

Ecological Aspects of Coal Mining Enterprises' Activity in Conditions of Digitalization

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Abstract. The study is devoted to the environmental aspects of coal mining enterprises' activity in digitalization of economy. It substantiates the statement that the innovative development of coal mining enterprises should be based on the concept of greening economy and greening production. The authors proposed modern environmental and economic instruments of state environmental policy. It is substantiated that in order to ensure the effective functioning of coal mining enterprises, it is necessary to apply new digital tools of resource and environmental policies focused on the use of modern software and analytical technologies: optimization packages of applied programs, solving geo-economic problems of visualization of ecological-and-economic state and development of territories. The results of study presented in the paper allow reconciling the complex and controversial tasks of greening enterprises and territories, implementing an adequate local environmental policy, taking into account the human adaptation to harmful natural and man-made factors.

1 Introduction

In modern conditions, the solution of environmental problems becomes extremely important. The impact of the environmental factor on sustainable social-and-economic development in the Russian Federation and its extracting regions, such as the Kemerovo Region, is becoming very significant. The problems associated with the environment have a direct impact on the political and legal institutions and the economy of the country. Today, the level of environmental quality is at a potentially dangerous stage of its development for the life of society in economic, legal, political, and social spheres. The depletion of country's natural resources threatens the living of state, society, individual.

With all its changes, modern economy of Russia still retains its raw materials orientation, and revenues from exporting the energy resources constitute the majority of the budget of the Russian Federation. Over the past 25 years, Kuzbass has become the leading export-oriented region in the Russian Federation, supplying raw materials to the world markets, primarily coal, as well as primary raw materials processing products — metals and chemical products. The structural reorganization of economy, about which much is said and

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written, has not yet acquired stable dynamics in Russia and Kuzbass. The federal budget and the investment climate largely depend on demand and price situation on the global energy market. The strict dependence of exporting energy and mineral resources on the situation on the world market leads to a decrease in stability of economy, ill-preparedness for crises, and also limits the growth rates of national and regional economies.

The increasing scale of mineral resources' extraction and the degree of human interaction with the natural environment cause an increase in environmental risk, because mining enterprises provide not only the material basis for industrial enterprises, but also are characterized by increased danger of technological processes, their negative impact on ecosystem and human health, as well as the impact of the environment itself on individual in the framework of natural-territorial-industrial complexes in coal mining regions of the Russian Federation.

Environmental aspects are of utmost relevance in the operation of coal mining enterprises. At the initiative of the Governor of the Kemerovo Region the regional complex project "Clean Coal - Clean Kuzbass" was launched in March 2019. Its task is to bring order to the coal enterprises of the region, to take measures in protecting the territories from heavyweights transporting coal. At the same time, the environmental component should be the basis for the development of industry, in particular, coal one.

2 Materials and methods

The Kemerovo Region is a region with a diversified economy, a high concentration of raw materials and processing industries, which inevitably has a negative impact on the natural environment and individual. For many years, according to experts, the Kemerovo region has occupied a leading position in Russia in terms of the number of environmental problems and their significance for society and economy, since the mining and coal industries have the greatest anthropogenic pressure on the environment and the most destructive impact on the state of ecosystems. The impact is associated with emissions of methane gas, active discharge of mine wastewater, with a large amount of accumulated and annually generated waste, which leads to absolute environmental damage [1].

As international and domestic practice shows the innovative development of coal mining enterprises should be based on the concept of greening economy, which refers to a combination of legal, organizational, managerial, financial, economic and technological measures using intensive coal mining technologies based on reducing pressure on the environment. At the same time, the goal of production – making profit at sufficient rates of economic development of the country or region – is preserved.

The increasing scale of extraction of mineral resources and the degree of human interaction with the natural environment cause an increase in environmental risk, because mining enterprises provide not only the material basis for industrial enterprises, but are also characterized by increased danger of technological processes, their negative impact on the ecosystem and human health, as well as the impact of environment itself on individuals in the framework of natural territorial production complexes. Thus, in 2017, Kuzbass produced 240.4 million tons of coal, and in 2035, in prospect, the planned production will be about 350 million tons per year. If the technological level of production remains the same, it will lead to the following irreversible changes in ecology of the region:

- a large amount of waste (rock) generated in the process of mining, with the total environmental damage from the open extracting method in about 10 times more than from underground one, which leads to the withdrawal from agricultural use of land used for storing waste – bio-agrotechnical violations;
- an increase in the level of natural radiation due to the formation of rock dumps;
- creation of dust emissions, especially in open mines – aerodynamic disturbances;

- pollution of water bodies by sewage generated during mining operations, flooding of areas adjacent to the mining enterprise – hydrodynamic disturbances;
- subsidence of soil under the mine workings, which leads to the formation of sinkholes, the formation of reservoirs, the inability to use the territory for economic activities, housing construction – geo-mechanical violations;
- violation of the ecosystem of the territory, the disappearance of a large number of flora and fauna representatives, including those listed in the Red Book – biocenotic violations;
- due to the violation of the ecosystem of mining regions – an increase in population incidence, a decrease in life expectancy.

As part of the country's environmental policy, environmental activities are multi-purpose in nature and provide the implementation of the following functions:

- compensation of negative environmental effects of economic development;
- stimulating the development of environmentally balanced and environmentally protecting measures and industries;
- suppression of inefficient use of resources in the direction of their economical use and reducing the environmental pressure;
- environmental control and monitoring of environmental activities of enterprises.

In the context of creating conditions for resolving environmental problems and modernizing the economy of the Russian Federation, defined as priority directions of the country's strategic development, formalized in international rules and regulations, in our opinion, new functions should be added that have an important meaning for economic participants – users of natural resources in view of changing internal and external conditions [2].

In our opinion, one of these new targeted functions can and should be the mandatory requirement and the need to implement environmental policies in accordance with the international standards that help reduce emissions by industrial participants at the regional and national levels, as well as at the micro level, without losses on a global scale. This function is enhanced by the fact that at present, taking into account globalization processes, there is not only an increase in international production, a ramification of value chains, but also an increase in the scale of management in environmental activities going beyond national boundaries, which predetermines the increasing role of international regulation and institutional structures in the environmental field.

To date, the state legal regulation of environmental safety problems arising in the coal industry is determined by both federal and regional acts, but there is no complete system of legal support for the greening process. In the future, it is necessary to improve the legal mechanism in the coal industry, which, according to the authors, should be based on a multi-level approach. One of the effective steps in this direction could be the adoption of the Environmental code by the experience of a number of foreign countries (France, etc.). The Environmental code should contain both the rules governing the protection of environment and the norms of criminal, civil, tax, administrative and other branches of law. Within the framework of proposed Environmental code, the advance development and long-term planning of land allocation and re-cultivated facilities for coal mining should be provided so that residents of mining regions and other economic entities located on the territory can timely reconfigure their economic process and lifestyle.

According to the authors, it is advisable to leave in the regions and transfer part of the environmental payments collected in the constituent entities of the Russian Federation to the so-called “Ecological and Innovation Fund” used to finance the introduction of new environmentally friendly technologies in order to stimulate innovative development of existing and new businesses in mineral and raw material clusters of territories.

The identification and analysis of environmental problems have shown that the most destabilizing environmental impact is caused by the functioning of the fuel and energy

complex in coal mining regions of the Russian Federation, including the Kemerovo region. The fuel and energy complex provides about half of the annual emissions of pollutants into the atmosphere from stationary sources, 30% of polluted wastewater, and 40% of industrial waste from enterprises located in the region. The level of air pollution in such mineral and raw material clusters exceeds the maximum permissible; the range of emissions is higher in the area of enterprises with open coal mining. Due to the significant scale of environmental damage in mineral and raw material clusters like the Kemerovo Region, it is not enough to use environmental and economic tools only at the regional level, they are advisable at the national level, and it is required to take into account payments depending on the region, on its natural, social conditions of functioning [3].

Effective environmental and economic instruments of state policy in mineral and raw material clusters should be developed on cross-industry basis, for example, in the form of supporting energy-saving business, which involves a transition from direct financial assistance from the state to building a system for implementing effective business projects in the relevant field, insuring commercial and industrial non-commercial risks. Measures for energy saving and efficient use of energy should become an obligatory part of regional programs for social-and-economic development of regions, including regional energy programs [4].

The definition of “greening economy” is closely related to the concept of “greening production”, but it has more narrow content. In this sense, the greening production means using technologies which advance the production processes to the natural cycles of substances in the biosphere, as well as reduce the danger of material production for nature and man implementing the basic and supporting processes at the micro level.

Greening production includes the implementation of the following processes:

- formation of theoretical and methodological approaches to the greening of enterprises, taking into account their form of ownership, features of production and sector of the enterprise;
- provision of technical and economic conditions for the greening of production both at the stages of design and construction, as well as at operation stage of enterprise;
- development and implementation of resource-saving technologies that allow comprehensive, rational use of raw materials on the basis of “deep” redistribution [5].

Ecologization of production (enterprise) is based on the introduction of innovative environmentally friendly production technologies, including the choice of locations for industrial complexes, taking into account their impact on the ecology of the region, the organization of environmental measures during its operation. Ecologization of an enterprise implies not only ecologization of product manufacturing and its consumption, which is especially important for complex products, but also ecologization of its utilization. The ideal option for greening production is to concentrate on one production site the technology of production and utilization of products.

At the level of the enterprise’s production activities, greening production involves the following actions:

- manufacturing of such types of products the use of which causes minimal damage to environment;
- introduction of production technologies according to the results of which minimum waste remains;
- use of effective cleaning means and methods;
- multistage redistribution of resources, creation of various versions of new products from industrial waste.

Ecologization of the economy and production contributes to the penetration of ideas and environmental problems in various sectors of economy, educating workers and consumers

who are aware of their responsibility for the ecosystem in terms of minimizing damage caused in the process of production and consumption.

In this regard, the development and implementation of a mechanism for environmental insurance is a relevant tool for greening coal mining enterprises. The object of insurance should be the risk of environmental pollution, and business entities are obliged to pay insurance payments, depending on the degree of their environmental hazard. Being accumulated in special insurance funds, such payments can create a basis for the guaranteed compensation of damage caused to environment.

By nature, pollution risk insurance may be voluntary or mandatory. The most environmentally hazardous business entities should be subject to compulsory insurance. All other users of natural resources can carry out voluntary environmental insurance or create their own reserve fund to compensate environmental and economic damage in case of accidental emissions of pollutants [6].

For the harmonious inclusion of environmental insurance of economic activities in the system of environmental and economic regulation, we must have a data bank of all business entities in the territory. Depending on their industry sector and environmental risk, it is necessary to establish the scope of responsibility and develop methods for determining insurance premium rates, to determine the organization – the holder of insurance payments (public or private), to carry out continuous monitoring of natural resource users' environmental activity, etc. The function of such a "holder" can be performed by the mentioned above "Ecological and Innovation Fund".

It seems relevant to use the experience of foreign countries in the field of paid environmental management. The system of paid use of natural resources that has been developed in Russia cannot be called effective. This is due to the fact that low rates of payments do not play a stimulating role. On the other hand, in the case of emergency excess emissions of pollutants into the environment, there is an objective impossibility of withdrawing funds from nature users due to the lack or absence of financial resources at all [7].

It is advisable to use the experience accumulated in other countries in the trade of pollution rights, which allows fulfilling the requirements of environmental standards for the region, and also creates a material interest for coal mining enterprises in greening their business activities.

In modern conditions, production and sales technologies lose or reduce their efficiency, products and services become open and transparent for consumers. The use of basic end-to-end technologies, such as big data, neurotechnologies and artificial intelligence, wireless technologies, virtual and augmented reality technologies, which are actual drivers of economic development, gains priority importance.

Authors consider digitization of economy to be a key point for Russia's social-and-economic development and the effectiveness of national and regional environmental policies.

The essence of an environmentally oriented change in the structure of economy consists in stabilizing the growth and production volumes of nature-exploiting, resource-extracting industries with the rapid development on a modern technological basis of all industries related to the transformation of a natural substance. Economic restructuring, which implies a redistribution of labor, material, financial resources in favor of resource-saving industries and activities, will significantly decrease the environmental intensity of products and services, reduce the burden on environment and overall need for natural resources. The same priority principle of greening economy and its ecological orientation should be transferred to the national and territorial level (regional and municipal). This also shows the principle of globalization, when an environmental problem of a global nature must be

solved locally in the mineral and raw material cluster by aggregating greening tools at the national, regional and municipal levels [8].

In our opinion, to ensure the effective functioning of ecological system, it is necessary to apply new tools of ecological and economic functioning mechanism in mining regions on a modern information technology base with solving data mining problems, knowledge discovery tasks, and environmental-and-economic interaction of participants and activities of environmental administration institutions of the territories.

At the level of the constituent entities of the Russian Federation and their municipalities, these innovative mechanisms are digital tools of resource-environmental policy focused on the use of modern software and analytical technologies: optimization packages of applied programs, solving geo-economic problems of visualization of the environmental-and-economic state and development of territories.

Situation centers of social-and-economic development of territories implementing effective management influences and making operational environmental-and-economic decisions can act as effective practical innovative tools in solving the above problems of ecologization of mining regions. One of the well-known examples of such centers is the Situational Center for Social-and-Economic Development of Plekhanov Russian University of Economics.

Such Situation Centers are established in a number of branches of the University, including Kemerovo Branch (Institute) of Plekhanov Russian University of Economics. Digital technologies available in the center allow solving environmental policy problems, monitoring the ecological and economic condition and development of territories of the Kemerovo Region using an information and analytical database, an automated information system for assessing the environmental and economic efficiency of business planning, as well as a computer program for geo-economic visualization and analysis of territory indicators.

3 Results and discussion

The system of knowledge created by the works of many scientists and related to the concept of sustainable development has laid the theoretical and methodological foundations of this multifaceted scientific category. As its most important aspect in the scientific mainstream environmental and economic relations are surely distinguished. The newest period in Russian history is associated with the modernization and diversification of economy, its adaptation to work without the former priority of commodity exports and high demand. All these features form the issues of effective regulation of relations in the field of ecology, as well as the creation of models of sustainable development that are adequate to time and conditions, the search for new forms and methods, views on the problems of regulation in the environmental sphere in the context of global development.

Taking into account the complexity and inconsistency of the tasks of greening enterprises and territories, it is necessary to use a systematic approach to solving them, consisting in developing regulators balanced with each other:

- methodology for the formation of a greening mechanism;
- innovative tools for resource-environmental policy at the level of the constituent entities of the Russian Federation and their municipalities;
- economic and mathematical models, algorithms, application packages, which together allow support for management decision-making in the field of greening enterprises and territories [9-12].

The analysis of environmental and economic instruments of state regulation in the field of environmental protection revealed that the modern regulatory mechanism in environmental management in Russia and its regions operates on a market basis only

partially in limited forms with elements of coercive measures of both economic and non-economic nature. There are great prospects for the development of market mechanisms for the sale of pollution rights in accordance with the current world practice of quotas in the environmental field [13].

To enhance the role of tax instruments in the environmental development of the Russian Federation, the following steps should be taken:

1. To give environmental payments a status of tax, that would be administered by tax authorities.
2. To envisage the payments for a negative impact on the environment in the target fund of a constituent entity of the Russian Federation (for example, "Ecological and Innovation Fund").
3. To increase the payment rates for the negative impact on the environment, but to provide incentives for nature users, who provide significant funds to finance measures to reduce the harmful effects on ecological system.

At the same time, the development and introduction of economic incentive methods, which include direct and indirect subsidies (investment and for covering operating costs) to private firms, regional and local authorities; loans at low interest rates, bank loans guarantees; provision of accelerated depreciation of cleaning equipment and other environmentally friendly equipment; preferential rates for indirect taxes on the sale of environmentally friendly equipment or its exemption from taxation; tax incentives for income from environmental programs to private enterprises; preferential tariffs to firms for wastewater treatment at municipal centralized water treatment plants, etc. deserve special interest [14-15].

In the conditions of digitalization of Russian economy, much attention is given to the use of digital tools of environmental policy at coal mining enterprises.

4 Conclusions

The innovative regulatory instruments in environmental field proposed in this study are a generalization of a part of modern practice and a consequence of the economy realities. Determining the number of regulation methods and tools in the environmental sphere should be carried out taking into account the adaptation of ecological-and-economic mechanism of the territories to working in economic instability, which is a key factor in modern Russian economy. The analysis of economic dynamics of the regions considering the resource wealth factor and the development of a management concept for this factor will be an important component in the development of a regional sustainable development strategy.

This will allow assessing the effects of anthropogenic pressure in the context of globalization, and locally implement an adequate environmental policy at a supranational, national, regional, municipal and micro level in conjunction with sustainable development of territories and taking into account human adaptation to harmful natural and man-made factors.

Expanding the use of digital tools of resource-environmental policy will help to involve specialists in the processes of learning the essence of economy on a new level, its digital structure, which can expand the boundaries of knowledge, increase the level of information exchange, and specialize the epistemological foundations for studying the digital economy. From the standpoint of coal mining enterprises, the practical significance of the proposed tools for environmental and economic regulation is the ability to change the environmental planning of enterprises, develop their environmental management in the context of globalization in accordance with the requirements of western partners and investors for the

environmental quality of the product supplied to the international market and the environmental standards of production process itself developed abroad.

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