A Dynamic Resource Database as an Element of Effective Deposit Management

Hard coal mining in Poland is withdrawing from the energy market. Deteriorating geological conditions and rising energy and labor costs are reducing the profitability of deposit exploitation. At the same time, current methods for estimating reserves do not sufficiently account for the impact of geological, mining, and market conditions on the feasibility of profitable extraction.

The ongoing development of digital tools enables the use of new methods for forecasting deposit conditions and simulating mining processes. The use of these tools can contribute to the creation of schedules that are more resilient to risks associated with the uncertainty of deposit parameter estimates and changing conditions as well as to an improvement in the financial performance of mining companies.

The concept of a dynamic resource base assumes that resources include only those parts of a mineral deposit that can be extracted safely and profitably. Therefore, the developed method outlines a procedure for determining a deposit's resource base based on an economic evaluation of its exploitation scenarios. To this end, a proprietary method was applied to estimate the efficiency of individual parts of the deposit and the deposit as a whole, by making use of discounted cash flow method and related metrics.

The method for determining the resource base uses a digital deposit model as the source of geological data. The digital mining model serves as the environment for processing production data. As part of the economic model, the method specifies an algorithm for estimating the value of coal and the costs of longwall mining, based on a proprietary allocation of costs broken down using Activity-Based Costing. Using these indicators, a tool was developed that allows for testing multiple variants of longwall mining of a mining parcel and selecting the longwall layout with the most favorable economic parameters. The longwall layouts generated by this tool were then evaluated in terms of the profit equivalent achieved and incorporated into mining schedules, whose economic efficiency was assessed based on the NPV. The time-varying adjusted WACC, determined based on a model of mining conditions' severity, was used as the discount rate. The method was verified by estimating reserves and developing mining scenarios for the example "N" deposit, whose model was created based on data from an actual hard coal deposit.

In summary, the developed method can assist mining companies in selecting deposit exploitation schedules and, for government authorities, serve as a tool for evaluating the mining sector's ability to achieve stable hard coal production while maintaining mining profitability.