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Macroeconomic Aspects of Low Emission Limitations in the Lubuskie Voivodship

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Abstract. The publication pointed to macroeconomic determinants of low emission reduction in the Lubuskie Voivodship. It was also emphasized that in the area of Lubuskie Voivodship, the problem of low emission is very serious even though the Lubuskie Voivodship does not belong to strongly urbanized and densely populated areas. Moreover, the most significant problems related to low emission in the Lubuskie Voivodship were indicated as well as the main sources of low emission and their impact on the most important macroeconomic parameters in this area were identified. The article also notes that previous actions that were to contribute to the reduction of low emission did not bring the desired effect. Low emission is not a characteristic feature of the Lubuskie Voivodship, this problem applies to all of Poland, where every year, according to the European Environment Agency, almost 50.000 people die prematurely due to excessive air pollution. At the end, the conclusions were presented.

Keywords: Low Emission, Middle Odra Region, Macroeconomy.

1 Introduction

The air quality in the Lubuskie Voivodship and in Poland as a whole is significantly different from the standards in most EU countries. This is despite the fact that the area of the Lubuskie Voivodship is not strongly urbanized and the average number of people living in 1 km^2 is smaller than the rest of Poland. The problem of low emission in the Lubuskie Voivodship is so complex that it should also be considered in macroeconomic terms. It should be emphasized that due to the complexity of the problem, it may be impossible to solve it in a short time. It is assumed that low emission is generated at an altitude not exceeding 40 meters from the ground level. The main low emission sources are home-heating boilers, road transport and small industrial plants [14, 15]. The purpose of the article was to indicate macroeconomic determinants of low emission reduction in the Middle Odra Region. No statistical data necessary for the preparation of this article are collected for the Middle Odra Region, therefore the authors of the publication were forced to use data on the level of emissions in the Lubuskie voivodship. The area of the Lubuskie voivodship largely coincides with the area of Middle Odra Region [16].

2 The Problem of Low Emissions in the Lubuskie Voivodship

People already knew about the harmfulness of dust to human health in the 16th century. This is evidenced by the work De re metallica by Georgius Agricoli, but it should be remembered that at that time mainly attention was paid to pollinated mines. Work in difficult conditions led to a number of diseases of the respiratory system [2]. Contaminated air therefore has a negative impact not only on the environment, but also on human health, because the toxins in the air pollute the soil, plants, water and food. The problem of atmospheric pollution, which is caused by low emission, does not affect only large cities where dense buildings predominate. Low emission is also a problem in rural areas and places of larger clusters of residential buildings, including single-family houses [12, 14]. Particularly the problem of pollution originating from domestic boiler rooms concerns older detached buildings, which are often non-insulated and equipped with an old, ineffective heating installation [17]. In addition to the ineffective heating installation, the quality of the fuel used is a very serious problem. In low-carbon coal-fired boilers, low-quality coal is often used, from which many substances harmful to human health and environment are released during combustion [29, 30].

A distinction must be made between low emission from gaseous and particulate pollutants arising in medium and large industrial plants and in power plants [14]. In recent years, the issue of gases and dust emissions to air from industry has been significantly reduced (Tab. 1 and 2).

Table 1. Emission of dust pollution by enterprises particularly troublesome in 2007-2016 [21].

Area		Lubuskie voivodship	Poland	Share (%)
Gas emissions (thousands of (Mg/year)	2007	1.6	94.8	1.7
	2008	1.4	76.8	1.8
	2009	1.4	61.7	2.3
	2010	1.4	62.5	2.2
	2011	1.3	57.5	2.3
	2012	1.2	52.4	2.3
	2013	1.1	49.5	2.2
	2014	1.0	47.4	2.1
	2015	0.9	44.3	2.0
	2016	0.9	38.6	2.3

Table 2. Emission of gas pollutants by enterprises particularly troublesome in 2007-2016 [21].

Area		Lubuskie voivodship	Poland	Share (%)
Gas emissions (thousands of (Mg/year)	2007	2 019.1	223 269.5	0.9
	2008	1 842.3	216 319.0	0.9
	2009	1 952.4	203 125.6	1.0
	2010	2 080.9	216 155.4	1.0
	2011	2 089.6	220 928.0	1.0
	2012	2 054.2	216 513.7	1.0
	2013	2 009.5	217 492.0	0.9
	2014	2 009.1	209 067.3	1.0
	2015	2 000.1	211 566.3	0.9
	2016	2184.2	210 849.4	1.0

It should be emphasized that the main source of pollutant emissions to the air in the Lubuskie Voivodship is low emission, which results from human activity. Natural emission, which results from processes occurring in nature, although it cannot be completely omitted during the analysis of this issue, is of marginal significance because it has a small influence on the air quality in the Lubuskie Voivodship. Low emission is a problem of densely populated areas. At the same time, the low emission, which usually comes from sources such as home-heating boilers, road transport and small enterprises, has a major impact on air quality, especially in cities [13, 26]. The size of this issue is difficult to estimate: it ranges from a few to a dozen or so percent of total emissions in areas with a developed heating network and up to several dozen percent - in areas where central heating systems do not cover. The largest share of low emission in total of pollutants that enter the air occurs in rural areas. Particularly high concentrations of pollutants, which are the source of low emission, are recorded during the heating season [14]. In areas of high traffic routes and densely populated areas, a significant issue is the low emission, the source of which is car communication [22]. When combusting fuels in automotive engines, many harmful substances enter the air. A serious problem in the Lubuskie voivodship is the age of cars. A large part of them are old cars, which are equipped with non-ecological engines. The data presented in Fig. 1 shows that as many as 86% of cars registered in the Lubuskie voivodship in 2016 are of 10 or more years old. It should be assumed that with the improvement of macroeconomic indicators, the age structure of cars in the Lubuskie voivodship will begin to change. Together with the increase in affluence of the inhabitants of the Lubuskie Voivodship, it is expected that the share of the oldest cars will decrease. As is the case, for example, in Germany. Moreover, passing cars contribute to the so-called secondary emission, consisting in picking up dust from roads by passing cars [26].

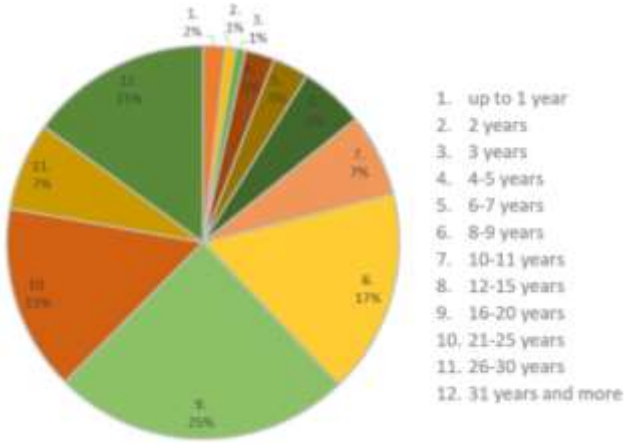

Fig. 1. Breakdown of passenger cars into groups due to their age in 2016 in the Lubuskie voivodship [21].

3 The Impact of Low Emission on the Lubuskie Voivodship Economy in Macroeconomic Terms

Low emission has a negative impact on many areas of people's lives. Also in macroeconomic terms, it is a significant problem for the economy of the country and the region. The negative impact of low emission is often indirect, but it cannot be neglected when analysing the impact of air pollutants on macroeconomic factors [4, 24 ,28]. It should be emphasized that one of the most harmful substances for human health is benzo(a)pyrene - B(a)P [31]. This substance in elevated concentrations occurs not only in the Lubuskie Voivodship, but also throughout Poland (Fig. 2). Low emission may have a negative impact on macroeconomic factors such as: quality of workforce, economic situation (region, country), level and structure of prices, economic growth rate, tax tariffs and fiscal policy [14].

One of the most important macroeconomic factors that is dependent on low emission is the quality of the workforce. People staying in places where low emission is particularly annoying will be more likely to get ill. It is not just about life-threatening diseases, such as heart or lung diseases, but also the quality of life, which is reduced by a higher risk of less severe factors affecting people's health. These include, among others, allergies that may occur more often in areas characterized by low air quality. Low emission can cause more days of absence from employees in the workplace due to illness. In turn, activities aimed at reducing low emission may contribute to reducing unemployment. The necessity to carry out tasks aimed at reducing the occurrence of harmful substances in the air may entail the creation of new jobs [16]. Such a situation may take place in mines where coal is mined, especially the lower quality, which contributes to the creation of low emission [31]. The low level of unemployment currently taking place in Poland seems to be a good moment to undertake activities

aimed at limiting the extraction of coal with the lowest heating parameters [17,25], which also contains a large amount of pollutants that are released during combustion.

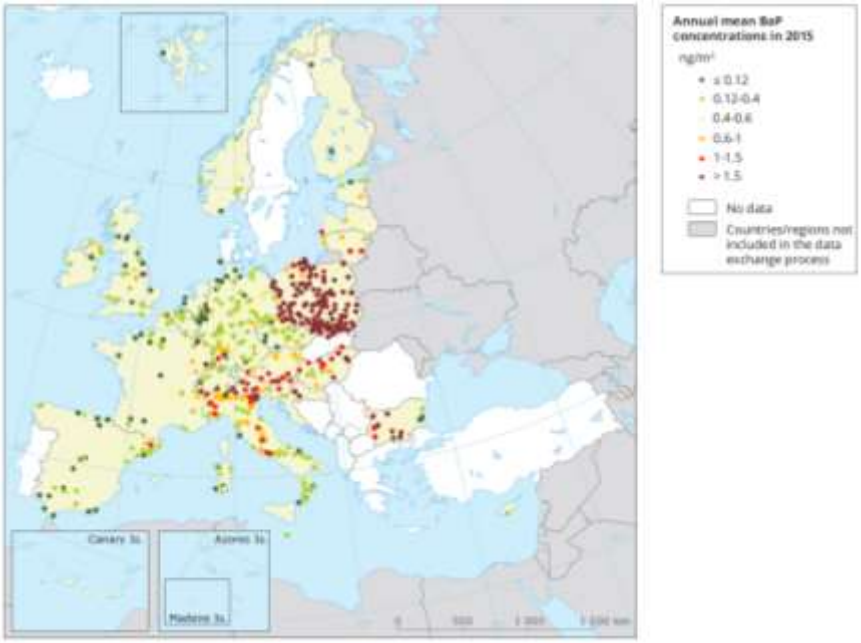

Fig. 2. Concentrations of B(a)P, 2015 [3].

It should be emphasized that individual substances that are part of low emission adversely affect human health [14]. Particularly noteworthy is the PM2.5 dust, which according to the reports of the World Health Organization has the ability to penetrate into the alveoli. It should be underlined that even short-term exposure to the increased concentration of PM2.5 dusts threatens the health and life of people due to respiratory system diseases, blood circulation and the number of medical cases that require hospitalization [11]. On the other hand, long-term arrival in a place where the concentration of PM2.5 is too high contributes to a shorter life span. It is estimated that the life of the average EU citizen is shorter due to this reason by more than 8 months [20, 23]. In Poland, however, it is estimated that people's lives are shorter by about 10 months. Poor air quality directly affects the poor health condition of the whole society, which in turn translates into increased budget expenditure for the treatment of diseases and costs associated with reduced productivity [6]. It is estimated that in the Małopolskie voivodship these expenses amount to approximately PLN 2.8 billion annually [18]. As a result of inhaling by people of air contaminated with an excessive amount of PM2.5, nearly 500.000 premature deaths are registered in Europe every year [21]. Poor air quality is the most important cause of premature death in the EU, which is associated with a polluted environment. It should be emphasized that polluted air contributes to ten times more deaths than road accidents. Only in 2010, poor air quality contributed to over 400.000 premature deaths. In addition, there have been numerous

cases of diseases that could have been avoided [17]. It is estimated that the overall external costs of the effects of poor air quality in Europe in 2010 ranged from EUR 330 to 940 billion [9].

The economic situation is an important macroeconomic factor that may depend on the low emission level. This can be particularly noticeable in local conditions. For example, entrepreneurs investing in the tourist sector may not take the risk of locating investments in a place where low emission is particularly burdensome. An important macroeconomic factor that may indirectly be dependent on low emission is inflation. Striving to maintain a low inflation level while maintaining a relatively high rate of economic growth is often difficult to achieve. These activities can be all the more difficult when the state budget is charged with a high financial penalty for too high a low emission level. The necessity to cover a possible financial penalty may entail the desire to launch more money on the market, which in turn will contribute to inflation which has a negative impact on the undertaking of structural actions [7]. Low emission may also affect the rate of economic growth. The Polish authorities may be forced to significantly increase expenditure on reducing low emission, which will entail the need to reduce the level of investment in other branches of the economy [27]. Such a situation may reduce the rate of economic growth. Estimates have been already known to limit the competitiveness of the European Union economy due to a number of environmental restrictions that are often not found in other countries outside the EU. This situation means that other economies that are not burdened by environmental restrictions are able to produce products at lower prices than in the EU [17]. This has a significant impact on the competitiveness of production.

This has a significant impact on the competitiveness of production [8]. Tax rates may be subject to changes due to low emission [1 ,5]. Higher taxation of non-ecological cars may be one of the elements of low emission impact on the state's fiscal policy. Fiscal policy should be understood as the selection of means for collecting public revenues, as well as the directions and ways of spending public funds to achieve economic and social goals, which have been set by public authorities [19]. State authorities may be forced to take unpopular decisions that will lead to higher tax burdens on citizens due to too much harmful substances in the air. The need to introduce may result not only from excessive concentrations of pollutants in the air, but also from commitments undertaken by individual countries as part of their functioning in the European Union. Moreover, there are a number of other actions by public authorities with regard to budget inflows and expenses, the aim of which is to strengthen controls and influence the distribution of income, as well as the level of economic activity of individual entities in the country. A large part of the impacts directly or indirectly affects the economic conditions of the functioning of households and enterprises and their decisions. Monetary policy has a significant impact on the market and preferential rate of credit allocated for pro-ecological activities aimed at reducing low emission [17]. As examples of other countries show through fiscal policy, it is possible to effectively influence the reduction of dust and gas pollutants that get into the air. At the same time, it is not only important to set higher tax rates for non-ecological heating installations or cars, but it is also significant to introduce various types of tax incentives and subsidies for ecological solutions. An example of a country that effectively

encourages its citizens to buy environmentally friendly cars is Norway, which has introduced privileges for all electric cars.

It should be noted that the level of emissions to air in Poland in 2015-2016, with few exceptions, was not limited (Tab. 3). When analysing harmful substances that are emitted into the air, it should be stated that the majority of them were characterized by a higher emission level in 2016 than in 2015.

Table 3. Emission volumes in the years 2015 – 2016 for the particular pollutants [9].

Pollutant	**2015**	**2016**	**2016/2015**
	Mg		(%)
SO_2	701 831.5	581 520.3	82.86
NO_x	704 824.3	726 431.2	103.07
NH_3	267 312.2	267 107.2	99.92
CO	2 370 432.8	2 505 631.3	105.70
NMVOC	590 627.8	608 858.3	103.09
TSP	342 017.6	352 306.1	103.01
PM10	248 654.5	259 165.3	104.23
PM2.5	138 343.5	145 506.9	105.18
BC	19 794.0	21 260.7	107.41
Pb	420.9	418.3	99.38
Cd	12.3	13.1	106.63
Hg	10.6	10.3	97.85
As	30.7	28.3	92.14
Cr	32.7	33.9	103.79
Cu	329.6	316.5	96.04
Ni	81.6	82.4	100.89
Zn	863.2	836.8	96.93
		kg	
PCB	627.3	634.3	101.11
HCB	4.8	4.9	101.89
PAH	139 467.9	146 344.4	104.93
	g I-TEQ		
PCDD/F	290.0	282.3	97.37

The harmful substances that significantly contribute to the low emission are:

- suspended dusts (PM10 and PM 2.5),
- nitrogen oxides (NO_x),
- sulphur dioxide (SO_2),
- carbon monoxide (CO),
- non-methane volatile organic compounds (NMVOC).

From the data presented in Tab. 3. it appears that almost all harmful substances that are emitted into the air, which low emission is an important source, increased in 2016 compared to 2015. The exception is only sulphur dioxide, whose level of emissions in

2016 compared to 2015 was significantly lower. In 2016, SO_2 emissions were lower by approx. 17% compared to 2015. The drop in emissions in Poland was mainly due to the reduction of emissions from professional and industrial power, which resulted from operators adapting from January 1, 2016 to the requirements resulting from implementation of Directive 2010/75/EU on industrial emissions in the scope of stricter emission standards for SO_2 [10].

Conclusion

In the Lubuskie Voivodship there are elevated concentrations of harmful substances in the air, the main source of which is low emission. High concentrations in the air B(a)P are particularly unfavourable, which often exceed the acceptable limits. B(a)P is not only one of the most dangerous for human health substance that gets into the air. B(a)P also affects the macroeconomic parameters of the region. So far, effective solutions have not been implemented that would lead to the reduction of low emission in the Middle Odra Region.

It should be emphasized that despite the development of air protection programs for all zones in the Lubuskie Voivodship due to exceeding the normative values: particulate matter PM10, B(a)P and arsenic. Moreover, the national program (Clean Air) is currently being launched to reduce low emission. The program provides for grants and loans that are to contribute to the right energy efficiency and reduce the emission of dust and other pollutants into the air from existing single-family residential buildings or to avoid emission of air pollutants from newly built single-family residential buildings. However, the effectiveness of the currently implemented solutions can only be assessed in the coming years.

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