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Coal industry in transition:

state of affairs of coal mine closure in the selected UNECE member States - challenges, lessons learned, ongoing projects, perspectives for the future

SERBIAN COAL DEPOSITS AND COAL MINES AT ACTUAL TRANSITION TO GREEN AGENDA

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AS THE INTRODUCE:
PRODUCTION OF ELECTRICITY AND PLAN IN ENERGY SECTOR

1. About 70 % of electricity is obtained from the coal (open-pit and undergorund) used in the thermal power plants of EPS (https: //www.eps.rs/lat/poslovanje-ugalj)

2. Hydroelectric power plants make up about 30 % of the total electricity production of JP EPS (https://www.oie.rs)

3. The share of production of four wind farms in 2020 was 2,6% of the total electricity produced (https://balkangreenenergynews.com/rs/elektromreza-srbije-spremna-da- prikljuci-vetroparkove-snage-28-gw-u-banatu/)

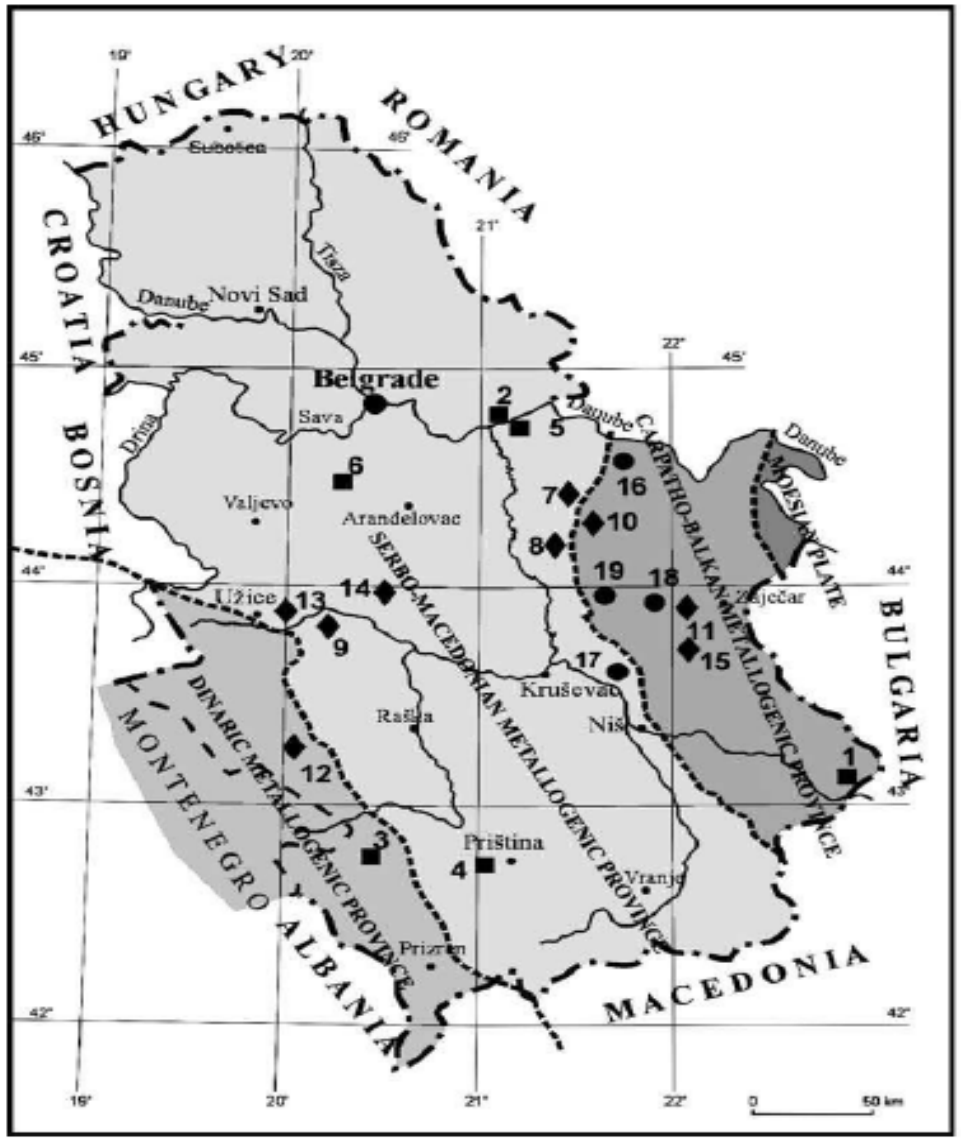
- THE MAIN IMPACTS AT THE EXISTING PLAN FOR ENERGY SECTOR

1. At November 2020 in Sofia ot the summit of Western Balkan Serbia signed the declaration on the green agenda with title: "THE CONTRACTING PARTIES COMMITTED TO WORK TOGETHER WITH THE EUROPEAN UNION TO MAKE EUROPE CLIMATE NEUTRAL BY 2050"

2. After that, at 2021 Serbia has innovated existing mining and energy law and passed new laws in the field of Renewable Resources

Source: https://jwww.ekapija.com/news/1970483/država-u-2018-daje-5-mil-eur-za-pocetak-zatvaranja-rudnika-resavica

DISTRIBUTION OF BROWN COAL DEPOSITS IN SERBIA



LEGEND:

---- Boundary of Metallogenic units (modified, Dimitrijević, 2000)

■ **Soft brown coal (Low-Rank C):**

1. Mazgoš, 2. Kovin, 3. Metohija,
4. Kosovo, 5. Kostolac, 6. Kolubara.

◆ **Dull brown coal (Low-Rank B):**

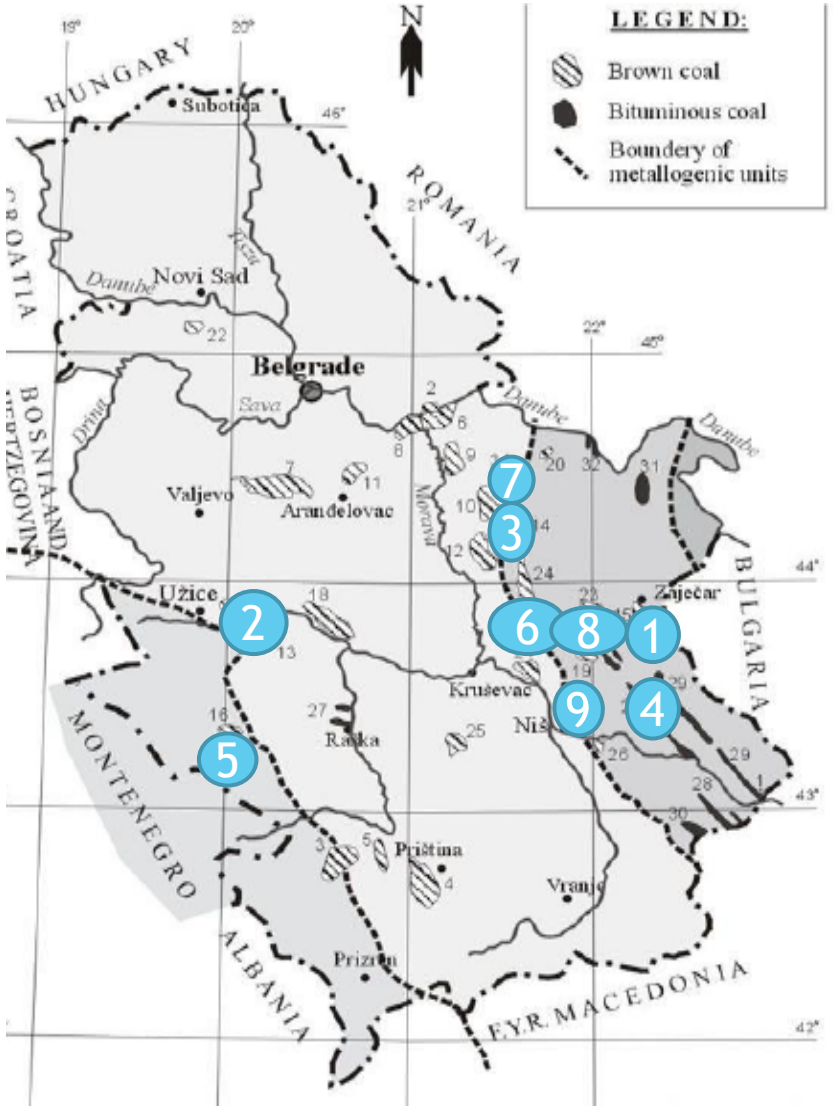
7. Mlava (Melnica deposit),
8. Despotovac,
9. Dragačevo (Tijanje deposit),
10. Krepoljin, 11. Lubnica,
12. Sjenica (Štavalj deposit),
13. Požega (Rasna deposit),
14. Zapadna Morava, 15. Soko Banja.

● **Bright brown coal (Low-Rank A):**

16. Zvižd (Derezna deposit),
17. Aleksinac,
18. Bogovina (East Field),
19. Senje-Resavica.

Source: International Journal of Coal Geology 68 (2006) 39–56

COAL MINES AT THE PUBLIC COMPANY RESAVICA



1. Coal mine “VRŠKA ČUKA” (anthracite)
2. Coal mines “IBARSKI RUDNICI” (hard coal)
3. Coal mine “REMBAS” (brown coal)
4. Coal mine “SOKO” (brown coal)
5. Coal mine “ŠTAVALJ” (brown coal)
6. Coal mine “BOGOVINA” (brown coal)
7. Coal mine “JASENOVAC” (brown coal)
8. Coal mine “LUBNICA” (lignite)
9. Coal mines “ALEKSINAČKI RUDNICI”

Source: Savic_DSGM (www.un.org)

GEOLOGY AND MINING PARAMETERS OF COAL PRODUCTION

Coal deposits/Mine	Type of coal	Geology	Coal reserves (A+B+C_1); (t)	Quality	Metan (Qrs-relative; Qas= absolute	Explosive coal dust	Produce (t/year End 2o17	Employers End 2016
Vrška čuka	anthracite	Productive horizon in Lower Liassic sediments (shale sandstones, clayey and quartz sandstones and coal seams)	2.276.678	7% Volatiles, ash 14%, S about 1%, moisture 2-3%, DTE >7000 kCal	Qrs=8,93 m^3CH_4/t Qas=0,147m^3CH_4/min		5.002	125
Ibarski rudnici	Hard coal	Tertiary lacustrine coal basin, Miocene age, with three horizons (sandstones, conglomerates, argillites, clays, tuffs and coal beds)	1.211.588	-30% volatile, ash 12-40%, S 5-6%, DTE 6000 K/cal	Qrs=0,025-0,245 m^3CH_4/t Qas=0,008-0,079m^3CH_4/min	✔	69.135	486
Rembas	Brown coal	Senj-Resava Miocene, lake coal basin: conglomerates, sandstones and red clays and sandstones,	7.429.150	Moisture up to 18%, ash up to 18%, S below 1%, DTE about 4500 k/cal		✔	169.010	1.172
Soko	Brown coal	Freshwater Tertiary series of the Sokobanj coal-bearing basin (conglomerates, sandstones and argillaceous sandstones overlying Upper Cretaceous limestone	50.935.724	Moisture -23%, ash 18%, DTE 4000k/cal	Qrs=11,74 m^3CH_4/t Qas=2,71m^3CH_4/min	✔	83.277	539
Štavalj	Brown coal	The Sjenica-Staval basin represents a deep tectonic basin. The coal-bearing sediments are of Miocene age (M2,3) and consist of four characteristic lithological horizons.	185.001.495	Moisture 24.93%, S 0.98%, coke 51.26%, GTE 20638 kJ/kg		✔	85.125	460
Bogovina	Brown coal	Lake Oligocene; a narrow zone of tuffs, andesites and marls divided into the western and eastern part; one and two coal layer		Moisture 24.50%, ash 28%, S 2.23%, DTE 10948 kJ/kg			11.245	255
Jasenovac	Brown coal	Kučaj - Belianica autochthonous, Jurassic,Miocene	176.744	Moisture 22.79%, ash 11.40%, S 1.01%, DTE 16 871 kJ/kg		✔	33.800	263
Lubinca	Lignite	Freshwater tertiary basin formations: conglomerates, sandstones, argillaceous sandstones and clays: two layers	10.025.533	Moisture -35%, ash 14% TDe 3000 k/cal		✔	48.807	342
Aleksinac* * Not active		Lake basin of Miocene age (sandstones, clays, marls, shales)		Moisture -0%, ash 10%, S 3%, TDE 500-5500k/cal	Gas coal			268

Some data for a Study on mine closure in Serbia; www.jppeu.rs

SOME MINING - GEOLOGY AND CLIMATIC CONDITIONS RISK MANAGEMENT

- Column and chamber-column excavation methods
- Coal mining is carried out by drilling and mining operations with manual loading of demined material
- Coal is exported in a combined way: by conveyor belts and pit wagons
- Coal seams of different thicknesses are excavated: from 1.5m to 10m
- Methane mode of operation in most mines with undergound exploitation
- Irregular spatial expansion of coal deposits and fault zones affect the production plan in mines
- Frequent and heavy rains affect production work in surface coal mines (e.g. especially in the Ibar mines during 2014 - Cyclone Tamara)
- Collective mining acidents
- In last 50 years in three coal mines with underground exploitation (Soko, Aleksinac, Resavica) died more than 200 miners at collective mining accidents
- After collective accident in Aleksinac mine 1989 year, mine is no longer active (90 miners died)
- Some data show that explosion can occur when the concentration of methane is 5-15% in the mining rooms

Source: : Savic_DSGM (www.un.org); www.jppeu.rs

PROCEDURE OF MINE CLOSURE

- **ALL ACTIVITIES ACCORDING TO THE LAW ON MINING AND GEOLOGY EXPLORATION**

- **THE PROCEDURE OF CLOSURE MINES INCLUDE**

1. **Mine closure program (Program)**
2. **The Main Mining project of closure mine**
3. **The Government approves the Program**
4. **The funds for the implementation of the Program are provided from the budget or at another kind**
5. **The Ministry controls the implementation of the Program**

THE MAIN OBLIGATIONS FOR HOLDER OF EXPLOITATION

1. to notify the authority that issued the approval for exploitation 30 days before the suspension of works
2. to must of reports on the measures taken to the relevant Ministry (for agriculture, water management and for environmental protection)
3. to protect the mining facility and the land on which the works were carried out
4. to undertake all measures of protection and rehabilitation of the environment in order to ensure the life and health of people and property
5. to submit all technical mining documentation on the state of mining works and
6. to submit state of coal resources and reserves at the time of suspension of works to the competent authority that issued the approval of exploitation

THE MAIN REASONS FOR CLOSING COAL MINES

1. Coal reserves exploitated or small amounts remaining
2. No potential for further development
3. The current exploitation of coal is not profitable
4. The technique and technology of coal exploitation is outdated
5. There are safety risks of coal exploitation (mountain shocks and methane)

THE MAIN PROBLEMS RELATED TO CLOSING COAL MINES

1. Closing costs
2. The safety of closing the mine
3. The problems of the local community after the closure of the mine and their solution
4. Monitoring the condition of environmental factors
5. Geohemichal monitoring around mine and conversion for the purpose of future land use
6. Rehabilitation of the field surface, costs and persons responsible for rehabilitation at the future: "conquering new activities for the survival of people, over-qualified workers in that area“
7. And other impact

- THE GLOBAL IMPACT OF TRANSITIONAL AND OTHER PROCESSES ON THE ENERGY SECTOR OF THE STATE AND THE COAL PRODUCTION
- USING COAL IN THE NEWLY CREATED CONDITIONS
- POSSIBILITY CHANGING OF THE PROGRAM OF USING NATURAL RESOURCES

THE CONSOLIDATION PROGRAM OF COAL MINES AT PUBLIC COMPANY RESAVICA

- **PROGRAM ADOPTED 2018**
  - **Established the concrete dynamic program were created, which precisely defined:**

1. **The remaining life of the mine**
2. **Dynamic production plan**
3. **Dynamic of labor movement and**
4. **Necessary funds until the end of exploitation**

- **AT 2018: FOUR MINES WITH SMALL REMAINING COAL RESERVES: TADENJE, JARANDO, VRŠKA ČUKA, BOGOVINA AND SENJSKI MINE WAS AT PROGRAM FOR CLOSING**
- **AT 2022: AT THE PLAN FOR CLOSING WAS ONLY ONE COAL MINE (JASENOVAC MINE)**

Source: Business program in JP PEU Resavica for 2018; Adopted version (www.jppeu.rs)

THE MAIN CONCLUSIONS

1. The closure of the coal mines is performed according to the law on Mining and geology exploration (2021)
2. The closure of the mines is carried out accordance Program
3. The closure to the Main Maining project of Permanent Suspension of work
4. The Government approves the Mine Closure Program
5. The funds for the implementation of the Program are provided from the budget or other source
6. The Ministry Mining and Energy controle to implementation of the Program

- Today is visible the influence of global energy supply conditions on the mine closure program and the use of coal
- Considering the social importance of the process of closing coal mines, if it is possible before closing the mines, it would be necessary to carry out control exploratory drilling in order to check the remaining or discover new coal reserves around the deposit

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Thank you for your attention!

Questions?

And with the miner's greeting
GOOD LUCK

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