

Summary

My PhD dissertation consists of two integral parts. The first one is an introductory description of the studies carried out. It includes the following issues: the current state of art, the reasons for the choice of research topics, the scientific and application goal of the dissertation, the area and methods of research, a synthetic approach to the results and conclusions, and a bibliography of the contributions cited. Additionally, it also takes into account the results and conclusions of comprehensive studies on the identification of the resources and prospects for the occurrence, documentation, exploration and storage of lignite for conventional energy, as well as alternative methods of lignite exploitation. They were published in the papers attached to the application form to the Scientific Council of the Polish Geological Institute – National Research Institute (PGI-NRI) as confirmation of my scientific achievements. The second part of this dissertation is a collection of thematically related publications consisting of: four articles (national journals, list of the Ministry of Science and Higher Education), one monograph, two chapters in Polish monographs, and an article from an English-language journal (list of the Ministry of Science and Higher Education).

The presented PhD dissertation is a comprehensive overview of the development possibilities of Polish lignite deposits, with favorable geological and mining conditions, in order to extend the dynamic sufficiency of lignite resources. This applies in particular to the zone of occurrence zones of lignite deposits with significant resources, enabling long-term activity of mining districts and extending the life of operating mines through the development of satellite deposits. The research, performed in this dissertation, is focused mainly on the Wielkopolska and Bełchatów regions. These are two of the eight lignite-bearing regions identified in the western and central part of Poland.

The assumption of the dissertation is to demonstrate the relationship between the sedimentation environment and the deposition potential of phytogenic sediments with deposit concentrations. It is also important to indicate the importance of the raw material potential of the lignite-rich deposits in the Poznań grabens and the Bełchatów region in terms of the possibility of their future development, based on comprehensive characteristics. Another assumption of the dissertation is to define the scope and method of proper documentation and presentation of geological data on lignite deposits to the extent

necessary to make investment decisions. This applies to the exploitation of deposits in a conventional manner and (possibly) using unconventional technologies for the exploitation and use of this raw material.

The research was carried out on the basis of a comprehensive analysis of published and archival materials, as well as my own, unpublished handwritten ones. The geological data, collected at the National Geological Archives of the Polish Geological Institute and its local branches, environmental protection and water management departments of provincial (voivodship) offices and their branches, and (if possible) geological enterprises, have been revised. These are abundant published and archival materials that contain the results of geological penetration and exploration research, and the occurrence of lignite in the Paleogene and Neogene deposits of Poland, mainly in the Polish Lowlands. In total, several hundred different items were analyzed, including deposit and mining maps, as well as borehole profiles. Inventory works and analytical tests of archival materials were supplemented with fieldwork, in particular profiling and sampling of drilling cores from lignite deposits. This was achieved, among others, by: 1) profiling and verification over 20,000 m of drilling cores made for the purpose of documenting the Żłoczew lignite deposit; 2) determining the stratigraphic profile of Paleogene and Neogene by making a series of boreholes in the Milicz–Twardogóra–Syców region; and 3) identifying the prospects for the presence of lignite in this region and determining the geological and mining parameters of coal occurrence. The obtained results became the basis for the creation of deposit profiles and their conceptual models. In the case of the Żłoczew deposit, a spatial model was created and resources suitable for gasification were additionally estimated.

In the situation of the resources depletion in currently exploited deposits and the need to further ensure the country's energy security, it is necessary to recognize lignite deposits as strategic. The Doctrine of the Polish Energy Policy until 2040 indicates lignite as one of the sources ensuring coverage of the growing demand for electricity. The resources of satellite deposits, located in the vicinity of the exploited main deposits, are of particular value for the lignite mining industry. Due to the conflict of mining activities, especially large-scale lignite mining by opencast (surface) methods, research on the development of new, previously unused in Poland, technologies for the management of lignite resources are becoming

increasingly important. Despite the negative recommendations to date, it seems necessary to identify the resource base in terms of unconventional methods of lignite mining, among which thermal gasification of lignite in the deposit (underground coal gasification – UCG) is in the foreground. In this case, lignite seams much deeper (>350 m) than those intended for opencast mining, as well as seams with a thickness below that adopted in the balance criteria (<3 m), may be taken into account.