МИРОВАЯ ЭКОНОМИКА

УДК 334.012/021
JEL Q43, Q48, O14, F52
https://doi.org/10.21122/2309-6667-2024-20-122-135

IMPROVEMENT OF THE ORGANIZATIONAL-ECONOMIC MECHANISM OF CHINESE COAL INDUSTRIES DEVELOPMENT: PROBLEM STATEMENT

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The article is devoted to the study of the current state of the coal industry in China and the prospects for improving the organizational-economic mechanism of its development in the context of global trends in the transformation of the energy sector and the modernization of the Chinese economy. Based on statistical data analysis, it is shown that since the founding of the People's Republic of China, the production capacity of the coal industry has been steadily growing, although the share of coal in the country's energy balance has gradually decreased. Given the increase in coal production and consumption, we should not talk about a reduction (or growth) in China's coal industry, but about its structural transformation. The article identifies and characterizes four main trends characteristic of the coal industry in China: the changing place of the coal industry in the energy balance of China against the backdrop of the growing share of renewable energy sources; technological modernization; organizational and managerial transformation; internationalization of business models of coal enterprises.

***Key words**: coal industry, China, decarbonization, green energy, energy security, economic growth, technological modernization, internationalization.*

Цитирование: Solodovnikov, S. Yu. Improvement of the organizational-economic mechanism of Chinese coal industries development: problem statement / S. Yu. Solodovnikov, Yu. V. Meleshko, J. Ding // Экономическая наука сегодня : сб. науч. ст. / БНТУ. – Минск, 2024. – Вып. 20. – С. 122–135. https://doi.org/10.21122/2309-6667-2024-20-122-135

Introduction. For a long time, the coal industry was a rare topic of economic research, especially in English and Russian. The unpopularity of this topic can be largely explained by the dominance of the post-industrial concept in scientific circles [1], according to which the service sector is recognized as the driver of economic development. Global financial and

economic crises have shown the limitations of this theory and have contributed to the subsequent reshoring of industrial enterprises to leading economic countries. A new impetus for the renewal of scientific interest in the coal industry in the last 5 years has been the aggravation of geopolitical and geoeconomic contradictions of powerhouse countries, since coal as a strategically important energy resource is used as an object of sanctions pressure. A special place in the actualization of coal industry research, although usually in a negative context, is occupied by the environmental agenda and the decarbonization trend.

Driven by the development of alternative energy, digital technologies and the economic growth of countries such as China, India, Brazil, etc., the global energy landscape has accelerated its evolution. However, it came as a surprise to many that in 2022, global thermal coal production reached a historic high of over 7.2 billion tons[1], and in 2023, it repeated the record, increasing by another 120 million tons[2]. Experts note: "Despite coal plant closures in some parts of the world, the global coal plant fleet has seen a net growth of 186 GW since the Paris Agreement was signed. To put this into perspective: 186 GW are more than the operating coal plant fleets of Germany, Japan, South Korea and Indonesia combined"[3]. At the same time, the growth rates of the global coal industry are distributed unevenly geographically, with a clear dominance of Asian countries, led by China: "In the United States and the European Union, demand fell by an estimated 100 million tons each, while it rose by approximately 220 million tons in China and 100 million tons in India. The global demand shift towards Asia persisted in 2023, with China and India currently accounting for 70 percent of total consumption"[4].

If the peak of coal consumption by the largest European countries was reached in the 1990s, then Asian countries have yet to do so, which is certainly connected with industrialization (neo-industrialization) and high rates of economic growth. It is impossible to carry out industrialization without cheap, accessible and stable energy resources. Coal in this sense still has few competitors. The role of coal for developing countries such as India and Indonesia will only increase in the near future, as experts warn: "… companies are still planning to develop an additional 516 GW of new coal-fired capacity. If built, these projects would increase the world's current installed coal-fired capacity by 25 %"[5].

China today ranks first in the world coal industry: "8 of the world's top 10 coal plant developers are state-owned Chinese power corporations"[6]. As of 2019, coal reserves in China are estimated at 141.5 billion tons (fourth in the world after the United States, Russia and Australia[7]). China accounts for 46.7 % of global coal production (2019)[8]. More than a third of the country's coal production (69 % in 2018) is concentrated in three provinces in the north and center of the country – Inner Mongolia, Shanxi and Shaanxi; with nine of the 14 coal bases located in the Yellow River basin, including northern, central and eastern Shanxi.

[1] The 2023 Global Coal Exit List: Failing the Phase-Out. P. 2 : [website]. – URL: https://www.coalexit.org/sites/default/files/download_public/urgewald_GCEL-2023_MediaBriefi-ng_final.pdf (access date: 01.09.2024)
[2] Agnolucci P., Temaj K. Coal market developments: Falling prices amid record-high output. June 21, 2024 : [website] – URL: https://blogs.worldbank.org/en/opendata/coal-market-developments--falling-prices-amid-record-high-output?_gl=1*izfu31*_gcl_au*MTY1MDc1NTQ4NS4xNzI2NjUwMD-Uw (date of access: 01.09.2024)
[3] The 2023 Global Coal Exit List: Failing the Phase-Out. P. 1 : [website] – URL: https://www.coalexit.org/sites/default/files/download_public/urgewald_GCEL-2023_MediaBriefing_fi-nal.pdf (date of access: 01.09.2024)
[4] Agnolucci P., Temaj K. Coal market developments: Falling prices amid record-high output. June 21, 2024 : [website]. – URL: https://blogs.worldbank.org/en/opendata/coal-market-developments--falling-prices-amid-record-high-output?_gl=1*izfu31*_gcl_au*MTY1MDc1NTQ4NS4xNzI2NjUwMD-Uw (date of access: 01.09.2024)
[5] The 2023 Global Coal Exit List: Failing the Phase-Out. P. 1 : [website]. – URL: https://www.coalexit.org/sites/default/files/download_public/urgewald_GCEL-2023_ MediaBriefing_final.pdf (date of access: 01.09.2024)
[6] Ibid. P. 1–2.
[7] Is this the end? How many years will the world's coal reserves last? 30.03.2022 : [website]. – URL: https://dprom.online/chindustry/ugol-zakanchivaetsya/ (date of access: 01.09.2024)
[8] Coal occupies an important place in the EAEU's electric power industry. 20.10.2020 : [website]. – URL: https://inlnk.ru/emVz75 (date of access: 01.09.2024)

For a long time, the coal industry served as the energy base for China's high rates of economic growth. Today, it still retains this status, as Chinese scientists point out: “Given my country's energy resources, which are rich in coal, poor in oil and short of gas, it is difficult to fundamentally change the energy structure dominated by coal in the short term. The coal industry is the ballast and stabilizer that supports the rapid development of China's economy and society and ensures national energy security” [2, p. 2.]. However, the coal industry of China faces new challenges. Being a strategically important infrastructure industry, it is highly dependent on the domestic and foreign economic, technological, social, and environmental policies. In this regard, it is necessary to update the theoretical, methodological, and methodical base for the development of the coal industry of China.

Results and discussion. Since the founding of the People's Republic of China, the coal industry has been constantly developing, although with varying intensity. In 1949, the volume of coal production was 320 thousand tons per year. By 1960, this figure had increased almost 13 times, reaching 4 million tons per year [3]. In subsequent years, production capacity continued to grow, largely due to successful geological exploration. From 2000 to 2009, China increased coal production by 2.4 times, making China the world's largest producer of this type of fuel. “From 2006 to 2017 China commissioned 692 GW of coal-fired capacity, more than twice the amount commissioned in the rest of the world combined”[1] – experts note. In 2016-2017, China announced the suspension of coal projects (with exceptions for projects located in impoverished areas and for residential heat and power projects), resulting in pause estimated 444 GW of coalfired capacity under various stages of development[2]. Despite this, China continues to lead the world in the amount of coal power capacity under development.

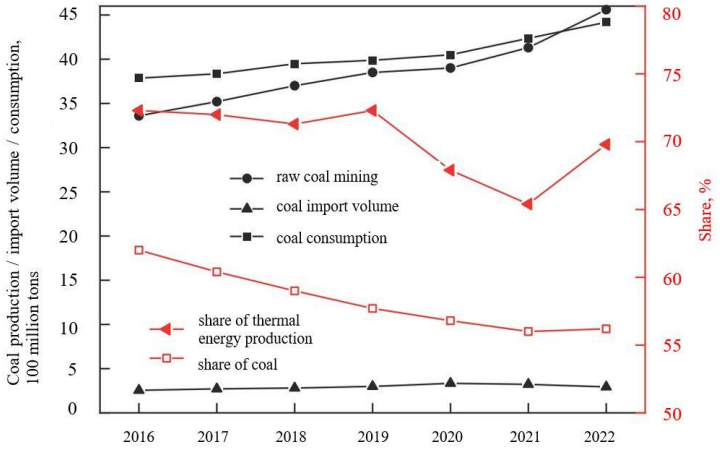

Figure – Coal production and consumption, share of thermal energy in China in 2016–2022.
Source: [2, p. 3].

Figure presents key statistics for the coal industry in China from 2016 to 2022: coal production increased by more than 1 billion tons, and consumption also increased, although at a slower rate. In 2023, China's production will increase by about 50 million tons[3].

[1] Boom and Bust 2018. Tracking the global coal plant pipeline. Report. March 2018 / Christine Shearer, Neha Mathew-Shah, Lauri Myllyvirta, Aiqun Yu, and Ted Nace. : [website]. – URL: https://thecoalhub.com/wp-content/uploads/2018/05/BoomAndBust_2018_r4.pdf (date of access: 01.09.2024)
[2] Ibid. P. 9.
[3] Agnolucci P., Temaj K. Coal market developments: Falling prices amid record-high output. June 21, 2024 : [website]. – URL: https://blogs.worldbank.org/en/opendata/coal-market-developments--falling-prices-amid-record-high-output?_gl=1*izfu31*_gcl_au*MTY1MDc1NTQ4NS4xNzI2NjUwMD-Uw (date of access: 01.09.2024)

Coal imports remain virtually unchanged in 2016-2022. In 2023, this figure increased to 470 million tons, up 61.8 % from the previous year [2]. By increasing imports by 150 million tons, China achieved a record high in global coal trade[1].

Since 2022, when the demand for electricity rose sharply due to drought and hydropower generation declined, coal mining capacity has again shown explosive growth. In 2022, coal output reached 4.56 billion tons, an increase of 10.5 % year on year. In 2022, the total profit of the coal mining and processing industry was about 1.02 trillion yuan, up 44.3 % year on year [2, p. 4].

From January to November 2023, China's coal output was 4.66 billion tons, up 2.9 % year-on-year [2]. China is developing new coal mines, and about 110 GW of new coal-fired power plants were approved in 2023[2]. According to experts, "China's coal output is expected to increase 36 million metric tons, or 0.8 %, to about 4.7 billion tonnes in 2024, a Chinese coal industry group said on Wednesday, slower than last year's 2.9 % growth"[3].

Despite the steady growth trend in China's coal industry indicators measured in physical terms, share indicators are characterized by a decline. Over the period under review, the share of coal consumption decreased by almost 4 percentage points. In 2019, the share of coal in the country's energy balance was 66.4 %[4], which is significantly higher than the world average, which fluctuates in the range of 23–28 %. In 2024, this figure in China fell below 60 % for the first time (or, more precisely, to 59.6 %)[5]. According to 2022 data, the country's electricity generation capacity is about 8.8 trillion kWh, of which the installed capacity of thermal energy accounts for about 52 %; thermal energy production accounts for about 69.8 %, of which coal energy accounts for about 58.4 % [2].

Due to the reduction in the share of coal as an energy resource, which is happening against the backdrop of China's announcement of a national strategy for greening and developing renewable energy, many experts predict a crisis in the Chinese coal industry in the very near future. Such conclusions are confirmed by the reduction in the number of coal mines in China to 4,313 [2, p. 4].

In our opinion, given the increase in coal production and consumption, we should not talk about a reduction (or growth) in China's coal industry, but about its structural transformation. This is evident, firstly, as a changing coal place in China's energy balance amid the growing share of renewable energy sources, secondly, as technological modernization, thirdly, as organizational and managerial transformation, and finally, fourthly, as a internationalization of business models of coal enterprises. Let us consider each of the four points in more detail.

1. The most important challenge for the development of China's coal industry has become the national "double carbon" goal of peaking carbon emissions by 2030 and achieving carbon neutrality by 2060. Today, China is already the largest country in terms of the volume of emissions reductions, and the most successful country in terms of the schedule of emissions reductions. As a result, coal companies are facing unprecedented restrictions in environmental policy.

The environmental agenda is being updated with varying intensity in all countries of the world today, which is largely facilitated by leading international organizations, European

[1] Agnolucci P., Temaj K. Coal market developments: Falling prices amid record-high output. June 21, 2024 : [website]. – URL: https://blogs.worldbank.org/en/opendata/coal-market-developments--falling-prices-amid-record-high-output?_gl=1*izfu31*_gcl_au*MTY1MDc1NTQ4NS4xNzI2NjUwMD-Uw (date of access: 01.09.2024)

[2] Ibid.

[3] China coal industry group expects output growth to slow in 2024. March 20, 2024 / Reuters. The Northern Miner Group. – URL: https://www.mining.com/web/china-coal-industry-group-expects-output-growth-to-slow-in-2024/ (date of access: 01.09.2024)

[4] Coal occupies an important place in the EAEU's electric power industry. 20.10.2020 // Eurasian Economic Commission. – URL: https://inlnk.ru/emVz75 (date of access: 01.09.2024)

[5] Coal's share of China's power generation falls below 60 % for the first time. 26.07.2024 // Jenergeticheskaja politika: Social, business and scientific Journal. – URL: https://energypolicy.ru/dolya-uglya-v-elektrogeneracii-kitaya-vpervye-upala-nizhe-60/novosti/2024/16/26/ (date of access: 01.09.2024)

politicians and the scientific community. In 2006, the Law on Renewable Energy Sources came into force in China. The importance of the environmental direction of development for China is explained by several factors at once.

Over decades of intensive industrialization and high rates of economic growth, China has accumulated many environmental problems, many of which are directly caused by the coal industry. Xi Xian and his colleagues, working on the problem of coal waste, note: "The coal-based energy structure and high intensity coal mining cause solid waste in mining areas to occupy land space, destroy the ecological environment and emit greenhouse gases" [4, p. 3620]. In addition, coal mining and processing are associated with such negative environmental effects as: mine water, mine gas, soil subsidence, damage to above-ground and underground water systems, volatile coal dust, etc. Against this background, the following statement appears justified: "In order to maintain their own importance, coal enterprises will need to embark on a path of green development, industrial planning and technological innovation" [5, p. 28]. China is one of those countries that has really managed to achieve significant success in implementing the concept of "green" coal, which involves safe and environmentally friendly development and use of coal [6; 7; 8; 9; 10], restoration of the ecological environment in mining areas [11; 12], burial and extraction of solid waste [13; 14; 15]. According to Chinese scientists, "through innovative mining methods, improving the recovery rate of coal resources and the large-scale disposal of coal-based solid waste, a new path is being paved for the green and sustainable development of the coal industry" [16, p. 3292].

It is necessary to distinguish between real environmental initiatives and simulacra (in the terminology of J. Baudrillard [17]). As we noted earlier, "despite the fact that in the EU member states the "green" path of development is widely declared and has become one of the basic principles of Eurocentric liberal ideology, in real life the aforementioned European green political movement should be recognized rather as a simulacra of concern for the environment" [18, p. 12]. The development of a green economy is then a simulacra, "when it can cause unacceptable economic damage to the country or individual large industrial enterprises and thus lead to a decrease in the competitiveness of the national industrial and agricultural complexes, as well as the rate of GDP growth, which, in turn, will cause a decline in the standard of living of the population, an increase in social tension in society, and protest sentiments" [19, p. 8]. As a result, "the simulation of the green agenda inevitably leads and will continue to lead to a deterioration of the environmental situation" [19, p. 8].

Today we can see a simulation of responsible environmental behavior in the global coal industry. "While climate scientists, the United Nations and the International Energy Agency have time and again called for an accelerated phase-out of coal, the vast majority of coal companies are still pursuing business as usual. Out of 1,433 companies listed on the GCEL (*Global Coal Exit List – authors' note*), only 71 companies – 5 % of the total – have put an end date on their coal business lines. <…> Out of the 71 companies that have announced a future coal exit, many have set phase-out dates that are far too late (*among them are companies from the USA, South Korea, Japan, Malaysia – authors' note*). <…> All in all, only 41 companies have adopted coal exit dates that could be considered Parisaligned. <…> Most of the 41 companies on the GCEL which have adopted Paris-aligned exit dates for their coal assets intend to replace their coal-fired capacity with fossil gas (*and not on renewable energy sources! – authors' note)*"[1]. The data presented is impressive. Of even greater interest, in our opinion, are the decarbonization methods practiced by some European companies. "Over the last decade, Czech-based company Energetický a průmyslový holding (EPH) became one of the EU's largest greenhouse gas emitters by acquiring old coal assets all over Europe. <…> in July 2023 that it would "completely abandon coal as a power generation source by 2030 reality", this

[1] The 2023 Global Coal Exit List: Failing the Phase-Out. P. 5 : [website]. – URL: https://www.coalexit.org/sites/default/files/download_public/urgewald_GCEL-2023_ Media-Briefing_final.pdf (date of access: 01.09.2024)

step will decarbonize nothing as EPH is simply offloading the majority of its coal-fired power plants and all of its lignite production into a new sister company, inaptly named EP Energy Transition. This company will have the same shareholder structure as EPH and will ensure that its coal assets operate until the last possible date: 2038. At the same time, it is completely unclear whether EP Energy Transition has been equipped with the provisions needed or the rehabilitation of the Lusatian lignite mines. The only thing EPH has phased out is its responsibility for the affected communities and the environment"[1], – GCEL experts describe.

As for China, in addition to solving real environmental problems, China's active international position on climate change issues contributes to the country's political status as a world power. The fact that the decarbonization of the electric power system is driven primarily by political reasons, rather than by the desire to solve environmental problems, is also supported by the current assessment of the life cycle of renewable energy sources in terms of CO^2 emissions. "Indeed, the emphasis on renewable energy in the context of the low-carbon energy transition does not take into account the overall environmental costs of producing renewable technologies: from mining to manufacturing solar cells, batteries for electric vehicles, wind turbines, and recycling metals and other components. When these costs are taken into account, it turns out that while renewables contribute to reducing CO^2 emissions and the low-carbon energy transition, they do not enable the transition to clean or sustainable energy" [20, c. 62], – written by N. V. Tereshin and I. Sh. Khasanov. In other words, whether green energy is a way to solve environmental problems caused by the use of carbon fuel, or only increases the negative anthropogenic impact on nature – this question is still open. However, today the national goal of "double carbon" allows China to position itself as a new world leader in the environmental agenda. Undoubtedly, decarbonization for China is a major reputational project.

Green energy has another consequence that is extremely important for the Chinese economy. The development of renewable energy sources has been accompanied by the development of related industries, namely the production of solar photovoltaic panels and wind turbines. Under the "Made in China 2025" Innovation Development Plan, the production of electric power equipment and products for "green" energy was identified as one of 10 industries designed to transform the country from a producer of cheap consumer goods of low quality into a supplier of high-quality industrial products with a significant share of its own technological developments. This industry contributes to the expansion of production and supply of high-tech products to foreign markets, primarily based on Chinese innovations, as well as to the expansion of the geography of Chinese technological standards and the formation of new value chains. China is gradually taking a leading position in the market of "green" technologies, displacing, in particular, Germany.

At one time, Germany, which did not have any significant reserves of traditional energy resources, managed not only to diversify its own energy balance through alternative energy, but also to become a world leader in "green" technologies. By promoting the environmental imperative in every possible way, including using the ideological and economic mechanisms of the European Union, Germany thereby provides a market for its "green" technologies in virtually all countries of the world. The physical absence of the necessary resource base (for a variety of reasons, including the depletion of the world's main deposits or their initial absence in a given territory, geopolitical conflicts and sanctions wars, etc.), on which the current technological order is based, can indeed become a factor stimulating technological innovations, leading to the emergence and establishment of a new order both at the local and global levels. Compared with Germany, China has an undeniable advantage – significant coal reserves and strong political power capable of pursuing a consistent energy and economic policy aimed at technological modernization.

[1] The 2023 Global Coal Exit List: Failing the Phase-Out. P. 5 : [website]. – URL: https://www.coalexit.org/sites/default/files/download_public/urgewald_GCEL-2023_ Media-Briefing_final.pdf (date of access: 01.09.2024)

2. It is in the context of technological modernization of the national economy that the development prospects of the Chinese coal industry should be analyzed. Since the 1980s, there has been continuous modernization of industrial capacities and an increase in their energy efficiency, a reduction in coal consumption for electricity generation, an increase in the efficiency of industrial and civil boiler houses, and an acceleration of electrification. This contributes to a decrease in the intensity of coal consumption (per unit) against the background of an accelerated growth in energy consumption in the country.

China's coal industry is an industry with significant contributions from advanced technologies, including those developed in China itself. The intellectualization of coal mines is being successfully implemented, using: unmanned intelligent mining systems, intelligent rapid mining technologies, digital twins of intelligent mining faces, and robotic coal mine systems [21; 22; 23; 24; 25]. "As of December 2023, a total of 1,651 intelligent mining faces have been built in 758 coal mines across the country. Among them, a total of 363 intelligent mining faces and 239 tunnel faces have been built in the first batch of demonstration coal mines in the country, with a production capacity of 6.2 billion tons, the average production capacity of one working face reaches 5 million tons, and the total investment in intelligent construction exceeds 200 billion yuan, which has greatly accelerated the fundamental change in carbon production methods and brought the high-quality development of the coal industry to a new level" [2, p. 4].

The factors that traditionally determine the need to implement digital technology in mining enterprises are: "cumbersome material and technical production base", "instability of the quality of the extracted rock and geological conditions of extraction", "qualitative heterogeneity of the stages of the production process", "shortage of qualified personnel and high personnel costs, complex and dangerous production conditions" [26]. Thanks to digitalization, the Chinese coal industry can also solve (fully or partially) problems with labor safety. Robotization and digitalization bring positive effects in terms of reducing harmful impact on the environment by reducing waste and increasing production efficiency.

However, as F. Liu, L. Guo, J. Zhang rightly state, "the current level of development of the coal industry is far from satisfying the national needs of Chinese-style modernization" [2, p. 3]. According to some estimates, the production of one unit of GDP in China still requires more than twice as much energy compared to the world average.

3. Technological modernization of the coal industry is accompanied by corresponding organizational and managerial changes. As in many other countries, the coal industry in China as a strategically important industry developed under strict state control. Although since 1978 China has begun to actively use external government loans, as well as private and corporate foreign capital in the coal industry, in the 1980s 70 % of the total investment in large state mines was budgetary investment. Since 1992, coal enterprises have been gradually corporatized and their economic powers have been expanded, and in 1998, in order to attract foreign investment, some state coal companies put small blocks of their shares up for sale on the foreign market. In 2001–2011, the PRC government strengthened control over this area, after which all coal enterprises in China once again became fully state-owned. As noted in the scientific literature, "deals in the power sector are mainly implemented by state-owned companies and facilitated by state-owned financial institutions" [27, с. 201]. State ownership is one of the factors in the successful technological modernization of the coal industry, since the state provides privileged access to national coal companies to financing and R&D instruments, political support in the implementation of complex and long-term projects. According to American scientists, as of the end of 2017, Chinese national development banks invested more in energy than the largest Western international development banks combined [28, p. 313].

Another factor in the success of the technological modernization of the Chinese coal industry is the structural reorganization aimed at closing small mines and transforming medium mines into large ones. The first wave of consolidation is associated with the reforms of

the 1970s – early 1980s, as a result of which about 40 % of all coal in China was mined at medium and large coal enterprises. Thanks to constant work in this direction, modern large mines in China combine industry, academia and applied research, and the organizational structure of the coal industry is an open innovation system with state-owned industrial enterprises as the main body.

4. One of the instruments ensuring stable growth of the coal industry in China is foreign economic expansion. China is actively pursuing a state strategy of transnationalization of energy companies (in terms of the territory of business, but not in terms of ownership structure): the rating of 100 largest global non-financial TNCs includes 4 energy companies from the PRC[1]. The structure of Chinese overseas investment is dominated by the coal industry and hydropower. "Internationally, Chinese financial institutions are the world's largest funder of overseas coal power plants, investing US$15 billion in coal projects from 2013 to 2016 through international development funds, as well as another US$13 billion in proposed financing <…>, – experts calculated. – CoalSwarm estimates that Chinese companies are involved in building, owning or financing at least 16 % of all coal-fired power plants being developed outside of China." [2, p. 9]. The largest recipients of capital from China in this segment are India, Indonesia, Mongolia, Vietnam, and Turkey. The coal industry is a niche in the world market that China quickly occupied after the voluntary withdrawal of many European banks and investment companies, largely due to the green energy trend.

The strategy of business transnationalization solves a whole range of internal and external problems of the Chinese coal industry: job cuts and loss of professional competencies during the recession and under the influence of digitalization, tightening environmental requirements for fuel industry enterprises, and a slowdown in the growth rate of the national economy. In addition to traditional investment income, China also receives new markets for coal mining, generating and network equipment. "As a result of foreign economic expansion in the electric power industry, China is developing existing or creating new markets for the sale of products from heavy industry enterprises, which, in the context of the structural transformation of the Chinese economy, could close or significantly reduce the scale of production" [27, с. 188], – notes R. A. Epikhina. Another important factor is the opportunity to promote our own smart grid and ultra-high voltage power transmission line technologies and standards at the global level. In 2015, at the UN Sustainable Development Summit, Xi Jinping put forward an initiative to create a global energy network[3]. One should agree with the following statement: "Considering that the service life of generating stations and power transmission lines (PTL) is several decades, the preconditions are being created for China's long-term dominance in one of the key infrastructure sectors in a number of countries and regions of the world" [27, с. 189].

Conclusions. Thus, the conducted analysis fully confirms the opinion of Chinese scientists: "the coal-fired power plant will remain an important support for electricity supply security and the integration of renewable energy for a considerable period into the future in China" [29, p. 2876]. The gradual reduction of the share of coal in China's energy balance, as well as fluctuations in the growth rates of new coal power plants, in our opinion, are not sufficient grounds for concluding that the role of the coal industry in the country's economy is declining. The question of the possibility of completely replacing coal energy with renewable energy, even in the long term, is premature (especially considering that the goals of «green

[1] The world's top 100 non-financial MNEs, ranked by foreign assets, 2022 // UNCTAD. – URL: https://unctad.org/system/files/non-official-document/wir2023_tab19.xlsx (date of access: 01.09.2024)

[2] Boom and Bust 2018. Tracking the global coal plant pipeline. Report. March 2018 / Christine Shearer, Neha Mathew-Shah, Lauri Myllyvirta, Aiqun Yu, and Ted Nace. P. 9 // The Coal Hub. – URL: https://thecoalhub.com/wp-content/uploads/2018/05/BoomAndBust_2018_r4.pdf (date of access: 01.09.2024)

[3] Six Agreements Signed and Plan for Belt and Road Energy Interconnection Released (n/y) // Global Energy Interconnection Development and Cooperation Organization. – URL: https://m.geidco.org/article/633 (date of access: 01.09.2024)

initiatives» go far beyond solving environmental problems). However, it is indisputable that today the coal industry in China (as well as throughout the world) is undergoing fundamental structural changes and reinnovation.

The reasons for the transformation of China's coal industry are often linked to the country's commitments under the Paris Climate Agreement or its entry into the WTO. In our opinion, China's energy policy should be viewed primarily in the context of its domestic economic policy (the need to diversify energy sources, modernize the technical base, and worsening environmental pollution problems). The Chinese government has pursued its own policy in this sector in order to ensure the country's national security, but not in order to comply with international rules. The principle of China's economic development announced at the 2023 Central Economic Work Conference is "to make progress while maintaining stability, to advance stability through development, and to create before destroying". We see the implementation of this principle in the coal industry development strategy.

The super-intensive development of renewable energy sources for the Chinese coal industry has not become a death sentence, as many expected. While maintaining its status as the main energy resource, the coal industry of the PRC is increasing production capacity within the country and especially intensively abroad, while simultaneously carrying out technological and organizational-managerial modernization.

The directions of further development of the Chinese coal industry will be determined not so much by the dynamics of world prices for coal (or alternative energy sources) or obligations assumed under international treaties, but by China's domestic policy in the area of technical modernization and structural reorganization of the economy, employment and social security, and environmentalization. When choosing promising directions for the development of the coal industry, China should focus on the broader context of the country's socio-economic development. The most promising approach is one in which the industry under consideration is studied not in isolation, but taking into account China's internal socio-economic problems and the country's new place in the global geo-economic space. At the same time, China, with its extremely successful experience of combining market regulation measures with planned and administrative ones, has at its disposal a wide variety of tools for developing the coal industry. This will ensure the speed of achieving the set goals and increase the success of their implementation, which is an absolute advantage compared to other countries.

References

1. Bell, D. (1973) *The coming of post-industrial society: A venture of social forecasting*. N.Y.: Basic Books.

2. Liu Feng, Guo Linfeng, Zhang Jianming [et al.] (2024) Synergistic mode of digitalization-intelligentization-greeniation of the coal industry and it's path of building new coal productivity. *Journal of China Coal Society*. 9 (1), 1-15. DOI: 10.13225/j.cnki.jccs.2024.0091 (In Chinese).

3. Zhu Anyu, Wang Qifei, Li Chengwu [et al.] (2024) Research on the prediction of death number in coal mine accidents under the rapid increase of coal production. *Journal of China Coal Society*. 49 (S1), 340-347. DOI: 10.13225/j.cnki.jccs.2024.0084 (In Chinese).

4. Xi Xian, Sang Shuxun, Liu Shiqi. (2024) Progress in research of CO^2 fixation and sequestration by coal mine solid waste mineralization and co-disposal of pollution and carbon reduction. *Journal of China Coal Society*. 49 (8), 3619-3634. DOI: 10.13225/j.cnki.jccs.2023.1075 (In Chinese).

5. Bekhtereva Yu. V., Morozova I. G. (2023). China's energy security perspectives. *Global economy and education*. 3 (2), 27-35 (in Russian).

6. Qian Minggao, Xu Jialin, Miao Xiexing. (2003) Green technique in coal mining. *Journal of China University of Mining and Technology*. 32 (4), 5-10 (In Chinese).

7. Qian Minggao, Miao Xiexing, Xu Jialin. (2007) Green mining of coal resources harmonizing with environment. *Journal of China Coal Society*. 32 (1), 1-7 (In Chinese).

8. Xu Jialin. (2019) Strata control and scientific coal mining – A celebration of the academic thoughts and achievements of Academician Minggao Qian. *Journal of Mining & Safety Engineering*. 36 (1), 1-6 (In Chinese).

9. Yuan Liang, Zhang Nong, Kan Jiaguang [et al.] (2018) The concept, model and reserve forecast of green coal resources in China. *Journal of China University of Mining & Technology*. 47 (1), 1-8 (In Chinese).

10. Yuan Liang, Jianc Yaodong, Wang Kai [et al.] (2018) Precision exploitation and utilization of closed/abandoned mine resources in China. *Journal of China Coal Society*. 43 (1), 14-20 (In Chinese).

11. Peng Suping, Bi Yinli (2023) Academician Minggao Qian directed ecological restoration research of arid and semi arid coal mining areas inwestern China. *Journal of Mining & Safety Engineering*. 40 (5), 857-860 (In Chinese).

12. Peng Suping, Bi Yinli (2020) Strategic consideration and core technology about environmental ecological restoration in coamine areas in the Yellow River basin of China. *Journal of China Coal Society*. 45 (4), 1211-1221 (In Chinese).

13. Pan Yishan, Song Yimin, Liu Jun (2023) Pattern, change and new situation of coal mine rockburst prevention and control in China. *Chinese Journal of Rock Mechanics and Engineering*. 42 (9), 2081-2095 (In Chinese).

14. Pan Yishan, Xiao Yonghui, Luo Hao [et al.] (2023) Study on safety of rockburst mine. *Journal of China Coal Society*. 48 (5), 1846-1860 (In Chinese).

15. Qi Qingxin, Ma Shizhi, Sun Xikui [et al.] (2023) Theory and technical framework of coal mine rock burst origin prevention. *Journal of China Coal Society*. 48 (5), 1861-1874 (In Chinese).

16. Wang Shuangming, Liu Lang, Zhu Mengbo, [et al.] (2024) Scientific problems and technology of the integration of «excavation-backfill-retention» of section coal pillar and mining roadway. *Journal of China Coal Society*. 49 (8), 3291-3315. DOI: 10.13225/j.cnki.jccs.2024.0592 (In Chinese).

17. Baudrillard, J. (1994) *Simulacra and Simulation*. University of Michigan Press.

18. Solodovnikov, S. Yu., Lyu, Xiao, Serhiyevich, T. V., Peng, Wenlong (2023) Economic interests affecting the dynamics of development of green and traditional economy in the context of increasing complexity of logistics of energy resources supply. *Ehkonomicheskaya nauka segodnja*. (18), 6-17. DOI: 10.21122/2309-6667-2023-18-6-17 (In Russian).

19. Solodovnikov, S. Yu., Meng Jialiang (2024) Transformation of the green agenda in the context of new regionalization: civilizational, cultural, economic and demographic contexts. *Ehkonomicheskaya nauka segodnja*. (19), 7-14. DOI: 10.21122/2309-6667-2024-19-7-14

20. Tereshin, N. V., Khasanov, I. Sh. (2023) Energy policy of the people's republic of china in modern conditions. *Global'naja jekonomika i obrazovanie*. 3 (1), 55-64.

21. Kang Hongpu, Wang Guofa, Jiang Pengfei [et al.] (2018) Conception for strata control and intelligent mining technology in deep coal mines with depth more than 1000 m. *Journal of China Coal Society*. 43 (7), 1789-1800 (In Chinese).

22. Kang Hongpu, Jiang Pengfei, Liu Chang (2023) Development of intelligent rapid excavation technology and equipment for coal mine roadways. *Journal of Mining and Strata Control Engineering*. 5 (2), 5-7 (In Chinese).

23. Kang Hongpu, Xie Heping, Ren Shihua [et al.] (2022) Development Strategy of China's Coal Industry under the Reconstruction of Global Industrial Chain and Energy Supply Chain. *Strategic Study of CAE*. 24 (6), 26-37 (In Chinese).

24. Wang Guofa, Zhang Liang, Li Shoubin [et al.] (2023) Progresses in theory and technological development of unmanned smart mining system. *Journal of China Coal Society*. 48 (1), 34-53 (In Chinese).

25. Wang Guofa (2022) New technological progress of coal mine intelligence and its problems. *Coal Science and Technology*. 50 (1), 1-27 (In Chinese).

26. Meleshko, Yu. V. (2022) Endogenous factors that determine the development of Industry 4.0 in the mining industry. *Bol'shaja Evrazija: razvitie, bezopasnost', sotrudnichestvo: Yearbook.* 5 (1), 893-895. (In Russian).

27. Epikhina R.A. (2019) The Role of Electric Power Sector in China's Global Economic Expansion. *Outlines of Global Transformations: Politics, Economics, Law*. 12 (6), 188-202. DOI: 10.23932/2542-0240-2019-12-6-9 (in Russian).

Статья поступила в редакцию 26 августа 2024 года

СОВЕРШЕНСТВОВАНИЕ ОРГАНИЗАЦИОННО-ЭКОНОМИЧЕСКОГО МЕХАНИЗМА РАЗВИТИЯ УГОЛЬНОЙ ПРОМЫШЛЕННОСТИ КНР: ПОСТАНОВКА ПРОБЛЕМЫ

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Статья посвящена исследованию современного состояния угольной промышленности КНР и перспектив совершенствования организационно-экономического механизма ее развития в контексте мировых трендов трансформации энергетического сектора и модернизации китайской экономики. На основании анализа статистических данных показано, что с момента образования КНР производственные мощности угольной промышленности постоянно росли, хотя доля угля в энергетическом балансе страны постепенно сокращается. Учитывая наращивание объемов добычи и потребления угля, следует вести речь не о сокращении (или росте) угольной отрасли Китая, а о ее структурной трансформации. В статье выделены и охарактеризованы четыре основных тенденции, характерные для угольной промышленности Китая: изменение места угольной промышленности в энергетическом балансе Китая на фоне роста доли возобновляемых источников энергии; технологическая модернизация; организационно-управленческая трансформация; интернационализация бизнес-моделей угольных предприятий.

Ключевые слова: *угольная промышленность, КНР, декарбонизация, зеленая энергетика, энергетическая безопасность, экономический рост, технологическая модернизация, интернационализация.*

Список использованных источников

1. Bell, D. The coming of post-industrial society: A venture of social forecasting / D. Bell. – N.Y. : Basic Books, 1973. – 616 p.

2. 刘峰，郭林峰，张建明, 等. 煤炭工业数字智能绿色三化协同模式与新质生产力建设路径 // 煤炭学报. – 2024. – 49 (1). – 1−15. DOI: 10.13225/j.cnki.jccs.2024.0091. = Лю, Ф. Синергетический режим цифровизации-интеллектуализации-озеленения угольной промышленности и ее путь создания новой производительности угля / Фэн Лю, Линьфэн Го, Цзяньмин Чжан [и др.] // Журнал Китайского угольного общества. – 2024. – 49 (1). – С. 1−15. DOI: 10.13225/j.cnki.jccs.2024.0091.

3. 朱安愚 ， 王启飞 ， 李成武 ， 汪陈徽. 煤炭产能高速发展下的煤矿事故死亡人数预测研究 // 煤炭学报. – 2024. – 49 (S1). – 340−347. DOI: 10.13225/j.cnki.jccs.2024.0084. = Чжу, А. Исследование по прогнозированию смертности в результате аварий на угольных шахтах в условиях быстрого развития мощностей по добыче угля / Аньюй Чжу, Цифэй Ван, Чэнву Ли, Чэньхуэй Ван // Журнал Китайского угольного общества. – 2024. – 49 (S1). – С. 340−347. DOI: 10.13225/j.cnki.jccs.2024.0084.

4. 奚弦, 桑树勋, 刘世奇. 煤矿区固废矿化固定封存 CO2 与减污降碳协同 处置利用的研究进展 // 煤炭学报. – 2024. – 49 (8). – 3619−3634. = Си, С. Прогресс в исследованиях по связыванию и секвестрации CO_2 путем минерализации твердых отходов угольных шахт и совместной утилизации загрязнений и сокращения выбросов углерода / Сянь Си, Шусюнь Сан, Шици Лю // Журнал Китайского угольного общества. – 2024. – 49 (8). – С. 3619−3634.

5. Бехтерева, Ю. В. Перспективы развития энергетической безопасности Китайской Народной Республики / Ю. В. Бехтерева, И. Г. Морозова // Глобальная экономика и образование. – 2023. – Т. 3, № 2. – С. 27–35.

6. 钱鸣高，许家林，缪协兴. 煤矿绿色开采技术 // 中国矿业大学学 报. – 2003. – 32 (4). – 5−10. = Цянь, М. Зеленые технологии в добыче угля / Мингао Цянь, Цзялинь Сюй, Сесин Мяо // Журнал Китайского университета горного дела и технологий. – 2003. – 32 (4). – С. 5−10.

7. 钱鸣高，缪协兴，许家林. 资源与环境协调 (绿色) 开采 // 煤炭学 报. – 2007. – 32 (1). – 1−7. = Цянь, М. Экологичная добыча угольных ресурсов, гармонирующая с окружающей средой / Мингао Цянь, Сесин Мяо, Цзялинь Сюй // Журнал Китайского угольного общества. – 2007. – 32 (1). – С. 1−7.

8. 许家林. 岩层控制与煤炭科学开采 – 记钱鸣高院士的学术思想 和科研成就 // 采矿与安全工程学报. – 2019. – 36 (1). – 1−6. = Сюй, Ц. Контроль пластов и научная добыча угля – чествование академических мыслей и достижений академика Мингао Цяня / Цзялинь Сюй // Журнал горного дела и техники безопасности. – 2019. – 36 (1). – С. 1−6.

9. 袁亮，张农，阚甲广，等. 我国绿色煤炭资源量概念、模型及预 测 // 中国矿业大学学报. – 2018. – 47 (1). – 1−8. = Юань, Л. Концепция, модель и прогноз запасов зеленых угольных ресурсов в Китае / Лян Юань, Нун Чжан, Цзягуан Кан [и др.] // Журнал Китайского университета горного дела и технологий. – 2018. – 47 (1). – С. 1−8.

10. 袁亮，姜耀东，王凯，等. 我国关闭/废弃矿井资源精准开发利用的 科学思考 // 煤炭学报. – 2018. – 43 (1). – 14−20. = Юань, Л. Точная эксплуатация и использование

ресурсов закрытых/заброшенных шахт в Китае / Лян Юань, Яодун Цзян, Кай Ван [и др.] // Журнал Китайского угольного общества. – 2018. – 43 (1). – С. 14–20.

11. 彭苏萍，毕银丽. 钱鸣高院士指导西部干旱半干旱煤矿区生态修 复研究 // 采矿与安全工程学报. – 2023. – 40 (5). – 857–860. = Пэн, С. Академик Мингао Цянь руководил экологическими исследованиями по восстановлению засушливых и полузасушливых районов добычи угля на западе Китая / Супин Пэн, Иньли Би // Журнал горного дела и техники безопасности. – 2023. – 40 (5). – С. 857–860.

12. 彭苏萍，毕银丽. 黄河流域煤矿区生态环境修复关键技术与战略 思考 // 煤炭学报. – 2020. – 45 (4). – 1211–1221. Пэн, С. Стратегическое рассмотрение и основные технологии в области экологического восстановления окружающей среды в районах добычи угля в бассейне реки Хуанхэ в Китае / Супин Пэн, Иньли Би // Журнал Китайского угольного общества. – 2020. – 45 (4). – С. 1211–1221.

13. 潘一山，宋义敏，刘军. 我国煤矿冲击地压防治的格局、变局和新 局 // 岩石力学与工程学报. – 2023. – 42 (9). – 2081–2095. Пан, И. Модель, изменение и новая ситуация в области предотвращения и контроля горных ударов в угольных шахтах Китая / Ишань Пан, Иминь Сун, Цзюнь Лю // Китайский журнал механики и инженерии горных пород. – 2023. – 42 (9). – С. 2081–2095.

14. 潘一山，肖永惠，罗浩，等. 冲击地压矿井安全性研究 // 煤炭学报. – 2023. – 48 (5). – 1846–1860. = Исследование безопасности горных выработок при ударах / Ишань Пан, Юнхуэй Сяо, Хао Ло [и др.] // Журнал Китайского угольного общества. – 2023. – 48 (5). – С. 1846–1860.

15. 齐庆新，马世志，孙希奎，等. 煤矿冲击地压源头防治理论与技术 架构 // 煤炭学报. – 2023. – 48 (5). – 1861–1874. = Ци, Ц. Теория и техническая основа предотвращения возникновения горных ударов в угольных шахтах / Цинсинь Ци, Шичжи Ма, Сикуй Сунь [и др.] // Журнал Китайского угольного общества. – 2023. – 48 (5). – С. 1861–1874.

16. 王双明;刘浪;朱梦博;蔚保宁;庄登登;屈慧升;何伟;邵成成;夏磊;周静. 面间煤柱与顺槽“掘-充-留” 一 体化科学问题与技术 // 煤炭学报. – 2024. – 49 (8). – 3291–3315. DOI: 10.13225/j.cnki.jccs.2024.0592. = Ван, Ш. Научные проблемы и технология интеграции «выемки-засыпки-удержания» угольного целика и горнодобывающего штрека / Шуанмин Ван; Вэй Баонин Чжу; Хэ Вэй Цюй // Журнал Китайского угольного общества. – 2024. – 49 (8). – С. 3291–3315. DOI: 10.13225/j.cnki.jccs.2024.0592.

17. Baudrillard, J. Simulacra and Simulation / J. Baudrillard. – University of Michigan Press. – 1994. – 164 p.

18. Солодовников, С. Ю. Экономические интересы, влияющие на динамику развития зеленого и традиционного хозяйствования в контексте усложнения логистики поставок энергетических ресурсов / С. Ю. Солодовников, Сяо Лю, Т. В. Сергиевич, Вэньлун Пэн // Экономическая наука сегодня : сб. науч. ст. / БНТУ. – Минск, 2023. – Вып. 18. – С. 6–17. DOI: 10.21122/2309-6667-2023-18-6-17.

19. Солодовников, С. Ю. Трансформация зеленой повестки в условиях новой регионализации: цивилизационные, культурные, экономические и демографические аспекты / С. Ю. Солодовников, Мэн Цзялян // Экономическая наука сегодня : сб. науч. ст. / БНТУ. – Минск, 2024. – Вып. 19. – С. 7–14. DOI: /10.21122/2309-6667-2024-19-7-14

20. Терешин, Н. В. Энергетическая политика Китайской Народной Республики в современных условиях / Н. В. Терешин, И. Ш. Хасанов // Глобальная экономика и образование. – 2023. – Т. 3, № 1. – С. 55–64.

21. 康红普，王国法，姜鹏飞，等. 煤矿千米深井围岩控制及智能开采 技术构想 // 煤炭学报. – 2018. – 43 (7). – 1789−1800. = Кан, Х. Концепция контроля пластов и интеллектуальной технологии добычи в глубоких угольных шахтах глубиной более 1000 м / Хунпу Кан, Гофа Ван, Пэнфэй Цзян [и др.] // Журнал Китайского угольного общества. – 2018. – 43 (7). – С. 1789−1800.

22. 康红普，姜鹏飞，刘畅. 煤巷智能快速掘进技术与装备的发展方 向 // 采矿与岩层控制工程学报. – 2023. – 5 (2). – 5−7. = Кан, Х. Разработка интеллектуальной технологии быстрой выемки и оборудования для угольных шахтных выработок / Хунпу Кан, Пэнфэй Цзян, Чанг Лю // Журнал по горному делу и контролю пластов. – 2023. – 5 (2). – С. 5−7.

23. 康红普，谢和平，任世华，等. 全球产业链与能源供应链重构背景 下我国煤炭行业发展策略研究 // 中国工程科学. – 2022. – 24 (6). – 26−37. = Кан, Х. Стратегия развития угольной промышленности Китая в условиях реконструкции глобальной промышленной цепочки и цепочки поставок энергии / Хунпу Кан, Хэпин Се, Шихуа Жэнь [и др.] // Стратегическое исследование CAE. – 2022. – 24 (6). – С. 26−37.

24. 王国法，张良，李首滨，等. 煤矿无人化智能开采系统理论与技术 研发进展 // 煤炭学报. – 2023. – 48 (1). – 34−53. = Ван, Г. Прогресс в теории и технологическом развитии беспилотной интеллектуальной системы добычи полезных ископаемых / Гофа Ван, Лян Чжан, Шубинь Ли [и др.] // Журнал Китайского угольного общества. – 2023. – 48 (1). – С. 34−53.

25. 王国法. 煤矿智能化最新技术进展与问题探讨 // 煤炭科学技术. – 2022. – 50 (1). – 1−27. = Ван, Г. Новый технологический прогресс разведки угольных шахт и его проблемы / Гофа Ван // Угольная наука и технологии. – 2022. – 50 (1). – С. 1−27.

26. Мелешко, Ю. В. Эндогенные факторы, обуславливающие становление Индустрии 4.0 в горной промышленности / Ю. В. Мелешко // Большая Евразия: развитие, безопасность, сотрудничество. Ежегодник. – М., 2022. – Вып. 5. Ч. 1. – С. 893–895.

27. Епихина, Р. А. Роль электроэнергетики во внешнеэкономической экспансии КНР / Р. А. Епихина // Контуры глобальных трансформаций: политика, экономика, право. – 2019. – Т. 12, № 6. – С. 188–202. DOI: 10.23932/2542-0240-2019-12-6-9.