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Sustainable development of lignite production on open cast mines in Serbia

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Abstract: Energy sector represents a key industrial branch for national, environmental and economic success. With its exclusive access to domestic deposits, lignite industry represents a guarantor of reliable raw materials, offering long-term supply security based on verified reserves. Currently operated coalmines in Serbia (Kolubara and Kostolac) have production around 36 million tons of lignite, and over 108 million m^3 of overburden. Consequently, sustainability of lignite production requires cost reduction and environmental protection, as well as capacity increase. In order to rationalise, and increase efficiency of Serbian lignite mines, it is necessary to focus the activities on major issues shown within the triangle of energy policy objectives (security of supply, competitive prices and environmental protection). Production process optimisation singled out several special programs. Equipment revitalization and modernization is necessary taking into account that majority of the currently operated machinery has a life up to 25 years. Production process automation would enable high level of technical operation in the field of open cast mines management. Lack of coal quality uniformity is the permanent problem resulting by great amounts of coal reserves to be used uneconomically. Planning and training at all levels and finally cooperative software for business procedures and work order management. The measures suggested are a key precondition for maintaining competitive position of lignite production on international level.
Keywords: lignite production; revitalization; automation; homogenization

1 Introduction

In the end of the last and at the beginning of this millennium, energy sector, together with the natural environment preservation, presents an essential factor of global sustainable development. Within this context, certain strategically important questions such as a sustainable coal mining and sustainable coal utilisation aroused, though they appear as different issues in developed countries and developing, i.e., transition countries. A solution of these problems requires settlement of specific questions, on both, regional and local national level.

Serbia possesses the great proven deposits of lignite (Fig. 1). The Serbian WEC Member Committee has reported that the proved amount of coal in place was over 21 billion tones, with most of it (97%) is a lignite. Within the other ranks, 6 million of whole 27 million tones of bituminous coal in place (22%) is deemed to be recoverable. The recovery factor attributed to the lignite reserves is approximately 66%. The pattern of Serbia's coal reserves has been replicated in the current production levels: lignite (mostly surface-mined) accounted for more than 98% of total output in 2005 year. Most of the lignite is used for electricity generation, with minor quantities being briquetted or directly consumed in the industrial and residential sectors[1–3].

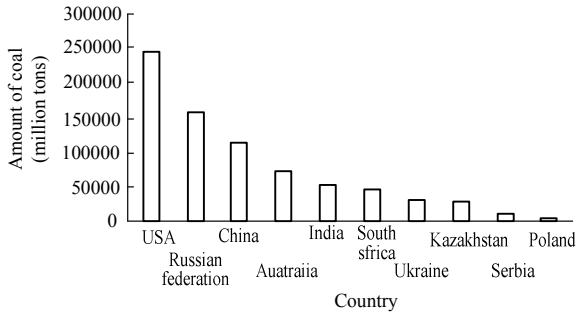

Fig. 1 Proved coal recoverable, the top ten countries

Coal is the most significant energy potential, with the share of 84% in the structure of energy reserves. At this moment lignite-fired power plants supply over 60% of electricity in Serbia.

Accordingly, energy sector, with its exclusive ac-

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cess to domestic deposits, represents a key challenge for the national, environmental and economic progress.

Coal production in Serbia is based on two mining basins: MB 'Kolubara' and MB 'Kostolac' (As of 1 July 1999, EPS does not operate their plants on the territory of Kosmet). Current capacity of these open cast mines is over 36 million tons of lignite (Fig. 2), with over 108 million cubic meters of overburden (Fig. 3). On the other hand, European integration in the field of energy sector requires permanent adaptation of technological and corporate structures in lignite mining, especially of costs and competitiveness in generation of energy prices In addition, in the past several years environmental requirements have been imposed as a special condition for European integration. Since 2004 electricity market has undergone liberalisation that resulted by emerge of private energy traders. A specific quality of Serbia's coal production is absence of a rough competition with other energy sources so far.

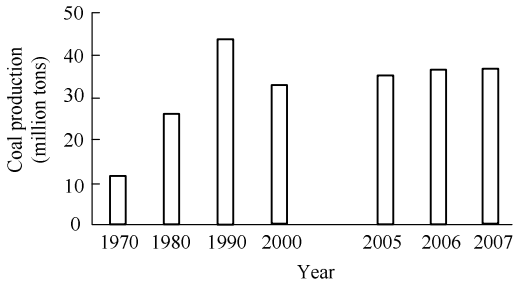

Fig. 2 Coal Production in Serbia

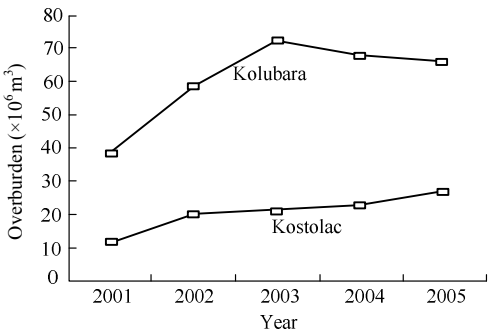

Fig. 3 Overburden removal

Also a tendency for coal demand in future has been increasing.

According to the expert predictions of the World Bank from the study developed in 2004 (The European Union's CARDS Programme for the Balkan Region), with annual increase in electricity consumption up to 1.1% and to maximum 1.6% (Table 1), Serbia would become a permanent electricity importer in 2012.

However, according to recent investigation the increase rate is higher than the anticipated one, warning that Serbia may face an electricity shortage several years earlier. Such predictions inevitably ask for urgent construction of new capacities for electricity generation, as well as for the modernisation and restructuring of existing mining capacities with production increase.

Table 1 SEE electricity demand forecasts CAGR 2003–2020 (%)

	Case 1	Case 2	Case 3
Albania	2.0	4.0	4.9
BiH	2.3	3.0	3.4
Bulgaria	0.8	1.6	2.5
Croatia	2.5	3.2	3.9
UNMIK	1.7	3.2	4.3
FYR Macedonia	1.5	2.5	3.0
Montenegro	–1.3	0.7	1.2
Romania	1.2	2.6	3.6
Serbia (excl. UNMIK)	1.1	1.1	1.6
SEE	1.3	2.3	3.1

2 Coal mining process optimization program retrospective

Impact of energy and environmental policies on coal mining in Serbia may be divided in several phases. During the seventies, after oil crises, supply security was placed in the focus of energy policy. In the course of this period, there was forceful modernisation of Serbian open cast mines, purchase of, modern mining machinery. In the second half of the eighties, environment protection was beginning to gain importance in the energy policy and investments. At that moment ex-Yugoslavia disintegrated, which led to a serious stagnation of European and international trends at all levels. However, the Government of Serbia designated a coal mine rehabilitation and coal production increase by as a top priority from 2001. Likewise, Development Strategy of Serbia relying of energy sector on the increase of domestic lignite production, together with the measures for production optimisation, revitalisation of existing and procurement of new equipment and rehabilitation of existing electricity generation capacities is the only proper path towards the sustainable development of the society[4–7].

3 Problems and programmes for coal mining process optimisation

3.1 Lignite production in Serbia

1) Secure provision of necessary lignite amounts and quality within the short, mid and long term periods;

2) Providing of economic lignite supply to power plants, based at the lowest prices and production costs;

3) Environmentally sustainable development.

3.2 Lignite production optimisation programmes in Serbia

3.2.1 Equipment revitalization and modernization

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