., necessary to properly function the state's energy security system. The politicization of state processes in terms of its strategic capabilities – monopolies (in any form), restrictions by third countries on the proper functioning of the state energy security system in terms of free movement of resources, goods, services, scientific and technological achievements, which are characterized by their critical importance for the population in order to achieve advantages in the geopolitical plane. The shadow economy is the illegal extraction (generation) of energy resources, illegal activities in the state's energy sector, and evasion of duties, rents, and taxes.

Human resources and migration processes – forced migration abroad of professional and able-bodied populations whose knowledge is indispensable (valuable) for the functioning of the state's energy security and the possible threat of political persecution. In determining the level of energy security of an industry, sector, region, etc., it is essential to choose an approach to determine its state at a certain time. We consider the following components to be essential aspects characterizing the state of energy security: ongoing processes; components that form these processes; elements that form the energy security system; role and functions of participants (components) of the energy security system [2].

At the same time, it should be noted that threats can be internal, caused by internal processes in the energy sector, as well as external, caused by forces that directly affect national interests (Figure 1).

In practical application to the energy security system, the factors of influence shown in Figure 1, because of their consistent combination together with the areas of implementation, form the procedure for regulating the ES.

No less attention should be paid to the sensitivity of the energy security system elements to internal and external threats. In its turn, the sensitivity of the energy security system (ESS) elements determines what kind of challenges (attacks) and their power can be withstood by a single element, area of operation, and processes (including process components) of the state energy security system.

In its turn, if we consider the sensitivity of the state's energy security system elements from the point of view of a systemic approach, sensitivity to external and internal factors

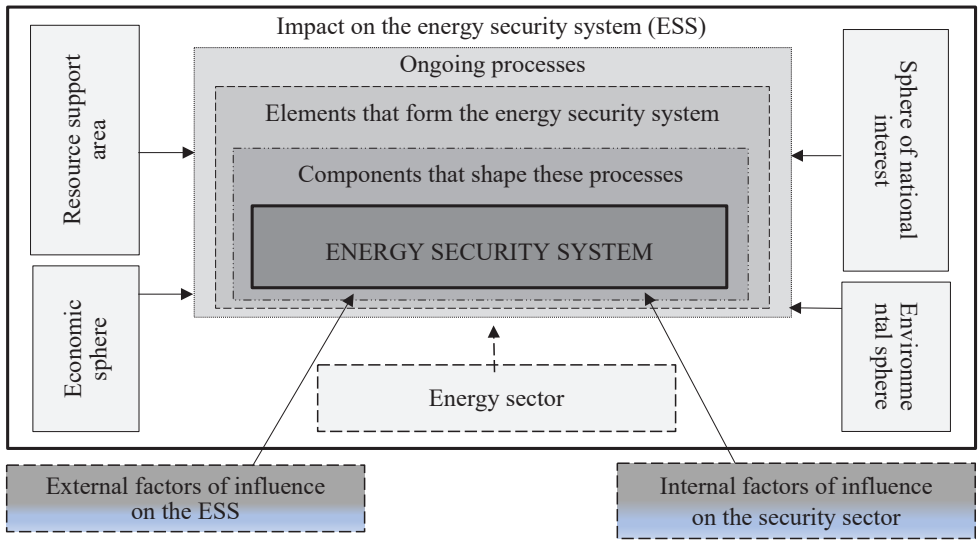

Figure 1. Processes, elements, and components of factors of influence on the state energy security system

that influence any of the state's energy security system elements worsens the level of quality of its functioning (energy resource, quality of service for the consumer sector, quality of functioning of the energy security system in general) (Figure 2).

To assess the level of security of the state's energy security system, the already known trends that negatively affect it can be noted and subsequently calculated. The calculation should compare the predefined threshold values of the indicators that best characterize the level of energy security about a particular area of the state's energy security (electricity, gas, renewable energy, etc.) [1; 6].

For example, a "power generation facility" may be exposed to threats of "attacks" that violate the sustainability principles of its operation, which may be caused by cyber-attacks on professional software, physical armed attacks, armed seizure, etc. The level of influence of threats (attacks) can be determined by assessing production losses, as well

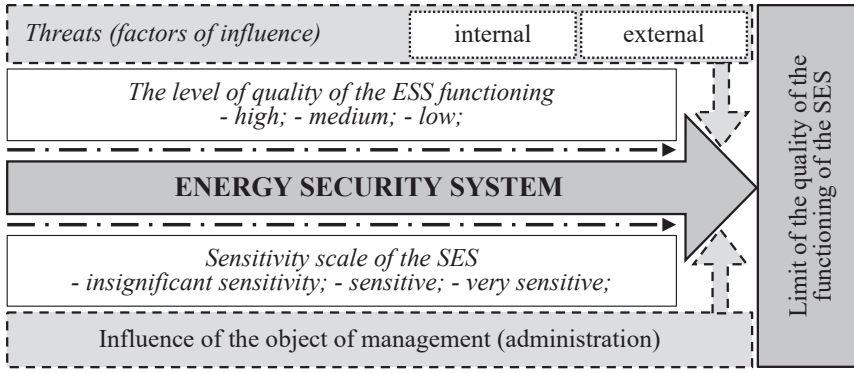

Figure 2. Sensitivity of elements of the state energy security system to external and internal factors that directly affect the quality of its functioning

as consequences (losses) resulting from external negative impacts and causing a stop of a stable production process at the facilities of the energy security system of the state or region (administrative area) [4].

In any case, violating the principles of balanced and stable functioning of the state energy security system is a consequence of the negative influence of external forces. In turn, we consider the consequence of the impact of possible threats on the goal of functioning the state energy security system. Usually, the value of this indicator is calculated by assessing the number of losses from the damage caused, including physical damage, monetary losses, property losses, reduced efficiency of energy generation, reduced GDP, shortage of energy resources for the consumer sector, and obstacles to the functioning of the state at all possible levels.

It should also be understood that a potential threat may sometimes be realized or fully realized. It is possible to prevent the probability of threats by implementing measures to prevent them. The probability of occurrence of threats to the energy security system, as well as their significance, can be determined by calculating the risks of the probability of occurrence. Thus, risks are an uncertain amount of impact (negative) on the objects of the energy security system or the probability that a potential threat may be realized, resulting in disruption of stability and full functioning of the state's energy security objects [8].

Risks retain their upward trend if the probability of a potential threat occurring, and the consequences caused by its impact are significantly increased. In other words, the volume of risks and the probability of their realization make it possible to calculate the level of hazards to record the significance of their direct impact on the state's energy security facilities.

Thus, in our opinion, risks in the energy security system of the state are the probability of transformation of the challenges faced by the energy security system into possible potential threats or the emergence of other circumstances that, by their nature, can potentially negatively affect the state's energy security system.

Risk management is the realization of establishing, changing, or preventing the possibility of risks and acceptable limits of risks that the energy security system or its objects (elements) can "withstand."

When risks arise, they should be assessed to change or prevent them. We have already identified the main types of threats that are most likely to affect Ukraine's national energy security system. In turn, as already noted, the risk determines the probability of specific threats. Their main features are outlined below:

– the risk of the possibility of using weapons, committing arson, and explosions, which together pose a threat to critical energy infrastructure, which is an integral part of the state's energy security system, and affects the management of human life and social order (terrorism, including military actions)

– the risk of targeted hostile actions carried out in cyber networks aimed at disrupting the principles of stable functioning, the state energy security system, and its information space (Cyber threat);

– the risk of possible disruption of the balanced functioning of the state energy security system (including its facilities) as a result of explosions, fires, and radioactive impact, which in their entirety impedes its proper functioning and poses threats to the environment and the population (Technological hazards);

– the risk of a possible shortage of resources (including energy, water, and food) that ensure the proper functioning of the state's energy security system (Crisis in Resource Potential);

– the risk of emergence of new and functioning of existing monopolies (in any form) of sectoral energy markets, which together form the state energy security system, restrictions by third countries on the proper functioning of the state energy security system in terms of free movement of resources, goods, services, scientific and technological achievements, which are characterized by their critical importance for the population in order to achieve advantages in the geopolitical plane (Politicization of state processes in terms of its strategic capabilities) [5];

– the risk of illegal extraction (generation) of energy resources, illegal activities in the state's energy security structure, and evasion of duties, rents, and taxes (Shadow economy).

– the risk of migration processes in terms of the outflow of industry professionals whose knowledge is indispensable for the state's energy security system (Migration processes).

If we are talking about identifying possible threats arising from unanticipated risks to the functioning of the state energy security system, we consider it necessary to define the following content areas: the risk of failure in the system of implementation of processes in the ES; the risk of failure and substitution of the elements and links of the ES; the risk of violation of the integrity of the NSS; the risk of loss of the intellectual and material basis for the functioning of the ESS; the risk of violating the functional and role positions of the components of the ESS.

To ensure the proper level of functioning of the state energy security system, it is necessary to control the prevention of the occurrence and realization of these risks. Also, for greater specificity of various potential threats to the functioning of the energy security system, the following are distinguished: threat by origin and nature of appearance; threat by the scale of implementation; threat by type of impact; threat by the environment of occurrence; threat by objects of influence; threat by the degree of impact; threat by the sphere of influence; threat by the principle of implementation; threat by the nature of implementation; threat by forms of identification [6].

Conclusions. Thus, analyzing the figure, we can conclude the following. To prevent possible risks to energy security resulting from the impact of potential threats, it is necessary to organize and ensure the possibility of timely detection of several potential threats. There is a need for an objective risk assessment to prevent deterioration or, if necessary, to restore the energy security system's proper state and the trajectory to improve its condition [2].

In general, we believe that the energy security system, which is an integral part of the national security, should be focused on potential threats in general. At the same time, at the level of state authorities, the national policy in the energy and fuel complex should be formed, attention should be focused on the systemic components of the SSE, while identifying potential risks and threats to the processes taking place in the SSE. In turn, the following main components of the ESS can be outlined in the process of identifying potential risks and threats: 1. Supply of energy services: electricity supply; supply of oil products; gas supply; heat supply; 2. Technical regulation; 3. Regulatory support; 4. Regulatory support; 5. Technical regulation of processes in the ESS; 6. Training of personnel; 7. Technological and scientific support of initiatives.

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