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Prognozowanie wielkości sprzedaży węgla kamiennego dla grupy kopalń

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Prediction of the quantity of coal sales for a group of coal mines

From the nineties to the present the transformation of the coal market has involved the significant reduction in energy intensity of the production processes and products, while the annual fluctuations in the coal demand have been maintained due to the fact that coal belongs to seasonal goods. Thus it becomes necessary to consider the issue of what the capability of the excavation face should be in order to satisfy ever lower, but still variable demand for coal. The answer to this question has also major significance in the analysis and evaluation of the energy security of a country.

The forecasting methods occupy an important place in the process of planning as they inform the "planner" what the probable absorption of coal market will be while maintaining the existing economic development strategy. It is necessary to use mathematical methods of forecasting in order to create a national economic development strategy. This justifies the scientific research related to the formulation of forecasting methods and techniques connected with creating a model enabling to predict the reliable quantities of coal sales.

This PhD thesis comprises a set of forecasting methods based on: the temporal decomposition of coal sales quantities using the fast Fourier transform (statistical method), the autoregressive model with external input (ARX) and the autoregressive model (AR). All the methods presented in the work were analyzed in detail. Consequently, the forecasting data obtained in this way were evaluated by the use of the ex post error, as well as the indicators of convergence and determination, that ascertain the adjustment to the course of the actual model in percentage terms. The forecasting data were also compared with the actual quantities of coal sales in the so-called step back, that is the prediction for the period for which we have the actual data. The results of these evaluations paved the way for the construction of a long-term forecast model with the lowest error values ex post, and the highest coefficient of determination. Each of these methods required the development of computer software. The software was implemented in the environment Matlab 5.3 and Matlab 7.0

The results were compared to projected estimates prepared by the Agencja Rynku Energii S.A for the Polish coal market.

For my doctoral thesis the forecasts of coal sales as an alternative source of energy were also developed, where the explanation variable was the sale of coal, while the explanatory variables were: the consumption of oil and natural gas.