



# Environment Quality: Impact From Traffic, Power Plant and Land Morphology, a Case Study of Prishtina

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**Abstract** – Environmental air pollution is a global health concern, a complex phenomenon which is directly reflected on public health, economic and human development. Environmental air pollution has been drastically multiplied, followed by the beginning of the new Millennium in Prishtina, the capital city of the Kosovo. The new millennium began as a crucial activity for the city of Prishtina in terms of demographic, human geography, social and economic phenomena. The presented study aims to determine prevalent traffic and land morphology composition attributes, which have influenced and continue to have environmental impact in the city of Prishtina. According to the conceptual findings from the empirical observations, the heavy city traffic and the land morphology structure, determine the urban air pollution level. Prishtina is generally polluted due to its geomorphic position in relation to the power plants Kosovo A, and Kosovo B. The impact of the above cited factors, is even bigger when the dominant winds prevail through valley, which encompasses the city. The findings from this paper propose the necessity of careful driven urban solutions.

**Keywords** – Environment; air pollution; architecture; urban solutions; climate

## 1. INTRODUCTION

Regarding to the spatial and urban design activities, Cities are open integrated environs, they are huge entities, which permanently transform enormous volume of mass and energy [1]. The spatial development of each city is unique, therefore, there are no identical design models that perfectly fit to a city as an urban solution pattern. There are varieties of urban conceptual guidelines, which can be transformed and adapted locally, hence, the issues of air pollution are spatially and environmentally unique. Moreover, as stated by World Health Organization, “The epidemiological and toxicological evidence on the effects of transport related air pollution on health has increased substantially in recent decades” [2]. While impact of air pollution is obviously a global health concern, there is a rise of global awareness, and persistent environmental actions of communities for a better quality of life, aiming to live in interrelated symbiosis with nature ‘again’. The Municipality of Prishtina has potential for the urban environmental solutions, and nowadays civil society activities further strengthen this ecological objective as a non-negotiable human right. Furthermore, according to World Health Organization, environment with degraded air quality are responsible for about 3 million people deaths annually, hence, this phenomenon produces global health hazard which affects all regions of the globe [3]. In addition, as far as air pollution in Europe is concerned, stated by European Environment Agency in which, “Estimates of the health impacts attributable to exposure to air pollution indicate that PM<sub>2.5</sub> concentrations in 2013, were responsible for about 467 000 premature deaths” [4], moreover, back to the 2012, European Environment Agency conclude on air pollution: 47 % degradation of life expectancy,

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as a consequence of heavy exposure to particulates [5]. The objective of this paper is to address three dimensions related to the air pollution in relation to the quality of life and environmental spatial actions, according to the present situation with major pollutants, such as prevalent traffic and the power plants, Kosovo A and B, as crucial contemporary human activities:

- How to improve the quality of life and urban environment?
- Is the impact of demographic spatial boom after yr. 2000, an irreversible phenomenon?
- How to ease the air pollution from traffic, and power plants?

## **2. METHODS AND PROCEDURES**

The research presented in this paper investigated the urban morphology of the city of Prishtina, focusing on air pollution and never-ending traffic consequences. The study aims to determine prevalent traffic and land morphology composition attributes, which have influenced and continue to have environmental impact in the city of Prishtina. The research methods consist of empirical observations on air pollution phenomenon, spatial change over the last decade and spatial interactions experienced by the city of Prishtina. In the research structure timeline, to receive a clearer data and material, the research was done by literature review, regarding the morphology of the spatial zone, human geography, urban planning, microclimate, environmental pollution and public health issues, emphasized with maps, documentations and drawings. Additional data contain photos, hand drawings of the urban morphology of Prishtina, with a close attention to the spatial position of the main polluters, power plants Kosova A and B, regarding the city urban composition. The data collected include maps, 3D research model of the urban design, features and attributes of the city space, prevalent traffic and air pollution data. Furthermore, the supplement information for this article are based on the examination of the Municipality archives, the Kosovo Civil Society Consortium for Sustainable Development 2017, Hydro Meteorological Institute of Kosovo, Ministry of Environment and Spatial Planning. Data measurements are based on the monthly report on air quality monitoring of US, Environmental Protection Agency, Air Now Department of State, for Prishtina, Kosovo [6]. Spatial changes of the city of Prishtina, has been the target research in crucial periods of the time. Chronographically, the following development plans are important as historiographic facts, which evidence the spatial arrangements of the urban zoning and development of the city of Prishtina:

- First Prishtina development plan, 1937;
- The second Prishtina development plan, 194;
- General urban plan, 1953;
- Addition to the general urban plan, traffic and city zoning, 1967;
- General urban plan of the Prishtina, 1969;
- Detailed general urban plan, 1989. Timeline projection, 1890–2000.

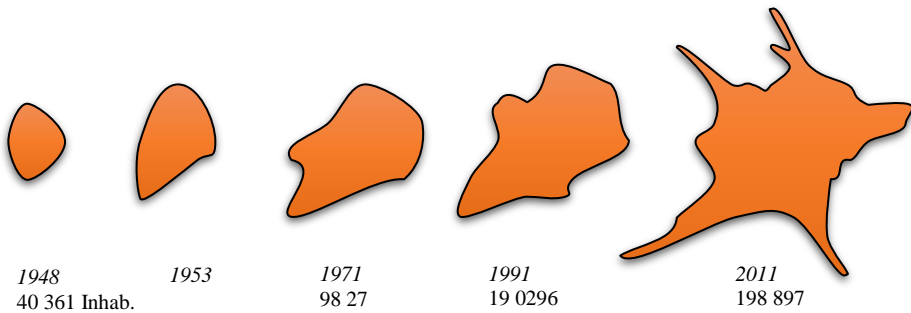


Fig. 1. Spatial changes of land morphology through decades, city of Prishtina.

In November 2016, Prishtina has endured air pollution at an alarming value according to the recent monitoring and presented data of this research, through AQI-Air Quality Index. As stated by the Kosovo Civil Society Consortium for Sustainable Development, the air pollution, respectively the AQI values in Prishtina clearly have evidenced permanent downgrade of air quality, as a result of power plants spatial closeness, huge volume of unbalanced traffic which are the main polluters of environment, and crucial threat to public health [7]. Hence, the city of Prishtina is influenced directly by air pollution in this season every year, in the last decades, but those levels of air pollution as cited bellow are extremely high than those expected in this period of year. Moreover, according to the statements made by the officials of Kosovo Environmental Protection Agency, it is stated that, “Kosovo’s air pollution is within normal rates, laws and directives?” [7]. Nevertheless, the heavy degradation of air quality has been experienced by most of the social structure of the population these days, and public health degradation continues to remain one of the main concerns of the urbanites of Prishtina, being the capital of Kosovo.

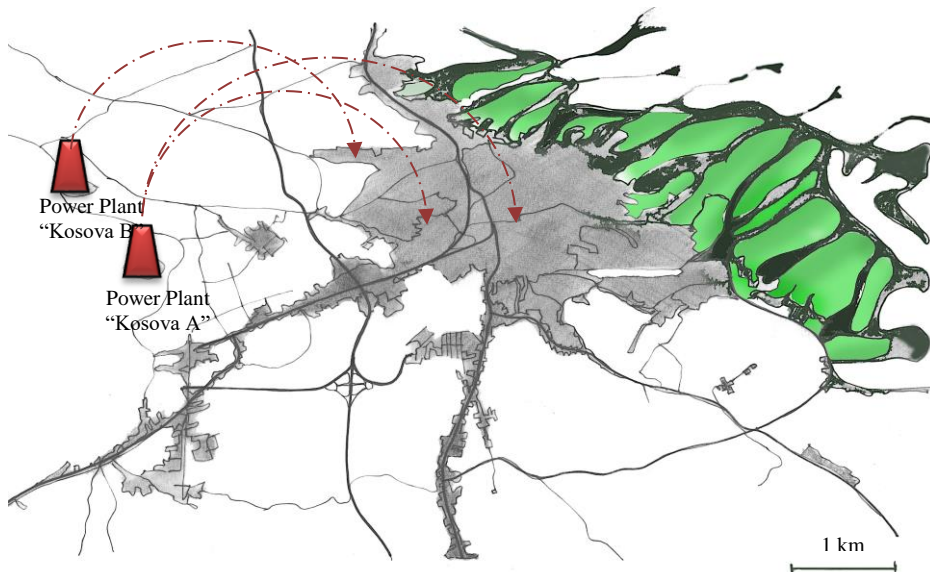


Fig. 2. The city of Prishtina: the land morphology and main polluters, power plants Kosova A and B.

Regarding the air pollution, this period of the year in Prishtina was a threat to the public health, hence, it is the right time to be alarmed to take the most necessary protection steps regarding the fact that near 750 premature deaths are reported annually in Kosovo, possibly caused by air pollution. Hence, the air quality represents the most fundamental concern that we must permanently maintain, regarding to the fact that each person daily inhale about  $14 \text{ m}^3$  to  $18 \text{ m}^3$  of air. The AQI is an index, which is related to the air quality. Environmental Protection Agency, EPA-US, calculates the AQI for five major air pollutants regulated by the Clean Air Act: which include measuring of Ozone, Particulates, Carbon Monoxide, Nitrogen Dioxide and Sulphur Dioxide [6]. According to the findings of the Organization for Economic Co-operation and Development, consequences of air pollution are estimated to become much more serious in the coming years and decades [8]. As a global environmental awareness rise, we must take the most accurate steps on sensibility and global awareness of air pollution, which will drastically increase in the coming decades, strengthened by the real evidence of premature deaths and serious diseases.

TABLE 1. RESULTS OF AQI, MAXIMAL VALUES PER MONTH IN 2016, PRISHTINA [6]

Year	Month	Day	Hour	AQI
2016	March	28	0	145
2016	April	3	21	82
2016	May	1	7	78
2016	June	20	22	70
2016	July	25	7	70
2016	August	1	2	59
2016	September	30	4	83
2016	October	24	2	155
2016	November	22	5	201

TABLE 2. RESULTS OF AQI, MAXIMAL VALUES PER MONTH IN 2017, PRISHTINA [6]

Year	Month	Day	Hour	AQI
2017	January	29	22	532
2017	February	2	2	259
2017	March	16	22	195

TABLE 3. VALUES OF AQI, LEVELS OF HEALTH CONCERN [6]

Air Quality Index Levels of Health Concern	Numerical Value AQI	Meaning
Good	0 to 50	Air quality is considered satisfactory, and air pollution poses little or no risk.
Moderate	51 to 100	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number people who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups	101 to 150	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
Unhealthy	151 to 200	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.
Very Unhealthy	201 to 300	Health alert: everyone may experience more serious health effects.
Hazardous	301 to 500	Health warnings of emergency conditions. The entire population is more likely to be affected.

TABLE 4. AQI MAXIMAL VALUES – FIRST WEEK OF JANUARY 2017, PRISHTINA [6]

Year	Month	Day	Hour	AQI
2017	January	1	1	436
2017	January	2	1	408
2017	January	3	0	292
2017	January	4	21	364
2017	January	5	0	210
2017	January	6	20	84
2017	January	7	23	248
2017	January	8	0	351

### 3. DISCUSSION

Environmentally, power plants running on coal, more or less continuously emanate particles, which directly contribute to air pollution, and ecologically degrade the overall environment. But, how much and in which scale do they contribute to the air pollution? It is a complex answer to address, moreover, it is a whole system which is interdependent and interrelated with many factors in this phenomenon. Hence, as stated by Sabioni, in the European Union the increased volumes of coal for power production will originate large scale of trace metals into the environment [9]. Airborne trace metals, the environmental quality, and air pollution are crucial factors which need to be interdisciplinary addressed [10]. On the other hand, automobiles and overall transport

vehicles have raised their quote in Kosovo, exactly there was 319 615 vehicles, registered in 2016, or more than 10.60 % in 2014, (288 828) [14]. Reference [11] shows that, annual carbon dioxide level in Kosovo produced from traffic and electricity generation altogether, are estimated at around 0.8 million tons produced in 2003, and this scale of emanation is in rise annually. As presented above, traffic is the crucial polluter on air quality, and regarding high scales of air pollution, the Ministry of Environment and Spatial Planning, the Department of Environment has adopted measures according to the Strategy and Action Plan on Air Quality, which are in a phase of serious review. Moreover, the whole Balkan region must also participate in global environmental actions in adopting the environmentally health strategies, related to the lately Paris conference environmental conclusions. Furthermore, nowadays the global communities stand very seriously to the public health quality standards, associated to the prevention of unlimited emissions of harmful and other gases that cause the ‘greenhouse effect’, and lead to the global warming. According to the Paris agreement [12], key conclusions of this accord, are as follows:

- The main objective, containing global temperature increase to below 2 °C;
- Reduction of global emissions utmost level, must be accomplished in shortest possible time;
- Green fund must be devoted, aid provided by developed countries to those states that are most affected by climate changes [12].

Municipality of Prishtina has adapted and adopted measures according to Strategy and Action Plan on Air Quality since years ago, according to the legal guidelines of the Strategy, implementation and action healing measures must have time dynamics, considering that the commitment and implementation of high standard accomplishment may be extended to the next decades [1]. Timeline implementation of the healing strategies, must be prioritized to the most crucial public health threats. According to the municipality approved timeline actions, targeted scale of environmental quality can gradually be improved, furthermore, reached level of air quality must permanent be controlled and sustained, ahead of targeted the next level of environmental healing actions.

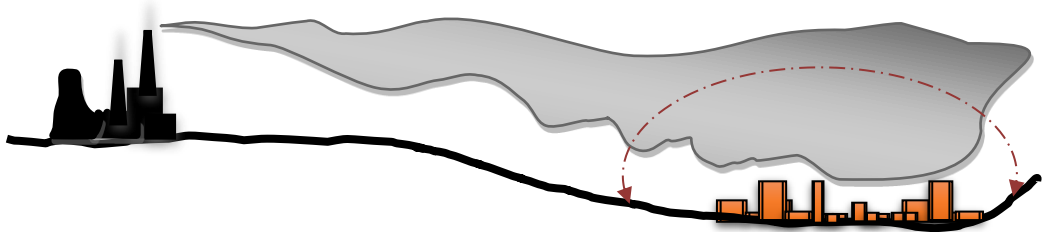


Fig. 3. City of Prishtina, land morphology and environmental climate hazard, according to the radius of emanation – Power plants Kosova A and Kosova B.

Because of the contemporary life style and in commitment to have community necessary services, it is quite normal to have optimal services for ordinary functioning of the city activities, running power plants for electricity supply, and functioning traffic for everyday activities of city urbanites. However, the first thing is that we have to identify and maintain the priorities related to the public health concern. Besides of AQI contained index, “motor vehicles emit at least 40 different air pollutants, usually concentrated within busy roadways” [13].

Carbon monoxide as an air pollutant, according to this study, is produced on the incomplete combustion of carbon containing fuel, which is the common case in Kosovo, according to the age of the used vehicles. According to the data provided by the Ministry of Internal Affairs in 2014 and Kosovo Agency of Statistics, there was a total of 288 828 vehicles registered in Kosovo, whereas only 111 855 produced from 2000 – ahead, and 60 % of other conveyance was made from 1950 to the 1999 [14]. Hence, the average age of vehicles in 2014 was 18 years [15]. Carbon monoxide have specific features to be associated with blood hemoglobin and thus to form Carboxyhemoglobin, and this is a stable complex, which prevents the transport of oxygen in the body. According to the Jacquez, “Hemoglobin binds with carbon monoxide 200 to 250 times more readily than with oxygen” [16].

Prishtina is generally polluted due to its geospatial position in relation to the power plants Kosovo A and B. The impact of the above cited spatial factors, is even bigger when the dominant winds prevail through valley which encompasses city. The need for qualitative life is non-negotiable right and demand, hence, the urban development and community public legal rights are enduring heavy challenges as a result of many contemporary life style attributes: persisting traffic, air pollution, social issues, economy and globalization. On the other hand, Kosovo is also participating in global trends, a process by which regional economies, societies and cultures are integrated through a global network of political ideas, communication, transport and market sharing [1]. According to the information from the Kosovo police, argued in 2013, Pristina with present urban infrastructure, cannot endure circulation of 120 000 vehicles daily [1], [17]. Hence, there are institutional and municipal activities on spatial development plans for the city. The new millennia began with crucial demands for Kosovo, in conditions of urban changes and human development. Nowadays, Prishtina is experiencing varieties of adapting changes in many social spheres.

Moreover, Prishtina has faced many demographic challenges. In 2000, Prishtina has doubled fast its population to 564 800 inhabitants [18], adding to this daily almost another 30 % of the population coming to city for work, possible settlement and migration. Actually, every development plan works according to the official data of registration of population of 2011, which states that Prishtina has officially 198 897 inhabitants. Looking at the everyday activities in the city, the above cited official data of population in Prishtina, is not quite persuasive as is seen, and thus, resulting not accurate on programming and prognosis for future city development plans.

Overall pollution as an environmental hazard, can't be addressed only locally, local actions are irreplaceable and vital necessary, but only through global actions we can expect the so much needed results and impact for better quality of life, and healthier population. In this paper, we argue that there is no alternative to the public health quality. The actual designed, operated, and implemented traffic methods are not the most fruitful approach to urban design of the city. As from spatial, urban, and traffic operational concepts we stand that we need more touchy measures:

- Shutting down the old and archaic power plant structures, building a new one;
- Implementing the best possible nanotechnology filters for the actual power plant chimneys;
- Redesigning the city traffic in a global scale;
- Expanding and growing the fund of traffic road with wider and better profiles;
- Special consideration should be given to the public city garages, which should serve many urban zones instead of one urban block. Furthermore, those structures to be considered as daily pit stop for coming vehicles in the city and should be located in second and third urban ring of the city spatial zone;

- Promoting the green traffic on the city: electric buses-cars, bicycles;
- Promoting and encouraging the public city transport;
- Extra and special prices, for parking places in the city zones.

In cases of hazard situations for the public health, like we faced in December 2016 and January 2017, and in overall winter season when the city is experiencing the heavy air pollution scales, actions to be considered are:

- Ban on traffic, vehicles with odd and even number license plates, consequently, the alternate days in the week;
- Public transport in the city to be free of charge;
- Evidencing public health hazard consequences in using the vehicles, in this period of extreme air pollution.

According to Tong et al., “Roadside vegetation barriers have shown the potential to reduce near road air pollution concentrations” [19]. Furthermore, in relation to the urban forestation, the city of Bologna has evaluated important factors for absorption of air pollutants, suitable tree species have been identified to fulfil this function [20]. Reference [21] shows a huge demand for energy in cities, and beyond the health consequences we must clearly devote alertness to just how crucial are holistic actions for energy efficiency, and symbiotically interrelated with environment and climate changes.

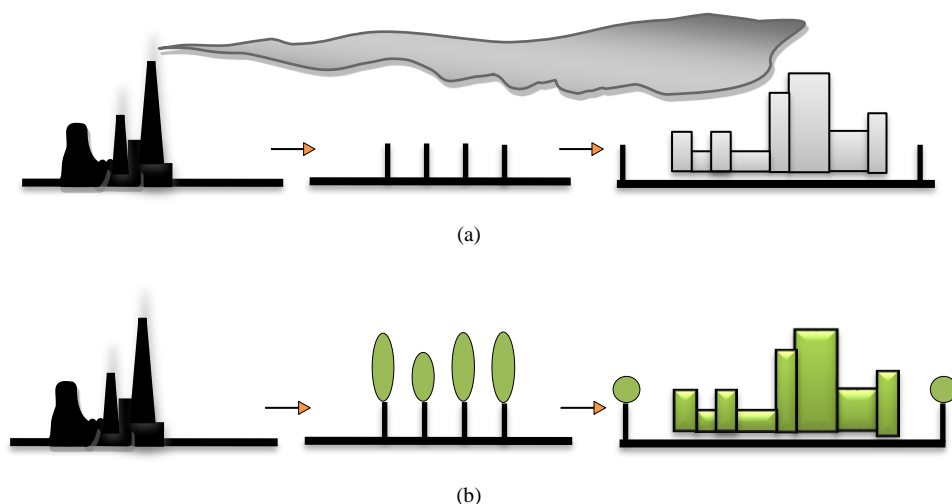


Fig. 4. a) City of Prishtina, air pollution with dominant prevailing winds; b) Proposed vegetation barriers as ecological tampon zones, between the city and heavy industry.

Related to the global interdependent awareness, reference [22] shows that: “The first energy efficiency action plan for the 2008, and efficiency action plan for the 2014–2016, are the most important planning documents of energy efficiency in Latvia”. Different parts of Europe, identical Efficiency Action Plans, referring to the common crucial health and climate issues which bring globalization of energy demands, and environment well-adjusted healing actions. Furthermore, the global well-coordinated healing strategies on air pollution, are the right direction on easing the overall degraded environment. We argue that preserving the environmental quality on each country independently are not appropriate holistic ultimate solution.



## 4. CONCLUSION

Environmental air pollution is a global health concern, which directly reflects on public health and human development. Air pollution has been drastically multiplied, followed by the beginning of the new Millennia in Prishtina, the capital city of Kosovo. Pollution can't be addressed only locally, hence, local actions are irreplaceable and vital necessary, but only through global actions we can expect the so much needed results and positive impact for the better quality of life. In this study, we argue that there is no alternative to the public health quality. Hence, as a sustainable urban strategy, as human development imperative we stand that we need more crucial actions. The present degraded level of air quality requires precise legal steps and activities, therefore, the research findings propose, promoting and implementing above cited measures as we consider that those environmental steps must be immediate, and nowadays they present irreplaceable policy actions for healthier communities in Kosovo. According to this research, with a proper implementation of proposed measures and actions, is indicated that the air quality of Prishtina can be increasingly achieved compared to the actual state, using municipality legal guidelines and under law executive acts.

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