

COAL QUALITY AND ITS ROLE IN THE ENERGY TRANSITION OF BOSNIA AND HERZEGOVINA: THE CASE OF TUZLA CANTON

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Abstract: Bosnia and Herzegovina remains significantly dependent on coal for electricity generation, making the quality of domestic coal and its future utilisation important issues in the process of energy transition. Tuzla Canton represents the most important coal-mining region in Bosnia and Herzegovina, with significant reserves of lignite and brown coal used primarily for thermal power generation. The aim of this study is to analyse the quality of coal from selected mines in Tuzla Canton and to assess its potential future role in the electricity system of Bosnia and Herzegovina.

The research was conducted using composite coal samples collected from the Kreka, Banovići and Đurđevik mines during the period from 15 to 19 June 2026. The analyses included moisture content, ash content, combustible matter and lower heating value. The obtained results indicate significant differences in coal quality between the investigated mines and individual exploitation fields. Lignite from the Kreka mine is characterised by high moisture and ash contents and a lower lower-heating value. The investigated brown coals generally have elevated ash contents, while coal from the Banovići mine demonstrates more favourable energy characteristics.

Particular importance is attributed to the coal preparation process at the Banovići mine, where separation removes a proportion of waste material, thereby reducing ash content and increasing the heating value of the coal. The results confirm that the energy value of domestic coal depends considerably on its geological characteristics as well as on the applied coal preparation and beneficiation processes. Differences in coal quality directly affect utilisation efficiency, the amount of fuel required for energy production and the quantity of ash generated during combustion.

The obtained results can provide a basis for improved planning of coal extraction and preparation, as well as for the selection of appropriate technologies for its utilisation. Particular attention should be given to improving selective mining and coal preparation processes in order to achieve more efficient use of available resources while reducing their environmental impact.

Although Bosnia and Herzegovina is gradually increasing the share of renewable energy sources, coal is expected to remain an important component in ensuring the stability of the electricity system during the coming period. More efficient coal extraction, preparation and utilisation may contribute to the rational use of domestic resources during the transition period. In the long term, the energy transition requires an increased share of renewable energy sources, improved energy efficiency and the gradual alignment of the thermal power sector with European climate and environmental requirements.

Keywords: coal, coal quality, energy transition, Tuzla Canton, Bosnia and Herzegovina.

1. INTRODUCTION

The energy sector of Bosnia and Herzegovina (BiH) has traditionally relied on domestic energy resources, particularly lignite and brown coal. Thermal power plants remain important for the electricity system; according to the Agency for Statistics of Bosnia and Herzegovina, thermal power plants accounted for **45.6% of gross electricity production in January 2026** (Agency for Statistics of Bosnia and Herzegovina, 2026).

Tuzla Canton is one of the most important coal-mining regions in BiH. Coal production in the area is closely associated with the operation of **Tuzla Thermal Power Plant**, which uses coal from the Kreka–Banovići coal basin. Consequently, coal quality and availability are important for reliable thermal power generation and security of electricity supply (JP Elektroprivreda Bosne i Hercegovine d.d. Sarajevo, 2026).

Although coal remains important, climate and energy policies increasingly focus on reducing greenhouse-gas emissions, improving energy efficiency and developing renewable energy sources. As a contracting party to the Energy Community, BiH has obligations related to decarbonisation, energy efficiency and renewable energy development (Energy Community Secretariat, 2024).

The European Union has established climate neutrality by 2050 as a long-term policy objective. The **Carbon Border Adjustment Mechanism (CBAM)** entered its definitive regime on **1 January 2026** and includes electricity among the covered sectors (European Commission, 2023, 2026). Therefore, fuel quality, power-plant efficiency and the emission intensity of electricity generation are becoming increasingly relevant.

Coal properties such as moisture, ash content and calorific value affect combustion efficiency, fuel consumption and emissions. The objective of this study is therefore to **analyse the quality of coal from Tuzla Canton and assess its potential continued application during the energy transition of Bosnia and Herzegovina.**

2. METHODOLOGY

The main coal-quality parameters relevant to boiler operation are **net calorific value, total moisture and ash content**. Higher moisture and ash contents generally reduce the effective energy value of coal and may negatively affect boiler operation.

Coal samples were collected daily during **15–19 June 2026** from active mining areas in Tuzla Canton. Sampling and laboratory analyses were performed by **INSPEKT RGH d.o.o. Sarajevo**, whose laboratory is accredited according to **BAS EN ISO/IEC 17025**, while its inspection body is accredited according to **BAS EN ISO/IEC 17020**.

Sampling and sample preparation followed **BAS ISO 5069-1:2002, BAS ISO 5069-2:2002 and BAS ISO 18283:2023**. The following parameters were determined:

- total moisture – **ASTM D3302/D3302M-22a**;
- ash content – **BAS ISO 1171:2012**;
- net calorific value – **BAS ISO 1928:2022**.

The results represent average values for the investigated mines and coal types during the sampling period. The laboratory data were obtained from internal reports of INSPEKT RGH d.o.o. Sarajevo (2026).

3. RESULTS

The analyses showed significant differences in coal quality among the investigated mines and mining areas, particularly regarding moisture, ash and net calorific value.

Coal from **RMU Kreka** is generally characterised by relatively high moisture and, in some mining areas, elevated ash content. The average net calorific value was **7,836 kJ/kg** for PK Dubrave and **8,783 kJ/kg** for PK Šikulje, with total moisture at PK Šikulje reaching **48.46%**. Coal from Mramor Mine showed more favourable energy characteristics, with an average net calorific value of **12,150 kJ/kg** (INSPEKT RGH d.o.o. Sarajevo, 2026).

At **RMU Đurđevik**, differences were identified between brown-coal types. Brown Coal I had an ash content of **44.90%** and a net calorific value of **11,169 kJ/kg**, whereas Brown Coal II had a net calorific value of **14,925 kJ/kg** (INSPEKT RGH d.o.o. Sarajevo, 2026).

Several commercial coal types from **RMU Banovići** showed more favourable characteristics. Separation processes can remove part of the waste material and improve the quality of the final product (RMU “Banovići” d.d. Banovići, 2026).

The highest net calorific value among the analysed coal types was recorded for **Omazići Mine, 19,794 kJ/kg**, followed by **M II Orah, 17,833 kJ/kg**, and **M II Grah, 17,569 kJ/kg** (INSPEKT RGH d.o.o. Sarajevo, 2026).

4. DISCUSSION

The results demonstrate substantial differences in the quality of coal produced in Tuzla Canton. These differences directly affect the amount of fuel required to produce a given amount of useful energy and influence boiler operating conditions.

A higher net calorific value means that less coal is required to obtain the same amount of energy. Conversely, high moisture content increases energy consumption because part of the combustion energy is used to heat and evaporate water. High ash content increases the amount of solid combustion residues and may complicate ash-handling processes.

Therefore, **quality control, coal homogenisation and appropriate blending and dosing** are important for maintaining stable fuel characteristics and reliable operation of Tuzla Thermal Power Plant (JP Elektroprivreda Bosne i Hercegovine d.d. Sarajevo, 2026).

The separation process at RMU Banovići is particularly relevant because removing part of the waste material can improve commercial coal quality and reduce the amount of mineral matter entering the combustion process (RMU “Banovići” d.d. Banovići, 2026).

Coal and the Energy Transition

The results must be considered within the broader energy transition of Bosnia and Herzegovina. European climate and energy policies aim to reduce greenhouse-gas emissions, improve energy efficiency and increase the use of low-carbon technologies (European Commission, 2019).

For the Western Balkans, these objectives are also reflected in the **Green Agenda for the Western Balkans**, which promotes decarbonisation, energy transition, sustainable production and environmental protection.

The transition is particularly complex for BiH because coal-fired power plants remain important to electricity generation, while coal mines support employment and economic activity in several local communities (Energy Community Secretariat, 2024). Consequently, the transition involves not only replacing coal with renewable sources but also modernising the electricity network, developing new generation capacities, improving energy efficiency and addressing the socioeconomic effects on mining regions.

NECP and European Energy Policy

The **National Energy and Climate Plan (NECP)** is an important instrument for aligning the energy and climate planning of Bosnia and Herzegovina with the objectives of the Energy Community and the European Union. It addresses emissions reduction, renewable energy, energy efficiency and security of supply (Energy Community Secretariat, 2024).

Increasing the share of renewable energy also requires investments in electricity networks, flexible generation and energy storage because solar and wind power are variable sources.

During the transition period, improving the efficiency of existing thermal power plants can reduce the amount of fuel required for the same electricity output and consequently reduce the emission intensity of generation.

CBAM and Electricity Generation

The **Carbon Border Adjustment Mechanism (CBAM)** is particularly relevant to Bosnia and Herzegovina because electricity is included among the sectors covered by the mechanism (European Commission, 2023).

Since **1 January 2026**, CBAM has entered its definitive regime. This increases the importance of embedded emissions in cross-border trade with the European Union.

For the electricity sector of BiH, the mechanism is relevant because of cross-border electricity trade. Coal-based electricity generally has a high CO₂ emission intensity, making the emissions associated with electricity generation increasingly important in relation to future trade conditions.

Reducing emission intensity can involve improving power-plant efficiency, optimising fuel use, reducing losses and gradually increasing electricity generation from lower-emission sources.

Renewable Energy and the Future Electricity System

Increasing electricity generation from solar, wind and other renewable sources is a major component of European energy policy (European Commission, 2019).

However, the integration of variable renewable sources requires simultaneous development of electricity networks, storage and system-flexibility mechanisms. For Bosnia and Herzegovina, this means that the energy transition will require a combination of different generation technologies and appropriate system management.

In Tuzla Canton, additional potential may exist for **solar energy, biomass and other locally available resources**, together with improvements in energy efficiency.

Prospects for Tuzla Thermal Power Plant and Coal Mines

The results show considerable differences among coal types and mines. Therefore, coal-quality control, homogenisation and appropriate fuel preparation remain important for stable thermal power plant operation.

At the same time, EU climate policy, the CBAM, the NECP and decarbonisation objectives create a long-term framework in which the emission intensity of electricity generation will become increasingly important (European Commission, 2019, 2023; Energy Community Secretariat, 2024).

The future development of the Tuzla Canton energy sector can therefore be considered through two interconnected processes: **improving the efficiency of existing energy facilities and gradually diversifying energy sources**.

5. CONCLUSION

The analysis demonstrated significant differences in coal quality among the investigated mines and mining areas of Tuzla Canton, particularly in terms of moisture, ash content and net calorific value.

Coal from **RMU Kreka** generally showed lower net calorific values and higher moisture and/or ash contents. The lowest average net calorific value was recorded at **PK Dubrave, 7,836 kJ/kg**, while Mramor Mine reached **12,150 kJ/kg**. At **RMU Đurdevik**, Brown Coal I had a net calorific value of **11,169 kJ/kg**, compared with **14,925 kJ/kg** for Brown Coal II.

The highest values were recorded for **Omazići Mine (19,794 kJ/kg)**, **M II Orah (17,833 kJ/kg)** and **M II Grah (17,569 kJ/kg)** (INSPEKT RGH d.o.o. Sarajevo, 2026).

Coal quality is an important factor in thermal power plant performance. Higher calorific value reduces the amount of fuel required for a given energy output, while high moisture and ash contents negatively affect combustion and increase the amount of combustion residues.

Because of the differences among available coal types, **coal homogenisation and appropriate blending and dosing are important for maintaining stable fuel quality for Tuzla Thermal Power Plant**.

At the same time, energy efficiency is increasingly important because higher specific fuel consumption generally results in higher emissions per unit of electricity generated. Improving the efficiency of existing facilities is therefore one possible measure for reducing emission intensity during the transition period.

The energy sector of Bosnia and Herzegovina is undergoing a long-term transition influenced by European climate policy, the NECP, CBAM and the development of renewable energy. This transition must also take into account electricity supply security, replacement generation capacities, grid modernisation and the socioeconomic importance of coal mining.

In the short and medium term, priorities include improving thermal power plant efficiency, enhancing coal quality and preparation, exploring biomass and other alternative fuels, and increasing renewable electricity

generation. In the long term, reducing dependence on coal will require new generation capacities, grid development, energy storage and other flexibility mechanisms.

Particular attention should be given to **just-transition measures in the mining regions of Tuzla Canton**, including the development of new economic opportunities.

Overall, the study indicates that **coal quality remains an important factor for stable and efficient operation of Tuzla Thermal Power Plant during the transition period**, while the long-term transformation of the electricity system of Bosnia and Herzegovina requires a combination of energy efficiency, modernisation, renewable energy development and gradual emission reductions.

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