

The Impact of Thermal Power Plants on Environmental Pollution in Kosovo

Shpresa Thaqi Ndrecaj and Agron Thaqi*

Department of Pharmacy, College of Medical Sciences, Alma Mater Europaea Campus College Rezonanca, Pristina, Kosovo

ABSTRACT

This study analyzes the impact of coal-fired power plants on environmental pollution in Kosovo. Coal-fired power plants are significant sources of air, water, and soil pollution. Air pollution includes emissions of pollutants such as nitrogen oxides and particulate matter, while water pollution results from the discharge of contaminated water into rivers. Soil pollution occurs due to the deposition of air pollutants and industrial waste.

To reduce environmental pollution, it is important to invest in alternative energy sources such as solar energy, wind energy, and hydropower. Measures should also be taken to treat contaminated water and establish safe methods for the removal and treatment of waste. Public awareness and education about environmental pollution and the importance of clean energy are also crucial in supporting the transition towards a cleaner and more sustainable environment.

The study utilizes data and information from the Kosovo Environmental Protection Agency, monitoring by the INKOS Institute, reports from international organizations, as well as relevant scientific research and other reports. The results indicate that environmental pollution from power plants in Kosovo has significant negative consequences on air, water, and soil quality, impacting human health and the broader environment. Meanwhile, to improve the situation, urgent measures and investments in alternative and sustainable energy sources are necessary.

*Corresponding author

Agron Thaqi, Department of Pharmacy, College of Medical Sciences, Alma Mater Europaea Campus College Rezonanca, Pristina, Kosovo.

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Introduction

Climate change and environmental pollution are issues that continue to dominate global debates, particularly highlighting energy sources such as coal. According to the IPCC (Intergovernmental Panel on Climate Change), coal is the most polluting fossil fuel, with the highest emission of greenhouse gases per unit of energy [1].

This creates significant problems for air, water, and soil quality. Air pollution emissions from coal-fired power plants contain heavy air pollutants, including sulfur dioxide, nitrogen oxides, and particulate matter [2].

These pollutants can contribute to respiratory diseases such as asthma and chronic bronchitis, and also have a severe impact on climate change. The water used for coal washing, if directly discharged into water bodies, will contaminate them. Fly ash from these plants will contaminate the soil when it falls on the ground. Air emissions from these plants, containing pollutants such as sulfur dioxide, nitrogen oxides, particulate matter, carbon monoxide, volatile organic compounds, and other metals like mercury, have implications for health and well being [3]. According to the EPA (U.S. Environmental Protection Agency) report, water used in coal fired power plants for coal washing and cooling systems, if not properly treated, can contaminate water sources with heavy metals such as mercury and lead, causing water pollution [4].

A similar statement is made in the World Health Organization report, stating that fly ash released from coal-fired power plants can deposit on the land surface and contaminate the soil with heavy metals, posing risks to human health and biodiversity. Coal-fired power plants are one of the largest sources of environmental pollution and major contributors to climate change. When coal is burned, it releases carbon dioxide (CO₂), a greenhouse gas that contributes to global warming [5].

Although coal-fired power plants provide a cheap and reliable source of energy, they have significant environmental and health costs. There is an urgent need to seek and invest in alternative and sustainable energy sources, such as solar, wind, and hydro energy, which have a much smaller impact on the environment and human health [1].

How is Kosova Doing?

Kosova is facing significant environmental challenges due to its heavy reliance on coal for electricity production. The power plants in Kosova, which are among the largest in the Balkans, are major sources of air, water, and soil pollution, causing negative impacts not only on the environment but also on public health. This document will focus on the consequences of environmental pollution from power plants in Kosova, highlighting the various pollutants released by this industry and their impact on human health and the wider environment. Kosova has a population of approximately 1.8 million people. Its electricity production is almost entirely dependent on two lignite-fired power plants: Kosova A (5 units with 800 MW installed capacity) and Kosova

B (two units with 678 MW installed capacity). The current capacity of these power plants is around 915 MW [6]. Kosovo A and Kosovo B are supplied with lignite from neighboring mines in Sibovc Southwestern and Sitnica. Kosovo has abundant lignite resources, estimated at 12.5 billion tons, which it claims to be the second largest in Europe and the fifth largest in the world. However, there is no infrastructure for oil or gas extraction, and there is no gas import infrastructure, offering an opportunity to transition towards a fully decarbonized energy system [6].



Figure 1: Source: Ministry of Energy and Mines (position of power plants in Kosovo)

Methodology

The information presented in this paper is based on a combination of sources from environmental science, environmental engineering, scientific studies, reports from environmental agencies, international organizations, and available literature. These sources include:

Agency for Environmental Protection of Kosovo (AKMM), Monitoring by the INKOS Institute, Reports from the World Health Organization (WHO), Publications from the Ministry of Environment and Spatial Planning (MMPH), Scientific studies and research on the impact of coal-fired power plants on the environment, Reports and studies published by national environmental agencies, Information from international organizations such as the United Nations (UN) and the United Nations Environment Programme (UNEP), Relevant scientific and technical literature, including scientific articles and specialized journals in the field of environment and environmental engineering, Air and water quality monitoring networks where data on pollution from coal-fired power plants is available.

Literature Review

The Impact of Power Plants on Environmental Pollution in Kosovo Air Pollution

One of the main sources of air pollution in Kosovo is the country's coal-fired power plants. Coal-fired power plants can emit a range of air pollutants, including nitrogen oxides (NO_x) and fine particles (PM_{2.5}) [7].

Kosovo A and Kosovo B are often considered the most polluting power plants in Europe [6]. The carbon intensity in Kosovo, measured by CO₂ emissions per unit of electricity produced, is the highest in the Western Balkans and about four times the EU average [8].

According to the IQAir 2019 World Air Quality Report, which collected and compared air quality data from over 4,000 global cities, Kosovo ranks as the 30th most polluted region in the world out of 98 countries and regions included in the list [7]. In Kosovo, a large number of people are exposed to concentrations of fine particles (PM) in the ambient air with a diameter of 2.5 micrometers or less (PM_{2.5}) that exceed the World Health Organization (WHO)

air quality guideline value of 10 µg/m³ and the less stringent European Union (EU) limit value of 25 µg/m³ [9].

This has also been reported in the European Commission's report on Kosovo, which states that people living near lignite mines and power plants in the municipality of Obiliq have reported higher rates of respiratory diseases [10].



Figure 2: Source: Reuters (Image Obiliq)

Our study is based on the reports of the Energy Corporation of Kosovo monitored by the INKOS Institute for air pollution, water pollution, and land degradation. In fact, from 2013 to 2018, there are detailed reports, while after 2018, there are only superficial reports that do not mention pollution. Therefore, the results presented below until 2018 are taken from the INKOS Institute.

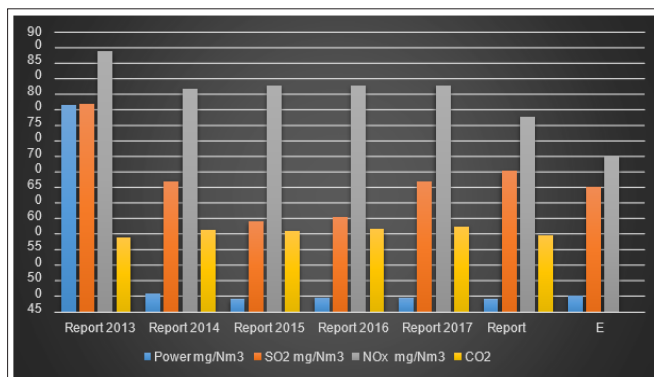


Figure 3: The Gases Released from the Kosovo A Power Plant and The Allowed Limit in the EU

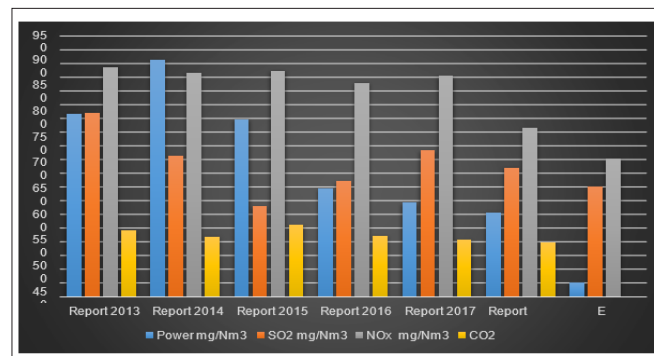


Figure 4: The Gases Released from the Kosovo B Power Plant and the allowed Limit in the EU

From the graphs, it can be observed that both power plants exceed the pollution limits compared to the allowed values in Europe. There is a slight decrease in gas emissions, but unfortunately, this

situation continues even after 2018, as shown by the monitoring of dust concentrations in Obiliq from February 7th to March 3rd, 2020, conducted by Bankwatch. It revealed a large number of exceedances of national daily limits and World Health Organization (WHO) standards for particulate matter (PM10) and fine particles (PM2.5), with many of them several times higher than the limits [11].

Water Pollution

The main energy production industry (Kosova B Power Plant) is located near the Sitnica River, and its operation does not comply with environmental protection standards and regulations. The wastewater generated from the operation of the power plant, with minimal treatment such as sedimentation, is discharged into the Sitnica River [12].



Figure 5: Source: BB Green Kosovo (Wastewater Channels of Kosova B Power Plant into the Sitnica River)

There are six main identified wastewater channels in the Kosova B Power Plant. These channels discharge at different points of the facility but converge into a single channel that releases water into the Sitnica River, located west of the power plant. Currently, Kosova B does not have any specific wastewater treatment plant, except for the sedimentation phase of wastewater to remove solids at the bottom [13]. The discharged polluted water from these plants into the Sitnica River results in significant pollution at the local and regional levels. The discharge of polluted water from coal mines, power plants, and existing ash disposal sites is a result of environmental negligence [14].

In a study conducted in 2021, the results are as follows: The temperature of these wastewater discharges ranges from 14-29°C, which can be considered high for some aquatic species. Electrical conductivity varies between 120-620 $\mu\text{S}/\text{cm}$. The pH values range from 7.81 to 10.5, making these wastewater samples alkaline. Total suspended solids (TSS) exceed acceptable limits. BOD and COD analyzed in the wastewater channels are above the limits, indicating organic and total pollutant loads. It has been observed that some metals (As, Hg, Pb) exceed the limits [12].

The collected polluted waters are discharged into approximately 25 water bodies mostly untreated, although legislation in Kosovo for the treatment of urban and industrial wastewater, regulated by Administrative Instruction No. 30/2014, requires all polluters to apply preliminary treatment of wastewater before discharging it into water bodies [15].

Soil Pollution

Thermal power plants, especially those that burn fossil fuels like coal, can significantly contribute to soil pollution due to the

release of harmful substances such as heavy metals (e.g., mercury, lead, arsenic) and other pollutants (e.g., sulfur dioxide, nitrogen oxides). Increased nitrogen pollution reduces the biodiversity of plants and affects their growth and survival, as well as lichens and other organisms, potentially leading to changes in the biological community. Carbon dioxide emissions from thermal power plants contribute to climate change, which affects ecosystems in various ways. Climate controls how plants grow, how animals behave, which organisms thrive, and how they interact with the physical environment. As habitats experience different temperatures, precipitation patterns, and other changes, the organisms that make up the ecosystems feel the effects [4]. In the case of Kosovo, which has historically relied on lignite coal for a significant portion of its electricity production, these environmental impacts can be considerable. When these harmful substances from power plant emissions are deposited into the soil, they can lead to soil pollution. The main pathway for these pollutants in the soil is usually through the deposition of air pollutants onto the land and through the disposal of coal ash. Large volumes of coal ash (from power plants with ash ponds) and mine waste are also disposed of each year without proper recycling measures [16].

According to the Kosovo Environmental Protection Agency, these power plants pollute areas up to 30 kilometers away from their location. Since this pollution is widespread, it has affected not only surface and groundwater but also agricultural land [17]. Furthermore, active operators in the industrial sector such as KEK, NewCoFeronikeli, and Sharcem, which generate industrial waste and dispose of it in designated landfills, are another source of soil and groundwater pollution. The amount of industrial waste generated in 2019 was 2,096,118.00 tons [18].



Figure 6: Source: Kosovo. Energy (Waste in the Area Surrounding Power Plants)

The thermal power plants in Kosovo have caused significant interventions in the natural landscape, and the degradation of mining areas is also highlighted in reports prepared after monitoring by the INKOS Institute. Mining practices have caused significant soil pollution, soil erosion, loss of natural vegetation, and destruction of animal habitats. According to the report by the Kosovo Energy Corporation prepared by the INKOS Institute, the total amount of coal produced during the year 2013 for the two thermal power plants was 1,360,556 tons. The amount of residual oil and the amount of waste material from oils in 2013 were reported to be 62,200 L, while this situation has significantly improved by 2018, with the amount of residual oil being 2,370 L [19,20]. However, the environmental pollution situation caused by KEK remains alarming, according to the Kosovo Environmental Protection Agency, as the active operator in the industrial sector, KEK, generates industrial waste and deposits it in designated landfills, thus being another source of soil and groundwater pollution [18].

Regarding the content of chemical elements such as As, Cd, Cr, Hg, Ni, and Pb, based on the obtained results and their comparison with the values determined by the Dutch List, it can be observed that their levels in the analyzed samples range from the lowest (Hg), i.e., below the detection limit of the laboratory method, to the optimal values, respectively, within the interval (Cr, Ni, Pb, As, and Cd), level B and C (New Dutch List), which require action to mitigate contamination, or continuous monitoring level [21].

Every coal-based energy corporation is aware of the significant environmental impacts and is obliged to protect and advance new methods of environmental conservation [23]. Soil pollution from thermal power plants is an important issue in Kosovo. At the same time, steps have been taken to improve technologies and reduce pollution.

Measures Taken to Improve the Environmental Situation

Kosovo has focused its actions on addressing environmental issues by aligning its laws with international standards. The main laws and their subordinate legislation that regulate environmental and energy issues applicable in Kosovo are:

Law no. 03/L-025 on Environmental Protection, Law no. 03/L-160 on Air Pollution Control, Law no. 04/L-147 on Water in Kosovo, Law no. 04/L-060 on Waste, Law no. 02/L-102 on Noise Protection, Law no. 03/L-233 on Nature Protection, Law no. 05/L-085 on Electric Energy, Law no. 03/L-163 on Mining and Minerals, Law no. 04/L-158 on Amendment and Supplement of the Law on Mining and Minerals, Law no. 02/L-26 on Agricultural Land, Law no. 03/L-214 on Environmental Impact Assessment, Law no. 03/L-043 on Integrated Pollution Prevention and Control, Law no. 03/L-230 on Strategic Environmental Assessment, Law no. 02/L-88 on Cultural Heritage, Law no. 05/L-081 on Energy, Law no. 04/L-016 on Energy Efficiency, Law no. 05/L-052 on Thermal Energy, as well as the accompanying subordinate legislation of these laws. These laws were formulated before 2010 but have been amended and supplemented in 2022 [24].

Despite the fact that Kosovo has aligned its laws, sub legal acts, procedures, and institutions with the legislation of the European Union, there are still differences in the level of implementation of measures for environmental pollution compared to the European Union (EU). The EU has developed and implements a series of specialized directives and laws for environmental protection. The organization and capacities of the EU are more advanced in addressing environmental challenges. On the other hand, Kosovo, as a new country with different challenges, may need more time and resources to reach a similar level of environmental responsibility. Additionally, the EU has its own air quality, water quality, and waste management standards, which may be stricter than those implemented in Kosovo so far.

Conclusion

In conclusion, it is clear that coal-fired power plants in Kosovo are significant sources of environmental pollution and major contributors to climate change. The emissions of air and water pollutants, as well as the pollution of land from these power plants, have significant negative consequences on air, water, and soil quality, impacting human health and biodiversity.

Recommendations

To improve the environmental pollution situation in Kosovo, it is essential to take immediate measures. These measures include: Promoting the diversification of energy sources by investing in renewable sources such as solar energy, wind energy, hydro energy,

and wave energy, in order to reduce environmental pollution from coal-fired power plants. This shift towards the use of renewable energy sources has significant benefits for the environment and human health.

Implementing clean technologies, utilizing advanced technologies in power plants can reduce air pollution and emissions of pollutants. Investing in pollution control installations and gas purification systems can reduce the negative impact on the environment.

Monitoring environmental risks, the government should take necessary measures to monitor the effects of power plant pollution on the environment and human health. Air, water, and soil quality monitoring systems should be updated and effectively determine the pollution from power plants and its impact on the environment. The use of strict environmental policies and laws, in addition to their formulation, the government is also obliged to enforce strong policies and laws that prohibit, control, and penalize environmental pollution from power plants. Setting high standards for air, water, and soil quality, and imposing strict penalties for violations, can encourage the industry to invest in clean and environmentally friendly technologies.

Promoting awareness and education, it is important to promote awareness and educate the population about the impact of power plants on the environment and the risks they pose to public health. Information and education campaigns can encourage individuals and communities to take action to protect the environment from power plant pollution. To achieve these goals, wide cooperation between government institutions, the Kosovo energy corporation, and the public is necessary.

Only through joint efforts and the engagement of all stakeholders can a sustainable change towards a cleaner and healthier environment for all citizens of Kosovo be achieved.

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