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SERBIAN UNDERGROUND COAL MINING - CURRENT STATE AND POSSIBILITIES FOR FURTHER DEVELOPMENT

Abstract

The underground coal mining in Serbia is faced with numerous problems and difficulties for quite a long time. The outputs decrease, the equipment and technologies are obsolete, the investments in development projects are minimal, while the business economy and wages are maintained primarily due to a significant financial help of the Government.

Besides, the status of the Public Enterprise for Underground Coal Mining (JP PEU Resavica), which includes nine Serbian underground coal mines, is still unsolved. Such situation only prolongs the agony, and the only way out is the restructuring of the company and transition to the market economy.

Keywords: underground coal mining, JP PEU Resavica, restructuring, market economy

1 INTRODUCTION

Since 1992, the all underground coal mines are gathered into the Public Enterprise for Underground Coal Mining, with its head office in Resavica. This company includes eight active coal mines, situated

in eastern and central Serbia (Vrska Cuka, Rembas, Ibar mines, Soko, Bogovina, Lubnica, Jasenovac and Stavalj), along with mining construction unit, RGP Aleksinac.



Figure 1 Coal mines included into JP PEU Resavica [8]

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2 DEVELOPMENT RESOURCES

During the years, the company had its ups and downs, but in recent years, the trend of negative business results is more and more obvious.

Although the overall situation with the Serbian underground coal mines is not satisfactory, some of them do have preconditions for further existence, development and profitable operations. The preconditions are mainly related to the coal reserves and other development potentials. On the other hand, some of the mines are faced with possible ending of their mining operations, due to lack of coal reserves and other factors.

In that sense, the restructuring of JP PEU Resavica is inevitable. Final decision has to be made by the Government, as the owner of mining resources and the company.

Development resources are an important precondition for existence and successful operation of any company, as well as economy in general [1]. In the underground coal mining, most important development resources are coal reserves, equipment, technology and human resources.

2.1 Coal Reserves

Total geological coal reserves of the mines included in the Public Enterprise reach 95,457,089 t, while minable reserves are 65,709,717 t. The Soko Coal Mine is in the most favorable situation, since 61% of geological and 58% of minable coal reserves belong to this mine [2].

Table 1 Geological and minable coal reserves for coal mines of JP PEU Resavica

Coal mine	Geological reserves, t	Mining reserves, t	DTE, kJ/kg	Energetic potential, GJ	Mton 1 ton=41,868 GJ
Vrska Cuka	1,506,900	1,114,755	21,110	23,532,478	562,063
Rembas	6,535,799	5,264,436	18,100	95,286,292	2,275,874
Ibar mines	2,573,120	2,444,464	14,934	36,506,463	871,942
Soko	58,022,430	38,294,804	18,239	698,458,927	16,682,405
Bogovina	2,033,740	1,862,902	16,615	30,955,150	739,351
Lubnica	13,528,900	10,146,675	14,349	145,594,640	3,477,468
Jasenovac	1,186,200	830,340	16,057	13,332,769	318,448
Stavalj	10,070,000	6,344,100	12,541	79,561,358	1,900,290
Total	95,457,089	65,709,717		1,123,228,046	26,827,841

By the available coal reserves, the Lubnica coal mine is in the second place, after Soko. Then, Stavalj and Rembas come. These four mines make 92% of total geological and 91% of total minable reserves. Other mines are far behind them. Total energetic potential of active coal mines reaches 1,123,228,046 GJ, or 26,827,841 tons of oil equivalents.

The balance reserves are estimated to 860 million tons, and they include active mines, remaining reserves of inactive mines,

explored deposits that have not been mined yet, as well as deposits that have been partially mined by surface mining, such as Cirkovac, along with some smaller deposits.

2.2 The Available Equipment and Technology

Generally, the mines included in the Public Enterprise for Underground Coal Mining Resavica are equipped poorly and the technology is very obsolete. Technology

of coal production has been practically unchanged for more than fifty years. Furthermore, in some mines, like Bogovina and Rembas, the level of mechanization was higher in 1960's than today. Today, there is no mechanized coal excavation, nor mechanized tunneling.

For years and decades, there were no investments into new equipment. The existing equipment is in poor condition, obsolete and amortized. The main job of technical sector in the mines is to keep this equipment as much operable as possible, so the coal production could be maintained at a certain level. Spare parts are an additional problem, since it is very difficult to provide them for such equipment. The available spare parts are usually of poor quality, obtained from various producers, thus making the maintenance costs very high.

The applied mining methods are also obsolete and low - productive. Most of the mines apply some variant of pillar mining, where coal is mined in narrow stopes by drilling and blasting. Coal is hauled by chain conveyors from the coal faces, and

further transport is organized through a system of several belt conveyors.

Due to low productivity, high costs and exceeded manual work, such system of mining was abandoned many years ago in most of the coal mines in the world. Generally, two systems of mining are mainly applied in modern coal mining: long wall mining and room and pillar mining. Development of mining equipment is following these systems. For instance, self-propelled hydraulic support is used in long wall mining, while numerous constructions of continuous miners were developed for the room and pillar mining. Such machines provide high outputs and improved safety, while reducing manual work.

Table 2 shows some of the Continuous Miners used in coal mines across the world for room and pillar mining and effects of their utilization, with their performance, number of room entries and size of the pillars in several coal mines of USA, China and South Africa. The performance given in meters shows the advance of entries, while performance in tons shows the coal output in a certain period of time.

Table 2 *The effects of application the Continuous Miners [3]*

Coal mine	Type of Continuous Miner	Number of entries and room width	Pillar dimensions, m x m	Peak performance	Availability, %
Elkhorn (USA)	12CM 7X2	5 entries, 6 m	12 x 12	3,300 t/shift	96 -98
Monterey No.2 (USA)	12CM 12X2	10 entries, 7 m	15 x 15	2,500 t/shift	97.6
Grandall Canyon (USA)	12CM	2.23 m x 6 m	-	210 m/day	-
Daliuta (China)	12CM 18	6 entries, 6 m	15 x 15	2,700 m and 92,000 t/month	-
Marrowbone (USA)	12CM 12 14CM 15	7 entries, 6 m	12 x 12	2,000 t/shift	-
Martin County (USA)	14CM 9X2	7 entries, 6 m	15 x 15	3,100 t/shift	97-98
Khutala (South Africa)	12HM 17 12HM 9	9 entries, 6 m	-	125,000 t/month	97-98
Loveridge (USA)	14CM 12	4 entries, 4.7 m	28 x 61	95 m/shift	-

If geological properties of the coal deposit are favorable, the long wall mining is applied. Following table shows data on applied long walls by countries.

Table 3 *Outputs achieved by long wall mining [4]*

Country	Number of long walls	Average output of longwall per shift, t	Average annual output by longwall, in million t
USA	69	3,475	2,502
Australia	30	2,360	1,558
Great Britain	36	1,667	1,157
China	244	1,511	1,070
Canada	2	1,499	1,138
Germany	66	1,423	966
South Africa	8	1,236	1,020
Polland	350	1,190	744
Russia	432	696	418
Ukraine	429	520	312

2.3 Human Resources

Long walls in the USA have provided the highest coal outputs, due to application the newest achievements in mining science, technique and technology, as well as favorable geological properties.

In a period between 2004 and 2015, the number of employees in JP PEU Resavica decreased drastically, by 23%. In recent years, the number of employees is around 4,000. [5]

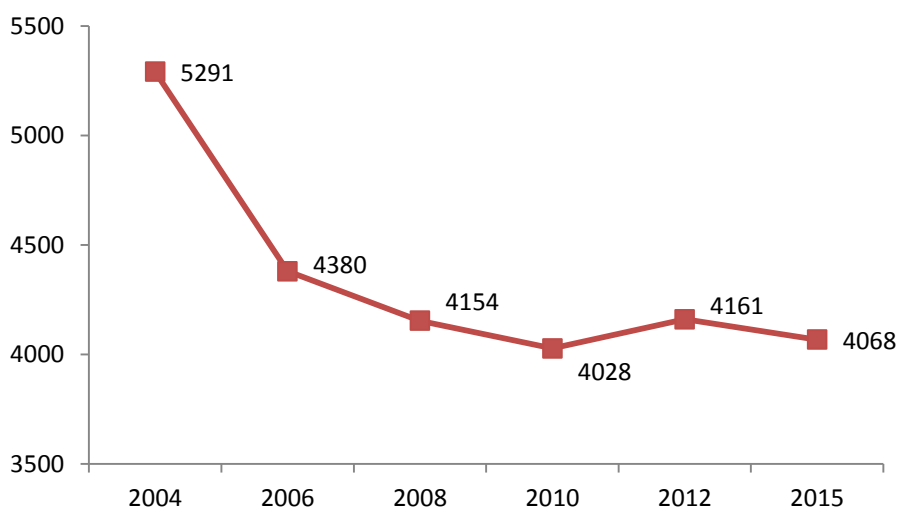


Figure 2 *Decrease of number of employees in JP PEU Resavica*

Rembas and Soko are the leading mines in number of employees, while Vrška Cuka is at the bottom. The average age of employees is around 40. There were many analyses regarding the structure of employees in the company, and they have all shown that there is an excess of non – production (administration) employees, while there is a lack of production employees at the same time. It is expected that this problem would be solved through restructuring the company.

3 PRODUCTION AND ECONOMIC EFFECTS

Business results of the company vary a lot, both by years and by sectors, which is a sign of certain instability.

3.1 Coal Production

From the moment when the company was created, the coal production, with some

oscillations, has a trend of constant decrease. From 960,973 t of excavated coal in 1992, it came down to 560,651 t in 2015. It means that the coal production was reduced by 400,322 t, or 42%. [5]

Top coal producers in the company are Rembas, Soko and Stavalj mines, while Vrška Cuka is on the bottom. The dominant type of coal is brown coal. Most of extracted coal is used for production the electric energy and domestic purposes.

There were many circumstances that led to decrease of coal production. As it was mentioned before, poor technical acoutrement is one of the reasons. That is why the production effects are also unfavorable: coal recovery is around 60%, low productivity (138 tons of coal per employee in 2015, 6 – 20.9 tons of coal per employee at coal face, 5.3 – 8.85 t of coal per employee in coal section, 50 – 169 t of coal per shift by mine, etc.

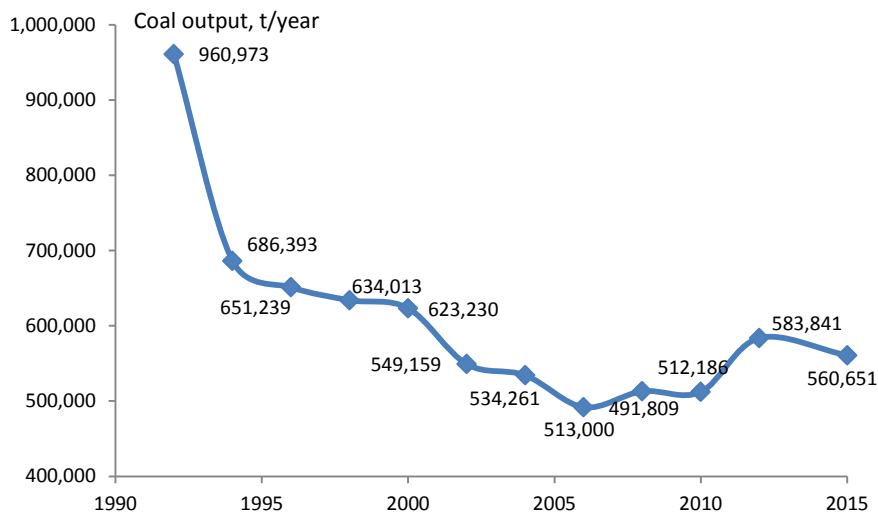


Figure 3 Coal outputs in JP PEU Resavica from 1992 to 1995

For example, in the Kazemir – Julius mine in Poland, due to the modern equipment and highly mechanized processes, the

effects of production process are following: 500 t is a daily output from a single coal face, with 20 employees on the sublevel

coal face (4 shifts with 5 employees), coal recovery is 65-75%, productivity at the coal face is 25 t per day for 6 working hours, the annual output per employee is 1,667 t, etc.

Besides, there is also a problem of lack of employees in production, along with lack of financial resources, both for ongoing production process and investments and development projects. If there is no significant change in this situation, it is realistic to expect further decrease of production.

3.2 Business Economy

The realized production effects have a direct influence to the business economy

of the company. In recent years, business results are mainly negative. In last five years, the company managed to gain profit only in 2014 [5].

Total loss in the observed period exceeds 8 billion RSD. Due to such business results in a long period of time, the cumulative loss exceeds the capital value of the company.

It should be added that the loss would be much higher without significant subventions from the government. In some years, these incomes exceeded the value of sold coal. In 2015, almost 70% of incomes came from subventions.

Table 4 *The achieved business results of JP PEU Resavica in a period between 2010 and 2015, in 000 RSD*

Year	2010	2011	2012	2013	2014	2015
Total income	5,678,874	5,833,109	7,850,001	8,250,699	10,587,381	6,537,148
Total expense	7,084,645	7,810,450	9,948,069	8,520,829	7,728,293	8,997,240
Profit (P) / Loss (L)	L 1,405,771	L 1,977,341	L 2,048,068	L 320,130	P 2,859,088	L 2,460,092

Source: Documentation of JP PEU Resavica and Serbian Business Registry Agency

The reasons for such business results are low productivity and high costs. In 2015, the cost price of a produced ton of coal was 13,161 RSD. At the same time, the average selling price, with all subventions, was 13,734 RSD. A difference between these two prices is minimal and inadequate to cover all of the business costs.

It should also be mentioned that the selling price of coal is determined administratively, and it is very low because it is a measure of protecting the life standard for households which use coal for heating. However, this measure is only applied to the coal producers, i.e. coal mines. Price of coal on the market is determined freely. This means that the coal prices at the dealers are 50 to 70% higher than the prices for the coal mines.

Wages in the company are pretty modest, especially considering extremely hard working conditions. In 2015, the average net wage reached 50 thousand RSD, which is some 10% above the average in the Republic of Serbia.

Also, the economy of resources is unfavorable. The company practically does not have its own financial means. Instead, its business economy is based on subventions and borrowed financial means. It makes every day operations very difficult and increases the costs.

4 POSSIBILITIES FOR FURTHER DEVELOPMENT

The current situation in JP PEU Resavica is unsustainable. Production keeps

decreasing, while the losses rise. Restructuring of the company is the only solution, along with readjustment to the modern, market based business environment.

A plan for consolidation of the company and further development was made in 2013 [6]. By this plan, the company should be consolidated first, thus making the base for profitable economy and long term sustainable development. In that sense, the investments were planned for mines with best development potentials, in order to raise their outputs (up to 300,000 t of coal for Soko and 2,000,000 t for Stavalj, along with the new Thermal Plant).

Based on the exploration works, some investments would be directed to opening and coal extraction in deposits that are not currently active, or only partially active, such as the Western Field of the Stavalj Mine, Cirikovac, Poljana, Kosa Zabela, Melnica and Western Morava Coal Basin. That way, domestic needs for this type of coal would be fulfilled. Also, the deposits of oil shale and borate minerals are planned for extraction.

Finally, the mines with low-grade coal reserves would be gradually closed. This group of mines includes Tadenje, Jarando, Vrska Cuka, Eastern Field and Senje Mine.

Naturally, such ambitious plan requires the significant financial resources, which are difficult to provide, especially with favorable interest. In that sense the Government, as the owner of the company, has a decisive role and huge responsibility.

CONCLUSION

The underground coal mining is an important segment of entire mining complex in the Republic of Serbia. Although its share in total coal production is minor, around 1.5%, it has an important role in supplying the thermal plants, industry and households with this product. The ucoal mining provides anthracite, hard coal, brown coal and lignite.

Coal, as an input, covers 70% of electric energy production in Serbia.

In recent years, the underground coal mining, organized through the Public Enterprise for Underground Coal Mining (JP PEU Resavica), comes through deep crisis. Decrease of production, lagging in technique and technology, business loss, unfavorable economy of resources and similar, are the main characteristics of this company's reality.

The exit from such situation exists. The Government, as the owner, has announced the restructuring. Company itself made a plan of consolidation a couple of years ago. The essence of changes is to invest in mines with good development possibilities in order to modernize them and increase the production significantly, and at the same time to gradually close the mines with low coal reserves and without development potentials. All of these has to be followed by measures of macroeconomic consolidation, with inclusion the eventual strategic partners.

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