Economic Conditions of Low Emission Reduction in Poland

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Abstract. The air quality in Poland is one of the worst in the entire European Union. A lot of factors affect a large amount of pollutants that get into the air. The most important of them include heating buildings, road transport and the functioning of industry. A large part of the pollutants that get into the air belongs to low emission, which appears at a low altitude above ground level (up to 40 m). In Poland there are exceedances of harmful substances in the air due to the lack of solutions that exist in other EU countries. However, these solutions are often costly and the authorities in Poland in recent years have not taken action that would help to solve the problem of poor air quality. The paper presents economic conditions that are related to reducing emissions in Poland.

Introduction

The problem of too much pollution in the air has been significantly reduced in most EU countries. In Poland, this problem has been limited only partially. So far, the emission of harmful substances into the air, which originated in the industry, has been significantly reduced. However, the so-called low emission has not been limited in Poland, which arises at a height of up to 40 m from the ground. The source of low emission is mainly flue gas from household boilers, road transport and small enterprises [1]. Among the substances that are part of low emission there should be distinguished:

- sulfur dioxide,
- Polycyclic Aromatic Hydrocarbons - including benzo(α)pyrene,
- PM10 and PM2.5
- nitrogen oxides,
- heavy metals,
- carbon oxides,
- as well as other poisonous substances such as dioxins.

The notion of low emission refers to pollutants getting into the air mainly as a result of combustion processes of conventional fuels. The burning of renewable fuels, such as wood, also contributes to low emission [2,3]. Low emission is an important factor that has a negative impact on human health and the environment. One of the harmful substances that has a particularly negative impact on human health is B(α)P, which is much more common in Poland than in other EU countries (Fig. 1). The problem of low emission is not only important in urban areas in Poland but also in rural areas. The aim of the article is to analyse economic conditions related to reducing low emission in Poland.
The Main Causes of Air Pollution in Poland

As the experience of richer EU countries shows, the problem of poor air quality can be significantly reduced. There are a number of regions in the EU that have a similar population density, altitude, the length of the heating season and show a number of other similarities to the regions in Poland. However, in Poland it seems to be difficult to solve. Not due to technological limitations or due to lack of access to ecological fuels. In recent years, the authorities in Poland have paid too little attention to efforts to reduce low emissions. The lack of actions and the insufficient amount of funds transferred to reduce low emissions in Poland contribute to a very poor air quality. This is evidenced by, inter alia, the high concentration of particulates PM2.5 in the air (Fig. 2). The problem of low emission began to be noticed after the reports of the World Health Organization, according to which in Poland every year 45 thousand people died due to diseases caused by contaminated air.

![Figure 1. Annual mean concentrations of B(a)P in 2015 [4].](image)

![Figure 2. PM2.5 concentrations in relation to the limit value in 2015 in the EU-28 [5].](image)

Poor air quality is determined by a number of factors, and one of them is economic constraints. In order to achieve the goal of improving air quality in Poland, it is necessary to run various economic tools. The analysis of the air quality state indicates that the poor quality of air in the country is mainly affected by low emission. However, the most serious problem in Poland related to low emission is pollution generated during the heating of buildings. Heating in Poland is characterized by a very high share of solid fuel consumption. This is because solid fuels are the cheapest. Therefore, low-quality
coal or wood is often used for heating buildings. Low emission could be significantly reduced by limiting the use of coal for heating buildings [6]. Moreover, these boilers used for heating buildings often do not meet any ecological standards, which intensifies the problem related to low emission in Poland [7,8].

The poor quality of air in Poland is also affected by road transport, which takes place throughout the year. And not only in the heating season as it is in the case of heating buildings. Emissions from the road transport sector in Poland constitute about 10% of pollutants that get into the air. The share of pollutants varies slightly between regions due to the density of population in a given area, the number of roads and intensity [9]. Road transport is more burdensome for the environment in Poland than in most other EU countries due to the much higher average age of cars [10]. Older cars that travel on Polish roads do not meet the current ecological standards. The average age of cars and Poland is 15 years.

**Economic Factors Affecting the Generation of Low Emission**

An unfavourable material situation of a large part of Poles makes the economic factor the main criterion when choosing the method of heating buildings. Solid fuels are relatively cheap, but also less ecological [11,12]. Therefore, hard and brown coal and wood are often used as a basic fuel for heating buildings [13,14]. It should also be noted that more energy-efficient boilers are more expensive than the popular non-ecological old-coal boilers in Poland, in which fuel is burned at too low temperatures [15].

Barriers, mainly economic ones hindering the fight against excessive air pollution in Poland, were also indicated by the General Assembly of the Union of Voivodships of the Republic of Poland. The most important problems include:

- unfavourable structure of fuel prices on the market and too low income of the society;
- too complicated and discouraging procedures related to co-financing activities affecting the improvement of air quality;
- the lack of a stable state fuel policy;
- social acceptance for the use of low-quality fuels and waste when heating households;
- low priority of ensuring proper air quality in the hierarchy of the importance of the objectives pursued by the state;
- lack of state incentives for the use of ecological fuels in households;
- insufficient public awareness of air quality and health effects of the existing state of affairs;
- insufficient financial resources for the implementation of air protection programs;
- a small share of renewable sources in satisfying heating demand [16].

Although the problems presented above have been known for years, most of them have not been solved in Poland so far [17]. Analysing the economic aspects of barriers to improving air quality in Poland, it should be noted that the reduction of emission to the atmosphere from industry has not stopped economic growth. However, the share of sources influencing the state of air quality in Poland has changed. Even 30 years ago, a definitely greater negative impact on the environment of the energy sector and industry was observed, and a smaller negative impact of the municipal and transport sector [18,19]. However, legal restrictions imposed on the industry, relating to the preservation of ecological production conditions have contributed to the reduction of emission from this sector of the economy. The reduction in emissions in industry was also influenced by technical and technological progress, which would reduce the negative impact of this sector on the environment. The reduction in emission in industry was also influenced by technical and technological progress, which would reduce the negative impact of this sector on the environment [20]. Unfortunately, the indicated solutions functioning in industry would be difficult to implement in installations heating single-family houses due to their high price [8,21]. In recent years in Poland, among the main causes of poor air quality, an increased share of municipal sector has been observed, with the share, to a much lesser extent, of the transport sector.
It should be emphasized that the current measures to reduce low emission in Poland have been insufficient. However, the introduction of solutions limiting low emission in other countries shows that achieving significant results in this area is feasible [22,23]. In Poland, an adequate number of financial instruments intended for households has not been implemented, which without support will not give up polluting heating installations. In addition, currently in Poland there is a lack of financial support for the use of renewable energy sources, which, replacing conventional sources, would contribute to lowering the level of low emission. In Poland, there is also a lack of support for the use of cogeneration, which significantly reduces the consumption of energy resources, which limits low emission [8]. Cogeneration could be implemented during the reconstruction of old heating plants for modern combined heat and power plants [24].

Summary
The low emission in Poland, the main source of which is local household boiler rooms and non-organic transport are the most important factors affecting the quality of air in the country. According to the authors, so far too little action has been taken in Poland to improve the air. Furthermore, most of the tasks planned to be implemented, aimed at reducing low emission in Poland, will not contribute to a radical reduction of harmful emission to the air. An exception may be some solutions introduced by some local government authorities, e.g. in the city of Krakow, where a number of economic and legal solutions, such as a ban on burning solid fuels in boiler rooms and co-financing for boiler replacement, give hope for a gradual reduction of the low emission problem. However, in order to be able to assume a significant improvement of air quality throughout the country, it is necessary to limit the number of old type of coal boilers. These boilers could be replaced with new ones that use natural gas. However, without financial support, a large part of residents will not decide to replace the old coal boiler with a more ecological one, which is more expensive and is powered with more expensive fuel.

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