Streszczenie w języku angielskim

Despite the decreasing demand for hard coal used for electricity and heat production in the last few decades, the issue of reducing the costs of supplying fuels to power companies still remains relevant. It is of particular importance in the context of high fuel costs and the imperative need to reduce emissions resulting from the active climate and energy policy conducted by the European Commission. Optimizing the selection of coal to meet the requirements of power plants in terms of quality parameters, translates directly into the financial benefits of energy companies. The reduction of emissions of harmful substances contributes to lower environmental protection costs, purchasing CO_2 emission allowances, and waste management costs.

The focus of this study were the domestic power generation units. In particular, this dissertation looks at the possibility of reducing costs related to the supply and use of coal, defined as the cost of fuel supply, environmental protection costs, and costs of CO_2 emission allowances. Moreover, this study investigates the possibility of obtaining revenues related to the use of combustion by-products. An important element of this work was to determine the impact of fuel parameters on the emission of harmful substances to the environment. Furthermore, a crucial part of the dissertation is to analyze elements and relationships affecting the process of supplying coal to power plants like hard coal supply and demand analysis, determining the quality parameters expected by power plants, and analysis of environmental aspects (mainly the need to meet the standards emissions under BAT conclusions).

The main goal of the study presented in this dissertation was a quantitative analysis of the cost reduction potential related to the supply and use of hard coal in power generation units, by considering the costs of environmental protection and CO_2 emission allowances in the process of planning the supply of coal. In this research, three components were included in the costs associated to the supply and use of coal (defined in the study as total costs): (a) cost of supplies (purchase and transport) of coal, (b) costs of environmental protection (i.e. environmental charges for harmful substances, costs of consumption of sorbents used in environmental protection installations, costs of waste management taking into account revenues from the management of by-products of coal combustion) and (c) costs of CO_2 emission allowances.

To achieve the goals set out in this study, a research methodology based on mathematical modeling was applied. Linear Programming was used for the development of a mathematical model that reflects the key relationships between suppliers of coal and power generation units. The mathematical model was implemented in the General Algebraic Modeling System (GAMS). The research scenarios analyze the impact of environmental protection and CO_2 emission allowances costs on the coal supply planning process and on the reduction of costs related to the acquisition and consumption of coal in power plants.

The analysis of the results - for the research scenarios - concerned the distribution of coal for the electricity production process, the value of emissions of harmful substances to the environment and the impact of additional cost components (environmental protection costs and CO_2 emission allowances) on the reduction of costs related to the supply and use of coal in power generation units. The main conclusions from the conducted study are as follow:

- The distribution of coals for the power plants in each of the scenarios met the imposed limitations on fuel quality parameters and compliance with the emission standards set out in the BAT conclusions. The selection of coal depends on the consideration of additional cost components in the objective function, formulated as the minimization of total cost of supplying and using coal.
- The appropriate selection of coal, as a result of including the costs of environmental protection and CO_2 emission allowances in the process of planning the supply of this fuel, reduces the total costs of supplying and use of coal in the electricity production process. However, depending on the specific cost-generating components in the objective function, the scale of this impact differs.
- The inclusion of environmental components and the cost of CO_2 emission allowances in the objective function increases the value of the component related to delivery costs. Nevertheless, the benefit obtained by reducing the other costs related to using coal is significantly higher. As a consequence, this leads to a significant reduction in the total cost of supplying and using coal in power generating units.
- The greatest potential for reducing total costs related to the supply and use of hard coal in utility power plants concerns the possibility of selecting coal with quality parameters contributing to the reduction of CO_2 emissions. Thus, decreasing the costs of carbon dioxide emission allowances, which is reflected in the results of model calculations..

It is important to highlight that the research, methodology, and presented results in this dissertation are of practical application, particularly within the context making strategic decisions regarding coal supplies, both by energy companies, coal suppliers, as well as by other participants of the fuel and energy sector.