The health harm of air pollution in BELGRADE

How coal power generation contributes to poor air quality and health risks

Air pollutants, gases and particles in the atmosphere strongly affect human health, the climate and the environment. The air in Western Balkan cities is usually dense with exhaust fumes, industry smoke or soot from coal power plants, especially during the autumn and winter season. Air pollution is the single greatest environmental health risk and one of the main causes of death and disease globally and in the region. Poor air quality is also a leading risk factor for major chronic diseases in adults, including heart and lung disease as well as cancer. While each one of us is threatened by poor air quality, some groups in cities, including children, the elderly and those already suffering from disease, are particularly vulnerable.

Lowering air pollution levels, by following the World Health Organization (WHO) recommendations, could prevent a significant number of chronic diseases and early deaths in cities each year. Decision-makers should be more ambitious in implementing long-standing commitments to improve the quality of ambient air. This series of HEAL briefings aims to showcase the sources of air pollution in four cities in the Western Balkan region, and highlight why a phase out of coal power generation and fossil fuels generally would be beneficial especially for city residents.

The Belgrade region has an area of 3,234 square kilometres, divided into 157 settlements. According to the 2019 data, 1,6 million permanent residents live on the territory of Belgrade. The average age of residents is 41,8 years[1].

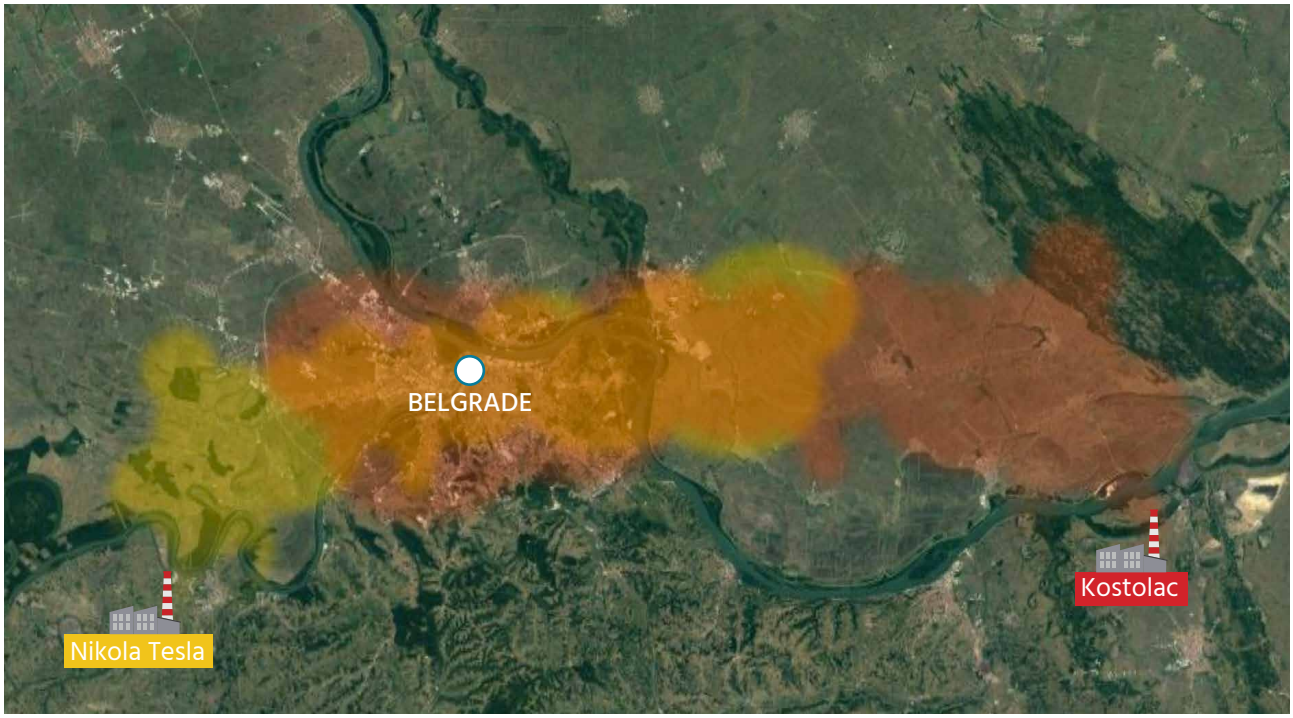
Poor air quality is a consistent problem throughout the year. Belgrade often experiences a temperature inversion during the autumn and winter which contributes to the locking of pollutants that are exhausted in and around the city, near to the ground. In 2020[2] , peak pollution saw NO_2 concentrations of 146µg/m^3, PM_{10} concentrations of 390µg/m^3, and SO_2 levels of 387µg/m^3.

[1] "Opštine i regioni u Republici Srbiji", 2020, Statistical Office of the Republic of Serbia https://publikacije.stat.gov.rs/G2020/Pdf/G202013047.pdf

[2] "Godišnji Izveštaj o stanju kvaliteta vazduha u Republici Srbiji", 2021. godine, http://www.sepa.gov.rs/download/izv/Vazduh_2020.pdf

How do coal plants contribute to poor air quality in Belgrade?

The sources of air pollution that impact air quality in this city include industrial activities, transport, energy production, energy and heat generation for households, agricultural activities and landfills. Belgrade is the capital of Serbia, a home to the coal industry that has burdened public health, the economy and the environment for decades. Not only is it used to produce electricity but coal is also burned to power industries and to heat homes. There are still three coal-fired heating plants for district heating based in the city of which two burned a total of 3,850 tons of coal, emitting about 10 and 27 tons of NO_x and SO_2 in 2020 alone[3].



A particular concern for health protection in Belgrade are the emissions from two large coal power plants Kostolac and Nikola Tesla, located about 95 and 35 kilometers from the city centre. Emissions of Kostolac and Nikola Tesla for sulphur dioxide (SO_2) have gone up in the last decade. Even though emissions of particulate matter (PM) have fallen by half, the amount being released is still 14 times more than an average EU plant. For SO_2, the two plants emit 35 times more than a coal plant in the EU[4]. Nikola Tesla and Kostolac were responsible for 99% of total emissions in 2020, emitting 355,112 tons of SO_2, 39,589 tons of NO_x and 9,489 tons of PM[5] compared to the total public enterprise "Electric power industry of Serbia" who emitted 355,534 tons of SO_2, 40,070 tons of NO_x and 9,535 tons of PM.

[3] Beogradske elektrane, a report upon request, HEAL archive

[4] Chronic Coal Pollution Serbia - Making the case for health promoting investments for zero pollution in Serbia", 2020, Health and Environment Alliance https://www.env-health.org/wp-content/uploads/2020/06/Chronic-Coal-Serbia.pdf

[5] "2020 Environmental Report", 2021, Electric Power Industry of Serbia http://www.eps.rs/eng/Documents/PE%20EPE%20Report%20on%20Environmental%20State%202020.pdf

Table 1 Emissions of power plants Nikola Tesla and Kostolac in 2020 for selected pollutants (in tonnes)[6]

Power Plant	SO_2	NO_x	PM
NIKOLA TESLA	217,597.21	30,712.23	7,870.68
KOSTOLAC	137,515.20	8,876.77	1,617.93
Total	355,112.00	39,589.00	9,489.00

Regarding other pollution sources, public transportation is equipped with about 1,600 vehicles where another 765,000 types of vehicles circulate throughout the city[7]. Most vehicles still run on diesel and gasoline engines. In the suburbs, a large number of households burn coal and wood for heating and cooking during the late autumn and winter, while intensive agricultural burning activities are present in the autumn. Municipal solid waste[8], industrial and hazardous waste also contribute to poor air quality. In addition, the large industrial plants for the production of steel and iron, and an oil refinery can be found in the vicinity of the city.

The health impacts of air pollution

The World Health Organization (WHO) says that no level of air pollution can be considered 'safe' and the link between air pollution and respiratory and cardiovascular diseases is well established. Particulate matter with a size of 10 micrometers (PM_{10}) or 2.5 micrometers or less ($PM_{2.5}$) leads to the greatest health burden. Annual mean PM concentrations in Belgrade[9] are significantly higher than what the World Health Organization (WHO) recommends[10]. In 2020, the annual mean for $PM_{2.5}$ was 5 times higher compared to the WHO guidelines, and more than two times higher for PM_{10}.

Breathing in particulate matter, even at low levels, can lead to physiological changes in the body that damage health. When inhaled, particles travel into the bloodstream and cause harm to our lungs and heart. They can cause strokes and lead to premature death. Studies also link particulate matter with harm to the healthy development of children, and diseases such as obesity and Alzheimer's. Poor air quality is also linked to chronic and acute respiratory diseases, which significantly degrades quality of life, such as bronchitis and the aggravation of asthma. Scientists continue to identify new ways that air pollution can harm our health, for example, there is increasing evidence linking air pollution to dementia and new evidence has shown that particles of air pollution travel through the lungs of pregnant women and lodge in their placentas, harming babies before they are born.

[6] "2020 Environmental Report", 2021, Electric Power Industry of Serbia http://www.eps.rs/eng/Documents/PE%20EPE%20Report%20on%20Environmental%20State%202020.pdf

[7] Ministry of Internal Affairs Serbia, a report upon request, HEAL archive

[8] -'Vinča landfill fire – who is responsible for 'golden utility project'?", Balkan Green Energy News, https://balkangreenenergynews.com/vinca-landfill-fire-who-is-responsible-for-golden-utility-project/?utm_source=phplist419&utm_medium=email&utm_content=HTML&utm_campaign=Newsletter+August+11%2C+2021+-+Balkan+Green+Energy+News

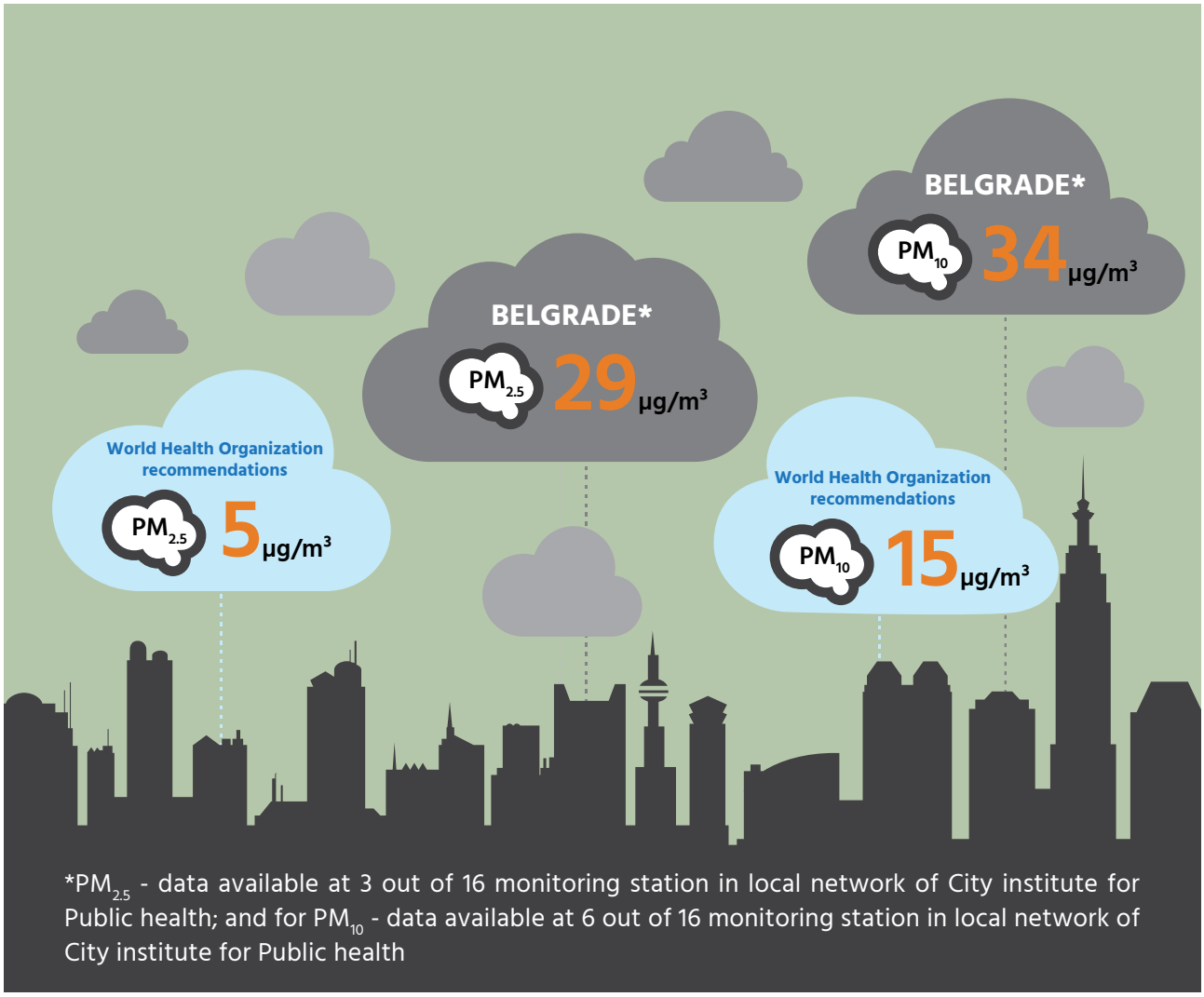
[9] Annual report on the results of air quality measurements on the territory of Belgrade in the local network of measuring stations, Belgrade City Institute for Public Health, a report upon request, HEAL archive

[10] WHO Global air quality guidelines, World Health Organization https://www.who.int/news/item/22-09-2021-new-who-global-air-quality-guidelines-aim-to-save-millions-of-lives-from-air-pollution

Newest studies show that even the lowest levels of air pollution have significant damage to health. Based on that new scientific knowledge, WHO has very recently revised their air quality guidelines. New Air Quality guidelines[11] recommend lower values for several pollutants, most notably for particulate matter $PM_{2.5}$, which causes the greatest health burden, for which a new annual concentration of 5μg/m^3 is now recommended, for nitrogen dioxide (NO_2), which has come under intense scrutiny in discussions on road transport and inner-city driving bans, a new annual concentration of 10μg/m^3 is now recommended (from previously 40μg/m^3).

The health toll of this persistent poor air quality is significant: According to the World Health Organization, air pollution is responsible for the death of 7 million people globally every year, while it is estimated that around 550,000 people die each year in the European region. In the Republic of Serbia, poor air quality leads to 3,585 premature deaths per year, including 1,796 in Belgrade alone[12].

Figure 1 Annual mean of particulate matter concentrations in Belgrade in 2020, compared to WHO recommendations



*$PM_{2.5}$ - data available at 3 out of 16 monitoring station in local network of City institute for Public health; and for PM_{10} - data available at 6 out of 16 monitoring station in local network of City institute for Public health

[11] WHO global air quality guidelines, World Health Organization https://www.who.int/news/item/22-09-2021-new-who-global-air-quality-guidelines-aim-to-save-millions-of-lives-from-air-pollution

[12] "Health impact of ambient air pollution in Serbia - A call to action", World Health Organization, https://serbia.un.org/en/22141-health-impact-ambient-air-pollution-serbia-call-action

The health impacts of climate change

Climate change is expected to make matters worse: According to a vulnerability assessment[13] for Belgrade, the vulnerability of the citizens to the effects of heat waves, extreme cold and floods in Belgrade is estimated as high. An increase in the level of greenhouse gas emissions affects the atmosphere and the surface which later, in turn, leads to climate change. It is well established that during heat waves air pollution goes up as well (e.g. the levels of ozone, which is another health harming pollutant).

Climate change assessments show that nine of the ten warmest years in Serbia occured after 2000 (measured since 1951), and in Belgrade fourteen of the fifteen warmest years (for the period 1888-2020) occurred in the 21st century. The year 2020 was the ninth warmest year since the beginning of the meteorological recording in 1888, with an average air temperature of 13.9°C. The deviation of the average annual air temperature in Belgrade in relation to the reference period 1981-2010 was in the interval of 1,4°C.

In 2020, 48 tropical days were registered in Belgrade, which is 11 days more than the average number - as well as 32 tropical nights, which were 15 nights more than the average. In the period from September 9 to 17, 2020, a heat wave was recorded in Belgrade. The latest date for the appearance of snow in Serbian cities was registered in Belgrade. The winter 2019/2020 was the fifth warmest winter in Serbia since 1951, and the fifth warmest in Belgrade since 1888[14].

The multiple risks of climate change threaten to reverse the progress of the environment and public health[15]. Tackling climate change requires decision-makers to provide a coordinated response to ensure a transition to a healthier future[16]. The burning of fossil fuels is responsible for more than a half of carbon pollution locked in cities worldwide. Coal is the biggest contributor to anthropogenic climate change. In 2020 the coal power generation of Serbia had released a total of 28.639.236,75 tons of CO_2[17], 4,5% and 5,7% higher compared to the year 2019 and 2018, which goes against the Paris Agreement goal.

Mayors active for healthy cities, clean air and a fossil fuel phase out

Being concerned about the effects of fossil fuels industry, mayors across the Globe in the C40 network have agreed to start "greening" the cities in order to expand uptake and access to clean, affordable electricity for millions of urban residents[18]. Increasing renewables leads to multiple benefits that result in mitigating the effects of climate change and will provide a healthier environment for all. To join the global effort, mayors of the nine participating municipalities in the Western Balkans (Bosnia and Herzegovina: Banovići, Kakanj, Lukavac, Maglaj, Tuzla; Serbia: Novi Sad, Niš; Montenegro: Pljevlja; North Macedonia: Bitola) have committed to undertake voluntary measures aimed to reduce air pollution in their municipalities under the Clean Air Regions Initiative (CARI)[19]. Cities under the CARI initiative will strive to adopt and implement local air quality action plans with ambitious policies and measures, share their experiences and learn about progress and achievements in other regions and the city of Belgrade unfortunately did not join the initiative but still has the opportunity to implement measures that clean up the air and protect health.

[13] "Climate Change Adaptation Action Plan and Vulnerability Assessment", 2015, City of Belgrade, Secretariat for environmental Protection http://www.beograd.rs/images/data/c83d368b72364ac6c9f9740f9cda05ed_6180150278.pdf

[14] Godišnji Bilten za Srbiju 2020. Godina, Republički hidrometeorološki zavod Srbije http://www.hidmet.gov.rs/data/klimatologija/latin/2020.pdf

[15] The 2021 report of the Lancet Countdown on health and climate change: code red for a healthy future, The Lancet https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(21)01787-6/fulltext

[16] Climate change infographic, Health and Environment Alliance. https://www.env-health.org/wp-content/uploads/2019/11/Climate-Change-Health-Infographic-V3.pdf

[17] "2020 Environmental Report", 2021, Electric Power Industry of Serbia http://www.eps.rs/eng/Documents/PE%20EPE%20Report%20on%20Environmental%20State%202020.pdf

[18] C40 Renewable Energy Declaration, C40 Cities https://www.c40.org/press_releases/renewable-energy-declaration

[19] Declaration "Clean Air Regions Initiative (CARI)", Energy Community https://www.energy-community.org/news/Energy-Community-News/2021/07/1.html

Recommendations

CITY AUTHORITIES

Set up a clean air for health action plan, including the path to reach WHO's air quality recommendations, and tackling the main pollution sources.

Make informed energy choices based on health and environment impact assessments and economic analyses to benefit the Belgrade city. Fossil fuel intensive cities are not environment friendly solutions for a healthier future.

Highlight the contribution of coal power plants to poor air quality in Belgrade and advocate for a coal phase out. This will lead to public health benefits as well as cost savings.

Establish a multi-agency task force so that all relevant parties can contribute to improving air quality by doing research on health and financial implications making sure that actions will lead to the best outcomes.

Increase air quality monitoring coverage and make data available 24/7 so that citizens can follow the recommendations to avoid health risks. City authorities need to implement air pollution risk management measures to keep citizens safe.

Initiate public campaigns to increase awareness among citizens about the health impacts of air pollution. City authorities should provide information on reducing exposure to air pollution.

HEALTH COMMUNITY

Increase the participation of health experts in decision-making processes to ensure that the implementation of preventive measures is up-to-date. Decisions have to be made in a real-time manner. Timely actions will prevent chronic diseases and premature death.

Highlight the true costs of coal power generation in public health and clean air deliberations and decisions at city level, and advocate towards increasing the public understanding of how public health will benefit in reducing coal's unpaid health bill.

As a health community, provide input in the development of clean air actions, as well as energy and climate policies, and support the implementation of measures to reduce coal pollution.

Communicate to the patients and to the public the links between air pollution and health, and how improvements of air quality will result in better health.

Promote strong climate action in order to minimize the impacts of heat and extreme weather events.

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