URBAN CHARACTERISTICS - AIR POLLUTION AND WASTEWATER

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ABSTRACT

The impact of pollution is mainly manifested in urban areas. The economy is also affected. Sustainable economic development can be achieved through measures leading to a reduction in emissions from transport, agriculture and energy. An important source of water pollution is both the industrial sector and the numerical growth of the population. This pollution influences the quality of drinking water resources. However, water quality is influenced by improper treatment of wastewater. Thus, the article presents an analysis of urban population exposure to air pollution by particulate matter. The article also presents an analysis of the degree to which the population is connected to urban wastewater collection and treatment systems. The analyzes are performed at the level of the member countries of the European Union.

KEYWORDS: *air pollution, wastewater*

1. INTRODUCTION

The exposure of the urban population to air pollution is monitored by following the values related to particles smaller than 2.5μm, respectively smaller than 10μm. Human health is affected by prolonged exposure in environments with high values of their influence (Sarbu et al., 2021). Urban pollution also influences people's social cohesion. Thus, the negative effects of pollution have effects on places of social manifestation of people, such as green spaces (Elmqvist et al., 2015). The decency of living conditions and their degradation due to pollution is a factor that influences health and life expectancy (Profiroiu et al., 2020). Intervention on environmental factors leads to the reduction or elimination of pollution sources (Rădulescu et al., 2020).

Implementing measures to reduce anthropogenic emissions is a goal of all countries. Thus, the aim is to reduce the effects of pollution on human health (Toscano & Murena, 2021).

A lower spread of air pollutants allows air quality to be maintained and improved (Bran et al., 2020). Thus, these measures lead to the weighting of air pollutant concentrations within the maximum permitted limits (Negescu Oancea, et al., 2020). From the point of view of air pollution, it is important that municipal waste incineration processes are monitored. Thus, in this incineration process, no unwanted pollutants can be found (Cichowicz & Stelęgowski, 2019).

The development of technologies also produces changes in terms of the environment (Bodislav et al., 2019). People, through the activities they carry out, influence the environment. In addition to gas emissions from vehicle emissions and the combustion of various substances, air pollution can also be caused by waste resulting from industrial activities (Soegoto et al., 2019).

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The industrial sector, as well as a numerical increase in population, can be factors that contribute to water pollution (Bran et al., 2018). Thus, the quality of drinking water resources is influenced by these pollutions. Improper wastewater treatment also negatively affects water quality (Burlacu et al., 2020). Reuse of wastewater, through the application of treatment and treatment, could reduce water shortages in some urban communities (Burlacu et al., 2020).
Wastewater treatment measures also have positive effects on the number of fish species in rivers.
The aim is for economic activities to have as little impact as possible on water sources. At the same time, by applying innovative technologies, water quality should not be negatively influenced. It is desirable for water to retain its qualities so that it can be used by other consumers (Radelyuk et al., 2021).
Wastewater treatment is performed through treatment plants. They have the role of protecting the environment. Most of the time, their operation is associated with the appearance of unpleasant aspects that lead to pollution, such as odors and noise. The storage of sludge resulting from the treatment process is also a health risk factor (Paśmionka, 2019).
The processes that lead to the recovery of wastewater are measures with significant impact on the environment. At the same time, the modification of the pressure exerted on the wastewater can be achieved by using wastewater evaporation technologies. Depending on local conditions, this process may have higher efficiencies, which depend on how the solid waste that is produced is managed (Dal Pozzo & Cozzani, 2021).
At European level, the burning of fossil fuels, as a conventional method of preparing hot water, is intended to be replaced by the use of waste heat sources, solar or wind energy. Thus, the effects on the environment may be smaller, which will lead to a reduction in pollution (Słys et al., 2020).

2. RESULTS AND DISCUSSIONS

Environmental pollution, as well as global warming, are influenced by the production models used to make the products. Due to the increase in industrial production, the consumption of resources also increases. This aspect leads to influencing the quality of people's lives (Angheluță et al., 2020). The table 1 presents the comparative situation of urban population exposure to air pollution by particulates smaller than 2.5µm, respectively smaller than 10µm, in micrograms per cubic meter (mcm).

Table 1. Comparative situation of urban population exposure to air pollution by particulates smaller than 2.5µm, respectively smaller than 10µm (micrograms per cubic meter)

Countries	Particulates < 2.5µm				Particulates < 10µm			
	2008	2012	2016	2019	2008	2012	2016	2019
European Union	17,5	16,8	13,9	:	26,4	24,9	21,5	:
Belgium	18,6	16,1	13,3	11,1	26,1	24,8	20,9	18,9
Bulgaria	41,5	29,3	20,2	19,6	60,4	45,9	36,8	30,4
Czechia	19,3	19,2	18,1	14,4	25,9	27,2	22,6	20,3
Denmark	10,8	11,1	10	10	21,4	17,4	15,1	16,5
Germany	16,1	14,3	12,9	10,9	21,1	19,8	17,8	16,1
Estonia	5,4	7,8	5,4	4,8	11,1	12,9	12,3	10,8
Ireland	:	:	8,9	8,8	14,1	12,7	12,5	12,7
Greece	24,3	18,4	14,7	14,1	41,6	30	29	27,5
Spain	14,2	13,7	11,3	11,8	26,9	24,8	20,7	19,4
France	15,5	16	12,7	10,4	24,1	23,9	19,2	17,4
Croatia	:	:	20,6	16	:	:	34,7	30,9
Italy	25,1	23	19,3	15,1	35,4	30,7	27,5	25,5
Cyprus	:	24,3	14,7	13,4	:	36,4	27,2	26
Latvia	19,4	17,3	15,4	12,1	23,8	22,8	19	20,2

Countries	Particulates < 2.5µm				Particulates < 10µm			
	2008	2012	2016	2019	2008	2012	2016	2019
Lithuania	:	:	9,3	11,1	18,5	20,3	24,1	21,9
Luxembourg	:	12,2	14,4	10,2	14,4	17,8	22,1	20,3
Hungary	:	23,4	:	14,4	29,3	28,8	25,3	24,4
Malta	:	:	:	:	:	:	:	:
Netherlands	16,3	13,5	11,2	10,4	25,3	21,2	19	19,1
Austria	19,9	16,2	13,1	12	22,6	22,5	18,3	17,4
Poland	33,5	27	23,3	19,3	31,7	37,4	31,3	27
Portugal	10,7	9,2	10,1	9,1	24,8	22,1	18,2	18,6
Romania	:	19,4	17,2	16,4	40,1	33,3	23,4	25,6
Slovenia	23,9	20,4	21,6	15,3	29,1	25,4	25,6	20,4
Slovakia	25,1	22,7	14,7	13,8	27,1	28,9	20,7	21
Finland	8,4	7	5,7	5,1	13,4	11,1	12,2	10,2
Sweden	9,2	6	5,6	5,8	17,4	14,1	12,3	12,3
United Kingdom	12,9	13,2	10,4	10,2	20,8	18,3	17,6	15,3

Source: processing according to data published by Eurostat, 2021

For particles <2.5µm, compared to 2008, in 2019, the values recorded decreased for all EU member states. The most significant decreases are observed in: Bulgaria (-21.9 mcm), Poland (-14.2 mcm), Slovakia (-11.3 mcm), Greece (-10.2 mcm), Italy (-10.0 mcm), Slovenia (-8.6 mcm). However, in 2019, values over 15 mcm are recorded in: Bulgaria (19.6 mcm), Poland (19.3 mcm), Romania (16.4 mcm), Croatia (16 mcm), Slovenia (15.3 mcm), Italy (15.1 mcm). Also, values below 10 mcm were recorded in: Estonia (4.8 mcm), Finland (5.1 mcm), Sweden (5.8 mcm), Ireland (8.8 mcm), Portugal (9.1 mcm), Denmark (10 mcm).

For particles <10µm, compared to 2008, in 2019, the values recorded decreased in most EU member states. Exceptions were Lithuania (+3.4 mcm) and Luxembourg (+ 5.9 mcm). The most significant decreases are observed in: Bulgaria (-30.0 mcm), Romania (-14.5 mcm), Greece (-14.1 mcm), Italy (-9.9 mcm), Slovenia (-8.7 mcm), Spain (-7.5 mcm). However, in 2019, values over 25 mm are recorded in: Croatia (30.9 mcm), Bulgaria (30.4 mcm), Greece (27.5 mcm), Poland (27 mcm), Cyprus (26 mcm), Romania (25.6 mcm), Italy (25.5 mcm). Also, values below 15 cm were recorded in: Finland (10.2 mcm), Estonia (10.8 mcm), Sweden (12.3 mcm), Ireland (12.7 mcm).

The evolution of the two indicators at European Union level is presented in the following figure.

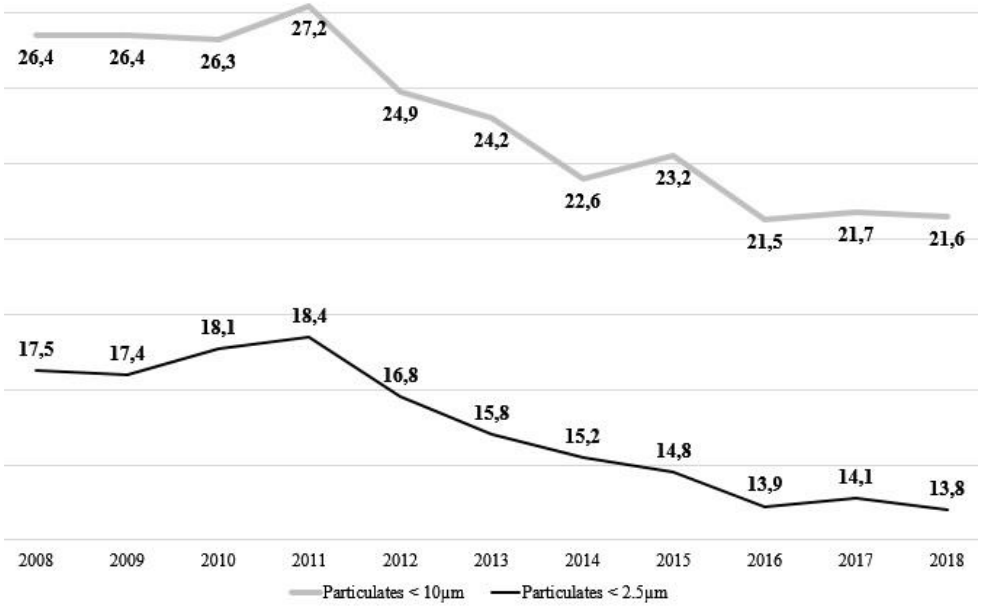

Figure 1. Evolution of urban population exposure to air pollution by particulates smaller than 2.5µm, respectively smaller than 10µm

Source: processing according to data published by Eurostat, 2021

It is observed that for particles <2.5µm, compared to 2008, in 2018, the values were lower (-3.7mcm). Also, for particles <10µm, the values were lower (-4.8 mcm). For both indicators, the trend for the period 2011-2018 is a decreasing one.

It is found that in terms of exposure of the urban population to air pollution by particulates, there are countries where the exposure is very high (Bulgaria, Croatia, Poland, Italy, Romania). There are also countries where the values of these two indicators are low (Finland, Estonia, Sweden, Ireland).

The following table shows the population connected to urban wastewater collecting systems (%).

Table 2. Population connected to urban wastewater collecting systems

Countries	2007	2010	2013	2016	2018
Belgium	87,4	82,2	86,85	87,83	87,98 (2017)
Bulgaria	69,65	70,62	74,7	75,69	76,19
Czechia	78,6	82,3	84,7	84,7	85,5
Denmark	:	90,3	90,8	91,8	92
Germany	97,1	95,7	96,158	97,124	97,124 (2016)
Estonia	75	81,6	82,4	82,8	82,9 (2017)
Ireland	65	:	63,97	64,23	64,23 (2017)
Greece	85	87,3	92,8	93,4	93,4 (2016)
Spain	:	98	:	96,52	96,52 (2016)
France	:	82	82,1	81,7	81,1
Croatia	:	:	54,6	54,6	54,6
Italy	:	:	:	:	94 (2009)
Cyprus	:	:	:	:	
Latvia	71,13	67,63	76,24	77,42	79,95
Lithuania	:	:	67	73,671	75,884
Luxembourg	:	97,1	99	100	100 (2017)
Hungary	69,8	72,3	74,99	80,65	82,002
Malta	98,27	98,35	98,43	98,54	98,87
Netherlands	:	99,3	99,4	99,45	99,5

Countries	2007	2010	2013	2016	2018
Austria	:	93,9	:	95,2	95,95
Poland	62,3	64,6	70,3	73,587	74,118
Portugal	74	:	:	:	85,82 (2017)
Romania	42,65	43,5	46,7	49,2	52,9
Slovenia	62,6	62,6	62,6	67,1	71,5
Slovakia	58,2	60,4	63,6	66,4	68,4
Finland	:	83	83	:	85
Sweden	86	86	87	87	87 (2017)
United Kingdom	:	97,3	:	:	97,3 (2010)

Source: processing according to data published by Eurostat, 2021

From the existing data on the EUROSTAT website, there is a higher interest for some countries to ensure the access of the urban population to wastewater collecting systems. Thus, for the most recent year for which statistics are available for this indicator, the highest values are recorded for: Luxembourg (100%), Netherlands (99.5%), Malta (98.87%), United Kingdom (97 , 3%), Germany (97.124%), Spain (96.52%), Austria (95.95%), Italy (94%), Greece (93.4%), Denmark (92%). Percentages lower than 70% are registered in: Romania (52.9%), Croatia (54.6%), Ireland (64.23%), Slovakia (68.4%). The interest to increase the share presented population connected to urban wastewater collecting systems made that, compared to 2007, the values increased especially for: Hungary (+ 12.20%), Poland (+ 11.82%), Portugal (+ 11.82%), Romania (+ 10.25%), Slovakia (+ 10.20%), Slovenia (+ 8.9%), Latvia (+ 8.82%), Greece (+ 8.4%) , Czechia (+ 6.9%).
Regarding urban and other wastewater treatment plants, Table 3 presents the comparative situation for the period 2007-2018 (%).

Table 3. Comparative situation of urban and other wastewater treatment plants, 2007-2018

Countries	2007	2010	2013	2016	2018
Belgium	68,7	75	76,22	81,71	82,75 (2017)
Bulgaria	42,28	47,76	56,44	63,14	63,92
Czechia	73,1	77	80	81,3	82,4
Denmark	:	90,4	90,8	91,8	92
Germany	96	95,7	96,158	97,124	97,124 (2016)
Estonia	74	81,5	82,2	82,8	82,9 (2017)
Ireland	63	:	61,12	62,63	82,9 (2017)
Greece	85	87,3	92,8	93,4	93,4 (2016)
Spain	:	96	:	88,28	88,28 (2016)
France	:	82	82,1	81,7	81,1
Croatia	:	:	52,9	52,9	52,9
Italy	:	:	:	:	62,5 (2015)
Cyprus	:	:	:	:	
Latvia	71,13	67,63	76,24	77,42	79,95
Lithuania	:	:	66,983	73,638	75,868
Luxembourg	:	95,7	98,2	98,5	98,6 (2017)
Hungary	66,5	71,7	72,76	78,18	80,434
Malta	8,41	20,04	98,43	98,54	98,87
Netherlands	:	99,3	99,4	99,45	99,5
Austria	:	93,9	:	95,2	95,95
Poland	62,3	64,6	70,3	73,5	74
Portugal	69	:	:	:	85,01 (2017)

Countries	2007	2010	2013	2016	2018
Romania	28,3	30,7	44,4	47,8	51,5
Slovenia	52,5	51,7	55,1	62,1	67,4
Slovakia	57	58,9	62,3	65,8	67,9
Finland	:	83	83	:	85
Sweden	86	86	87	87	87 (2017)
United Kingdom	:	99,5	:	:	100 (2014)

Source: processing according to data published by Eurostat, 2021

It should be noted that for the most recent year for which statistics are available for this indicator, the highest values are recorded for: United Kingdom (100%), Netherlands (99.5%), Malta (98.87%), Luxembourg (98.86%), Germany (97.124%), Austria (95.95%), Greece (93.4%), Denmark (92%), Spain (88.28%). Percentages lower than 70% are registered in: Romania (51.5%), Croatia (52.9%), Italy (62.5%), Bulgaria (63.92%), Slovenia (67.4%), Slovakia (67.9%).
The share of urban and other wastewater treatment plants increased compared to 2007, especially in: Malta (+ 90.46%), Romania Poland (+ 23.2%), Bulgaria (+ 21.64%), Ireland (+19, 9%), Portugal (+ 16.01%), Slovenia (+ 14.9%), Belgium (+ 14.05%), Hungary (+ 13.93%).
The interest of the local administration for wastewater is also observed by the comparative situation of the percentage of resident population not connected to urban and other wastewater treatment plants presented in the following table.

Table 4. Comparative situation of percentage of resident population not connected to urban and other wastewater treatment plants

Countries	2007	2010	2013	2016	2018
Belgium	18,7	7,3	10,43	5,91	:
Bulgaria	27,37	22,86	18,26	12,55	12,27
Czechia	5,4	5,3	4,7	3,4	3,1
Denmark	:	0	0	0	0
Germany	1,1	0	0	0	:
Estonia	0	0	0,2	0	:
Ireland	3	:	2,85	1,6	:
Greece	0	0	0	0	:
Spain	:	2	:	8,24	:
France	:	0	0	0	0
Croatia	:	:	1,7	1,7	1,7
Italy	:	:	:	:	:
Cyprus	:	:	:	:	:
Latvia	0	0	0	0	0
Lithuania	:	:	0,017	0,033	0,015
Luxembourg	:	1,4	0,8	1,5	:
Hungary	3,4	0,6	2,23	2,48	1,568
Malta	89,86	78,3	0	0	0
Netherlands	:	0	0	0	0
Austria	:	0	:	0	0
Poland	:	:	:	0,087	0,118
Portugal	5	:	:	:	:
Romania	14,2	12,8	2,3	1,5	1,3
Slovenia	10,1	10,9	7,5	5	4
Slovakia	1,1	1,5	1,3	0,6	0,5

Countries	2007	2010	2013	2016	2018
Finland	:	0	0	:	0
Sweden	0	0	0	0	:
United Kingdom	:	0,4	:	:	:

Source: processing according to data published by Eurostat, 2021

From the existing data on the EUROSTAT website, it is observed that there are countries where all or almost all the urban population is connected to urban and other wastewater treatment plants: Denmark, Germany, Estonia, Greece, France, Latvia, Malta, Netherlands, Austria, Finland, Sweden, United Kingdom, Lithuania, Poland, Portugal, Slovakia. Higher percentages for the population not connected to urban and other wastewater treatment plants are observed for: Bulgaria (12.27%), Spain (8.24% in 2016), Belgium (5.02% in 2017), Slovenia (4%), Czechia (3.1%).

3. CONCLUSIONS

The use of renewable energy resources can be a solution that local communities can apply in order to reduce air pollution (Angheluță et al., 2019). From the analyzes performed, it is found that, even if, compared to 2008, in 2019, in many countries the values recorded for urban population exposure to air pollution by particulates lower than 2.5µm decreased, in 2019 they remain high for: Bulgaria, Poland, Romania, Croatia, Slovenia, Italy. For particles smaller than 10µm, the situation is similar. The countries with high values are: Croatia, Bulgaria, Greece, Poland, Cyprus, Romania, Italy.
Regarding population connected to urban wastewater collecting systems, there is a higher interest for some countries to ensure this access (Luxembourg, Netherlands, Malta, United Kingdom, Germany, Spain. Percentages lower than 70% are registered in: Romania, Croatia, Ireland, Slovakia Also, in most European Union countries, all or almost all of the urban population is connected to urban and other wastewater treatment plants.

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