Comparative assessment of development risks in lignite basins of Danube region in Serbia

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***Abstract*—** The paper identifies the global factors of development risks in the lignite basins of the Danube region in Serbia, whose effects are enhanced due to the global economic crisis. Paper presents comparative assessment of development risks in the Kolubara and Kostolac lignite basins, by application of the comprehensive development framework approach, SSIA (Strategic Spatial Impact Assessment) and *Spyder* method. Increasing risks and dynamics of market and regulatory changes (especially acceptance of the Kyoto Protocol and other mechanisms), as well as the renewal of interest in the recovery of coal sector indicates an increasing pressure on the transformation of the mining and thermo-energy sector: structural, property-management, socio-economic, technical, institutional, environmental and territorial aspects. Paper argues that management of development risks in basins has an essential role in increasing competitiveness and sustainable development of the Danube region in Serbia.

***Keywords*—**Comparative assessment, comprehensive development framework approach, development risks, lignite basin, Serbia, sustainable development.

I. Introduction

GLOBAL economic and financial crisis, decrease in energy resources stock market price, drastic decline in the value of mining companies and volume of transactions, increase of various business risks and uncertainties, and a number of other factors in the energy sector are of great importance to assess prospects for sustainable development of coal complex in Serbia. Strategic development and business risks involved are usually at the macroeconomic level where they need to be "translated" on the operational corporate level. On the other hand, the expansive development of new and renewable energy sources, commitment to sustainable development, strengthening environmental pressure by public on mining and energy companies, global climate change, increasingly stringent requirements of environmental protection, construction of a supranational regulatory framework of energy policy and many other factors directly or indirectly affect the overall concept, policies, instruments and measures in strategic planning of the coal sector.

Manuscript received March 11, 2011. This work was supported by the Ministry of Science and Technological Development, Republic of Serbia.

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The mining sector is known by the risks that are both a challenge and an opportunity for the sector. Dynamic changes of growth in demand for consumer products are driving the broadest development changes, until the emergence of global economic and financial crisis.

Available coal reserves are becoming hard to approach while the price of their exploitation is increasing. This trend will probably continue in future. An increasing number of development risks requires considering the ways we can affect these trends in order to manage the business risks. For companies it is important to identify key strategic business risks and their management in order to determine the lowest price of the planned and implemented measures, especially environmental protection measures.

Generally, the universal risks in the mining and energy sector have been classified as: [3] a) strategic, b) financial (prices, structure of capital, liquidity and loans, accounting and reporting), c) production risks (technical, social, planning, production channels, political, safety, joint venture investments) and d) risks due to the consent (legal, regulative, standards of business management). According to the same source, the strategic business risks in mining sector are*: I – macro risks* (retaining social work permits, challenges of the climate change, resource nationalism)*, II - sectorial* (industrial consolidation, lack of quality infrastructure, increase of regulations), *III - production risks* (certainty in energy use, rise of costs, access to infrastructure, shortage of skilled and educated workforce) [4]. Lack of knowledge, access to infrastructure, and necessary consolidation and restructuring of companies are risks that will seemingly augment in the near future. This classification has been helpful in assessing risks in the development of lignite basins in Serbian part of Danube region.

II. Identification of Developmental Risks in the Lignite Basins of the Danube Region in Serbia

In the strategic development planning of a mining and energetics area, it is necessary to include risk assessments. The key risks of the future development of Kolubara and Kostolac lignite basins are generally presented like business risks and strategic business risks in mining and energy sector.

The Kostolac lignite mining basin is located in the plain part of North-East Serbia, on the right bank of the river Danube, near the City of Požarevac. Kostolac lignite basin is connected with the rest of Serbia by highway in the European corridor X, railway and Danube. It covers 539 km^2, while the production area encompasses ca. 28 km^2. The development of

coal mining in town Kostolac started already in 1870. Kostolac lignite basin is located in Požarevac municipality. In 2010 the City of Požarevac had 45,000 inhabitants and 22,000 employees, of which 3,500 were employed in coal-energy corporation (TEKO "Kostolac") - one of 11 companies in the composition of public enterprise „Electric Power Industry of Serbia" (EPS). The company's total capital and commitments in 2009 were 593 million € and annual production was 8.6 million tones, while the average monthly salaries in 2010 were 500 €/per employee (more than twice of the average salary in Serbia, that is 320 €/monthly). The mining-energy and industrial capacities are located inside the basin – the Coal Mine, two thermal power plants (TPP) and many industrial enterprises that were, earlier, a part of the TEKO Kostolac corporation. The installed capacities are: coal production at 9 million t/per year; two TPPs of 1,007 MW with electricity production of 5,897 GWh/year or 14.4% of the total electricity gained from power plants in Serbia.

Picture 1. Positions of Kolubara and Kostolac lignite basins in Serbia (● – Kolubara; ■ - Kostolac)

The second lignite basin - Mining and Energy Generation Basin "Kolubara" (MEGS "Kolubara") is located in the Belgrade metropolitan area, approximately 40 km south-west of Belgrade. Its surface area covers some 547 km^2, while the production area encompasses ca. 134 km^2. Industrial and related facilities and installations cover some 62 km^2. Total population of the area is 82,000 inhabitants. More than 30,000 people are employed, out of which some 10,500 in the mining and energy generation sector [1]. Production of lignite open cast extraction in the Basin surpasses 30 million t/year, 65.7 million tones m^3 overburden and the average energy generation by its power plants reaches 1,161 Gwh/per year or 75% of the total annual lignite coal production in Serbia, and 3.1% of its total energy production [2]. It is the biggest industrial zone in Belgrade metropolitan area [28].

A. Applied Methodological Approach

The identification of main risks of the development in the lignite basins is based on the comprehensive development framework approach, i.e. on comprehensive integrated approach in spatial planning in which meta-management role in the integration has coordination of energy sector activities through cooperation between different levels of management and decision making. The applied approach involves correlation and linkages between national, subregional, regional and local levels so that the control lines and mechanisms are harmonized as much as possible. This approach coincides with the new macro-regional EU approach which aims to strengthen synergy between the general and sector (energy / mining) policies. The approach includes the principle of inclusiveness and co-ordination of a wide circle of actors (regions, municipalities, economic actors, social actors, civil society, financial institutions, international organizations) to greater prosperity for residents of areas of the Danube region, strengthening cooperation and coordination, especially as this is a very attractive and competitive area in the Danube region. The suggested approach is theoretically and methodologically based on new role of regional policy that implies mobilization of inner strengths and resources in development and mitigation of effects of global economic crisis, with emphasizing local responsibility and strengthening public-private partnership. This kind of approach provides greater certainty for creation of conditions for coexistence of different projects in the space as well as the possibility for different forms of integration of sectoral policies in territorial development of the area. This approach is based on the principles of integrated and long–term holistic development, with focus on possible factors of uncertainties. The empirical evaluation of the spatial development of lignite basins in the Danube region has been conducted based on a comparative analysis of the indicators by Spider method. The Spider method is a tool used to compare and visualize relations of a territory or of development options, by using relevant indicators.

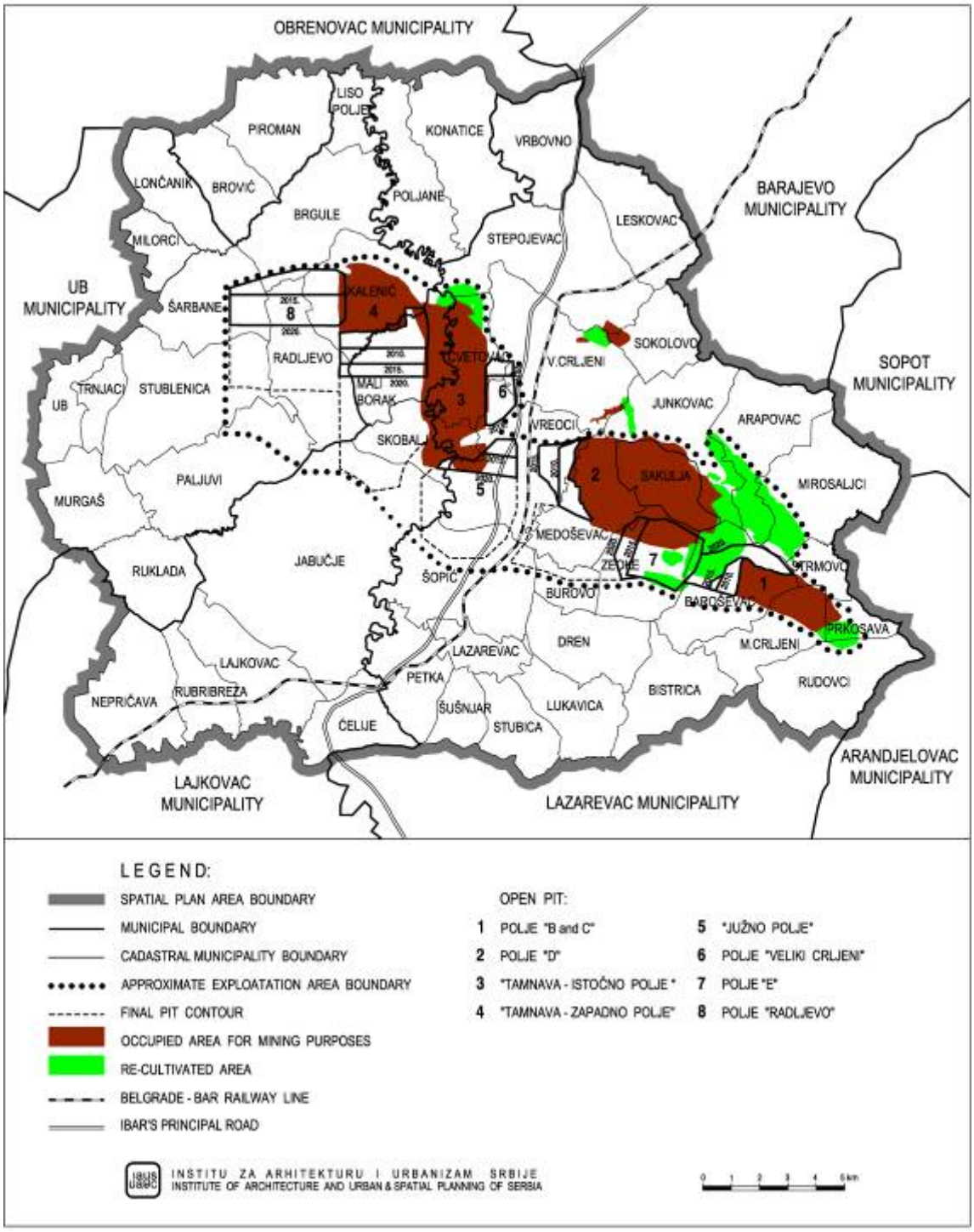
B Discussion on the Main Risks of the Development in Lignite Basins

We have identified ten principle risks for the development of lignite basins in the Serbian part of Danube region, as well as several others whose importance could increase in the coming years. The principle business risks in the development of lignite basins are:

1. *Restructuring and privatization of the companies MEGS Kolubara and TEKO Kostolac* - For greater market power, increase of production and diversification of strategic business risk, mergers and acquisitions are generally often taking place in this sector. Risk assessment and increase of the capital costs can also be included in this due to the global economic crisis.

The basic orientations of development policies for the following period are determined by the development and modernization of the mining and energy generation complex in the Danube area, according to the results of the restructuring

Picture 2. Spatial organization of Kolubara mining basin [1]



and forthcoming privatization. The plan for restructuring of MEGS and TEKO companies, adopted by the Government of Serbia and steering committee of public company "Electric power industry of Serbia" (EPS), implies secession of two groups of companies: 1) core activities (mines, power plants and administration); 2) non-core activities (production and repair of mining and industrial equipment, metal constructions, cauldrons for power plants, machinery, rubber processing, transport services, maintenance, facilities cleaning and maintenance, recultivation, catering, construction, etc.). The restructuring program includes a social program for a few thousand workers redundant.

Resolving the question of debts towards the creditors of MEGS is vital for attracting the future partners. According to available data over 70% of debt is towards government creditors. Unless the current trend of unemployment growth is

stopped, this would impede the possibility of establishing a new development concept that would include a necessary dimension of social sustainability as well. The restructuring and privatization of MEGS and TEKO will generate, apart from the already existing redundant employees, a new unemployment, which will make this problem even more difficult to solve.

When it comes to EPS enterprise, in order to improve efficiency and profitability of the system, it is necessary to undertake substantial organizational adjustments at the level of the entire system, and at lower managerial levels. In terms of ownership status, organizational changes may strengthen corporate development and management. Instead of existing organization structure of EPS, which consists of 11 companies, seven directorates and two independent sectors, in which it is hard to manage organizational and functional coordination and decision harmonization, the new organizational structure should reduce the number of basic organizational units. Contribution could be made from the activation of technological innovation in the telecommunications network, as well as improvement of operational management. In terms of ownership status, organizational changes will be accompanied by the strengthening of corporate business and development, and the possible transformation of EPS.

Appropriate staff rationalization, improvement and rejuvenation, as well as strengthening of planning-strategic function in the development defining, should help EPS to become the most competitive player in the SEE. Development of renewed EPS would have big multiplicity effect on economic growth and development.

In the process of ownership transformation and consolidation of energy sector in Serbia, we should take into account new trends in EU countries that public property includes traditional forms of *public ownership* and new forms of *public participation*.

According to OECD data [21] new forms of public ownership have sharpened competition with the private sector, which is confirmed by the fact that power system is in private or majority private ownership in only four countries in EU-27 (UK, Germany, Belgium and Spain).

In the process of restructuring and ownership transformation of mining and energy companies we should bear in mind several challenges, in particular underlined by the global economic and financial crisis. Haney and Pollitt [22] indicate five key challenges in the field of public ownership of energy resources. *First,* after 20 or more years of electricity market liberalization, the reform in EU countries is still underway. *Secondly,* climate change and related policies impose significant new requirements and investments in the energy sector. *Third,* political concern about the security of fossil fuels reappears in many countries. *Fourth*, movement toward large-scale privatization with independent regulation could raise questions of political legitimacy. *Fifth,* the global financial crisis has caused particular concern in the energy sector which private capital market will not be able to finance due to the growing investment demands and uncertain profit. A very high proportion of public ownership in the energy sector continues to be significant despite the long-term trend towards privatization, competition and independent regulation in the energy sector, as indicated by new research published at the University of Cambridge. One of key results of this research is proving that the theoretical case of public ownership in the energy sector may be more attractive now than in the recent past. According to the same source, public ownership still remains a potentially very important for the energy sector. Case studies show that public participation can co-exist with the liberalized electricity market, including the level of retail market. They also show that public ownership can be achieved trough a significant number of forms, including: a joint venture / joint ownership, consumer trusts, state and municipal ownership, as well as through the mechanisms of business and choice of management or board of directors. Models of mixed public-private ownership in the energy sector are constantly improving. Many countries in Europe, in fact, have yet to introduce any significant private participation in the electricity sector.

2. Price of coal and electric energy - The average price of electric energy in Serbia is 5 euro cents/kWh which is less than in the EU-27 countries. The price of electric energy in Serbia still serves to maintain social peace, because electricity is cheaper than in the rest of Balkan region. Due to this fact, the value of energy system is debased and its development is limited in the long term. The low price of electric energy cannot provide the financial means necessary for investments. The price of electric energy should be on the average level of the South East European region. Serbia is obliged to have this average price also according to *the Energy Community Treaty of South East Europe* [5]. Up to 2013 electricity price in Serbia should be increased by about 60%. If that is not done, one can expect that the company will continue to suffer huge financial losses and accumulate debts. In addition to the real price of electricity, compensation of losses and debts can be refinanced only from specially approved budget and by selling the company assets.

According to estimates [6], due to the global economic and financial crisis the mining sector has run into trouble. In 2008 there was a sharp fall in coal prices and share prices of mining companies. In August 2008 the average price of coal was about 146 EUR/t, in January 2009 - 67 EUR/t, while in March 2009 the price has fallen to 51.8 EUR/t [7]. The average price of electricity in the EU-15 countries in 2005 was 10.74 euro cents/kWh, while in the EU-27 10.46 euro cents (with differences from 5.76 to 13.5 euro cents/kWh) [8]. The lowest rates were in Estonia - 5.76 euro cents/kWh, Poland 5.83 euro cents/kWh, and higher in the UK 10.15 euro cents/kWh, Germany 13.4 euro cents/kWh, Italy 14.4 euro cents/kWh. After the fall of electricity prices in 2009 to the level of 20-30 euro/MWh, prices began to rise slowly in 2010 [9]. The electricity prices in Europe in Q3 2009 were 40.9 euro/MWh and in Q2 2010 approximately 42.15 euro/MWh. The same trend of slow growth in 2010 was expected for the price of coal. In the first half of 2010 electricity price for households

in EU-27 countries are significantly higher – 16.76 eurocents/kWh, with differences among countries - 27 eurocents/kWh in Denmark, 23 eurocents/kWh in Germany, 20.1 eurocents/kWh in Norway and Belgium, while the lowest prices are in Bulgaria - 8 eurocents/kWh, Romania – 10.2 eurocents/kWh, Croatia - 11 eurocents/kWh, etc. Electricity price is 30-70% lower for industry, depending on the country, in average10.37 eurocents/kWh.

3. ***Lack of investment funds*** due to more severe conditions and the availability of funding sources in the financial market.

4. ***Shortage of qualifications, knowledge and skills*** - The growth and development of the sector imply qualified human resources, employees with skills and knowledge. Shortage of such human resources, especially managers, engineers and others is the main strategic business risk for the mining companies. Due to the shortage of highly qualified human resources, the average age of the employees in the company has increased. The rise of unemployment, economic problems in the business activity of basins, a fall in the standard of living and a rise in poverty, with a slow dynamic in the establishment of new enterprises in the private sector has started the immigration of the local population, in particular the young, educated workforce. Both lignite basins in Danube region employed more than 25,000 workers in 1990, but only 14,000 workers in 2010 in mining and thermal-energy sectors or around 28% of total employees. Also, those sectors dominated in making GVA (Gross Value Added) in both basins of the Danube region economy with share of 35-40%.

5. ***Access to infrastructure*** - The expansion of production in the mining sector is being faced with increasing obstacles regarding access to infrastructure. Infrastructure owners do not adequately follow the needs of mining complex, because they do not have clear signals from the market to invest in new infrastructural facilities (e.g., ports, ships, railways etc.) in order to maximize the production capacities in mining. Therefore, the mining companies are greatly tempted to own their proper infrastructure, which is a paradox. By combining the high risks of production with the low risks in the infrastructure sector, this could reduce the value of the enterprise.

The transportation and geographical position of Danube region, where MEGS Kolubara and TEKO Kostolac are located, is favorable. From viewpoint of the regional transportation communications, this region is located on the European Corridor X and Corridor VII Danube river. Among the above-mentioned corridors PEN, network TINA and Corridor IV (Berlin-Istanbul) through Romania and Bulgaria are the greatest competitors to Corridor X in this part of Europe. One problem is the lack of government funds for quality maintenance of the rail infrastructure that occurred as a consequence of the overall situation in Serbia in the '90-ties. The lack of relevant port on Danube for transportation of raw materials, plaster and ashes for TEKO is evident today.

One of the uncertainties in future development of lignite basins is the possibility for a construction of the gas pipeline „South Stream", or possible abandonment of its construction. In the future it is necessary to effectively eliminate bottlenecks and improve EPS power transmission and distribution infrastructure (on the whole territory of Serbia, including the Danube region), which are now technically limited.

In terms of business of Public enterprise EPS, including the mining complexes in Kolubara and Kostolac basins, future plans need to be based on consistent achivement of strategic aims of EU energy policy from the so called *Green book* („Towards a European strategy for the security of energy supply") [25] which defined model "3 plus 20 plus 20". That should be long-term strategic goal for EPS, too: reduce the greenhouse gases emissions for 20% till 2020 compared to the 1990; in the same period reduce total energy consumption for 20%, by improvig the energy efficiency in production and consumption; increase share of renewable energy sources in final energy consumption to 20%, and increase the share of biofuels in total consumption of petrol and diesel to 10% (up to 2020).

6. ***Accessibility to deposits and preserving social work permits*** – From the standpoint of providing a planned basis for obtaining location permits for the implementation of activities of public interest in the development of coal mining, very important is the proposal of the European Association for Coal (EURACOAL) that the legal system of the EU and individual countries should provide and develop ways to ensure access to coal deposits, regardless of whether it is underground or surface extraction. In accordance with received social work permits, the sector has to provide the high-dividend to society, security to employees, as well as quality health and environment for citizens. Loss of license leads to the loss of access to resources. Attempts to reach sustainable development in the mining sector are done through three components: environment protection, economic growth and social equality. Social work permits function as part of society and acceptable customs and behavior. Preserving permits or obtaining the new ones is becoming more difficult due to production growth. Mining companies have an image of "bad guys" who are dangerous, dirty and disruptive towards the environment.

According to Euracoal data [10], reserves of lignite in three basins in Serbia were 15.92 billion tonnes (including Kosovo basin). Reserves of lignite in Kolubara basin are 1.8 billion tonnes and in Kostolac basin 0.6 billion tonnes. Under Danube riverbed and riverside near town Kovin there are around 269.8 million tonnes of lignite [11]. In 1991 started exploitation with watercraft dredge in two pits under Danube riverbed. The annual lignite production in the area of Dubovačka island across Danube near Kostolac basin was 100,000 t.

In the Kostolac lignite basin there are deposits of oil and natural gas (on the Kostolac island and in the rural area). The start of exploitation of oil and gas in this area is planned for 2010-2020 by Russian company NIS [12].

7. Harmonization with the EU legislation and application of the Kyoto Protocol, ratified by Serbia in 2007 [13] - The awareness of importance of climate change effects has

increased in the last decade, as these effects imply: changes in regulations, costs of changes and harmonization, limitations of infrastructure, political instability, a sudden change in consumer behavior and strategic business risks in accordance with the new development mode of mining and industry towards a mandatory introduction of a low-carbon economy.
Emissions' trading is an important policy measure to reduce environmentally harmful emissions. Mining and power plant sectors and/or individual companies allocated a fixed number of emissions allowances by government for a specified period for a specific pollutant such as CO_2 or SO_2. If a particular participant's actual emissions exceed these allowances, another participant's surplus allowances may be purchased to ensure a balance of emissions and allowances. This gives participants the choice of reducing emissions in actuality or by purchasing an appropriate number of allowances to match actual emissions. Because the total number of allowances is capped, emissions reductions will be made, but the place where these reductions are made is not important for global air pollutants (CO_2). Undoubtedly the effect of CO_2 emissions trading will mean an increase in coal prices and electricity prices as the generators pass on their costs to consumers.

In the future, it can be expected that carbon will be labeled on products and traded globally, and that there will be strict regulations and significant taxes on carbon itself. Mining companies will have to adjust their business to the requirements of ecological regulations towards a low-carbon economy. Most companies will accept minimal responsibility and radically lower their carbon intensity. Low-carbon companies will have a competitive advantage on the market.

The EU Climate Package was adopted in December 2008, and includes the EU ETS Directive, Directive on renewable sources and Directive CCS [14]. The power plants capacities that use fossil fuels independent of their type will have to use the CCS (Carbon Capture System), which is becoming the general requirement for the industries of Europe. The industry will have to pay for the collecting, transportation and storage of carbon, which should be implemented by 2020. The focal point of storing carbon lies on its collection in accordance with the IPPC Directive, while the transport is regulated in accordance with the regulation on transporting natural gas.

In January 2009, the EC has adopted the Recovery Package with the proposal of 1,250 billion € for five big CCS projects. According to the CCS Directive, the countries will decide if they and where to build CCS, i.e., the companies decide if they will use CCS based on the conditions in the carbon market. The main goals and principles of this directive are to provide the legal framework for managing environmental risks. According to the EU Directive of ETS, a public bid for the energy sector permits will start from 2013. The system of trading with CO_2 emissions is simultaneously a catalyst for the support of the CCS concept.

When CO_2 is captured, transported and safely storage, it is treated as it has no emissions. The CO_2 emissions trading system is the driver support for CCS.

In accordance with the Kyoto Protocol, in the period 2008-2012 the EU-15 countries have agreed to reduce emissions of six greenhouse gases by 8% compared to the year 1990 (where CO_2 has the largest share of emissions), which has implications on all sectors. According to the document *Sustainable Electrical Energy, The Case for Electrical Energy Efficiency: Europe* [30], it is equated with a reduction of 336 million tons of CO_2 equivalent. The ten new EU members have an obligation to reduce greenhouse gases emissions by 6-8%. The EU has accepted to lower CO_2 emissions by 8% by 2012, which has certain implications on all sectors. In addition, the EU has committed to reduce its energy consumption for 20% by 2020, and that renewable energy sources participate with 20%. Till 2030 the countries of EU-27 should decrease emission of equivalent CO_2 for 16.4% [15].

According to Eurostat data, equivalent emissions of CO_2 in EU-27 were 5,045.37 million tones in 2007. The greatest contribution gave Germany - 956.1 mil t, UK 636.68 mil t, Italy 552.7 mil t, Spain 442, Poland 398.8 mil t, etc. Total CO_2 emission for Serbia in 2004 was 56.7 millions t or 242.5 kg CO_2 per person. Consistent data in 2003 emission of CO_2 in Serbia were 4.75 t/per capita [16]. Serbia is not listed in the Annex B of the Kyoto Protocol and is not obligated to reduce its greenhouse emissions, but was given the possibility to adopt this obligation. It is certain that the environmental protection costs will burden the business in Serbia even more in the future period. For the sanitation of environmental problems, great financial means are necessary. It is still unclear how the means for sanitation of environmental problems of lignite basins will be provided i.e., priority sanitation for the environmental hot spots.

Delaying the application of Kyoto Protocol would certainly postpone the writing of development documents which are based on the principles and criteria of sustainable development in the lignite basins in Serbia.

Price of permits for CO_2 emissions in January 2010 started to decline slightly after a period of growth. In 2009 price of the emission permits was 13.13 euro/t of CO_2, while the expected level in 2012 is 11.38 euro/t of CO_2 [17].

When it comes to operations of EPS public enterprise, including the mining complex, in the future we need to achieve the key strategic objectives of the EU energy policy from the "Green Paper Towards a European Strategy for the security of energy supply" [25]: reduction of emission of greenhouse gases for 20% by 2020 compared with 1990, reducing total energy consumption by 20%, improving energy efficiency in production and consumption, increasing the share of renewables in energy consumption to 20%, and others.

8. ***Increase of costs*** - The increase in demand influences the increase in the use of production capacities. The danger of an increase in costs is vital for company competitiveness. While higher prices for electricity and coal result in increased revenues of mining companies, cost of capital and increase of production costs marginalise it. The problem spreads from production through distribution channels, affects the increase

in the cost of building new generating capacity, construction of access infrastructure (road, rail, ports) and the internal infrastructure in the basin or in open pits. Costs of energy, materials and labor are subject to inflation. This impact on the mining companies increases the pressure on the production limits resulting in the high-risk investment profile of the company, increases the advantage of portfolio optimization, consolidation and share of the risky arrangements.

Global economic and financial crisis has forced majority of mining companies to increasingly resort management and optimization of production costs, close nonprofit capacities, assess dynamic and feasibility of existing and new capacities.

In the era of the boom of commodity prices, the motto was „production at any cost". During that period, there was no strict control of production costs. With the global financial crisis, this has changed and cost management at a corporate level is becoming an important business strategic risk. Uncertainties in the global markets, climate change and other factors force the companies to be careful in creating a new development mode and managing costs.

In the development of EPS it is important to improve financial results of this enterprise. In the Spatial plan of Kostolac lignite basin [23] it is indicated that the operating results of EPS are caused by exchange rate differences, poor level of payment for electricity supplied, the cost for employees of power companies in Kosovo, theft of electricity, etc.

EPS receivables of electricity, heat, process steam and coal from customers are about 0.7 billion euros, which is approximately equivalent to amount that would be enough to build a coal-fired power plant of 400 MW. According to EPS estimates, electricity theft in 2009 was 4.5% of total produced energy. Unfortunately, no significant changes have been done to minimize this lost. EPS losses in transmission and distribution in 2009 were around 80 billion euros and they are significantly higher then at regional competitors. EPS liquidity was maintained due to the reduction of operating costs (especially costs for maintaining and repair of electric-power and mining equipment) and investments reduction. The current rate of indebtedness was 13.3%, i.e. it is low, so sure it would not significantly increase [31].

In mining basin Kolubara in the last couple of years there is enormous increase in the cost of business services costs as well as possible misuse due to which started the investigation by the competent authorities.

According to the EPS development document [24] in the period till 2015 investments over 9 billion euros are foreseen, out of which company's net assets - 3.4 billion, credits - 3.8 billion and loans from the strategic partners around 2 billion euros. Due to low electricity price and decrease of their own funds, EPS will likely be forced to include a larger volume of resources of strategic partners and loans, despite the worsening conditions of borrowing. During the compilation of *Work and development plan 2008-2015* [24] it was planned that there will be increase in the energy price, but that did not happen. Therefore EPS will have to rely more on sources of strategic partners and loans, than on its own resources.

The future financial structure will change a lot, because there will not be any more big donations, and conditions for taking loans have worsened and they are expected to be even worse in the future period.

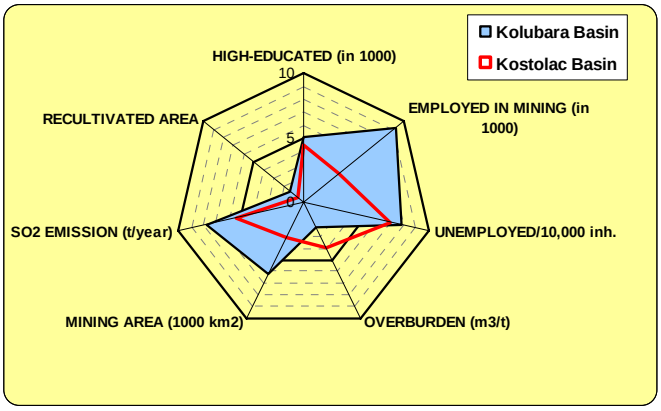
It is planned to increase work productivity in EPS (measured by ratio of consumed labor and production, for example, labor to produce one ton of coal, or one generated KWh), as it lags back compared to competitors in the region.

Mining company TEKO in Kostolac basin has successful business results. Mining company Kolubara (MEGS) over a long period had operating losses, primarily due to the enormous growth of the cost of business services as well as possible abuses.

The structure of costs of the mining industry mainly depends on local factors. Excessive costs of basic activities, especially of energy products, production costs, as well as the absence of necessary investments and the opening of new pits, could threaten competitive business activity of lignite basins in the Danube region in Serbia.

Comparative survey of the development indicators in the lignite basins in Danube region is shown in Fig.1.

Fig.1. Indicators of development in the lignite basins in the Danube region



9. Ecological problems in the lignite basins. According to the EU Program on the environment and sustainable development [18], it is estimated that the environmental quality in the Danube Basin in Serbia is among the most endangered in Europe. According to the Spatial Plan of the Republic of Serbia [19], in the planned state of environment, Kolubara and Kostolac basins are classified as much polluted sites. A hundred-year-old practice of mining has been the main source of degradation and environmental pollution in this region and wider. The worst effects were caused by the open pit mines and technological processes in TPPs.

Main environmental problems refer to air pollution, land degradation (both quality and visual impact) and water pollution. Opencast mines are located close to cities and other settlements. Dust from power plants creates a big problem for local environment but also has trans-boundary impact. TPPs in both lignite basins and dump ash located on the bank of the Danube near Kostolac have large negative impact on the air,

soil, ground- and underground water pollution in the Danube river alluvium, thermal load of the environment, even to the occasional detention of navigation on the Danube, etc. The emissions of CO_2 and SO_2 increased by 8-12 times due to the lack of desulphurization facilities. Emissions of airborne particulates increased 11-70 times, depending on the age of TPPs and efficiency of the electrostatic/electric filters. Mining activities, TPPs complex and overburden dumps are sources of degradation of agricultural land (ca. 3,000 ha in Kostolac lignite basin and 6,200 ha in Kolubara lignite basin, in 2010), and air pollution. EPS plans to invest 1.5 billion euro for building a new TPPs and creation of new open pits in the Kolubara basin, as well as 1.2 billion euro in environmental projects [20].

10. ***Certainty in energy use*****.** Mining is energy intensive activity that depends on the efficient and sustainable energy supply. Insufficient investment in national infrastructure may induce restrictions in demand of mining companies. Mining companies are high-adjective of energy in the extraction of their products, such as energy producers and other sectors (power plants, steel factories, refineries, etc.). Oil prices, concern for climate change, energy hunger of emerging economies and political considerations are important elements for energy security. All this is happening at the moment when technical, physical and spatial conditions are deteriorated and when open pit and underground mining requires increasing overburden due to severe exploitation conditions.

In the period till 2020 in EPS (including TEKO and MEGS) should be provided introduction of energy management tools, such as energy "audit" and to establish and monitor energy indicators. Energy *audit* includes data collection and analysis, diagnosis of existing situation, and reporting, as well as defining prospects, for the following activities: collecting information on energy use in production and consumption, collecting information about maintenance of equipment and installations in production; defining parameters and establishing a system for their ongoing monitoring in the manufacturing processes, the establishment of main energy consumers catalogue, the definition of *hot spots*, ie., locations and segments where the losses are obvious; compilation of preliminary and permanent energy balances, establishing a system of energy indicators, with associated system for measuring the energy consumption; preliminary defining the system of measures to reduce energy consumption in industry and services; system testing through pilot projects and areas; and defining a rounded system of energy efficiency, with long-term, medium- and short-term goals and action programs. Important instrument of energy management will be parallel establishment and monitoring of energy indicators, in different segments of energy production and consumption [31].

From 2013 in European mining should be applied ten principles of sustainable development and new sustainable mining indicators recommended by ICMM (International Council on Minning and Metals), 2005.

11. ***Increase of regulations*** - With the uncertainties on the global energy market, political (and environmental) pressures on the mining and energy sectors are rising. This has an impact on competitiveness, security of resource usage and corporative responsibility. That become a growing complex of risks, especially because of the impact that national regulations have had on the sector's global position [2]. Some of the strategic risks such as consolidation of firms, climate change concern, preservation of social work permits and other all lead to an ambience in which the global regulators are increasing the requirements for the mining and energy sector. It is a complex issue and requirement, especially for big international corporations with business activities in many countries that are under the jurisdiction of several national regulations. The mining companies are exposed to the trend of an increase in regulation and greater diversification of rules.

Over the next few years in Serbia will be fully realized provisions of the *Treaty on establishing the Energy Community of Southeast Europe*, which regulate establishment of a stable regulatory and market framework in the SEE and the EU in the area of creation and implementation of planned regulations, environmental protection, competition and the strengthening of the electricity market. According to the *Energy law* of the Republic of Serbia, and to the corresponding international agreements, energy market management is defined based on corresponding methodology (by special bylaw *Rules on functioning of energy market)*, that is approved by the Energy agency of the Republic of Serbia. According to this methodology (which determines the tariff elements for calculating electricity prices for tariff customers), the price should cover costs of supply, technical efficiency and compliance with the EU regulations. Prices that the Serbian government has so far controlled/approved are not in line with prices that would result from consistent application of the mentioned methodology, but are significantly lower, in which the Government is largely ruled by social reasons and interests [31]. This is a major source of reducing the EPS income.

With the aim to protect socially vulnerable electricity consumers, the Government of Serbia has in 2009 adopted *Action plan to solve the social consequences of the Energy Community*.

Application of mentioned documents would enable EPS to become fully market company, which produces consumer goods as well as other energy producers, while social policy in this area would be managed in a way that does not harm its market and development position. This would create the required balance between the so-called qualified and tariff electricity customers [31]. By full market opening till 2015, any customer of electric power will be able to choose whether to purchase electricity on the open market (by the open, i.e. market prices), or at regulated prices (by applying the aforementioned methodology and tariff system). It should be emphasized that full and consistent application of this principle would still be limited, because it is not reasonable to expect rapid elimination of technical barriers and improvement of power transmission and distribution network, which is now limited, and that is technical and functional condition for its implementation. Although in the first period the application of these principles/rules would lead to a

significant increase in electricity prices in Serbia (as a result of the current much lower prices than the average in the regional market), it is estimated that over the medium term this will lead to a relative reduction of average electricity prices (in line with the existence of the free market).

12. *Community resettlement, relocation of suprastructure and infrastructure* - Resettlement is one of the preparatory activities and implementation of recommendations of EU energy policy on resolving regional and spatio-environmental consequences of restructuring and development of mining basins and companies. Perspective spreading of mining exploitation requires relocation of population, settlements, and different activities. This requires compilation of appropriate resettlement plans that need to be harmonized with practice and World Bank Directive on involuntary resettlement [26], [27]. The absence of application of this directive and experiences of good practice from other countries may be an additional risk factor in the process of resettlement in lignite basins in Danube region and in Serbia [5].

Among other risks are [11]: emergence of independent rich funds, availability and limitations of water, development of new technologies that could induce exploitation of uneconomic reserves, increased importance of communication with NGOs and the public is a growing risk, introduction of private ordinary shares into the mining sector as a great strategic business risk.

I. Conclusion

The complex of coal extraction and processing is being exposed to different internal and external impacts, uncertainties and risks. In the future we can expect increasing pressure on the transformation of the sector, due to the requirement to reduce the role of fossil energy sources, primarily coal. Development and operations in the coal sector will increasingly take place as a result of reflection on the international market and requirements of constant growth of competitiveness and productivity, based on the principles of sustainability. In the immediate future in the production of electricity from coal fundamental question is related to the reduction of CO2 emissions in accordance with Clean Coal concept.

Lignite is the base of Serbian energy development, while Danube region represents the “energy heart”. The increase of competitiveness and energy efficiency in the lignite basins is an integral part of the efforts for the sustainable development of Danube region in Serbia. The main risks for the development of the lignite basins in Danube region are the following [29]:

1) Delay in the process of restructuring, consolidation and the completion of privatization, as well as alternatives to a development that is not based on the principles of sustainability, could strengthen the current highly risky and socio-economically unacceptable trend of development.

2) Very important risk for the development in the lignite basins are environmental requirements for the optimal utilization of resources and the protection of the environment; growth of costs due to application of environmental regulative; overconsumption of energy products in the systems MEGS and TEKO.

3) The start of a new sustainable development cycle will be impeded, unless the problem with the lack of younger, highly-educated and highly-skilled population is not properly tackled.

4) Without technological innovations and new technological knowledge, the basins have no perspective for starting a development cycle.

5) The main risks for development of coal complex are: lack of capital for new investments, lack of working capital, and insufficient adjustment of production to a market-based economy.

In the following period, it will be necessary to implement complementary measures of energy and industrial policy, by which the mining-energy complex will gradually begin to eliminate its economic, social, and environmental-spatial risks.

Although Serbia has ratified Kyoto protocol in 2007 and has no obligation to apply it before 2015/2017 (regarding the fact that it is on the list of Annex 2), strategic development planning of energy and mining sector requires preparations and adjustments of development policies in accordance to general trend, especially respecting strategic business risks in this sector.

Harmonization of the Serbian energy sector is particularly important because of the planned full implementation of the Directive on carbon emissions trading system from 2013, when is planned transition on full public sale of permits for CO_2 emissions for the energy sector. Application of CO_2 emissions trading system is also the initiator of support for the implementation of CCS Directive, which is planned to be introduced in the EU till 2020. Harmonization of strategic development in the energy sector involves the application of these concepts in the documents of EPS

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