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STRUCTURE OF COAL IN THE ENERGY BALANCE OF SERBIA

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Abstract

Energy balance is a document that defines annual amounts of energy and energy sources needed for orderly and safe supply of energy consumers.

In order to achieve the defined energy balance and increase the stability of energy supply, it is necessary to fulfill the prerequisites defined by Regulation of changes and additions of Program of achieving Strategy of Energy Development in Serbia till 2015, for a period between 2007 and 2012, brought in April 2010 (Official Gazette of Serbia, No 27/10).

Coal is definitely the most important energy source in Serbia, since it has a largest share in the structure of Serbian Energy Balance, which would also be the main subject of this paper.

Key words: *energy balance, energy, energy sources, coal.*

INTRODUCTION

Energy balance is a document that defines annual amounts of energy and energy sources needed for orderly and safe supply of energy consumers in a three year period: realization report for previous year, estimation of current situation and a plan for following year. This document is made based on monthly and annual reports on production, processing and supply of energy and energy sources, according to methodology of International Energy Agency and Eurostat.

Measures of energy sources are expressed by physical units, such as: solid fuels in thousands of tons (000 t); liquid fuels in millions of tons (Mt); gas fuels in millions of cubic meters (calculated on cubic meter of gas); electric energy in gigawatt-hours (GWh); heat energy in terajoules (TJ) and in million tons of equivalent oil (Mtoe). A ton of equivalent oil is equal to 41.868 GJ or 11.63 MWh of electric energy, or 2 t of stone coal or 5.586 t of raw lignite coal. [1]

CONVERSION OF ENERGY UNITS

Entire energy flow is enlaced into three energetic systems:

- Primary energetic system; this system provides the structure of overall primary energy, available for consumption. It includes both domestic energy production from primary energy sources (coal, oil, natural gas, hydropower, renewable energy sources) and net import of primary energy (presenting the difference between import and export of energy sources), along with net import of electric energy. A report on renewable energy sources utilization enlists statistical data on utilization of hydropower, geothermal energy, production of solid biomass and heating timber. Republic of Serbia has an obligation to enlist entire energy production from renewable sources, according to Agreement on Energy Community.
- System of primary energy transformation; it includes energy sources necessary for process of primary energy transformation, along with energy production (including domestic consumption, as well as losses in transformation, transfer and distribution of energy to final consumers). Structure of this level consists of thermal power plants, hydroelectric power plants, thermal power and heating stations, heating stations, energy stations, oil refineries, coal processing plants and blast furnaces.
- System of final energy; it includes both consumption in non-energetic purposes (non-energetic consumption) and consumption of final energy in energetic purposes. Consumption of final energy in energetic purposes is divided in to two sectors. The first one includes structure of consumption: industry, transport and other consumers (households, public and commercial enterprises and agriculture). The second sector present structure of energy sources: solid fuels, liquid fuels, gas fuels, electric energy, heat energy, and renewable energy. Due to lack of reliable data on structure of final energy production in energetic purposes, it has to be estimated.

Data from numerous institutions were used in design of Energetic Balance of Serbia, such as: Bureau of Statistics, Energy Agency, Customs Administration, Public Enterprises for Energy Distribution (JP Elektromreza Srbije), Gas Distribution (JP Srbijagas), Oil Distribution (JP Transnafta), Underground Coal Production (JP PEU Resavica), Serbian Oil Industry (NIS), network of heating stations and producers of blast furnace gas. [1]

Table 1 shows conversion factors for energy measuring units in international statistics.

Table 1. Conversion of energy units

	TJ	Gcal	Mtoe	MBtu	GWh
Terajoule (TJ)	1	238.8	2.388×10^{-5}	947.8	0.2778
Gigacalorie (Gcal)	4.1868×10^{-3}	1	10^{-7}	3.968	1.163×10^{-3}
Million tons of equivalent energy (Mtoe)	4.1868×10^4	10^7	1	3.968×10^7	11630
Million Btu (MBtu)	1.0551×10^{-3}	0.252	2.52×10^{-8}	1	2.931×10^{-4}
Gigawatt-hour (GWh)	3.6	860	8.6×10^{-5}	3412	1

Btu – British thermal unit

ENERGY BALANCES BY ENERGY SOURCE TYPE

Energy balance may be defined by each specific energy source: oil; oil derivatives and biofuels; natural gas; coal; electric energy; heat energy and renewable energy sources.

As it was mentioned before, this paper is focused on coal balance, which means that only this type of energy sources will be analyzed. Since input parameters for analysis of energy balance in 2014 are not available yet, energy balance for 2013 will be analyzed, based on planned and actual results in coal production.

COAL

Coal balance enlces production, processing, import, export and consumption of coal, as well as production and consumption of blast furnace gas. Needs of coal for orderly supply of consumers in 2013 were covered with domestic production (98%) and import (2%).

Underground, surface and underwater coal mining

Serbian coal mining includes production of anthracite, brown coal and lignite coal, carried out in following coal mines:

- Underground coal mines, enlaced in Public Enterprise for Underground Coal Mining (JP PEU Resavica), producing anthracite, brown coal and lignite coal;
- Surface coal mines, Kolubara and Kostolac, producing lignite coal, enlaced in Public Enterprise of Electric Energy (JP EPS);
- Underwater coal mine Kovin, producing lignite coal.

Planned production for 2013 was 4% higher than production achieved in 2012, and it was estimated to reach 641,000 tons.

Planned and actual production and consumption of coal

Actual results in underground coal production achieved in 2013 were as follows: production reached 601,439 t of coal, or 93.8% of planned production. [4]

As for surface coal mining, plan for 2013 was 39,676 Mt (million tons) of coal (29.971 Mt from Kolubara and 9.705 Mt from Kostolac). The planned production was 5% higher than production achieved in 2012 (37.781 Mt).

Actual surface coal mining production results are as follows: 30,709,715 t of coal were extracted in Kolubara and 8,803,759 t in Kostolac. This means that actual coal production in 2013 met the plan. [3]

In underwater coal mining, the plan was to exceed the production achieved in 2012 by 30% and produce 220,000 t of coal.

The results on underwater coal exploitation in 2013 are 182 210 t, which represent 91.1 % achievement of annual plan. [5]

The structure of domestic coal is contributed by 98.6 % of lignite and only 1.4 % contribution of anthracite and brown coal. From the total domestic coal production in 2013, 94 % is planned to be utilized in thermal power plants for electricity production.

Net coal import considers the import of deficit amounts of coal, primarily coke for metallurgical facilities, high calorific value coal for industrial needs and brown coal for mass consumption. The net import considers the minimum amounts of export of brown coal, lignite, dried lignite and coke. For 2013 the coal import was planned to 0.436 Mtoe, which was a 20 % decrease related to the 2012 plan (0.545 Mtoe).

Total available amount of coal from domestic production and net import in 2013 were planned to 8.144 Mtoe. The consumption structure plan considered the maximum consumption of coal for transformation in the amount of 7.256 Mtoe which is 89 % of total available amount.

Coal consumption for transformations

Coal consumption for transformations consists of:

- Consumption for electricity production in the amount of 7.086 Mtoe which is 7 % increase compared to 2012 (6.636 Mtoe);
- Consumption for coal processing in the driers and blast furnaces, that is the production of dried "Kolubara" lignite, amounts of coke for blast furnaces and production of blast furnace gas. 2013 plan was to use 0.170 Mto of coal for processing which is 45 % decrease related to 2012 due to the fact that Smederevo ironworks stopped working. The production of dried lignite in 2013 reached 450 000 t, 15 % less than in 2012.

The final coal production in 2013 was 1.076 Mtoe and is decreased for 11 % compared to 2012. These amounts consist of non energetic use (0.22 Mtoe) and final consumption for energetic purpose (1,053 Mtoe). Industrial use contribution to final consumption is 39 % while other sectors contribute 61 % (out of which the dominant 30 % goes to mass consumption in individual households for heating purposes).

STRUCTURE OF COAL CONTRIBUTION IN TERMS OF EXPLOITATION SYSTEM

The structure of coal in physical volume in relation to its origin (surface, underground or underwater mining operations) according to the 2013 plan from Energetic balance of the Republic of Serbia is shown in table 2.

Table 2: Structure of coal contribution in terms of exploitation system

Type of exploitation	Production (t)	Contribution (%)
Surface mining	39.675.000	97,87
Underground mining	641.000	1,57
Underwater mining	220.000	0,54
Total	40.537.000	100,00

CONCLUSION

Based on the planned and achieved parameters it can be seen that coal production from surface mining, meaning open pits Kolubara and Kostolac, was fully achieved in the amount of 39 513 474 t, which is the most important for energetic balance of the Republic of Serbia, considering its total balance structure contribution of 97.87 %.

Regarding the underground mining operations, the production was 601 439 t (93.8 % plan achievement). It might seem not so bad but based on the Program for achievement of Strategy for energetic development of Republic of Serbia up to 2015 for the period from 2007 to 2012, adopted in April 2010 (Official gazette of Republic of Serbia 27/10), it was anticipated that underground coal production in 2012, 2013 and 2014 should be 1 340 000 t of coal [2].

Considering the 1.59 % contribution to Energetic balance and deviation from the Program it is urgent to create a Strategy for underground coal mining development, so underground mining could, through increase of production, have more significant contribution to energetic balance of Republic of Serbia.

The results of underwater coal mining for 2013 show the production of 182 210 t which is 91.1 % plan achievement. Since the contribution of underwater mining to energetic balance is negligible so the production of Kovin mine has marginal significance. However, Kovin also extracts gravel as a constructive material and gravel production of 323 369 t had highly positive effect to Kovin mine financial profit.

As a summary it can be stated that energetic balance of Republic of Serbia, at least from the aspect of coal as energetic material, is satisfactory. It is of the highest importance that surface mining meets the plans with the tendency of clear vision and production increase in the future, since considering the contribution structure of energetic balance surface coal mining is the base of energetic system stability.

Underwater coal mining enters the energetic balance with negligible contribution and its status will adapt to its own existential needs.

Underground coal production is in highly unfavorable position since the production stagnates for a long period of years, there are no announcements of new mines nor is the technological process being modernized. Having in mind the contribution to energetic balance of 1.59 % it is obvious that Serbia has no interest in investing in such (expensive) underground mining. The way out of this situation is for the profession in underground mining to fight for the status on its own through technology advance and innovative thought. Without the significant increase of production underground coal mining in Serbia is leading itself towards extinction.

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[3] *Technical data from the public enterprise "Elektroprivreda Srbije"*.

[4] *Technical data from the Public enterprise for underground coal production "Resavica"*.

[5] *Technical data from the business company for underwater coal production "Rudnik Kovin, AD Kovin U restrukturiranju"*,

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THE EVALUATION OF THE ENVIRONMENTAL IMPACT OF COAL EXPLOITATION IN THE RURAL AREA OF JERMA- BABUŠNICA

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Abstract

This paper deals with the segment of the environmental impact of coal exploitation in the deposit of coal "Jerma", with a special emphasis on the development of rural areas. Extensive technical data from studies, reports and projects were used in the study, associated with analytical methods of analysis and synthesis. The subject of this research is coal deposit of "Jerma", where it is planned to re-exploit coal by the underground system. In the paper, the impact of groundwater exploitation on the environment was analysed. The main objectives of the research are contained in a desire to make a realistic assessment of the impact on the area around the mine and the environment in general, considering the available information about the deposit of coal.

Key words: coal, mines, underground exploitation, environment, rural area, Jerma mine

INTRODUCTION

The influence of the underground coal mining on the environment on the surface is the subject of study and analysis of various experts, technical and others, from many angles,[1]. Coal production, whether performed by the ground or underground system of exploitation, is one of the basic activities of modern society and has a negative impact on the environment.

This influence is manifested by exhausting of natural resources, the destruction and pollution of the environment. Regardless of the above, mining has remained a necessity. Experts dealing with underground coal mines have the task to carry out exploitation with a maximum of economy and safety and with a minimum of jeopardizing the working environment [2]. The evaluation of the previous and current influence as well as the impact assessment in the next period is only possible if the criteria for identifying the influence are defined, the parameters of influence are recorded, the types of parameters are determine and the methods of measuring and monitoring are defined [3].

Pollution, contamination and degradation of working environment and the impact on the health of humans, animals and plants are being monitored, assessed, and it will be a long-term task and work of experts primarily. The system of monitoring (the assessment of air food and water quality) is not yet compatible, at the appropriate level and there are different methods and procedures of sampling, laboratory analysis and control [4].

A large number of rural areas in the Republic of Serbia is characterized by depopulation and economic underdevelopment, while urban centers record a higher concentration of population and economic activity. This tendency is negatively affecting the development, so it is necessary to develop programs, projects and future strategic directions of sustainable development of rural areas, in line with their specific characteristics, economic and non-economic functions, as well as the demands of the domestic and international environment [5].

Rural areas are unique because of their spatial and socio-cultural identity. What matters is that the adequate practice of rural development calls for understanding of the relationship people share with the natural features and phenomena around them [6].

Coal mines, or production facilities of coal mines are the specific objects and are opened where coal deposits are located and are built in accordance with statutory requirements and regulations. This significantly limits alternative solutions to design mining operations.

In order to minimize the negative impacts as much as possible, measures for prevention and rehabilitation must be taken. The reduction of environmental impacts is achieved by adequate protection within the existing technology of exploitation, by research and application of new technologies that have minimal negative impact on the environment, by remediation of negative consequences of exploitation, as well as a continuous training of technical staff for solving tasks in the field of environmental protection.

In the territory of the Republic of Serbia there are numerous researched, exhausted and abandoned deposits of bituminous coal. At the moment, coal is exploited only in the Ibar Basin and Vrška uka. The exploitation of these basins is underground. The current needs of Serbia for stone coal are substantially higher than current production and are covered by imports [7].

In the case of the economic assessment of the mine and coal deposits, it is necessary to take into account the structure of energy sources in the country, which shows that in Serbia, when it comes to coal reserves, the total balance reserves of coal accounts for 1%, brown coal 17% and 82% of lignite [8].

On the approved exploitation field of "Jerma" mine, the exploitation of stone coal will be carried out. The coal deposit "Jerma" belongs to a group of lean bituminous coal with a very low volatile content (10-15%) and moisture content (1-3%). The coal contains a high degree of carbonification, whose low calorific power with no moisture and ash content usually ranges from 30,000 to 34,000 kJ / kg.

The coal deposit "Jerma" is black, shiny to very shiny, if clean, free of mineral impurities. The fracture of it is uneven, and by its macrostructure it is homogeneous. It is of grainy texture, which occurs as a result of intense tectonics, and is very brittle.

THE MAIN CHARACTERISTICS OF COAL DEPOSITS

The first mining operations on exploration and the opening of the mine "Jerma" were launched in the period before World War I and with several interruptions were carried out until 1962, when the mine was definitely closed. [9]

In the early eighties there were serious plans for the mine to restart, but it has not been realized yet, although the coal basin "Jerma" has a higher calorific value than all the coal exploited in Serbia and the confirmed reserves of "B" category are over 5,000,000 metric tons, but it is estimated that the potential reserves are considerably larger. The amount of the confirmed coal reserves is shown in Table 1.

Table 1. Confirmed coal reserves

Layer	Category of reserves	Balance reserves (t)
The underlying stratum	B	4.045.050
Overlaying stratum	B	1.630.550
Total	B	5.675.600

The mining field of the coal basin "Jerma" is located in the southeastern part of Serbia, in the northwest of Ruj mountain, southwest of Pirot and Dimitrovgrad and it formally belongs to the municipality of Babušnica. The largest village in the area of the coal basin is the village of Rakita.

Babušnica Municipality has 124 km of border, 18 km of which with Bulgaria, the area of 529 km²; 12,307 inhabitants according to the census from 2011 (3427 fewer than in 2002).

Babušnica is located on the main road M-9 from Leskovac to Pirot, which connects the highway E-75 (south of Europe) and the international road of first order Pirot-Sofia E-80 (to East Europe). It is located 65 km southeast of Nis, 25 km southwest of Pirot and 55 km northeast of Leskovac.

The area of the exploitation field is connected by the asphalt road of 4 km with the village of Zvonce, which connects one asphalt road of the length of 22 km with the international route of the first order Pirot-Sofia E-80 and the train track of the standard gauge Nis-Pirot-Dimitrovgrad. The village of Zvonce connects another 24km long asphalt road with the main road M-9 (Pirot-Leskovac).

Babušnica Municipality is one of the most underdeveloped municipalities in Serbia, with an extremely high unemployment rate. According to the data from the municipal Web site taken on 31st Dec. 2008, the number of the unemployed was 2,107, and the total number of the employed is 855 (only 270 of which having permanent jobs).

The management of the mine used to be in the village of Rakita, which, according to the census of 1991, had 455 residents. There are 300 adult inhabitants in the village of Rakita, and the average age is 46.9 years (44.9 with men and 49.0 with women). The village has 131 households, and the average number of members per household is 2.60. The population of this place is very inhomogeneous, and in the last three censuses, a tendency of population decline was noticed.

The village of Rakita, once the most promising in Babušnica municipality has fallen to only a few tenths of living of households.

The former mining colony with more than two hundred families, which were financed by working in a nearby coal mine "Nova Jerma", and upon its closure in 1962 in coal mines of "Resavica", "Vrška uka", "Moravica" and others, now survives its worst days. This is proved by the fact that the primary school in the village of Rakita is attended by only a few students [10].

Morphologically, the area belongs to medium mountainous areas, with very large differences in levels, ranging from 700 - 1400 m above sea level. The terrain is morphologically very jagged, with steep slopes.

The wider area includes Zvonacka spa with accompanying tourist facilities. The most important monasteries are Poganovo (included into the World Cultural Heritage), the Sukovo monastery, Temska and others. Between Zvonacka Spa and Sukovo there is a gorge of the Jerma river. The exploitation or digging plants at the location have no impact on the natural and cultural goods as they are located outside the mining area.

Babušnica Municipality has a relatively poor network of waterways. There are three river basins - the Lužnica, Jerma and Koritka river. The largest river basin is Lužnica, the length of which is 38km. In the vicinity of the mining areas the most important rivers are Rakitska river, Vu edol stream and Vodeni ište that flow into the Zvonacka river and farther into the Jerma river. The village of Rakita obtains water from village wells and water supply from the water intake Vu edol. The mine facilities are not located in the sanitary protection zone.

In the wider and narrower area archaic and Paleozoic sediments and igneous rocks, Mesozoic limestones, sandstones and marl can be found. The most prominent is Golemi Stol (1239m) which belongs to the northeast side of Lužnica mountain. The south side is completely bare and rocky with sandbanks and notches, while the North is under the beech trees and the eastern under pastures. The geological structure and tectonics caused the occurrence of a number of wells and springs (Ljuberaško, Linovsko, Sura evsko, Izvorsko, Provaljeni ko, Resni ko, Striževa ko, Gornjekrnjinsko, Radoševa ko, Stolsko, Kijejsko, Raljinsko, Valniško etc.). These springs have different volumes and a number of them were used for the mining purposes. The only thermal spring in the territory is Zvonacka Spa. The thermal water comes from a crack in the limestone terraces, the volume of which is 9 l / sec, and the temperature 28-29°C.

The mineral wealth of this area is insufficiently explored. So far, the incomplete research has identified the existence of certain minerals and non-metal, but their reserves have not been estimated, except for coal.

The identified natural mineral resources are:

- Graphite, found in Modra Stena,
- Coal deposit, indicated in the region of the villages of Crvena Jabuka and Studena
- Copper, found in red sandstones near the village Vave,
- Dolomites, found in Suva Planina and Jerma valley
- Tuffs, located near the villages of Zavidince, Radoševca and Krnjina,
- Quartz sand, found near the village of Bogdanovci and Striževca,
- Oil shales are found in the region of the village Raljin.

The relief of the area is hilly - mountain and is part of the Carpathian-Balkan system formed in the Tertiary. The relief is characterized by several morphological entities (Lužnica, Zvonacka part Zuplanjska basin) and low and medium mountains with the highest peak of Ruj (1704m).

According to the intensity of seismic activity the narrow area of the site belongs to the 7 MCS zone. In the municipality of Babušnica studies have identified different types of soil. It was also found that about 22% of the land is sour, that the presence of humus is low and limited to Lužni ka valley. The watercourses have generally a tendency to flood, and significantly influence the occurrence of erosion of soil and flooding areas along the waterways.

There are no sensitive facilities that could be affected by coal mining on the location of Jeram coal basin. The nearest hospital is located in the town of Babušnica, a medical clinic in the village of Zvonca. The elementary school to the fourth grade and also the church are situated in the village of Rakita, which is outside the exploitation field. There are no other buildings in the inner area.

A little farther from the exploration area there are Jerma River Gorge, Poganovo monastery and Zvonca spa as well as the habitat of the plant „Venus hair“ for which procedures to be put under protection as a natural resource have been launched.

The Municipality of Babušnica is a middle and rarely populated area. In the southeast, along the distance of 18km, the municipality borders with Bulgaria, to the east with the municipality of Dimitrovgrad, in the northeast – the territory of Pirot, in the north and northwest with the municipalities of Bela Palanka and in the west- Gadžin Han municipality, in the southwest and south it borders with the territory of Vlasotince and Crna Trava.

According to the climatic characteristics, the closer and wider area, belong to the zone with a moderate continental climate, which features cool, wet winters and long and hot summers. Babušnica has got slightly colder climate than it would be expected for its latitude and longitude because of its slightly higher altitude, as well as the effect of temperature inversion, which is a characteristic of Lužni ki valley, where cold air falls to the bottom of the valley at night so the nights are quite cold, especially in summer. The average air temperature in January as the coldest month is -2° to -4°C, and in the hottest month of July it is from 26° to 35°C. The annual precipitation is 800-900mm, with the highest levels of rainfall in May-June, and the lowest in March. The area is with divergent flow of air masses during the year, although north and northeastern winds are more frequent.

The Jerma Mine is situated at an altitude of about 800m long and cold winters and moderate warm summers, and with significant precipitation. As this is an underground mining, weather conditions have no particular impact, except for the transport of coal and delivering reproductive material.

The Government of the Republic of Serbia, at its meeting on 13 September 2014, adopted the Decree which declared a protected area – The Special Nature Reserve "Jerma which is located in southeast Serbia and includes the massif Grebena and the mountains of Vlaška, as well as the area of the river Jerma . SRP "Jerma" extends across the municipalities of Babušnica, Dimitrovgrad and Pirot, It occupies the area of 6994.5 ha and forms a unique complex of valleys and limestone cliffs with imposing cliffs. It is characterized by exceptional floristic and phytosociological diversity with the presence of a large number of endemic, rare and endangered plant and animal species. The high geomorphological forms, numerous speleological objects, as well as interesting and significant hydrographical phenomena and processes contribute to the beauty and attractiveness of the area. Also, typical landscape elements, cultural, ethnological and historical heritage make this region unique [11].

THE TECHNOLOGICAL SOLUTIONS TO THE EXPLOITATION

The technical and technological solutions to the exploitation of coal in the pit of "Jerma" are based on the natural geological conditions, primarily elements of spreading and the number of coal layers, their thickness and type of supporting walls. In addition, waters, the properties of dust and gas have considerable influence in the basin.

When choosing the location and opening ways the concentration of works was made and previously made undermains were used, which will be repaired and their use for export or ventilation will be determined. These undermains will lead into the coal seams in the northern part of the mine and the development of mineral deposits in the excavated areas will be continued. Making room is planned to be performed by standard technology of drilling and blasting operations and support placement with steel support. Excavation will be done using the widely frontal excavation method, a cutting coal combine and by timbering the open space with a special support. The transport and export of coal will be carried out with the systems of belt and rake carriers, while the upper rail facilities will be used for the delivery of raw materials to the mine.

The drainage of the basin will be done by making the water flow down to the lowest point, into the water collector, where it will be taken out with pumps and pipelines onto the surface.

The ventilation of the pit is planned to be done artificially, depressing the central air distribution, using the main fan, which is installed on the surface.

THE ASSESSMENT OF THE ENVIRONMENTAL IMPACT

Based on the analysis of the current situation of environmental protection at the location and the analysis of technical and technological solutions to the future exploitation of the mine "Jerma", the assessment of the mutual influence has been provided.

The changes in air quality and the impact of the changes on the environment. The potential danger for the air in the environment is suspended particles (mineral dust) the emission values of which, in certain natural conditions, can be above the limit value prescribed for the inhabited areas. In the specific case, the dust can be found on the plateau in front of the pit during operation of transport equipment mines, as well as on the plateau at the processing plants. This phenomenon can be significantly reduced and limited by regular spraying of water during the summer months.

The possible impact of noise, vibrations, heat and radiation. There are regulations on protection from noise and vibration, covered by a system of measures (technical, organizational ...) to protect from noise, vibrations, heat and radiation when planning construction of facilities or the use of machines and equipment as the source of this phenomenon, so it is not expected that there will be any negative effects. The analysis of technological origin of those phenomena proved that, in contrast to the working environment, there is no environmental threat to the facilities that are the subject of this study.

The changes in water quality. If we take into account the technological process of coal exploitation in the pit and the drainage system designed with precipitators and water collectors, and assuming that technological discipline will be at the required level, it can be concluded that the mine water will have no negative impact on environment.

The water from the pit is discharged into the recipient chemically correct, since the deposition of solid particles has already been performed in the precipitators.

The current source of water supply of the village Rakita is outside the excavation plants of the project and is not expected to be endangered.

The changes of meteorological parameters and climate. Our mines with underground exploitation have a small capacity and low impact on the earth's surface, groundwater and surface water, fauna and flora of the area and do not affect the climate characteristics of the area.

This is particularly the case with pit "Jerma" ". Flora and fauna in the area are preserved. Some insignificant disorders of the groundwater level (only within the deformed field) are expected to happen. Therefore, it can be concluded that coal mining in the pit will not influence the meteorological parameters and climate characteristics of the area.

The changes in ecosystems. The underground coal mining in the pit "Jerma" will affect the environmental factors in the area of the mine, or ecological system as a whole to an insignificant extent.

After the re-cultivation of degraded areas and after many years, the self-regulation of ecological factors occurs in the environment, and it is estimated that

the local changes in the exploitation field will not affect the ecological system of the area as a whole.

The changes in the population's health. A detailed analysis of the technological process of coal exploitation, as well as the work of external objects exclude the possibility of effects on human health.

The changes in population density, concentration and migration. The work of mine "Jerma" in this area will have a beneficial impact on the population and concentration of population in the narrow and wider area and surrounding villages. The opening of the mine would result in additional migration of population and economic development of the surrounding villages and municipalities. This would stop the negative trends of population migration in this area.

The change of the purpose and use of land. The exploitation of coal from the pit "Jerma" will lead to small changes of the purpose and use of land - the land will be used for the construction of the mine infrastructure, and the formation of tailings and coal dumps.

These are relatively small areas without a significant impact on the overall state of the environment.

The changes of the municipal infrastructure. The construction of the mine will lead to the construction of roads necessary for the transport of coal. This construction will expand the municipal infrastructure of the area, which is positive from the public, social and economic point of view.

The electric grid, the system of water supply, telephony, as well as the objects of service industries will also be built.

The changes of protected natural and cultural resources. According to available data, there are no registered archaeological sites, or cultural monuments which could possibly be endangered as protected objects in the exploitation area. There are no specially protected parks of nature in the mining area either.

The changes of landscape characteristics. The underground coal mining in the pit "Jerma" will have a little impact on the landscape characteristics, which will generally manifest itself by forming tailings and partial deformation of the surface due to the works of excavation of coal in shallow parts of the bay.

The landscape characteristics will be altered by the construction of external infrastructure facilities of the mine.

The mutual relations between environmental factors and the intensity of the impact.

Activities on the exploitation of coal in the mine deposit "Jerma" have a slight impact on the environment, and by the apprehension of the impact, it can be concluded that the level of impact will be "low", except for the exploitation of mineral resources and degradation of land, where middle level of impact is estimated, because ore is non-renewable mineral resource, and because the land can not restore the original relief completely. Coal mining has a positive influence through the intensification of development, growth of population and the living standard, where medium level of influence is expected .

MONITORING THE IMPACT OF COAL MINING ON THE ENVIRONMENT

After starting exploitation work, systematical monitoring of the situation in the area of the mine should begin. Monitoring should continue after the termination of operation as long as negative impacts are present and remediation is complete. Practically, it is necessary to record all changes in the area of the mine in all phases: pre exploitation, during operation and after the operation.

The conditions before mining involve construction status of the area that will be occupied by all the facilities of the future mines, the percentage of a given working activity of the population, a list of economic operators, the displayed percentage of area under agricultural production and forest area as well as industry, the content of flora and fauna with the achieved level of natural harmony, the quality of soil, water and air, the condition of watercourses and water reservoirs, number of sources and their yield, the level of groundwater and others. The conditions during operation include a record of the exploitation area with landfills, dumps roads, administrative and auxiliary buildings and other structures, the type and quality of buildings and facilities, road networks, electrical network, hydro construction, etc. Geological data on coal seams and associated sediments are also recorded , the dynamics of mining operations, the data on measurements of noise, dust cover, evaluation of soil and landfills, changes in the quality and content of flora and fauna, changes in the population and their work activities in a wider area of the mine, the damage of the surface, changes in the size and number of watercourses, water sources and reservoirs with the analysis of water quality, areas contaminated with waste oils and lubricants and others. The conditions after the operation include a record of the geometry of space waste and tailings, infrastructure as a result of mining production and final record of all previously monitored conditions and phenomena. [12].

Monitoring the impact of exploitation in the pit "Jerma" on the environment should be performed as follows:

- Daily visual inspection of planning tailings and slope stability,
- Quarterly geodetic control of the surface tailings and the angle of the curve,
- Half-yearly geodetic measurement of the surface strain of the field with the specified profile lines until the stabilization period, and afterwards, if necessary,
- Quarterly measurement of water levels in nearby wells,

- Regular monitoring, according to mining regulations, of the inflow of water into the underground rooms,
- Quarterly determination of water quality on samples from pits and from external streams (before and after the influx into the recipient)
- Monthly measurement of the amount of mine air ventilation holes and the content of harmful gases in the output air stream.

CONCLUSION

The situation of energy in Serbia, as well as the environment, is such that it requires an increase in the balance of power generation from thermal power plants. Coal is the most important source of energy in Serbia, and it is estimated that in the next 30 years it will maintain that position.

Coal reserves in the coal basin "Jerma" include coal of high calorific value and with a wide range of applications.

The elements of geometry of coal seams demand the application of the system of underground exploitation exclusively, which is characterized by low environmental impact compared to the system of surface exploitation. Also, coal mining and its impact on the environment, compared to the exploitation of minerals, is low.

The influence of groundwater exploitation in the basin of "Jerma" on the environment will be reflected as follows:

- Mine water will be taken out of the pit chemically unchanged, but with possible content of solid particles, which can be avoided by treating in precipitators
- The process water will not be used in the technological process, and for the removal of dust in the air pits drinking water will be used,
- The content of harmful components in mine air that will erupt through the fan into the atmosphere will not affect the state of the environment, given the harsh mining regulations, which ensures the content of harmful components below the MRL,
- There is possibility of dust during transportation on outer roads, the transport of coal and overburden and importation of mining equipment, as well as with manipulations in landfills and depots, which is successfully eliminated with water spray,
- The impact of excavation on the surface of the ground, or its deformation, is not expected to a greater extent, while the impact on the landscape will be taking the land on which mine infrastructure facilities will be built.

It is important to emphasize that the project will have positive impact on the welfare of the local population and consumers of coal.

With the construction of the mine, roads, telephone communication and a network of small businesses particularly in the field of catering, trade and other services will develop. This will increase employment in this extremely undeveloped area. which is now characterized by high level of migration and continuous population decline.

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LEGISLATION TO PRESERVE AND FACILITATE BIOLOGICAL RESOURCES IN UNDERGROUND COAL EXPLOITATION

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Abstract:

Underground exploitation of coal represents specific economic activity which, besides the risk to the employed, has the impact to the environment. The impact and manner of presentation of underground exploitation are subject to study and analyse of various professions, both technical and others from various aspects. The policy of the state and local authorities regarding the environmental protection might be understood on the basis of greater number of actual regulations that, each from its point gives light to understanding this problem. In this work the aspects of basic home regulations for environment protection was given to keep and advance biological resources in the area of underground coal exploitation.

Key words: *biological resources, coal, mines, legislation.*

INTRODUCTION

Exploitation of natural resources and keeping biological diversity, are in conflict between each other. We need biological resources, but it is necessary to keep them in long run. Therefore the compromise is sought between the keeping and using these biological resources. In that way we practically adopt the concept of sustainable (accorded, long term) use. For the last decades the economic points of view and ecology have been confronted, especially under the condition of population growth, development of technology and increase of living standard of population in many countries.

Underground coal exploitation is specific for its technological process being both underground and above ground, having the impact to the narrow and wider environment around the mine. The practice of both home and foreign underground mining there is the evidence of the underground coal exploitation influence to the air, water, soil and objects, as well as the surround environment.[2]

Basically the exploitation leads to accelerate the process of environmental decay of mainly in three aspects:

- Depletion of reserves;
- Destruction of environment, and
- Pollution of environmental factors.

Notwithstanding to the quoted above, the mining has been and is the necessity.

The specialist dealing with coal exploitation face the most prominent task: necessity to exploit with maximum economy and safety the deposits with minimal endanger to labour force and environment. The underground exploitation degrades fewer environments in comparison with surface exploitation, but here appears sinking of terrain, storage of barren soil, mining objects with bunker, workshops and other storages, as well as dwelling objects for people.

Mining must accept the environmental protection as its activity, as technology of digging, ventilation, transport, processing and alike. In that sense the legislation expedites severe obligations of connection mining-environmental protection.[3]

BIOLOGICAL RESOURCES IN REGIONS WITH ACTIVE MINES AND REVIEW OF EXISTING LEGISLATIVE

Biological values and resources are within the total biological diversity, in its practical, scientific, economical, esthetical, and ethical and culture historical dimension. According to the widest accepted definition the term biological diversity or bi diversity (bios-life; diversion- variety) meaning the gene ensemble (genetic diversity), types (diversity of species) and ecosystems (eco system diversity) on earth or any of its part. [1]

While analysing the influence of works of undergoing coal exploitation to the environment, basically there are narrow and wider area of exploitation. Thus the narrow areas are under the direct influence of exploitation, whereas wider off the mining works zones and often research area, but they are specified for the evaluation of eventual impact of the underground exploitation.

In wider areas of active mines the protected natural areas are registered, cultural historic monuments and protected types of flora and fauna, but it is found out that the same underground exploitation has no damaging effects, forest vegetation and pastures covers the greatest part of narrow mine areas, whereas the agriculture soil is less present. The plans and animals species are characteristic for this geography zone in Serbia, with all climate and other characteristics.

Protection of flora value and sustainable biological resources is one of most important strategic priority in protection of environment and accommodated long run sustainable development both in globally and at the level of each country, and Serbia too.

Basic craft Law on mining (Official Gazette RS, no. 88/11) and Rule on technical norms for underground exploitation of coal (Official Gazette RS, no.) regulates among other issues the protection of environment and proscribes measures that have to be carried out in that field. The field of protection of environment, for its greatest part relating to biodiversity, is regulated directly or indirectly by following acts:

- Law on environmental protection (Official Gazette RS, number. 43/11);
- Law on evaluation of influence to environment (Official Gazette RS, number. 36/09);
- Law on strategic evaluation of influence (Official Gazette RS, number 88/10);
- Law on protection of nature (Official Gazette RS, number 91/10);
- Law on protection of air (Official Gazette RS, number 10/13);
- Law on waters (Official Gazette RS, number. 93/12);
- Law on agricultural ground (Official Gazette RS, number 41/09);
- Law on waste management (Official Gazette RS, number 88/10);
- Law on protection of plants (Official Gazette RS, number 101/05);
- Law on protection of plants from decease and pests (Official Gazette RS, number 101/05);
- Law on recognition and protection of agricultural and forest products (Official Gazette RS, number 28/00);
- Law on sustainable use of fish fund (Official Gazette RS, number 36/09);

- Regulation on protection of natural rarities (Official Gazette RS, number 93/93);
- Convention on policy of biodiversity in SR Yugoslavia (Official Gazette SRY, number 22/94);
- Law on forests (Official Gazette RS, number 93/12);
- Law on national parks (Official Gazette RS, number 101/05);
- Law on hunting (Official Gazette RS, number 20/09);
- Law on cultural heritage (Official Gazette RS, number. 22/11);
- Law on animal welfare (Official Gazette RS, number 41/09);
- Law on planning and construction (.Official Gazette RS, number 72/09);
- Law on proclamation and protection of strictly protected and protected wild species of flora, fauna and fungi (Official Gazette RS, number 5/10);
- Regulation on control of wild flora and fauna use and turnover (Official Gazette RS, number 31/05);
- Law on protection and sustainable use of fish fund (Official Gazette RS, number 36/09);
- Regulation on proclamation of strictly protected and protected wild species of flora, fauna and fungi (Official Gazette RS, number 5/10).

In procedure of obtaining permission for exploitation (Article 57) the holder of the exploitation design must provide documentation from the field of environmental protection as follows: confirmation on location, act issued by relevant ministry for environmental protection and confirmation for institution for protection of cultural heritage, and act of relevant ministry for waters.[5]

To precede further activities, that is to obtain permission for mining works it is necessary to create technical and design documentation (Article 64-78). Namely, mining works should be carried out upon the prior receipt on mining design and obtaining permission for work execution. The extraordinary rule stipulates the content of mining designs that have compulsory protection of environment. Attached to the mining design submitted to the relevant authority there should be attached obligatory Study of influence of the exploitation to environment, approved by the relevant republic authority for environment protection. The Study must have the appendix with stipulated permissions issued by other relevant bodies, connected to environment. The creation of these studies is stipulated by special Law on evaluation of influence to environment (Official Gazette RS, no. 135/04).

In the part relating to the protective measures, the Law on mining in Article 108 stipulates the duty of the obligation of the holder of exploitation as follows:

- To plan measures to prevent endanger of water regime and environment, that is measures of re-cultivation and sanction and to provide the execution of such stipulated measures;
- Register data on kinds and quantities of dangerous and hazardous matters being used for carrying out activities, that is keeping evidence on types and quantities of dangerous, hazardous and waste materials that he exhaust or storage into environment;
- Carries out measures and conditions to prevent endanger of water regime and environment quoted in analysis of the environment (Study) influence of carrying out the activity to the environment and water regime in relation to the special law.[4]

The Article 109 stipulates that the water protection measures and environmental protection provides:

- Direct monitoring of executing such stipulated protective measures for water and environment;
- Creating preventive protection plans for accidents, incidents and other damages;
- Follow up of the activity to the water regime and environment;
- Giving proposals for protection measures and facilitate environment and water regime in relation to the special law.

In addition to the quoted Law on mining (Article 130) obliging the holder of exploitation that his duty is in the course and upon the completion of executed exploitation works, the latest date one year from the completion of works in zones where mining works were completed, to carry out re-cultivation of soil, as pre the design of re-cultivation of soil, made in relation to the special regulations, that is to undertake protective measures to the soil whereupon the works were done and soil protection and waters, too.

While planning coal exploitation in any zone the start-up document is Spatial design of Republic of Serbia of 2010 – 2020 (Official Gazette RS, no.. 88/10). The Spatial design basically directs and controls organization and spatial landscaping, but it contains propositions from other developing areas:

- Protection and use of natural resources (agricultural and wooden grounds, waters, mineral and energy raw materials);
- Basics of population dispersion;
- Development and arrangement of city and village areas;
- Principles of spatial organization of public administration;
- Location conditions and directing re-settlement of industry;
- Development and re-settlement of local (hydraulicity, energetics, transportation network and telecommunication systems);
- Development and organization of touristic zones;
- Sustainable use of natural resources and protected and developed environment.

Spatial design comprises chapter on application and execution of a) general, and i b) particular goals as well as on instruments for their execution.

a) **Basic general objectives** are acquiring rational organisation and spatial arrangement of space by accommodating its use with possibilities and limits in free use of natural and created values, as with needs of long run social and economic development, as follows:

- General objectives in sustainable use of natural resources and protection of environment;
- General objectives in the field of protection of natural resources;
- General objectives in the field of protection of biological diversity.

b) **Basic special objectives** in the field of environment protection, among others, comprising objectives in the field of protection of environment and natural resources, hydraulicity, water protection, soil protection, and etc.[6]

At the zones proposed for protection as natural resources, construction, regulation, and use up to the bringing forth resolution on protection, might be done only upon the corresponding designs and upon the prior executed evaluation of natural resources and analysis of impact to the environment. For each protected, sparse and endangered species, the spatial and urban plans should necessary stipulate regimes of protection in areas where the protected natural resources are, based upon the conditions of relevant authorities.

BASIC REGULATIVES TO PROTECT ENVIRONMENT OF UNDERGROUND COAL EXPLOITATION

From the set of existing acts relating to the protection of environment in the field of human resources and keeping biological diversity in relation to activity of underground exploitation of coal, there are basic regulative

Law on protection of environment (Official Gazette RS, no. 66/91, 83/92, 53/93, 67/93, 48/94, 53/95, 135/95, 43/11).

As per the Law on protection of environment, „natural resources are following natural resources: air, water, soil, forests, geological resources, flora and fauna”, whereas „biodiversity (biological diversity) is the diversity of organisms within the species, within the types and eco-systems and comprises total diversity of genes, species and ecosystems at local, regional and global level ”.

It is also quoted as: „The protection of biosphere comprises protection of organisms, their collective and habitats, including protection of natural processes and natural balance within the ecosystems, providing their sustainability. Biodiversity and biological resources protect each other and are used in such a way as to enable their existence, diversity, renewal and improvement in case of degradation”.

Law on protection of nature (Official Gazette RS, no. 36/09, 91/10)

This law stipulates protection and keeping nature, biological, geological and landscape diversity as well as the part of environment.

As stipulated by Article 2, the objective of the Law is:

- 1) Protection, keeping and facilitating biological (genetic, species and ecosystems), geological and landscape diversity;
- 2) Conforming human activities, economic and social plans, basis and designs with sustainable use of renewable developing plans, programs and non-renewable natural resources and long term protection of natural resources and long term protection of natural ecosystems and natural balance;
- 3) Sustainable use and/or management with natural resources and goods, providing their function protecting their function by keeping natural values and balance of ecosystems;
- 4) Timely prevention of human activities and doings that might lead to permanent impoverishment of biological, geological and landscape diversity, and also the perturbed with negative impact to nature;
- 5) Estimate and follow up status in nature;
- 6) Improve status of perturbed parts of nature and landscape.

As stipulated by Article 8, planning, arrangement and use of space, natural resources and protected regions, is to be carried out on the basis of spatial and urban designs, plans and designs, basis and programs for management and use of natural resources and goods in mining, energetics, traffic, hydraulics, agriculture, forestry, hunting, fishing, tourism and other activities having the impact to nature, in commodity with measures and conditions of protection of nature.

As stipulated by Article 27, thus protected natural goods are:

- 1) Protected regions (strictly protected region, special natural reserve, national park, natural monument, protected habitat, landscape of exceptional quality, nature park).
- 2) Protected species (strictly protected wild species, protected wild species).
- 3) Movable protected natural goods.

As stipulated by Article 36, wild species that are endangered or might become endangered, that have special importance from genetic, ecology, ecosystem, scientific, health, economic and other aspect, are protected as strictly protected wild species or protected wild species.

As stipulated by Article 38, the flock of inter connected or spatially close ecological regions enables free gene flow and substantially attributes to preserve natural equilibrium and biological diversity thus making ecological network.

Within such an ecological network its parts are connecting via natural or artificial corridors. Raising ecological network provides connecting and preservation of ecological regions, that is renewal of habitats with eroded appropriate condition, as well as preservation of endangered species.

As stipulated by Article 55, organization, use, spatial arrangement and construction of objects at the protected area is done on the basis of spatial plan of the area for special usage that is urban plan, in relation with the law. The quoted plans must be in compliance with act on proclamation of protected area and management plan for protected area.

As stipulated by Article 71, the protection and preservation of wild species understands prevention of all actions having the impact to degradation of appropriate status of wild animals' population, destruction or damaging their habitats, nests, coveys or destruction of their life cycles that means appropriate condition.

As stipulated by Article 72, while carrying out works and activities in nature and use of natural resources from the habitat of wild species, measures, methods and technical means are applied to facilitate preservation of appropriate condition of species, that is not to endanger wild species and/or the habitats of their population, or those activities might be limited in period which coincides with important phases of their life cycle.

As stipulated by Article 74, the following activities are prohibited as use, destroy and undertaking other actions to endanger strictly protected species of flora, fauna, fungi and their habitats. In relation to the aforesaid it is prohibited to:

- Destroy units of plants and fungi and their developing forms by picking, collecting, cutting or digging from roots, in any phases of their biological cycle and endanger or destroy their habitats;
- Hold and trade with indigenously strictly protected plants and fungi and their development forms;
- Catch and keep and /or kill, strictly protected species in any phase of biological cycle, damage or destroy their developing phases, eggs, nests and pockets, and also the zones of their propagation, resting place and endanger or destroy their habitats and alike.
- Disturb, especially during propagate period, raising progenies, migration and hibernation;
- Cut migration roads;
- Hide, keep, trade, export, import, traffic, estrange or in any other way acquire or publicly exhibit animals including all their derived and development forms.

As stipulated by Article 79, the use of some tools is forbidden which serves for catching and killing wild species of animals, to disturb and endanger their population and/or habitats, harm their welfare, and might provoke their local disappearance.

As stipulated by Article 91, for temporary and/or permanent establishment of protected wild animals, dedicated receptacles are to be created. Receptacle in sense of this law is the ground or zone with objects made for temporary or permanent care of individual wild animals that are not capable to take care of it independently so it might spend some time there until its permanent resolution of the problem.

Regulation on proclamation and protection of strictly protected and protected wild species of flora, fauna and fungi („Official Gazette RS”, no. 5/10)

This Regulation proclaims wild species of flora, fauna and fungi, to keep their biological diversity, natural gene fund, that is species that have extraordinary importance from ecological, eco-systematic, biogeography, scientific, health, economic and other aspects for the Republic of Serbia, as strictly protected wild species or protected wild species so measures to make safe protected species and their habitats are stipulated.

Protected species proclaimed by this regulation as strictly protected wild species are quoted in: Annex I – Strictly protected wild species, whereas protected wild species in Annex II species – Protected wild species. Protected wild species that are under the control of use and turnover in relation to the special rules are marked in special way in Annex II. Protection, management, hunting, use and growing of population by fish close season of endangered species of wild game and fish, marked in Annex II with letters L and R that are stipulated by hunting and fishing regulations.

Strictly protected wild species of plants, animals and fungi are wild species of wild plants that has disappeared from the territory of Republic of Serbia or its regions, but returned through programs of re-introduction, extremely endangered, endangered, relicts, locally endemic, stone endemic, internationally important and protected wild species, of extraordinary importance for preservation of biological diversity in Serbia.

Protection of strictly protected wild species is carried out by the means of forbidden use, destroys and undertaking all activities that might endanger wild species and their habitats, as well as undertaking measures and activities to manage populations, stipulated by this regulation and special law. Exceptionally, strictly protected wild species might be used under conditions and in a way as stipulated by the Law on protection of nature, based upon the permission of the ministry in charge of natural protection issues.

Protected wild species of flora, fauna and fungi are wild species that in nature are not endangered at the moment to the extent that they are threatened to disappear or become critically endangered, as they are vulnerable, endemic, indicator, key and umbrella species, relicts, internationally important and protected wild species, as well as species that are not endangered but for their appearance might easily be mistaken for strictly protected species.

The protection of wild species is carried out with limited application of destruction prohibition and undertaking other activities creating damage to species and their habitats, as with undertaking measures and activities of management of population, stipulated by these regulation and special law.

The protection and keeping strictly protected and protected wild species is carried out by undertaking measures and activities for population management, such as:

1. Habitat protection;
2. Following up population species and factors of their endanger, especially following and decreasing influence of climate change to highly vulnerable species and their habitats;
3. Bio-technical measures;
4. Re-introduction of species on the territory of Republic of Serbia or some its parts, that is growing species in conditions off the natural habitat (ex situ) and on natural habitats (in situ) for their return to nature;
5. Sanitation and revitalization of damaged habitats;
6. Carrying out measures of compensation by creating new locality having the same or similar features to other localities in order to increase strength;
7. Support to scientific research, educational activities and polarisation of preservation and protection of species;
8. Collecting stem individuals for reproduction, breeding of their off springs and turn over in commercial purpose in relevant registered plantations and farms;
9. Relocating units of strictly protected species in case of accidental situations (pollution of air, water and soil, mass invasion of crawlers, reptiles, and alike);
10. Increase in number of strictly protected species beyond optimal number, as stipulated by the special program, that is development program for hunting ground brought forth by relevant ministry for agriculture, forestry and hydraulics;

11. Finding corresponding place for the re-introduction of migratory species, as region of importance for the species development cycles, or habitats of migratory species (fed, cantonment, convey, migratory corridors, change of fur).

Regulation on control of use and turnover of wild flora and fauna („Official Gazette RS”, no. 31/05)

The Regulation on control of use and turn over wild flora and fauna stipulates wild species of flora, fauna and fungi used by men (as eatable, natural, spicy herbs and alike) as being protected and collecting them from natural habitat, use and turn over, is put under control and fees for their use is defined.

Collecting, use and turnover of such protected species is put under control to enable its sustainable use by preventing these species from natural habitats in quantities and in a way that might endanger their survival in future, structure and stability of their community.

The control of collection, use and turnover of protected species, in relation with this regulation covers:

- Protective measures and conditions for collection, limits and prohibition of collection, use and turnover of protected species;
- Follow up of the population status in natural habitats to evaluate quantities of particular protected species that in the collecting season from natural habitat might be approved;
- Fulfilment of conditions and manner of permission issue for collecting, use and turnover of protected species;
- Register data on issued permissions on protected species and quantities collected on the basis of permission, used and put in turn over;
- On protected species (plantation and other ways of growing), on plantation capacities and given penalties for acting contrary to the regulation.

The regulation puts under control use and turnover of wild flora and fauna 122 species (94 flora species, 3 lichens, 15 fungi and 10 fauna species.).

CONCLUSION

Biological resources must be used for survival, economic and social prosperity of mankind, but it is also clear that biological resources could not be endlessly and without control depleted as it would lead to question the stability and survival of biosphere. Global policy of Republic of Serbia in the field of environmental protection that is protection and upgrading biological resources as its basic segment is in conformity with legislative course of developed countries of Western Europe. This field is legally well covered, sometimes with a number of various laws finance and other responsibility is defined. However, the authorities are stipulated responsible to follow up and regulate this field.

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FROM THE MINING AREAS TO THE TOURIST DESTINATION SPACE OF STARA PLANINA MOUNTAIN

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Abstract

Stara Planina mountain has a great potential for developing of rural tourism, such is met in a small number of mountains in our country. It is very rich in biological, geological and cultural heritage. However, this region due to large-scale migration of local population, until recently, was not an attractive tourist destination. Serious tourism development in Stara Planina starts when the state has recognized the potential and aspirations of the local population, for that the what nature has given advantage for economic progress and development. Eastern Serbia has good conditions for the development of rural tourism thanks to its geographical position, the varied landscape, cuisine, folklore, multinationality, rich cultural heritage. Natural beauty of Stara Planina mountain in combination with the culture, traditions, culinary specialties and music of Eastern Serbia can become a recognizable tourist brand that would improve the image of the region and the state, and because of that lately Stara Planina reveals a strong potential for the development of rural tourism. The aim of this paper is to highlight the strategic directions of sustainable development of rural tourism on Stara Planina mountain area of abandoned mines that are within a certain period were almost the only source of income for the inhabitants of the surrounding villages. Today, the mining settlements can provide new potential tourists travel deals that have a wide range of different content, all in order to meet their needs and desires.

Key words: *mining settlement, mine, tourism, local community, tourist destination, sustainable development*

INTRODUCTION

Stara Planina mountain has vast natural resources for tourism development. The mere fact that the greater part of Stara Planina extends along the border with neighboring Bulgaria, has long been out of the main tourist attractions. This fact has made it possible to largely preserve its natural and social characteristics, (Stankov i drugi, 2010:41-58).

The landscape of abandoned uranium mines that were once the main livelihood of some residents is short lived, however, is certainly welcome any new activity, which for the population of this area provides adequate livelihoods. So is their chance in the rural tourism, which also returns and the desire to preserve life in the countryside.

Rural tourism includes a wide range of accommodation, cultural events, celebrations, sports, entertainment and other activities that take place in a typical rural setting. It can be performed a general definition of rural tourism, that rural tourism is a concept that **encompasses all tourist** activities that take place in the rural area.

Rural tourism is the way of an effective presentation, preservation of objects of natural and cultural heritage, landscapes, traditions and customs (Daugstad, 2008; Su, 2006). Rural areas are rich with ecological and cultural diversity in the form of rural communities. Rural communities have until recently relied on the abundance of natural resources, however, in the 20th century, major technological and economic changes have led to significant transformations in agriculture as well as in other renewable sources of industry and is ultimately affected the dependency of the community towards them.

Thanks to its rich cultural heritage and attractive landscapes, Stara Planina has strong potential for the development of rural tourism. Therefore, the rural tourism in Eastern Serbia as a combination of different forms of tourism, which introduces visitors to the life, art, culture and heritage of a particular place is very suitable for the development of the rural economy. In this way would certainly enhance the quality of life and reduce poverty, while at the same time and stop environmental degradation.

The inclusion of rural households in offering tourist services represents a new approach and dimension to the development of rural areas, and in the background tourist activity in a rural setting registers new ways of expression where higher prices and sizes that evolution, spectacular socio-economic phenomenon such as rural tourism.

This study tends to the positioning of rural tourism in Stara Planina and to definitely discover problems and the resources at their destination, and also to give suggestions for their improvement. The effects arising from the development of rural tourism in Stara Planina may be, the preservation of environmental quality as well as all development resources, and social integrity and preservation of the local community and affirm the cultural integrity of destinations Stara Planina.

CONCEPT OF SUSTAINABILITY OF RURAL TOURISM

Tourism in general, and rural tourism in particular, in recent years become increasingly important industry with very rapid growth. The society in which we live and which is dependent on information and communication technology caused that man has a natural need to come from the world of technology and seek „shelter“ in nature, and in this segment rural tourism is gaining in importance.

The most general and the now famous definition of sustainability and sustainable development is that sustainable development should enable development that meets the needs of present generations without harm to future generation. The very concept of sustainability and sustainable development noticeable are the three key dimensions on which sustainable development is based, namely: social dimension, the natural environment and economic dimensions. However, the United Nations Commission on Sustainable Development (2001) in their frames has introduced a fourth institutional dimension that implies the role of civil society, public participation and so on.

Lane (1994) notes that the sustainability has the strong interaction with rural tourism and sustainability and that is crucial and essential importance for the development of rural tourism, primarily because it provides a sustainable system of governance with a view to the preservation of sensitive areas, balance requirements to protect development, stimulating economic growth of local communities and preserving the essential characteristics of rural areas.

A strategic approach of sustainable development of rural tourism is the creation of conditions and creating strategies primarily by the local community and local government representatives (Ruhanen, 2013: 80-98) in order to form the foundations on which sustainable development is based of certain rural tourism areas. However Ruhanen (2013) notes that the insufficient implications or if there are too small efforts by the government, especially local governments in the terms of sustainable tourism development, therefore the rural tourism. Rural areas are unique primarily because of their spatial and socio-cultural identity. It is important that adequate practice of rural development call for understanding and the relationship that people share with the natural features and phenomena around them, (Chigbu 2014: 264-277).

Strategies for achieving the goals and success of rural tourism development must be based on the strengths and attributes that rural area possess with the activation of all stakeholders (local communities, local authorities) to the exploitation of the same, because the ultimate development of rural tourism in a particular rural area contributes to the development of the areas in all aspects and segments.

GENERAL CHARACTERISTICS OF THE AREA OF ABANDONED MINES ON THE STARA PLANINA MOUNTAIN

On the western slopes of Stara Planina mountain on the east of the village Kalna, in the range of beech forests, there is a mineral field "Janja". Schematic representation of the territory is shown in Figure no. 1. In the framework of this ore field at the end of the fifties, was conducted uranium mining from three mines: "Mezdreja", "Gabrovnica" and "Srne i Do", which stopped working in 1966. In the mine field, along with separation in Kalna, there were more than 800 miners which has worked in three shifts. Miners were mostly locals from the area, who are active during the operation were financially secure, a mineral field has heralded a revival of the whole of Eastern Serbia.

As a result of mining, the area around these former uranium mine, partly has degraded natural ecological balance. All mines were underground exploitation. As part of the mine "Mezdreja" there is a plant for ore processing capacity of 60 t / day, and in the mine "Gabrovnica" built the plant with capacity of 200 t / day. Installations for the processing of ore were hydrometallurgical type, so there was no possibility of air pollution. The tailings from the mines delayed is close to the mining pit. At the end of the sixties, leads to the termination of mining and all three mines were closed. When it is made a certain conservation of mines and processing plants. Mine field "Janja" covers an area of approximately 30 km², at an altitude ranging from 500 m to 950 m above sea level, and is now covered with forest vegetation. In the wider area of ore field "Janja", in addition to the settlement Kalna, larger settlements of rural type are Gabrovnica, Inova, Vrtovac, Janja, Balta Berilovac and Mezdreja, which are in the process of migration, mostly residents remained without or with very few, mostly elderly households. (Niki & drugi, 2012:163-174). Locals have long time ago moved away in search of a better life. Since then, this area has begun to decline, and a villages to die. All of this is attributed to industrialization, since the rural population then went en masse to the cities in search of existence and better living conditions.

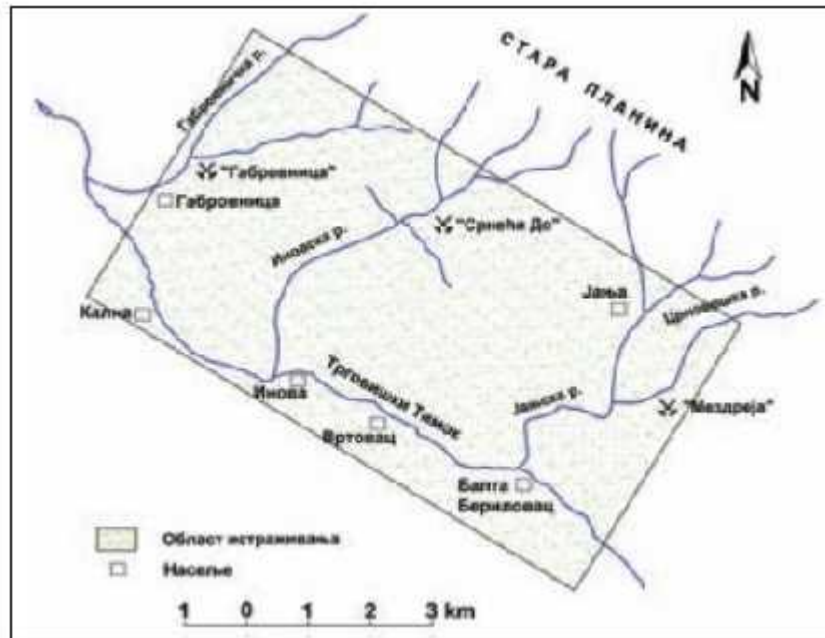


Figure 1. Schematic view of ore field „Janja“[8]

Nowadays is different, the desire to preserve life in the countryside and open new opportunities for safe existence, many has returned to the village where they founded their own business. Thus, many households started to deal with rural tourism. For now there are 16 categorized rural households. Each of these households is specific in its own way, but in every guest awakens chirping birds, fresh air and smells of nature (<http://glassrbije.org/privreda/turizam-u-staroplaninskim-selima>). Also, many people are staying in this region with the aim of change in everyday nutrition, in order to start a healthier lifestyle.

SUSTAINABLE DEVELOPMENT OF RURAL TOURISM IN THE STARA PLANINA MOUNTAIN

The very concept of sustainable development has been defined in several ways, which is mostly confined to the same, and that includes a balanced economic, social and cultural development without compromising the environment, and to thereby enable future generations to develop on the same level or higher, (Jovi i , 2002:15). Wealth, maintained and attractive natural resources, a large number of traditional agricultural households, as well as the growing interest of the international tourism market for rural tourism experiences are pretty solid foundation for the development of rural tourism in the whole of Serbia, (Maksimovi i drugi, 2015:162-172). Therefore, the sustainable development of rural tourism as well as its management involves reducing the negative impact on the environment with the possibility for improvement which causes management care about the environment that is similar to quality management, (Stefanovi i Kicošev, 2006:56-58).

The development of of tourism on the destination of Stara Planina could very easy to make and negative consequences especially if is out of control. However, controlled access in rural tourism in Stara Planina, the larger portion of the population can make a substantial income, to the economic and social, (Šteti , 2007:85-88). Lack of finance is often a stumbling block for many who live in this place. The tourist forces which should be reflected in the economic and socio-cultural impact of tourism in this area, which is missing, can be found in the role of women in tourism in this region as well as joint overcoming obstacles as threatening elements of rural tourism development, (Ghaderi i Henderson, 2012:47-54). Therefore, it is critical to engaging local governments, tourism organizations, as well as entrepreneurs from other activities to give maximum contribution to the sustainable development of rural tourism in this destination. They are definitely one of the backbones of strategic plans and therefore must take into account a number of strategies that are simple, and always be possible to solve the unequal distribution of investments, (Baležentis i drugi, 2012:1-6). Based on previous research, (Sanagustín i drugi, 2011: 551–557), tourist demand increasingly seeks to avoid the traditional tourist destinations and are already looking for a return to the traditional and typical values and authenticity of which appear to be new tourism products with new environmental, ecological and social parameters. Therefore, it is necessary to conduct a series of studies in order to define the strategic directions for the sustainable development of rural tourism in Stara Planina mountain, especially on the destination ore field "Janja".

RESEARCH METHODOLOGY AND RESULTS

Participants in the research

The study sample was consisted from 116 respondents employed in local government municipalities Zaje ar and Knjaževac, then the employees in the tourism and hospitality sector and the respondents employed in other sectors (culture, transport, agriculture, etc.). The survey covered the unemployed respondents randomly selected who are also residents of the municipality of Zaje ar and Knjaževac.

As a research tool was used a questionnaire. The survey was composed of closed questions. The first set of questions contains socio-demographic data, while the second set questions is related to the importance of the program for the sustainable development of tourism in Stara Planina. In the third set of questions are presented effects that occurs development of rural tourism on the Stara Planina in the fourth set are questions that indicate the strategic directions of development of rural tourism of Stara Planina, as well as suggestions for their improvement. For the significant indicators are taken the responses of local government, tourism and hospitality sector, sectors of other activities (culture, transport, agriculture etc.), as well as responses from unemployed respondents. In the second, third and fourth set of questions, the answers are offered by the respondents on a scale of 1 to 5, where 1 means strongly disagree and 5 Strongly Agree.

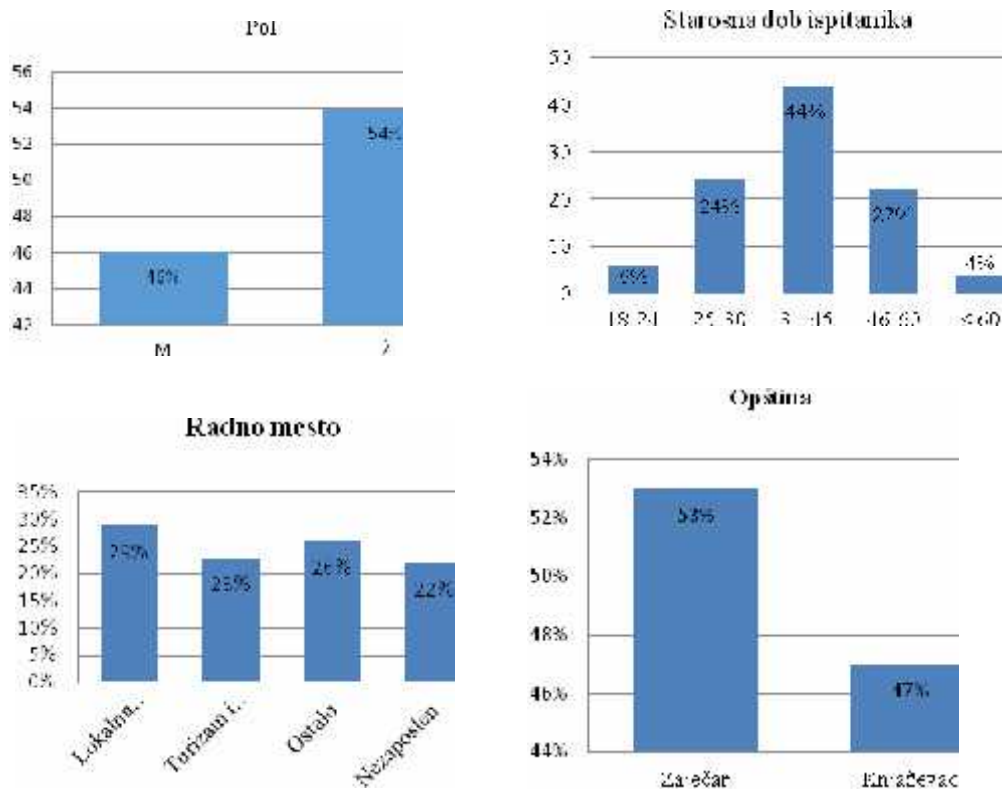


Figure 2. Demographic characteristics of respondents

The study included 46% women and 54% men. Of all the patients, 47% were residents of Knjaževac, and 53% were residents of the municipality Zajecar. The largest age group of respondents aged between 31 to 45 years of age, and this is 44% of the total number of respondents, then 24% have from 25 to 30 years, 22% of respondents aged 46 to 60 years, and 6% within the age of 18 to 24 years, while only 4% of respondents have more than 60 years. From the total number of respondents 29% were employed in local government, and employees in the tourism sector in the hospitality industry is 23%, and in other sectors (culture, transport, agriculture, etc.), 26% of respondents, while 22% of unemployed respondents.

Results of conducted research

Research has shown that the program of tourism development of Stara Planina Mountain is important and significant because 58.82% of local government employees is fully compliant and more than 50% of employment in the tourism sector agrees that the creation of a program for sustainable development of tourism on the Stara Planina is needed.

More than 45% of employees in local government have declared that they have a desire to be involved in the development program for the sustainable development of rural tourism on Stara Planina mountain while respondents employed in other companies and unemployed respondents in most inconsistent or neutral for inclusion in the program development.

Employees in the tourism and hospitality sector totally agree (38.46%) that tourism is important to their community and that they benefit from tourism, while respondents from other companies (46.67%) and unemployed (53.85 %) totally disagreeing with the statement that tourism is important for their community and they still do not see the benefits of tourism.

Strategic positioning of the sustainable development of rural tourism in Eastern Serbia, is of great importance for the development of tourism Stara Planina mountain because with that statement is completely agreed employees in the tourism and hospitality sector (61.54%) and also employees in local government (47.06%) while the other subjects are substantially neutral.

Rural tourism is an alternative to mass market tourism due to the fact that it draws segments of tourists who are interested in staying in the countryside and rural areas and is therefore an important and significant drafting program of sustainable tourism development on Stara Planina mountain. With this statement is fully in accordance with 60% of employees in other firms, employees in the tourism and hospitality sector, 53.85% of them employed in the Local Government (41.18%) were completely agree with this statement.

Based on the value of a statistical test as shown below in Table. 1. The statistical differences were detected results from the assumed theoretical values and that the majority of respondents agreed and totally agreed with the statement that the creation of a program for sustainable development of tourism in the Stara Planina important and significant.

Table no 1. Statistical test of the importance and significance of the program of sustainable tourism development of Stara Planina

	Test value	df	Error probability
Pearson Chi-Square	41,908	12	0,000

The following set of questions is related to the effects resulting from the development of rural tourism on Stara Planina mountain. One of the questions is to preserve the quality of the environment and of all development resources and with that is completely in accordance with 61.54% of respondents from the tourism and hospitality sector while from the local government fully is in accordance with 47.05% of the respondents. Similarly responded and employees from other business entities while responding jobless represented the lowest percentage (38.46%).

The realization of economic profits is also an important effect resulting development of rural tourism on Stara Planina mountain, because with it the highest percentage is fully in accordance (53.85%) from the tourism and hospitality sector while from the local government are fully in accordance with 52.84%, and the same statement part in accordance with 46.67% of respondents from other business entities.

Also, an effect that occurs development of rural tourism on Stara Planina mountain is to preserve the social integrity of the local community. Employees in the tourism and hospitality sector are the most totally agree (53.85%) while employed in local government over 55% full and partial agree that preserving the integrity of the social community is an important effect resulting development of rural tourism on Stara Planina mountain. Other business entities totally agree (46.67%), and the unemployed were partially inconsistent (43.15%) with the above statement.

To preserve the integrity of affirmation of cultural destinations like Stara Planina effect that occurs development of rural tourism on Stara Planina mountain, almost 60% of local government is totally and partly concurring and employees of other business entities were 46.67% totally agree.

Higher employment in the tourism sector is also a significant effect resulting development of rural tourism on Stara Planina mountain as respondents has confirmed on their responses. Completely agree unemployed respondents (53.85%), employed in the tourism and hospitality sector (53.85%) and employees of other business entities (53.33%).

To preserve the rural environment and cultural heritage as an effect which occurs development of rural tourism on Stara Planina mountain is fully in accordance with 56.9% of the total number of respondents. Of this, the highest percentage in the tourism and hospitality sector (69.23%), followed by 66.67% from other business entities, 47.06% from the local government and 46.15% of the unemployed respondents.

Motivating the local population to remain in the countryside is very important effect that occurs development of rural tourism on Stara Planina mountain. Of the total number of them 56.9% totally agree with this statement. Of this, 69.23% of employees in the tourism and hospitality sector and 66.67% of the employees of other business entities is totally consistent with this statement.

Based on the value of a statistical test as shown below in Table. 2 it can be seen that the results obtained in the study statistically different from the assumed theoretical values and that the majority of respondents agree and totally consistent with the effects resulting the development of rural tourism on Stara Planina mountain.

Table no 2. Statistical test the effects resulting the development of rural tourism on Stara Planina mountain

	Test value	df	Error probability
Pearson Chi-Square	79,152	12	0,000

Strategic directions for the development of rural tourism Stara Planina mountain are essential for the development of agriculture as an important part of the regional economy. From the total number of respondents 33.33% of the employees of other business entities is fully in accordance, then 35.29% of local government employees and employees in the tourism and hospitality sector and the unemployed with 46.15% completely agree that the development of agriculture is an important part of the regional economy as one of the strategic direction for the development of rural tourism of Stara Planina.

As the strategic directions of development of rural tourism Stara Planina occurs and the inclusion of rural households in tourism, which is the highest percentage of unemployed respondents (61.54%) complete agreement because it automatically pulls the opportunity for their employment. Employees in Local Government (41.18%) and employees in the sector other business entities (53.33%) were totally agree that the inclusion of rural households in tourism is an important strategic direction.

The lowest percentage (38.46%) of employees in the tourism and hospitality sector were totally agree that the inclusion of rural households in tourism is an important strategic direction.

Education and information of the household host and the household members to engage in this activity is also one of the important strategic development of rural tourism of Stara Planina mountain, which agrees with the highest percentage of 61.54% of the unemployed respondents, then 47.06% of local government employees and 46.67% sector employees other business entities and the lowest percentage of respondents, 38.46% of employees in the tourism and hospitality sector showed complete agreement with this statement.

Development of economic and non-economic activities that meet the needs of tourists is also an important strategic direction for development of rural tourism Stara Planina mountain which are employed in local government in most totally agree (64.71%), followed by those employed in the sector other business entities, 40% or an employee (38.46%) in the tourism and hospitality sector.

The next strategic direction of development of rural tourism of Stara Planina is the protection of the environment for which were total of 56.9% of the respondents agree completely. Since it is in the sector other business entities totally in accordance with 73.33% in the tourism and hospitality sector is totally in accordance with 61.54% in local government is fully in accordance 58.82% while that of unemployed respondents 56.15% partly concurring and 23.08% partly dissenting.

For the protection of natural and cultural resources of Stara Planina and the organization of an integrated sustainable development as a strategic direction of development of rural tourism of Stara Planina 38.46% of employees in the tourism and hospitality sector is fully compliant, followed by employees of the Local Government (52.74%) and unemployed (53.85%), while the largest percentage (80%) of the employees of other business entities totally accordance with this constatation.

Based on the value of a statistical test as shown below in Table. 3. The statistical differences were detected results from the assumed theoretical values and that the majority of respondents agree and totally agreed with the proposed strategic directions of development of rural tourism of Stara Planina mountain.

Table no 3. Statistical test of the strategic directions of development of rural tourism of Stara Planina

	Test value	df	Error probability
Pearson Chi-Square	52,961	12	0,000

Suggestions for improvement of rural tourism on Stara Planina mountain is the last set of questions to which respondents gave their opinion.

Participation of local government in the implementation of the sustainable development of rural tourism is important for 52.94% of local government employees and 53.85% of those employed in the tourism and hospitality sector while only 30.77% were totally accordance with the this statement.

That the participation of small and medium-sized enterprises in the sector of the tourism industry important, especially by local entrepreneurs, declared that 41.18% of local government employees.

Employees in the tourism and hospitality sector for the same proposal, 38.46% of them is fully compliant, while only 20% of employees in the sector other business entities fully compliant.

Based on the value of a statistical test as shown in Table. 4 clearly shows that the results obtained in the study statistically different from the assumed theoretical value and that majority of respondents agree and totally agreed with the proposals for the improvement of rural tourism on Stara Planina mountain.

Table no 4. Statistical test proposals to improve rural tourism on Stara Planina mountain

	Test value	df	Error probability
Pearson Chi-Square	25,483	9	0,002

CONCLUSION

Based on the results, it can be concluded that the rural area of Stara Planina in the area of ore field "Janja" rehabilitate and increasingly gaining in importance. With the cessation of mine was stopped and the potential disruption of the ecological balance. The wealth of natural resources, unspoiled nature and traditional rural households, as well as growing interest for the tourist market experiences of rural tourism, are all significant and is therefore an important and significant creation program of sustainable tourism development in Stara Planina.

The development of rural tourism on Stara Planina mountain generated positive effects, the most significant being that has been proven through research, conservation and environmental quality of development resources, the preservation of social integrity of the local community, motivating the local population to remain in the countryside through the implementation of economic profit, and the preservation of cultural affirmation integrity destination Stara Planina.

The development of economic and non-economic activities that satisfy the needs of tourists and environmental protection, the inclusion of rural households in tourism as well as education and information of the host and household members to engage in this activity is an important strategic direction of developing rural tourism on Stara Planina mountain.

For the implementation of the sustainable development of rural tourism is an important participation of local government as well as the participation of small and medium-sized enterprises, especially by local entrepreneurs.

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