



## Problems associated with the emissions limitations from road transport in the Lubuskie Province (Poland)



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### HIGHLIGHTS

- In the article presents problems associated with main causes of low emissions from road transport.
- The article presents actions that can contribute to limitation of low emissions in Lubuskie Province (Poland).
- We focus the three-scenario simulation of annual emission that could take place in 2020.

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### ABSTRACT

According to the report of the World Health Organization (WHO) on the list of 50 cities with the most polluted air in Europe as many as 33 are located in Poland. All the cities that are on the list exceed the maximum concentration of dust recommended by WHO at least three times. In the Lubuskie Province there is a very serious problem of maintaining good air quality. The air in Poland is among the most polluted in the European Union and this also applies to less-industrialized areas, such as Lubuskie, where the concentration levels of substances hazardous to human health and the environment are recorded as exceeded. One of the main factors affecting the poor air quality in the region is road transport. It is not just a problem near roads with heavy traffic, but also applies to the cities, where there is a large movement of cars, which are often old and do not meet current environmental standards. This article aims to identify the main sources of low emission from road transport and identify potential solutions to help reduce emission from this sector. The actions aimed at limiting low emission from road transport can bring a significant positive ecological effect. The aim of this article is to review one of the main sources of low emission in the province of Lubuskie, which is transportation. Moreover, the authors of the paper indicate the main problems associated with the emission coming from road transport and describe the possibilities for opportunities to reduce pollution from this sector. In addition, the article presents the three-scenario simulation of annual emissions from passenger cars that could take place in 2020.

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## 1. Introduction

Poland has a very serious problem with excessive amount of harmful emissions that pollute the environment (Dzikuć, 2015). Due to the excessive air pollution in Poland each year die prematurely more than 48 thousand of people, which is several times

more than are killed in road accidents. In 2012, an estimated 6.5 million deaths in the world (11.6% of all global deaths) were associated with air pollution. According to the report of the WHO on the list of 50 cities with the most polluted air in Europe as many as 33 are located in Poland (World Health Organization, 2016). In 2015 the European Commission brought the case to the European Court of Justice in Luxembourg against Poland for failure to comply with EU air quality legislation (Wędzik et al., 2017). For too many air pollutants Poland has to pay a penalty of up to 1 billion euro. Although the analysis of previously conducted assessments of air quality indicates that the level of pollutants emitted into the

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atmosphere in Poland was reduced still the level of concentrations of certain substances in the air is considerably exceeded. A particular problem in Lubuskie and throughout the country is particulate matter PM<sub>2.5</sub>, which is particularly harmful to human health and life (Eeftens et al., 2015). Such small grains with no obstacles reach upper respiratory tracks, the lungs and pass into the blood (Polichetti et al., 2009). In the case of prolonged exposure to the increased concentrations of particulate matter, they can have a significant impact on the course of heart disease or increased risk of developing cancer. The bad air quality in Poland is mainly affected by low emission that comes from the pollutants released into the atmosphere with emitters not exceeding 40 m in height (Dzikuć and Adamczyk, 2015). The formation of low emission in Poland is mainly the effect of an installation for heating and means of communication (Burchart-Korol et al., 2016). The aim of this article is to review one of the main sources of low emission in the province of Lubuskie, which is transportation. Moreover, the authors of the paper indicate the main problems associated with the emission coming from road transport and describe the possibilities for opportunities to reduce pollution from this sector (Fameli and Assimakopoulos, 2015; Casals and García, 2015). It should be noted that low emission occurs typically at the level of up to 10 m, which is a problem especially during calm weather, as the pollution remains in the vicinity of their formation. This results in a significant negative impact on the people living nearby. The problem of emissions from the road transport sector relates specifically to congested cities and surrounding roads, which handle the increased vehicular traffic.

Transport in Europe is responsible for almost one quarter of greenhouse gas emissions and is a major cause of air pollution in cities. The European Union assumes that by 2050 greenhouse gas emissions from the transport sector should fall by at least 60% from the level taking place in 1990. In contrast, the emissions of harmful substances to human health from air transport into the atmosphere must be radically reduced (European Commission, 2016).

## 2. The road transport as a source of emissions to air in Poland

The emissions from road transport sector adversely affect human health and the environment, by producing about 10% of the impurities that reach the air in Poland. This share is slightly different in each province and the differences are affected by factors such as the number of roads, traffic and population density in the particular area. The pollutants, which mostly come from the transport sector are mainly:

- nitrogen oxides,
- carbon monoxide,

- suspended particulates PM<sub>10</sub> and PM<sub>2.5</sub>,
- aromatic hydrocarbons,
- heavy metals.

Among all the pollutants from road transport emitted into the air nitrogen oxides have the largest share. In 2014 nitrogen oxides coming from road transport had more than 30% share in the total emissions of the substance in Poland, which had the largest share in 2013 (Table 1). Although the amount of nitrogen oxide emissions is largely dependent on changes in emissions from fuel combustion processes in the energy and can be relatively quickly reduced by reducing the consumption of solid fuels (Dzikuć and Piwowar, 2016; Piwowar and Dzikuć, 2016), which shows an example of a significant part of the EU countries, in the case of road transport the amount of emissions in Poland is decreasing very slowly. Most of the reductions were caused by the decline of the heavy industry and lower share of coal in the late 1980s and early 1990s. Substantial emissions from road traffic contribute to the national total. Compared to the year 2013, in 2014 NO<sub>x</sub> emissions decreased by 6.5%. Decrease in emissions in road transport was caused by lower use of liquid fuels (Dębski et al., 2016). Although there is an increasing share of new cars that meet the environmental standards for newly manufactured vehicles, which emit significantly less NO<sub>x</sub> (Xu and Lin, 2016), however, the total number of vehicles on Polish roads increases. Emissions of NO<sub>x</sub> decreased by over 32% between 1990 and 2014. NO<sub>x</sub> and particulate matter had the highest share in the road emission in Poland (Table 2).

Another pollutant, which has a large share in the total emission in Poland is carbon monoxide. The emission of this substance is an important issue not only in the Lubuskie Province but throughout the country. The carbon monoxide emission in 2014 was over 20% share of the total emission in the country. It should be noted, however, that the level of carbon monoxide emission was slightly reduced in 2014 compared to 2013 (Table 3). CO emission in Poland depends mainly on changes in the quantities of used coal and wood for heating by households (Dzikuć, 2013). However, the high share of CO emission coming from road transport suggests that the total emission also strongly depends on the amount of fuels and

**Table 2**  
Emissions of NO<sub>x</sub> and particulate matter from road transport in Poland (Department of Climatology and Atmosphere Protection (2017)).

Specification	NO <sub>x</sub>	Particulate matter
Cars (weight up to 3.5 Mg)	50%	63%
Trucks (weight over 3.5 Mg)	38%	28%
Buses	6%	4%
Farm tractors	6%	5%
<b>Total</b>	<b>100%</b>	<b>100%</b>

**Table 1**  
Emissions of nitrogen oxides in Poland in years 2013–2014 (Dębski et al., 2016).

Emission source	Emissions of NO <sub>x</sub>				
	2013		2014		2014/2013 %
	Mg	%	Mg	%	
Combustion processes in the industry	68 210.7	8.81	67 975.1	9.40	99.65
Combustion processes in the production and transformation of energy	244 475.7	31.58	217 220.4	30.04	88.85
Combustion processes outside the industry	93 749.1	12.11	84 036.2	11.62	89.64
Production processes	23 454.5	3.03	23 776.6	3.29	101.37
The use of solvents and other products	0.1	0.00	0.1	0.00	100.00
Road transport	230 467.2	29.78	220 625.4	30.51	95.73
Other vehicles and equipment	100 387.5	12.97	96 832.2	13.39	96.46
Waste management	1719.4	0.22	1820.5	0.25	105.88
Agriculture	11 623.0	1.50	10 827.6	1.50	93.16
<b>Total</b>	<b>774 087.2</b>	<b>100.00</b>	<b>723 114.1</b>	<b>100.00</b>	<b>93.42</b>

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