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INFRASTRUCTURE CATEGORISATION FOR RE-USE OF COAL MINE „LIPNICA“

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SUMMARY

Summary: In the northern synclinorium of Kreka coal basin, lignite mine ″Lipnica″ was opened in 1950 in Lipnica settlement nearby Tuzla city. During the exploitation period, mine produced 40 million tons of lignite. By extracting the coal reserves, mine was shut down in 1991. Underground caves were filled by classical methods present in underground mining and all entries are sealed. The ground infrastructure remained preserved and has had usable values in three periods when infrastructure was used for various purposes. Conversion for re-use of mining infrastructure is not defined by any categorisation for infrastructure conversion use as the planning element of sustainable development for active or shutdown mines. The article defines categories of sustainable development based on utilizing mine infrastructure on the sample of "Lipnica" mine. The universality of categorisation points out the possible options of optimal re-use of coal mine infrastructure, indicating implementation of a mining company sustainable development concept, either in government or private ownership.

Keywords: categorisation, sustainable development, business incubator, Lipnica mine

1. INTRODUCTION

Lipnica mine was located in the northern synclinorium of the Kreka coal basin, where organized and planned lignite exploitation began in 1950. The determined reserves of lignite at the Lipnica location were:

- The second roof coal seam: 25,490,942 t,
- The first roof coal seam: 6,181,470 t,
- The main coal seam: 6,282,864 t,
- The footwall coal seam: 6,479,412 t.

  Total: 44,434,688 t

A number of infrastructural facilities for mining purposes were built in the area of the mine yard at the very beginning of exploitation: the administrative building, the building for the storing of mine materials, the cloakroom and the miner's bathroom and restaurant were built in the 1960s, while the infrastructure for the rescue squad and the fire department were built in 1977. In 1980, a machine workshop, a temporary warehouse and a workshop, a warehouse for finished products, a warehouse for reproduction materials, a renovated restaurant and a porter's office were built in the compound, and a year later an electrical

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workshop, an administrative building and an internal gas station were built. In 1985 and 1986, the transport power station "BEKORIT - KULI" was built, the call hall and mining bathrooms were reconstructed - by removing the chains on which the miners held the wardrobe, and tin cabinets were purchased for this purpose, the boiler room for central heating, ambulant within the compound, car repairing workshop and the archive for the mine.

The mentioned facilities were built in the safety pillar for the Joševica stream. All buildings are connected by modern asphalt roads from several sides.

The buildings were supplied with water from two independent sources: connection to the water supply network of the city of Tuzla and local supply through a deep well and a reservoir with a volume of 11,000 litters.

With the system of sewage network and septic tanks, with the help of the Joševica stream, the issue of waste water was solved.

Electricity supply was solved by the construction of a transformer station and the branching of the low-voltage network, so that all buildings in the vicinity of the Mine were electrified.

The mine had a telephone network installed in all facilities, and it was connected to an automatic telephone switchboard in the Lipnica settlement.

"Lipnica" mine ensured the construction of a modern swimming pool in the mine area, which still exists today, but is not in operation due to neglect.

As part of the "Lipnica" Mine, several facilities were opened that were indirectly related to coal production. First, the "Mining Overhaul and Maintenance" facility was formed, and then in 1956, the "Exploratory Drilling Section" (later renamed to OOUR "Drilling and Drainage").

After the economically interesting coal reserves were exhausted, "Lipnica" mine stopped coal production in 1991. The mining equipment was pulled out of the underground rooms, the old mine works and the entire mine were closed, and most of the openings, i.e. entrances to the pit are sealed. The coal separation facility was dismantled, and the entire area of the mine yard was closed. This ended coal production in the "Lipnica" mine, in which 40 million tons of lignite were produced from the beginning of exploitation to its closure, out of the planned 44.4 million tons.

Figure 1. Administration building of the Lipnica mine - today the administration of the incubation centre

Figure 2. Mine „Lipnica" 1949. - 1991. Year, produced 40.000.000 tons of coal

2. THE FIRST AND THE SECOND RE-USE OF „LIPNICA" MINE INFRASTRUCTURE

After of exhaustion of economically interesting of coal reserves, mine „Lipnica" stopped its production of coal, as planned in the year 1991. The workforce of "Lipnica" mine has been deployed to other mines and facilities within the "Kreka" mine company. The mine facilities were not demolished or devastated, and the accompanying infrastructure was not destroyed either.

After the cessation of coal production and the closure of the mine, part of the infrastructure facilities and installations began to be adapted for the installation of the machine factory "Perilica", in cooperation with the company "Končar" from Zagreb. Cooperation with the company "Konačar" was the first concrete step in the process of finding a solution for the sustainability of the mine infrastructure, which was preserved and planned.

War actions in the territory of the former Yugoslavia, that is, the Republic of Bosnia and Herzegovina, in 1992 stopped the aforementioned activities, in connection with the use of the "Lipnica" complex in Lipnica local community. In a very short time, the entire mine compound was occupied by a military formation and a barracks was formed, and the military units remained in that area until 2001. In the period from 1992 to 2001, the aforementioned facilities were used by the Army of the Republic of Bosnia and Herzegovina - until 1996, and after that, until mid-2001, by the FBiH Army[1.]. The reduction in the number of members of the armed forces led to the abolition of the army barracks of the Federation of Bosnia and Herzegovina in Lipnica. The buildings and land in the "Lipnica" complex were once again made available to the "Kreka" Mine company as the owner of the property.

3. THE THIRD RE-USE OF „LIPNICA" MINE INFRASTRUCTURE

In order to utilise the existing mine infrastructure, and already started ideas on re-use of place in sections for coal production, mine „Kreka", as owner of the complex, made agreement with the Municipality of Tuzla (today City of Tuzla), that the municipality establish a company, which will use space under favourable price of yard rent, by large number of small scale start-up companies. On that way, Municipality of Tuzla, established a public company JP RPC Tuzla - Public Company Tuzla, INCUBATOR „Lipnica", d. o. o., to whom mine „Kreka" gave miner' yard complex for rent in the year of 2004. Since the establishing the incubator, in private business were involved over 30 companies, and during the year of 2020, in the Incubator was located 31 private companies. Working activities in companies are production of cleaning items for disinfection, disensects and deratisation, production of wormwood, business management consulting, packing of liquid food products, production and selling of industrial oils and ubricants,

Figure 3. PC RBC TUZLA INCUBATOR „LIPNICA" D.O.O.

production of shoes, re-fixing and service of electric engines, production, packing and distribution of agricultural products, terminal reserve of stocks of material, purchase and installation of equipment for production and reparation of reserve parts for pumps and electro materials, production of eco-wormwood and eco-wood of the beech, administrative jobs, service of light weapons, production of natural juices,

1. In 2005, the Army of the Federation of Bosnia and Herzegovina was transformed into the Armed Forces of Bosnia and Herzegovina

make-up, printing, packing and distribution of adhesive paints, filling – up of gas for houses and companies, certificating of small and middle growing companies, space for warehouses, productions of tea and natural oil, mechanical treatment, printing, production of mushrooms so-called „bukovace", production of kids-toys by persons with special needs, production of ALUMINUM and PLASTIC carpentry, production of mechanical parts and pharmacy.

4. ELEMENTS OF CATEGORIZATION FOR RE-USE OF INFRASTRUCTURE AT "LIPNICA" MINE

The infrastructure of the "Lipnica" mine has a number of benefits that affect the conversion of facilities. It is important that the existing infrastructure has retained elements of functionality, except for a smaller number of devastated buildings or dilapidated buildings that can no longer have a useful value.

4.1 EXTERNAL INFRASTRUCTURE

The second grouping of functionality elements is non-mining, i.e. external infrastructure that is preserved and functional (asphalt road and connection with other parts of Bosnia and Herzegovina, railway).

The "Lipnica" complex is located northwest of Tuzla, 11 km from the city centre. It is connected by an asphalt road with a width of 7 m to the main road Tuzla-Doboj in Bukinje, and via this road to the main road Tuzla-Sarajevo, Tuzla-Orašje, Tuzla-Zvornik and Tuzla-Bijeljina.

The normal gauge railway Lipnica - Bukinje was put into service in 1953 and had the primary function of transporting coal from the Lipnica mine to the Tuzla thermal power plant and to other consumers. The railway was used for passenger traffic for a very short time during the war, when road traffic was difficult primarily due to lack of fuel. With the end of the war, railway traffic was suspended, and the tracks remained for possible future use.

The swimming pool is not in operation, and it is not in such a dilapidated state that it cannot be revitalized and renovated.

4.2 INTERNAL INFRASTRUCTURE

The "Lipnica" complex contains 26 built buildings with an area of 14 to 3,100 m^2, i.e. a total ᵃrea of about 11,000 m^2, as well as a land area of about 160,000 m^2. The mine compound as a basis for assessing functional sustainability is well preserved, the buildings are of solid construction (the buildings have full or partial functionality), the internal road infrastructure (asphalted roads and driveways) and all accompanying elements of the infrastructure are functional (water supply, electricity, sewage network, telephones, surveillance, central heating). The regulated stream Joševica flows through the complex, which can be treated as a significant water resource.

Figure 4. River Joševica, flows through compound PC RBC TUZLA INCUBATOR „LIPNICA" D.O.O, the trough has been completely renovated - concreted along its entire length

Based on the assessment of the condition of the facilities carried out by the Kreka mine in 2009, the elements of infrastructure categorization can be defined in terms of the new use (re-use) value of all infrastructure facilities. A total of 26 buildings of varying degrees of utilization and devastation were

recorded, as well as the connection of the buildings with asphalt roads, water, sewerage network, and in some parts there is a communication system within the complex with a branched telephone network that is connected to the telephone exchange in the Lipnica settlement. Electricity is supplied through existing transformer stations and separate low-voltage electrical installations, with the fact that a number of buildings do not have an adequate electrical network due to outdated installations and devastation. Heating of buildings is solved by two built kettle's which using coal as power.

4.3 CATEGORIZATION OF CONVERSION OF INTERNAL AND EXTERNAL INFRASTRUCTURE

In the context of creating a categorization of mine infrastructure repurposing, all infrastructure facilities were analysed from different aspects in order to define the categorization of infrastructure repurposing. In the earlier period, a basic and group division of buildings was made into buildings that can be used without additional works, buildings that require work and buildings that are not profitable for renovation. Given that the mine compound in Lipnica has illustrated the possibility of repurposing mining facilities into production-business facilities, the same mine compound complex can serve as a model for defining the repurposing of other mining facilities that have infrastructure that has no use value, and which is rapidly deteriorating due to lack of maintenance and devastation.

In order to assess the possibility of reuse of facilities and the sustainable development of mining facilities, a categorization of the conversion of internal and external infrastructure was developed. Categorization is based on a detailed assessment of each object in terms of its physical and legal condition, the possibility of connection with external infrastructure, and an assessment of the possible conversion of the object in the segment of business activities and financial investments in infrastructure. The basic categories are:

- objects that can be used without investment,
- objects that need basic repair,
- objects that need basic infrastructure,
- objects that do not need investment in access roads,
- objects that require investment in renovation up to 5000 KM (2500 EUR),
- objects that require investment in renovation up to 50,000 KM (25000 EUR),
- facilities that require investment in renovation of more than 50,000 KM (25000 EUR),
- facilities that cannot be repurposed, objects that must be demolished/removed.

Each of the categories also contains subcategories that more precisely determine the categorization of the object and the possibility of conversion. The categorization of conversion has not been treated in the professional literature, so this paper is a scientific and professional contribution to the evaluation of the possibility of using the mine infrastructure and conversion of buildings into usable value. To illustrate the categorization, table 1 shows examples of categorization based on the assessment of the infrastructure of the former Lipnica lignite mine near Tuzla.

5. SUMMARY

The previous work of JP RPC TUZLA INCUBATOR "LIPNICA" doo Tuzla, in the period from 2004 to 2020, provided favourable conditions for the settling and business operations of 110 companies, in which 679 workers were employed. Out of the total number of companies that have used the services of RPC so far, 81 companies are incubated business entities, which started their business in this incubator and within which they had a very important form of support for a successful start. Today, in 2021, 31 private companies are located in JP RPC TUZLA - INCUBATOR "LIPNICA" doo Tuzla. The industrial yard - Lipnica complex is in extremely good condition, and the Incubator Centre itself has a tendency to expand and welcome new workers.

In order to use the infrastructure of mining facilities, of which there are a significant number in the area of the Kreka basin, an analysis of the possibility of repurposing facilities and the possibility of sustainable development of mining companies is necessary. Sustainable development is based on the repurposing of facilities and changing the business policy of the owner of the mine infrastructure. The assessment of the possibility or success of the conversion of facilities can be determined by categorizing the conversion of

Table 1. Example of categorization of infrastructure buildings on location of former mine „Lipnica"

Building	Building condition	Highness and square area	A year of build	Overall condition of building	Electric energy	Condition of electric parameter	Water installation	Condition of water installations	Heating	Kind of heating	Condition of heating installation	PTT	Condition of PTT installations	Roof	Re-use of the infrastructure	Category
Reception gate	Building made of bricks	Ground floor building, 18 m^2,	1980	Untouched Re-built	Yes	220 V 15 kW	No	Not in function No installation	Yes	Central heating Coal	Good in function	Yes	Good in function	Good Re-built, Downed 10°	Reception gate, Entry control, control of parking	Building without investment
Headquarter building wing 1	Building made of bricks	Basement + ground floor, the first floor + Base area 407 m^2,	1960	Untouched Re-built	Yes	220 V 60 kW	Yes	Good	Yes	Central heating Coal	Good	Yes	Good	Leaked by rain Sanitized	Office space, except basement which can be warehouse or manufacturing area	Building requests investment till 5000 KM
Headquarter building wing 2	Building made of bricks	Basement + ground floor, the first floor + Base area 97 m^2,	1960	Untouched Re-built	Yes	220 V 60 kW	Yes	Good	Yes	Central heating Coal	Good	Yes	Good	Bad Leaked by rain Sanitized	Office space, Except basement which can be warehouse or manufacturing area	Building requests investment till 5000 KM
Wardrobe and bathroom	Building made of bricks	Ground floor, + floor Ground floor: 1.394,25m^2 Floor 151,2 m^2	1970	Building re-built Roof and front part of facade	Yes	220 V 80 kW	Yes	Good	Yes	Central heating Coal	Good	No	Not in function Developed Installation in good form	Leaked by rain Sanitized	Manufacturing section	Building requests investment till 50000 KM
Restaurant	Assembly facility	Ground floor 428,22 m^2	1980	Re-built	Yes	220 V 50 kW	Yes	Good	Yes	Central heating Coal	Good	Yes	Good	Plate of salonite Not leaking	Manufacturing section, office	Building without investment
Ambulance	Building made of bricks	Ground floor 412,65 m^2	1986	Re-built	Yes	220 V 30 kW	Yes	Good	Yes	Central heating Coal	Good	Yes	Good	Sanitized totally	Manufacturing space, store	Building without investment
Rescue squad building	Building made of bricks	Ground floor 2.100 m^2 + 72 m^2 + 16 m^2	1977	By facade, building overflowed and devastated	Yes Off connection	220 V 30 kW	Yes	Good Not in function	Yes	Central heating Coal	Not in function	Yes	Not in function	Plate of salonite Not leaking	Not in use (Property of mine „The Kreka")	Building need basic infrastructure
Storehouse	Building made of bricks	Ground floor 200 m^2	1980	Re-built and in good ondition	Yes	220 V	Yes	Good	Yes	Central heating coal	Good	Yes	In function	Plate of salonite Not leaking	Manufacturing area, storehouse	Building requests investment till 50000 KM

the internal and external infrastructure of the mine compound area. Categorization includes the spectrum of the status of objects, on the basis of which objects can be categorized and their new use value can be defined.

Stopping the operation of mining production facilities, regardless of the causes, implies the abandonment of the mine infrastructure, which is functional and can be repurposed. In the context of the conversion of facilities, it is necessary to foresee the conversion of future mines in the preparation of project documentation, especially in the Main Mining Project, with the aim of sustainable development of the mine, with all its facilities and infrastructure. Conversion activities must be carried out on time while the infrastructure has a useful value, and thus a more favourable financial valorisation, since over time the buildings deteriorate and lose value. When evaluating the possibilities of repurposing facilities, it is necessary to use the categorization of facilities in order to get the clearest possible picture of the possibilities of repurposing mining infrastructure.

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