# METHODS FOR ASSESSING THE GREEN ECONOMIC EFFICIENCY OF MINING INDUSTRY ENTERPRISES

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***Annotation.*** *The mining industry, as one of the sectors of strategic importance in the world economy, plays a leading role in the formation of large capital flows, technological innovations and the labor market. However, this sector is also associated with environmental problems, in particular, damage to the environment and the threat of depletion of natural resources. From this point of view, assessing the green economic efficiency of the mining industry, rational use of resources, waste reduction and control over the introduction of ecological innovations are one of the current scientific and practical issues today.*

***Keywords:*** *industrial enterprises, theories, efficiency, economy.*

The concept of a green economy allows for the assessment of the mining industry by adding environmental efficiency and social sustainability to traditional economic indicators. Within the framework of this approach, increasing production volumes with minimal damage to the environment, attracting renewable energy sources, and systematically reducing environmental risk factors become priorities. In particular, strategies of mining enterprises aimed at waste management, efficient use of water resources, and reducing energy consumption are important criteria for determining green economic efficiency.

In today's era of globalization and increased environmental risks, accurate and scientifically based methods are necessary to assess the green economic efficiency of the mining industry. These assessment methods allow for a qualitative and quantitative analysis of the impact of industrial activities on the environment. These scientific approaches serve to transform the mining industry in the direction of environmental sustainability and are consistent with the goals of national and global economic development.

Although most of the assessment methods used today to assess the green economic status of the mining industry are focused on state policy, there are also approaches to interpreting the economic basis. The proposal for an economic assessment of the environment by R. Cabe in 1989 was put forward with this view: “a combination of natural resource accounting with the concept of national income and the analysis of natural resources and environmental health is based on product accounting”.

"In the 1960s, initial studies were carried out on the assessment of the environmental impact of the mining industry, which mainly studied the level of pollution and its impact on human health. For example, in the USA, in 1969, the National Environmental Policy Act (NEPA) was adopted, which introduced the Environmental Impact Assessment (EIA) process. This method made it possible to assess the environmental impact of mining projects in advance. On its basis, reclamation processes were included in the design and estimate work, and cases of non-compliance with it were observed, which resulted in fines." According to it, the assessment method was carried out as follows:

(1.1) Where: C- Concentration (mg/m³) – the amount of pollutants in the air; Q- Pollutant output (mg/h); H- Height of production pipelines (m); V- Wind speed (m/s). This formula was used to determine how dust and gases emitted during mining processes affect the air. This formula was developed based on the so-called Gaussian dispersion model, which describes the distribution of pollutants in atmospheric air. The Gaussian dispersion model and the equations based on it were inspired by the principles of the German mathematician Carl Friedrich Gauss. This model was later developed by various atmospheric physicists and ecologists. It is very important in assessing air pollution and determining the environmental impact of emissions from industrial facilities.

Conventional valuation methods and formulas are considered insufficient to determine the green economic potential and efficiency of mining enterprises. Accordingly, Polish economist Van der Zee and his research colleagues in 2004 proposed a step-by-step method combining the CBA model and the MCA to analyze costs and benefits in order to support decision-makers in selecting the most market-friendly options for landfill mining projects. Developing this approach, Van Passel in 2013 created a CBA modeling tool that covers the various stages of the waste mining process, including soil extraction, waste sorting and pre-processing, the incineration process and unforeseen costs. It also covers a wide range of benefits, including waste-to-materials (WtM), waste-to-energy (WtE) and land reclamation. In addition, the conditional valuation method (CVM) was used to estimate the social benefits of landfill waste extraction and recovery.

The green efficiency index is important in assessing energy efficiency, rational use of resources and the environmental impact of technological processes. This indicator is aimed at reducing the carbon footprint of the mining industry and increasing environmental sustainability.

The green labor efficiency indicator assesses the efficiency of the workforce and environmental working conditions in mining enterprises. This indicator is directly related to technological efficiency and resource conservation. Ensuring environmental safety in mining and developing green labor will serve to improve this indicator.

Through these indicators, the mining industry can be developed in accordance with the environmental and economic goals of the biocluster. Each indicator is important for

developing a green economy and ensuring environmental sustainability in mining, and the biocluster approach creates an effective system for comprehensively managing these processes.

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