

Abstract

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The scientific purpose of the dissertation titled “**The methodology of eco-efficiency assessment of the shaft underground coal gasification method, for the purpose of electricity production**” was to develop a methodology to assess the eco-efficiency of the underground coal gasification method of residual coal seams using the shaft method, for the electricity production.

So formulated scientific objective allowed to achieve utilitarian goal which was to determine eco-efficiency for the technology of shaft underground coal gasification from residual coal seams, for the purpose of production of electricity, as well, as referring obtained results to the results of the assessment of eco-efficiency for the technology of production of electricity in coal-fired power stations (the reference technology).

A literature review on methods of assessment of eco-efficiency revealed that published results of eco-efficiency analysis refer to various economic and environmental efficiency indicators. It was also found that the guidelines included in the ISO 14045:2012 standard are not sufficient. This is the case with the process of selecting appropriate life cycle assessment method, as well as with how the economic efficiency assessment method is decided. Lack of guidelines for selecting appropriate method of life cycle evaluation, in order to perform assessment of environmental efficiency, together with the method of assessment of economic efficiency, has become motivation of the research.

The developed method of eco-efficiency includes specifically defined actions and steps, which should be taken for the purpose of evaluation of environmental and economic efficiency of the UCG. The developed methodology of eco-efficiency assessment has been validated through the shaft underground coal gasification for production of electricity. The thesis includes both: environmental and economic efficiency assessment of the life cycle of the technology of the underground coal gasification. A literature review has revealed no published results of scientific work related to evaluation of eco-efficiency of the shaft underground coal gasification process in the residual coal seams for the purpose of production of electricity. Technology and cost assumptions for the installation examined were developed upon input data found in literature on experimental results of underground coal gasification, as well as pre-project and project documentation for a pilot installation for shaft underground coal gasification in a local coal mine.

Obtained results of the assessment of eco-efficiency have been subject to vulnerability analysis, which allowed to define determinants of eco-efficiency in the shaft UCG technology for production of electricity.

Developed evaluation method for eco-efficiency assessment allows decision making process in coal mines in the scope of application of the shaft UCG technology in residual coal seams, or to support decisions regarding evaluation of the coal mine energy system in relation to energy supply network or UCG. Developed methodology may be used for assessment of eco-efficiency not only with regards to the coal gasification technology, but also for another clean coal technologies.