



THE RESERVE BASE OF HARD COAL IN POLAND: A REVIEW OF CHANGES IN THE PROCESS OF RESTRUCTURING OF THE COAL MINING SECTOR

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Abstract. On the turn of the 1980s and 1990s several unfavourable events affected the Polish hard coal mining. Critical for the mining sector were breakdown of the country's request for energy and drop of coal prices on the world market. In the period of 1989–1998, Poland's economic reserves (balance sheet resources) of hard coal decreased by 17%, and the industrial reserves dropped by 41%. Simultaneously, there was and there is still in progress a programme of technical and economic restructuring of the hard coal mining. According to the restructuring programme of coal mining, the total yearly output of Polish hard coalmines will drop from 101 million t in 2003 to 80 million t in 2020. However, there should be taken into consideration that in consequence of 2003–2020 liquidation of consecutive coalmines, ceasing of mining of the coal balance sheet reserves contained in seams below 1.50 m thick as well as other factors may limit the recoverable reserves of coal. In this context, it is highly possible that in the period 2010–2020 the availability of coal resources will be one of the critical problems of hard coal mining in Poland.

Key words: hard coal, reserves, restructuring, mines, Poland.

On the turn of the 1980s and 1990s several unfavourable events, generally connected with the collapse of the state-controlled economy, affected the Polish hard coal mining industry. Critical for the mining sector were: decrease of the country's request for energy and drop of coal prices on the world market.

Production capacity of Polish hard coal mines, reaching in 1989 about 180 million ton per year, proved dramatically too high in respect of the country's demands and possibilities of economic export. In this situation, a very deep restructuring of the hard coal mining sector was needed. The restructuring was initiated in 1989, and still continues with various intensity.

On the territory of Poland, there are three areas with the Upper Carboniferous coal deposits: Lower Silesian Coal Basin (LSCB), Upper Silesian Coal Basin (USCB), and Lublin Coal Basin (LCB).

At the beginning of the hard coal mining reforms in Poland, the economic reserves of hard coal amounted to 65,850 million ton in 121 coal fields (as on the 31st December 1989; Przeniosło, 1990).

With respect to the Polish coal basins, the hard coal economic reserves are shown on [Table 1](#).

With respect to the hard coal economic reserves and industrial reserves within exploitation fields (active mines and mines under construction in 1989), the reserves are shown on [Table 2](#).

In 1994, a new Mining and Geologic Law was brought into effect. At the same time, a new recommended criteria for economic reserves were introduced. Comparison of "old" and "new" criteria for economic coals presents [Table 3](#). The table shows that the raise of criteria requirements of coal quality occurs with regard to economic reserves, as well as simultaneous standardisation of criteria used with regard to different coal types. The greatest impact on the decrease of hard coal economic reserves has the assumption of 1.0 meter minimum thickness of coal seams and requirement of economic reserve exploration to the depth of 1,000 m only (except for mines in which there are possibilities of further exploitation). In accordance with the new Mining and Geologic Law, different criteria may be used for each hard coal deposit, but they have to be approved by the responsible geologic administration.

A progressive verification of hard coal economic reserves is contained in subsequent new geological reports and their supplements. It is also done in new pre-feasibility studies.

Except for the changes in economic reserves, caused by the new criteria, some changes were caused by the liquidation of several coal mines. In the period of 1989–1998, as result of the restructuring process, the number of operating coal mines was reduced to 63 (60 in USCB, 2 in LSCB, 1 in LCB). At the same time, Poland's hard coal economic reserves decreased by 17%, however, the coal industrial reserves dropped by 41%. With

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Table 1
Economic reserves of hard coal in Poland
(as on the 31st December 1989)

Coal basin	Number of deposits	Economic reserves [mln ton]
LSCB	7	461
USCB	101	57,679
LCB	13	7,710
Total	121	65,850

Table 2
Hard coal economic reserves and industrial reserves
within exploitation fields in Poland
(as on the 31st December 1989)

Coal basin	Number of mines	Economic reserves [mln ton]	Industry reserves [mln ton]
LSCB	5	389	251
USCB	66	29,415	16,430
LCB	2	763	455
Total	73	30,567	17,236

respect to the USCB, the economic reserves decreased by 31%, but industrial reserves decreased there by 39%. The most extensive changes in the resource base were observed after 1994 when the new criteria of coal reserves classification were introduced.

Simultaneously, there was, and there is still in progress, a programme of technical and economic restructuring of the hard coal mining, aimed at increase of efficiency of mining processes and at improving economics of the coal mines. This programme also caused some changes in the hard coal resource base, mainly in the category of industrial and technically recoverable reserves. The changes were caused by the following factors:

- decreasing the mining of seams with thickness lower than 1.50 m, as well as of seams dipping more than 45°,
- limiting the mining of coal seams with ash content above 20%,
- dropping the mining of coal seams in tectonically complex parts of deposits,
- limiting the mining in areas characterised by a high risk of natural hazards (e.g. rock bursts, water and methane hazards, etc),
- limiting the mining in planned investments protective pillar zones (e.g. construction of A-1 and A-4 highways, crossing Upper Silesia).

The “governmental programme of hard coal mining reform in Poland for the period 1998–2002”, along with its further corrections, assumed a significant acceleration of the restructuring processes, such as:

- decrease of hard coal output in 2002 to 101 million ton, and in 2020 to 80 million ton,
- final closure of hard coal mining in Lower Silesia,
- leaving only 39 operating coal mines in Upper Silesia after the year 2002.

Verification of resource base, liquidation of coal mines, and exploitation of hard coal during the period 1998–2002 will cause further decrease of economic and industrial reserves. In the largest Polish coal basin: the Upper Silesian Coal Basin, industrial reserves in active mines will amount to about 8,500 million ton at the end of the year 2002 (Table 4).

Evaluation of the country’s hard coal resource base, from the point of view of its sufficiency for the nearest future, concentrates on the recoverable reserves existing in working levels of coal mines, and in levels under construction. Due to the financial problems of the hard coal mining, it seems difficult to expect that any substantial investments will increase the industrial and recoverable reserves.

On the contrary, further limitation of those reserves, caused, for example, by the construction of highways, should be expected. Only in the area of Gliwice Coal Company, the protection of highways will lock-up about 150 million ton of recoverable reserves.

Table 3
Recommended criteria for geological exploration of hard coal deposits; limit values for economic seams; fundamental parameters

Parameter	Order No 18 of the Minister of Mining and Energy, 21.04.1971		Recommended criteria of the Ministry of Environmental Protection, Natural Resources and Forestry for the mineral economic resources (1994)	
Maximum depth of exploration	1,000 m		1,000 m	
Minimum thickness of coal seam (with interlayers of barren rocks up to 5 centimetres thick)	Power coal 1.00 — ash content <40% 0.80 — ash content <20%	Coking coal 0.70 — dip angle to 35° 0.40 — dip angle above 35°		
Minimum calorific value	Power coal >3 000 kcal/kg (12,570 kJ/kg)		Power coal 15,000 kJ/kg	
Additional parameters				
Maximum sulphur content			Power coal 2%	Coking coal 1% (in dressed coal)

Table 4
Hard coal reserves in exploitation fields in USCB
(in million ton)

Reserves [mln ton]	1981	1989	1998	2002 (evaluation)
Geological	39,882	42,282	39,650	~36,000
Economic	28,243	29,531	20,430	~18,000
Industrial	15,897	16,535	10,079	~8,500

The balance of recoverable hard coal reserves, as on 31st December 1998, in operating mining levels and levels under construction, was 4,250 million t, including 3,100 million t contained in seams of thickness above 1.50 m (Kicki, Sobczyk, 1999). Up to the year 2002, the depletion of recoverable reserves caused by mining as well as by the consecutive closure of mines, will amount to 1,350 million t. The decrease of recoverable reserves caused by mining will amount to about 550 million t, and decrease of industry reserves caused by liquidation of coal mines, will amount to 1,000–1,300 million t.

If we count this for recoverable reserves, and use an extraction coefficient of 0.73 (Gabzdyl, 1999), we will receive an additional decrease of recoverable reserves at about 730–810 million ton.

If we assume (it is possible) that after the year 2003 coal mines will exploit coal seams of thickness above 1.50 m only, the amount of recoverable reserves in operating hard coal mining levels should be assessed at about 2,000 million t.

If we assume, simultaneously, that the hard coal output in 2003–2020 will change in linear way from 101 million t in the year 2002, to 80 million t in the year 2020, 1600 million t of hard coal will be mined out in this period.

Comparing these evaluations, we should also take into consideration that the decrease of hard coal recoverable reserves may be caused by other factors, not only by the exploitation of coal seams of thickness above 1.50 m. During the period 2003–2020, liquidation of consecutive coal mines is being planned (about 15 mines), and other factors, for example, economic, may influence the recoverable reserves. In this context, it is highly possible that during the period 2010–2020 the accessibility of resources will be one of the critical problems of hard coal mining in Poland.

In the analysis of the hard coal economic resources, there is a few necessary generalizations and simplifications. It is a consequence of the fact that process of verification of the hard coal economic resources is a very dynamic process. Its stabilization is being expected after the year 2002.

Nevertheless, this analysis does not show a very optimistic picture of the resource base and its sufficiency in the long-term perspective.

The main conclusions from this analysis are:

- necessity of rational management of the hard coal resources in the working levels and in the newly opened parts of the coal fields,

- necessity of opening a new working levels in existing mines after the year 2005, and surely after the year 2010; it will be connected with great costs,

- to prevent sudden decrease of the hard coal output as after the year 2020 we may expect necessity of constructing some new hard coal mines.

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