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DEVELOPMENT OF THE UKRAINIAN COAL BASINS AS A SOCIO-ECONOMIC SYSTEM

Purpose. To assess the development of the territories of the Ukrainian coal basins as functioning of a socio-economic system.

Methodology. The authors used the methods of conceptual generalization, comparison, synthesis and analysis in the study. Its methodological apparatus allowed the authors to consider the “Synchro-mining” model and the Vagonova model, and to offer a development assessment of the territories of the Ukrainian coal basins as functioning of a socio-economic system.

Findings. The economic efficiency of the development of the Ukrainian coal basins depends on two main indicators: 1) coal reserves and the quality of its production technologies; 2) the way economic activities affect social processes. This approach allows us to assess the development of the Ukrainian coal basins as a socio-economic system.

As a result of the analysis, the authors found that:

1. The amount of coal production in Ukraine over the past 42 years has dropped by 6.5 times, from 218 million tons in 1976 to 33 286.4 million tons in 2018.

2. The Ukrainian coal industry was not affected by the fourth industrial revolution; accordingly, coal mining technologies lag, on average, 20–30 years behind the technologies used in the world coal industry.

3. The use of outdated technologies has a negative impact on the environment, in particular on the lithosphere, hydrosphere, atmosphere and on the regenerative ability of biota.

4. The actual monopolization of the coal industry, as well as the lack of competition in the domestic market, has led to a disruption in the distribution of the benefits of goods and services among the population of the coal-mining regions. Material and social security of the population involved in the extraction and processing of coal does not correspond to the risks taken by miners. Moreover, social processes in the territory of coal basins are regressing.

The obtained results indicate a regression of the Ukrainian coal industry as a socio-economic system.

Originality. The authors suggested an assessment of the development of the Ukrainian coal basins as functioning of a socio-economic system. Analysis of fossil fuel reserves and technologies of its extraction, on the one hand, and the degree of influence of economic activities on social processes, on the other hand, allows us to make theoretical and practical assessments of the economic efficiency of the development of Ukraine’s coal-producing regions.

Practical value. Consideration of coal production in the Ukrainian coal basins as functioning of a socio-economic system reveals the possibility of a comprehensive assessment of the development efficiency of coal-producing regions. The study suggests a basis for building the development models of coal-mining regions, which take into account the technogenic load on the region, as well as the impact of economic activities on social processes. The creation of such socio-economic models will make it possible to clarify the development strategy of coal-mining regions, and to make theoretical and practical assessments of their development.

Keywords: *coal mining, Ukrainian coal basins, socio-economic system, economic efficiency*

Introduction. The coal industry is one of the basic areas of the economy of Ukraine. Its history began in 1721 and led to the creation of a unique culture of mining activities, with its own symbolism, traditions, music, architecture, visual arts, literature [1]. Traditions, beliefs and professional knowledge of coal industry workers became the heritage of Ukraine’s culture. They are an integral part of the worldview of Ukrainians, especially those living in the eastern regions of Ukraine, which in Ancient Greece was designated as a key term of antiquity “arete” [2]. “Arete of a Miner”, “arete of Donbas”, in ancient senses, mean the essence of the outlook and the main motive of behavior in a socio-economic system.

Recently, however, the scientific literature mostly focuses on renewable energy sources or “green” technologies: the use

of the solar, air, and water energy [3]. According to the data from “2017 Renewables Global Futures Report,” renewable energy provides more than 20 % of the energy supply in more than 30 countries of the world, and 100 % in Iceland and Norway [4]. It raises a question of the expediency of using fossil fuels, respectively, of the socio-economic development of the coal industry. This is primarily due to the exponentially increasing cost-based part of eliminating the negative factors that coal-mining enterprises have on the environment and human health. The term “post-mining” has been introduced into scientific circulation, which in the English language literature denotes a complex process of ecosystem restoration in the regions of fossil fuel production. The term was actively used in England at the end of the 20th century, when the government of Margaret Thatcher began to massively close down coal mines and solve the legal, economic, social and environmental

problems of coal-mining regions. The analysis of the list of official documents that the UK government uses in its work points to the concern of the British government about the negative impact of the coal industry (and not only!) on climate change, greenhouse gas emissions, etc. [5].

The production and use of high carbon fuels, e.g. oil, coal and natural gas, have an irreversible effect on the ecosystem and human health. In particular, the emission of carbon dioxide into the atmosphere increases the radiative forcing and contributes to global warming. Financing of recovery processes does not only reduce the economic benefits of using fossil fuels, but is also the main reason for finding alternative sources of energy, e.g. the use of “green” technologies [6]. The basic principles of participation in the Intergovernmental Panel on Climate Change (IPCC) are the basis of the modern strategy for the development of the UK economy. The work of experts is aimed at reducing and eliminating the influence of anthropogenic factors on the environment and human health [5].

Along with increasing doubts about the prospects for the development of the coal industry in the highly developed countries of the world, there is an alternative point of view. For example, in the book “Economics of the International Coal Trade. Why Coal Continues to Power the World”, which was released by authoritative Springer publishing house, the author expresses an idea that “mankind needs to embrace coal as the “bridge” from the Oil Age to the Solar Age (through the “New Energy Revolution”)” [7]. Schernikau L. claims that humanity does not have an alternative to coal in the near future. Today, coal accounts for 40 % of electricity generation and 30 % of primary energy. Schernikau believes that it is necessary to invest in reducing the emissions of dust, nitrogen oxides and sulfur oxides, thereby achieving more efficient burning of coal. The choice of this strategy will reduce the negative impact of the coal industry on the environment and, accordingly, increase its social and economic effect [7].

In the article, the authors will assess the future development of the Ukrainian coal basins as a socio-economic system. The authors believe that the economic efficiency of the development of the Ukrainian coal basins territories depends on two main indicators: 1) the reserves and methods (technologies) of fossil fuel production; 2) to what extent the manufactured product meets the needs of consumers, primarily in the territory of these regions. This means how economic activity affects social processes and is determined by them.

Results. In the article “Synchro-mining: civilized solution of the problems of mining regions’ sustainable operation”, the authors suggested a new concept for the sustainable development of mining areas [8]. They tied the development of mining areas to the management efficiency and duration of the activities of mining enterprises. There was proposed a model, which the authors called “Synchro-mining”. The novelty of this model lies in the fact that existing mining enterprises are obliged to invest in the business projects that presuppose the emergence of economic, social and environmental risks following the depletion of mineral resources and the closure of mining enterprises as subjects of economic activities. As a matter of fact, the model of “Synchro-mining”, proposed by the authors, provides for solving the problems that are inherent in depressed regions at an early stage of the development of a mining region. The model provides for the final result of any mining activities: depletion of fossil fuels and, as a result, economic decline, social tensions and environmental imbalances in the region.

Vagonova O. proved that the cause of the negative anthropogenic impact on the environment was the short-term management strategies of mining enterprises, taking into account only the quantitative indicators of production and neglecting the principles of rational use of natural resources [9]. The latter strengthen the responsibility of mining enterprises for the state of the region’s ecosystem. Vagonova suggested the model that resolves a contradiction between the desire of manage-

ment of mining enterprises to obtain greater profits and the need for social, economic and environmental development of the region. The novelty of the Vagonova model lies in the fact that it offers new methodological bases for the development strategy of mining enterprises, which involve the comparison of the externalities in production and the expected regulatory changes in the rational use of natural resources [9].

Unlike the studies examined above, our task is to assess the development of the territories of the Ukrainian coal basins as a socio-economic system. Let us consider the first main indicator of the socio-economic system: reserves and methods (technologies) of fossil fuel production in the Ukrainian coal basins.

In Ukraine, it is customary to allocate three coal basins: the Donets, the Lviv-Volynian and the Dnipro basins. We suggest a brief description of them.

The key place in the resource market of Ukraine belongs to the *Donets coal basin* (Fig. 1). Its area is about 50 thousand km². According to the State Informational Geological Fund of Ukraine, the balance reserves of coal in the basin as of January 1, 2018 amount to 51.4 billion tons [10]. The Donets coal basin was opened in 1721; it began to be actively used since 1796. The highest rate of coal mining was in 1970. During this year, 177.8 million tons of coal was mined. Over the entire period of developing the coal basin, approximately 8 billion tons have been mined. The depth of development in most mines reaches 1100 m [11].

The Donets coal basin is located on the territory of Donetsk, Luhansk, Dnipropetrovsk, Kharkiv and Poltava regions. In Russia, it embraces the territory of Rostov region. Since the end of the 19th century, the territory of the Donets coal basin was considered as the most industrially developed. The Donets coal basin remains the main fuel and energy base of eastern and central Ukraine, where the centers of the chemical industry and mechanical engineering are located. In Ukraine, it is the most densely populated area.

The history of the formation of the Donets coal basin, as well as the impact of coal mining and the technologies used on the environment, health and culture of the population, are actively investigated by Ukrainian and foreign scientists. A remarkable finding is, e.g. a large-scale study of Douwe, J. J. van Hinsbergen and a group of authors, which was published in the authoritative scientific publishing company “Nature Research” [12]. The authors presented field studies of the sedimentology of the middle Carboniferous of the Donets coal basin. This study does not only broaden the understanding of the history of the existing ecosystem, but it also allows us to make predictions of the characteristics of its change under the conditions of the current rates of coal mining and technology.

Poplavsky O. analyzed the influence of regional features of the historical development of the Donbas on the formation of

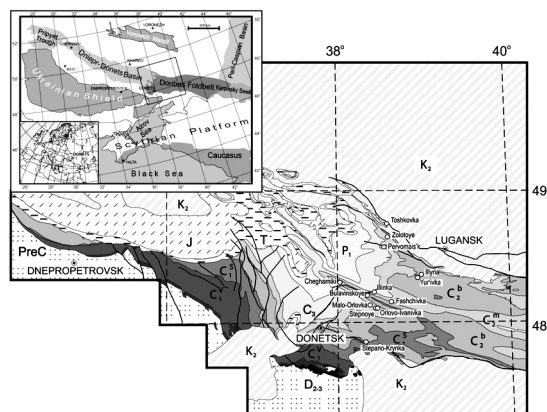


Fig. 1. Geological map of the Donbas Foldbelt, and in the inset, the location of the Donbas in the regional East European structural framework [12]

value-semantic orientations of the population, and also identified and examined the components of regional patriotism [13].

The second most important coal mining industry in Ukraine is the *Lviv-Volynian coal basin* (Fig. 2). Its area is about 10 thousand km². The Lviv-Volynian coal basin is located on the territory of Lviv and Volyn regions. The history of the development of the Lviv-Volynian coal basin is not as long as that of the Donetsk coal basin, accordingly, the formation of the socio-economic system of this coal-mining region is not so well-established. Despite the fact that the theoretical rationale for the existence of this basin was made in 1912 (by the Russian geologist M. Tetiayev), the first mine opened much later. Only in 1950, on the outskirts of the village of Dorohynychi, a mine was launched with the extraction of 1000 tons of coal per day. The balance reserves of the coal basin are 1331,8 million tons [10]. The depth of the deposits is from 300 to 1200 meters. In structural terms, the Lviv-Volynian coal basin is the south-east closure of the Lublin coal basin (Poland) [14].

Zonal localization of high-quality coals and low-grade raw materials, as well as oil and gas fields of various sizes that are widespread in the Lviv-Volynian coal basin, were investigated by V. Guliy, and G. Lepigov [15].

The development of the Lviv-Volyn coal basin led to the formation of new industrial complexes, in particular the Burshtyn thermal power plant in 1965 and the Dobrotvorskyy thermal power plant in 1955. Consequently, the population of the region has increased significantly, its vocational orientation and social security has changed.

The third Ukrainian coal basin, the *Dnipro*, has an area of about 100 thousand km². The balance reserves of brown coal amount to 2,177 million tons. [10]. About 0.5 billion tons of these reserves are suitable for open-cast mining. The depth of coal seams ranges from 10 to 150 meters. The development of the basin has been performed from the second half of the 19th century. The Dnipro coal basin is located in the central regions of Ukraine: Zhytomyr, Vinnytsa, Kyiv, Cherkasy, Kirovohrad, Zaporizhzhia and Dnipropetrovsk. The history of the development of the Dnipro coal basin, as well as its current state, is considered, e.g. in the study by V. Kulish, who reaches the following conclusions [16]:

1. The reserves of brown coal in Ukraine and its extraction make it possible to ensure a significant contribution to the economy of Ukraine, as well as to the energy security of the state.

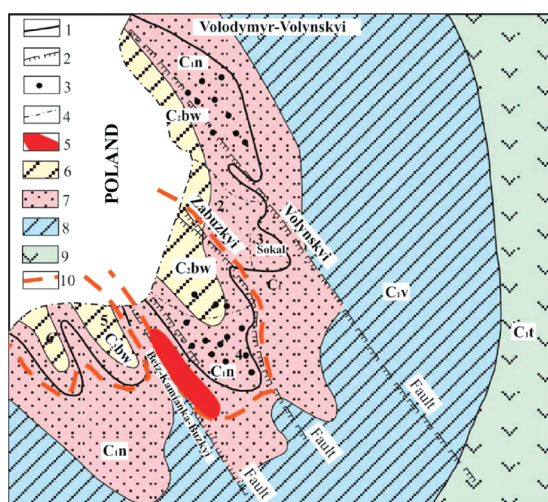


Fig. 2. Geological map of the Lviv-Volyn Coal Basin [15]:

1 – coal seam n°; 2 – faults; 3 – coal mines; 4 – contour of deposits; 5 – Velyki Mosty gas deposit. Layers: 6 – Bashkirian; 7 – Namurian; 8 – Visean; 9 – Tournaisian. Hard coal deposits: 1 – Volynske; 2 – Zabuzke; 3 – Sokalske; 4 – Mezhyrichenske; 5 – Tiahlyvske; 6 – Karivske; 10 – contour of possible gas columns

2. The cost of brown coal mining is 2 times cheaper than stone.

However, in spite of obvious economic efficiency, “in Ukraine, brown coal as an energy carrier is unfairly forgotten” [16]. Currently, all brown coal enterprises have been liquidated or are in the process of liquidation.

In general, summing up the assessment of coal reserves in the three main Ukrainian coal basins, we can draw the following conclusions:

1. Until 2014, Ukraine was the third largest coal producer in Europe. The coal industry is still one of the basic sectors of the economy of Ukraine.

2. According to the Ministry of Energy and Coal Industry of Ukraine, coal mining in 2018 amounted to 33 286.4 million tons. In this range, extraction of coking coal amounts to 5 809.1 million tons; that of energy coal is 27,477.3 million tons [17]. If we compare these figures with those of the year 1976, when the national coal industry achieved maximum production of 218 million tons, we can conclude the following: *Ukraine’s coal industry is rapidly losing its economic efficiency*. The reduction in production by 6.5 times over the period of 42 years is a figure that characterizes a catastrophic decline of the socio-economic system.

3. The authors of the study “Coal industry and hybrid economy”, using a large-scale analysis of global trends, proved that “almost all underground coal mining performed by shaft method has become unprofitable” [18]. In order to reduce unprofitability, e.g. the US mines increase the rate of coal production. Given the sharp reduction in the amount of coal produced in Ukraine, the loss-making ratio of its production increases.

Considering the methods or technologies of coal mining, some facts are worth noting. Currently, the mines of the Ukrainian coal basins are considered by the owners as a source of enrichment, by the state – as a source of replenishment of budget funds, and by the city and district councils – as an employer and donor of local social programs. It is for this reason that investments in expensive coal mining technologies, which reduce the anthropogenic burden on the region’s ecosystem, are not a priority for an owner, local authorities and the state. The lack of investment by owners has led to the fact that the technologies used in deep coal mining in the mines of Ukraine lag, on average, 20–30 years behind the technologies used in the world. The point is that the Fourth Industrial Revolution (Industry 4.0) did not affect the Ukrainian coal industry. The whole complex of changes that occurred in economics, management, sociology, etc., which is disclosed, for example, in the article by A. Kravchenko and I. Kyzymenko [19], did not affect the development of the Ukrainian coal basins. Therefore, unlike the organization of the world coal industry, coal mining in Ukraine is carried out using outdated technologies that harm the environment and human health. In fact, as follows from the “Synchro-mining” model, which was proposed by H. H. Pivniak, P. I. Pilov, M. S. Pashkevych, D. O. Shashenko [8], there occurred an imbalance in the development of the territories of the Ukrainian coal basins, which aggravated their economic, social and environmental problems.

A decrease in the economic efficiency of coal mining in the Ukrainian coal basins, in particular, a decline in the amount of coal mining and the use of outdated technologies, are, in our opinion, due to the following main reasons:

1. World market trends: against the background of a decline in world coal prices, the costs of coal production increase. And the reason is not only the constant need for capital investments in modernization of production, introduction of new technologies, etc., but also meeting the new requirements of miners’ trade unions, pressure of environmental, public organizations, etc.

2. Inefficiency of management, starting from the level of state administration, and ending with management directly in the mines of the coal basins.

3. Lack of the development strategy of the coal industry in Ukraine and the political will of the government.

4. Lack of necessary funding from the state and the owners of mines.

5. Corruption in the industry.

6. The conflict in the east of Ukraine. Until 2014, there were 160 state-owned coal mines in Ukraine, which produced 72–85 million tons of coal annually. Now in Ukraine there are 102 state mines, but only 33 are considered as such operating outside the conflict zone [11].

Thus, we examined the first main indicator of the socio-economic system: coal reserves and methods of its production in the Ukrainian coal basins. To evaluate the efficiency and quality of the socio-economic system, we must consider its second indicator: the degree of satisfaction of the population of the coal-producing regions with the goods produced. It is important for us to understand how the production of coal in the regions of the coal basins meets the needs of the population, or how economic activities affect social processes. First of all, it concerns the state of the environment, people's health and the distribution of profits among the participants of the socio-economic system.

If we consider the environmental impact of coal mining in the Ukrainian coal basins, this effect can be divided into:

1. The impact on the lithosphere. It is about geomechanical and geochemical effects. For example, in the study "The impact of deep underground coal mining on Earth fissure occurrence", the authors investigate the spreading of cracks on the earth under the influence of geotechnical and geological consequences of deep underground coal mining [20].

2. The impact on the hydrosphere. It is about hydrodynamic and hydrochemical effects. For example, O. Iziumova established the laws governing the formation of the agrophysical properties of the soil, and also revealed the complexity of the technological regulations for the restoration of land after open mining [21]. This is a high cost issue taking a long period of time, so that the water areas polluted by coal production waste will reach their original, optimal characteristics.

3. The impact on the atmosphere. It is about gas-dynamic and heat transfer effect. For example, A. V. Pavlychenko has developed a methodology for assessing the indicators that determine the level of environmental risk of emissions of pollutants from coal mines into the atmosphere (from the main ventilation shaft, pipes of a mining boiler house, dumps, etc.). Pavlychenko suggested new ways of "localizing dust emissions from the coal mine into the atmosphere based on their perception with dispersed water resulting in the precipitation of a fine fraction of dust or their catching by an electrostatic precipitator with low aerodynamic resistance" (A. V. Pavlychenko).

4. The impact on biota, on its regenerative ability. Accumulation of heavy metals in cells of living organisms, in particular, cadmium, chromium (VI), etc., leads to the disruption of cellular metabolism and physiological processes, including growth inhibition, decrease in productivity, etc.

5. In general, considering the technogenic impact of coal mining in the Ukrainian coal basins on the environment, an increasing amount of higher activity waste is worth noting (A. V. Pavlychenko).

As the researchers mentioned above claim, due to the backwardness of coal mining technologies, as well as the lack of proper control by the state, public organizations, the local population and trade unions, the ecosystems in the coal-mining regions of Ukraine have been disturbed. Ferrovannadium sludge, blast furnace gas sludge, polluted wastewater discharges into surface water bodies, dust and gas emissions, and much more bring the ecology of coal mining regions to the brink of disaster.

Let us consider the effect of coal mining on human health. The frequency of diseases occurring to people in coal-mining regions is estimated according to the law of Poisson distribution. There is a connection between the flow of failure of the

protective functions of the body of an "average" person and the overall level of anthropogenic stress on the region. This relationship allows detecting a high incidence of human diseases in coal mining regions. A. McIvor and R. Johnston in the study that has already become a classic one, showed that coal dust is the main cause of the spread of the diseases such as pneumoconiosis, emphysema and bronchitis among miners. The authors proved that the profession of a miner has a high level of risk. This is the joint work and well-coordinated management of key actors of the socio-economic system: doctors, managers and employers, the state and trade unions, which can reduce this risk to the limits of admissibility [22]. The book by A. McIvor and R. Johnston is remarkable for the fact that, on the one hand, it links together the history of medicine, the work of miners, the history of coal mining technologies and social processes in coal mining regions. On the other hand, it shows the existing gap between working conditions, "working" culture and the attitude of the state and mine owners to the miners' work, their health, as well as the material and social support of their work, in the coal industry of Ukraine and the states of Europe, the USA, Australia, etc.

The attitude of management, local councils and the state to mining enterprises as a source of profit does not meet the needs of the population of coal-mining regions. Mines and coal basins are not regarded through the "Synchro-mining" model. The profit from coal mining is spent on satisfying short-term strategies, rather than investing in business projects that are capable of compensating for the upcoming economic, social and environmental problems combined by the term "post-mining". Therefore, in the coal industry as a socio-economic system, the distribution of the benefits from the produced goods and services is disturbed. The population, as a producer of goods and services, as the main actor of social processes, does not receive the corresponding material and social benefits from production, and thus, does not have a reverse, positive impact on the development of economic activities.

In the book "Coal Industry and Hybrid Economy", the employees of the Institute of Industrial Economics, the National Academy of Sciences of Ukraine, came to the following conclusion: "...today's Ukrainian economy cannot fundamentally change its energy and industrial policy and refuse to operate its own mines, because none of the three alternative solutions to the resource problem (expanded coal imports; increased consumption of gas fuel; the development of "green energy") does not guarantee energy security of the country" [18]. Large-scale analysis of the coal industry in Ukraine conducted by the authors of the book A. Amosha, Yu. Zaloznova and D. Cherevatskiy showed that despite the catastrophe (the authors' term) in the coal industry of Ukraine and the obvious benefit of buying imported coal, but not the coal mined in Ukraine, the state is directly dependent on the coal industry. This dependence is due to two main reasons [18]:

1. Monopolization of the world coal industry and the actual lack of competition. This forces the Ukrainian government to focus mainly on the extraction of coal from its own mines, even despite its obvious economic unprofitability.

2. Political instability, to which massive closure of mines will lead. As the history of many states has shown, the trade unions of miners have exerted and are still capable of exerting considerable influence on the internal politics of the state, including economic and social spheres.

Accordingly, the conclusions made by A. Amosha, Yu. Zaloznova and D. Cherevatskiy correlate with the results obtained by the authors of the study.

Conclusions. In the study, the authors regarded coal mining in the Ukrainian coal basins as the functioning of a socio-economic system. The analysis of coal reserves and methods of its production in the Ukrainian coal basins, on the one hand, and the degree of influence of economic activities on social processes, on the other hand, proved the existing imbalance in the socio-economic system. The authors concluded that the

organization of social and economic processes in the Ukrainian coal basins is not cost-effective.

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Розвиток українських вугільних басейнів як соціально-економічної системи

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Мета. Оцінити розвиток територій українських вугільних басейнів як функціонування соціально-економічної системи.

Методика. У дослідженні автори використали методи концептуального узагальнення, порівняння, синтезу та аналізу. Методологічний апарат дослідження дозволив авторам розглянути „Synchro-mining“ модель і модель О. Вагонової, та запропонувати оцінку розвитку територій українських вугільних басейнів як функціонування соціально-економічної системи.

Результати. Економічна ефективність розвитку українських вугільних басейнів залежить від двох основних показників: 1) від запасів вугілля та якості технологій його видобутку; 2) як економічна діяльність впливає на соціальні процеси. Такий підхід дозволяє оцінювати розвиток українських вугільних басейнів як соціально-економічну систему.

За результатами аналізу автори дійшли до наступного:

1. Кількість видобутку вугілля в Україні за останні 42 роки скоротилося в 6,5 раз, із 218 млн т. у 1976 році до 33 млн 286,4 тис. т. у 2018 році.

2. Українську вугільну промисловість не торкнулася четверта промислова революція, відповідно, технології видобутку вугілля відстають від технологій, що використовуються у світовій вугільній промисловості, у середньому, на 20–30 років.

3. Використання застарілих технологій здійснює негативний вплив на навколишнє середовище, зокрема на літосферу, гідросферу, атмосферу й на здатність біоти до самовідновлення.

4. Фактична монополізація вугільної промисловості, а також відсутність конкуренції на внутрішньому ринку, призвели до порушення розподілу переваг товару й послуг серед населення вугледобувних регіонів. Матеріальне й соціальне забезпечення населення, задіяного у видобутку та переробці вугілля, не відповідає ризикам роботи шахтарів. Соціальні процеси на території вугільних басейнів регресують.

Отримані результати вказують на регрес української вугільної промисловості як соціально-економічної системи.

Наукова новизна. Автори запропонували оцінку розвитку українських вугільних басейнів як функціонування соціально-економічної системи. Аналіз запасів викопного палива й технологій його видобутку з одного боку, і ступінь впливу економічної діяльності на соціальні процеси з іншого боку, дозволяє зробити теоретичні та практичні оцінки економічної ефективності розвитку вугледобувних регіонів України.

Практична значимість. Розгляд видобутку вугілля в українських вугільних басейнах як функціонування соціально-економічної системи відкриває можливість

комплексної оцінки ефективності розвитку вугледобувних регіонів. Дослідження пропонує основу для будівництва моделей розвитку вугледобувних регіонів, в яких ураховується техногенне навантаження на регіон, а також вплив економічної діяльності на соціальні процеси. Створення подібних соціально-економічних моделей дозволяє уточнити стратегію розвитку вугледобувних регіонів, зробити теоретичні та практичні оцінки їх розвитку.

Ключові слова: видобуток вугілля, українські вугільні басейни, соціально-економічна система, економічна ефективність

Развитие украинских угольных бассейнов как социально-экономической системы

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Цель. Оценить развитие территорий украинских угольных бассейнов как функционирование социально-экономической системы.

Методика. В исследовании авторы использовали методы концептуального обобщения, сравнения, синтеза и анализа. Методологический аппарат исследования позволил авторам рассмотреть „Synchro-mining“ модель и модель А. Вагановой, и предложить оценку развития территорий украинских угольных бассейнов как функционирование социально-экономической системы.

Результаты. Экономическая эффективность развития украинских угольных бассейнов зависит от двух основных показателей: 1) от запасов угля и качества технологий его добычи; 2) как экономическая деятельность влияет на социальные процессы. Такой подход позволяет оценивать развитие украинских угольных бассейнов как социально-экономическую систему.

В результате анализа авторы установили:

1. Количество добычи угля в Украине за последние 42 года сократилось в 6,5 раз, с 218 млн тонн в 1976 году до 33 млн 286,4 тыс. тонн в 2018 году.

2. Украинскую угольную промышленность не коснулась четвертая промышленная революция, соответственно, технологии добычи угля отстают от технологий, ис-

пользуемых в мировой угольной промышленности, в среднем, на 20–30 лет.

3. Использование устаревших технологий оказывает негативное влияние на окружающую среду, в частности на литосферу, гидросферу, атмосферу и на способность биоты к самовосстановлению.

4. Фактическая монополизация угольной промышленности, а также отсутствие конкуренции на внутреннем рынке, привели к нарушению распределения преимуществ товара и услуг среди населения угледобывающих регионов. Материальное и социальное обеспечение населения, задействованного в добыче и переработке угля, не соответствует рискам работы шахтёров. Социальные процессы на территории угольных бассейнов регрессируют.

Полученные результаты указывают на регресс украинской угольной промышленности как социально-экономической системы.

Научная новизна. Авторы предложили оценку развития украинских угольных бассейнов как функционирование социально-экономической системы. Анализ запасов ископаемого топлива и технологий его добычи с одной стороны, и степень влияния экономической деятельности на социальные процессы с другой стороны, позволяет сделать теоретические и практические оценки экономической эффективности развития угледобывающих регионов Украины.

Практическая значимость. Рассмотрение добычи угля в украинских угольных бассейнах как функционирование социально-экономической системы открывает возможность комплексной оценки эффективности развития угледобывающих регионов. Исследование предлагает основу для строительства моделей развития угледобывающих регионов, в которых учитывается техногенная нагрузка на регион, а также влияние экономической деятельности на социальные процессы. Создание подобных социально-экономических моделей позволит уточнить стратегию развития угледобывающих регионов, сделать теоретические и практические оценки их развития.

Ключевые слова: добыча угля, украинские угольные бассейны, социально-экономическая система, экономическая эффективность

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