DE GRUYTER
OPEN
DOI:
10.1515/manment-2015-0091

Management
2017
Vol. 21, No. 1
ISSN 1429-9321

MACIEJ DZIKUĆ
MARIA DZIKUĆ
MARIANNA SINIČÁKOVÁ

The social aspects of low emission management in the Nowa Sól district*

1. Introduction

The district of Nowa Sól and the entire Poland have a very serious problem with air quality. According to WHO, due to too high concentrations of harmful substances die about 48 thousand of people each year. The main reason for an excessive amount of air pollution is low emission, which is formed at a level of 40 m above the ground (Dzikuć, Adamczyk 2015). The most important low-emission sources include household boilers, used to heat buildings, small industrial plants and road transport (Talbi 2017). The solution to the problems related to low emission will be associated with many social problems, because it will be necessary to introduce solutions that will increase expenditure incurred by households. To reduce the problem of low emission it is necessary to properly manage the various types of instruments that will allow for the gradual introduction of a number of regulations without the opposition of the local community. The top-down introduction of regulations in a short period of time, which already exist in other EU countries could lead to incurring substantial costs by

Maciej Dzikuć, Ph.D.
University of Zielona Góra ,
Faculty of Economics
and Management
Maria Dzikuć, Ph.D.
University of Zielona Góra,
Faculty of Economics
and Management
Marianna Siničáková, Ph.D. Ass. Prof.
Technical University of Kosice,
Faculty of Economics

* This study was conducted and financed in the framework of the research project "Economic, ecological and social aspects of low emission limitations in the Middle Odra", granted by the National Science Centre in Poland, program SONATA, grant No. 2015/19/D/HS4/00210.

households that have already had a lot of economic problems. Different types of legal solutions should be supplemented by measures to prevent the further impoverishment of the population (Zarębska, 2013).

The aim of the article was to identify opportunities for the reduction of the negative environmental impact occurring mainly during the production of thermal energy in the household boilers in Nowa Sól Functional Area, the area of which is identical with the district of Nowa Sól. Moreover, aim of this article was to identify opportunities for the reduction of low emissions, which comes from road transport. The installations producing thermal energy used to heat the buildings often are fired with low-cost fuels, such as low-quality coal or coal silt, which is the waste coal (Urban, Dzikuć 2013). The use of this type of fuel should be limited in the first place. Besides, it is necessary to consider the introduction of regulations that limit low thermal installations, and so often consume twice as much fuel than systems based on newer technical solutions (Zarębska, Dzikuć 2013). Reducing the number of inefficient heating systems should give the greatest ecological effect of actions that can be taken to reduce low emission in the Middle Odra area (Piwowar, Dzikuć 2016). Apart from replacing energy inefficient boilers fired with solid fuel among many activities that should be undertaken in order to reduce low emission the attention should be particular paid to:

- limiting the number of old cars that do not meet current environmental standards,
- prohibiting the entry of older cars to cities centres,
- extending heating networks,
- expanding public transport, particularly in densely populated areas,
- reducing heat losses, especially in older buildings through a comprehensive thermal modernization.

2. Social problems related to low emissions in the Nowa Sól district

Nowa Sól Functional Area is located in the south-eastern part of the Lubuskie Province in the district of Nowa Sól. The whole territory of Nowa Sól Functional Area is situated in the Middle Odra, with an area of 771 km^2. On 31.12.2015 the district of Nowa Sól had a population of 87 339 citizens (Central Statistical Office of Poland, 2017). The district of Nowa Sól is located approx. 80 km from the Polish-German border. The district includes: municipality: Nowa Sól; urban and rural communes of Bytom Odrzański, Kożuchów, Nowe Miasteczko, rural communes: Kolsko, Nowa

Sól, Otyń, Siedlisko. The capital of the district is the town of Nowa Sól, which is an important transport hub of road, rail and water communication. Nowa Sól is a town with a high number of operators (tab. 1.) against the rest of Nowa Sól Functional Area. The district of Nowa Sól significantly reduced emissions, the source of which were particularly onerous industrial plants (tab. 2.). It should be stressed that the data in the table 2. do not include CO_2 emissions, which in 2015 amounted to 19 thousand of Mg and accounted for over 99% of all greenhouse gas emissions. (Plan Gospodarki Niskoemisyjnej dla Nowosolskiego Obszaru Funkcjonalnego, 2015).

Table 1. Number of economic entities in the Nowa Sól district divided into communes

Community	Number of economic entities - as at 30.09.2014.
Nowa Sól - City	2 329
Nowa Sól - Commune	329, including 40 production plants
Bytom Odrzański	380, including 6 production plants
Kolsko	161, including 2 production plants
Nowe Miasteczko	300, including 14 production plants
Kożuchów	717, including 4 production plants
Siedlisko	80
Otyń	387, including 13 production plants production plants production plants

Source: Plan Gospodarki Niskoemisyjnej dla Nowosolskiego Obszaru Funkcjonalnego, Pracownia Projektowa ARCHIDROG, Poznań 2015, p. 27

Table 2. Emission of air pollutants from enterprises especially harmful to the environment in the Nowa Sól district (2011-2015)

Years	Gaseous pollutants (excluding carbon dioxide) Mg	Particulate pollutants Mg
2011	257	52
2012	274	48

2013	175	42
2014	133	29
2015	180	19

Source: Central Statistical Office of Poland www.stat.gov.pl (10.01.2017 – date of access)

The problem of low emissions in the Nowa Sól district is mainly related to the low income of a large part of the population living in the area. However, this is not the only reason for this. There are a number of other reasons that directly affect the poor air quality in the area of the Nowa Sól district. These include social issues such as the lack of knowledge about the harmful effects of low-quality combustion of fuels and waste in home boiler houses and the use of old and not ecological cars (Dzikuć, Adamczyk, Piwowar, 2017). Unfortunately, it is often the case that residents of the Nowa Sól district burn their fuel and waste in their furnaces, even though they know what the consequences are. Some people in the Nowa Sól district ignore ecological issues that are related not only to the environment but also to the health of people. Unfortunately, some people think that their actions have little impact on the environment. Although the inhabitants of the Nowa Sól district, whose actions contribute to the deterioration of air quality, are not the overwhelming majority, it is still too much. It turns out that the actions of some residents lead to the crossing of certain harmful substances in the air.

3. Analysis of the current situation and planned actions to reduce the emission in the Nowa Sól district

Despite the significant reduction of emissions from industrial plants still an unsolved problem remains the issue of low emission, which mainly comes from the boiler rooms located in detached houses, which are equipped with installations of the old type, usually coal-fired. (Adamczyk, Dzikuć 2014). The scale of the problem can be provided by the level of PM10 emission. The poor air quality in the district of Nowa Sól and throughout the country has taken place continuously for many years (European Commission, 2017). It is worth noting that the EU rules on air quality require Member States not to exceed the annual limit value of PM10 concentration of 40 $\mu g/m^3$. It should be noted that individual member states set different alarm levels (Piwowar, Dzikuć, Adamczyk 2016). In Poland, the alarm level for PM10 is as high as 300 $\mu g/m^3$. This is a very high level,

as compared to the Czech Republic and Hungary, the alarm level is announced when the concentration of PM10 is three times lower than in Poland (100 µg/m^3). Moreover, in Poland a day allowable concentration of PM10 was set at 50 µg/m^3 and this value should not be exceeded more than 35 times in a calendar year (Dyrektywa 2008/50/WE, 2008). In practice, many cities in Poland are not able to meet this requirement. The failure to implement the solutions that will reduce dust emissions, may result in the imposition of penalties on Poland of billions of PLN (Dzikuć, Łasiński 2014). Also, in the district of Nowa Sól, and the whole Lubuskie, the measurements of emission into the atmosphere in 2013-2014 showed that a major problem in air pollution are too high concentrations of PM10, which took place in the vicinity of each of the six locations where the measurements are taken (Susek 2015).

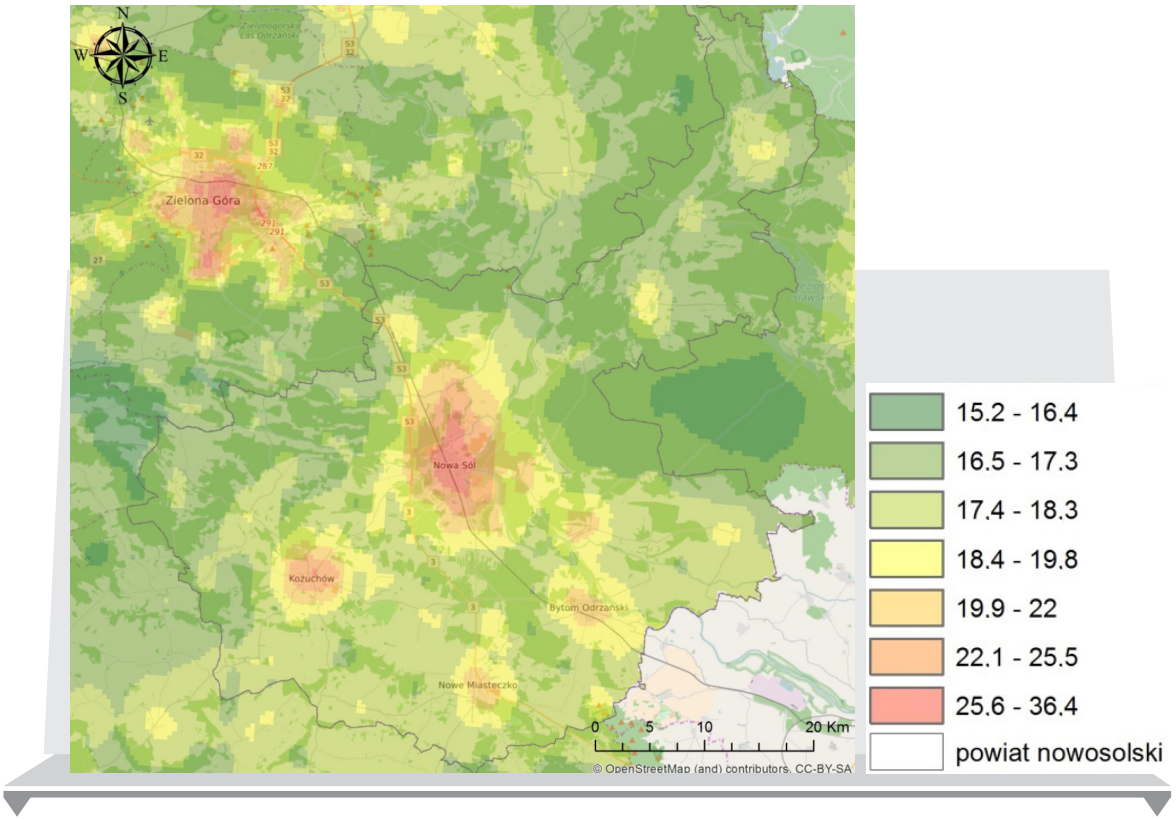

Figure 1. The average annual concentration of PM10 [µg/m^3] in the Nowa Sól district in 2015

Source: Informacja o stanie środowiska w powiecie nowosolskim na tle wyników badań kontrolnych i monitoringowych przeprowadzonych w 2015 r. w województwie lubuskim, Wojewódzki Inspektorat Ochrony Środowiska w Zielonej Górze, Zielona Góra 2016, p. 29

In the district of Nowa Sól dominate household boilers fired with solid fuels (mainly coal and wood). In the municipalities their share is 70-90% (Plan Gospodarki Niskoemisyjnej dla Nowosolskiego Obszaru Funkcjonalnego 2015).

Although the main reason for poor air quality in the district of Nowa Sól are household boilers, also emission from road transport is a major source of emissions in the analysed area. One of the substances that gets into the air during transport by road are nitrogen oxides (NO_x). NO_x emission has a high share of total emissions of this pollutant in Poland and is over 30%. It should be noted that despite the increase in the share of new cars that meet current environmental standards, however, the total number of vehicles on the roads of the district of Nowa Sól increases.

During the combustion of liquid fuels in car engines into the air are emitted gas and dust pollutants generated during the wear and tear of vehicles and roads. Apart from a large local traffic taking place especially in urban areas an additional problem for the district of Nowa Sól is transit traffic. The places in fig. 2. with an increased level of nitrogen dioxide emission coincide not only with the town of Nowa Sól, but also the course of the national road no. 3 (north-south), which during the day was passed by an average of about 15 thousand of cars in the first half of 2015. The traffic in the district of Nowa Sól is constantly increasing, not only because of the rapidly growing Kostrzyn-Slubice Special Economic Zone Inc. having its branch in Nowa Sól, but also because of a much larger number of cars (Generalna Dyrekcja Dróg Krajowych i Autostrad 2016).

For a full picture of the problem of the presence of the increased levels of pollutants in the district of Nowa Sól it would be also necessary to add two drawings presenting the average annual concentration of particulate matter PM2,5 and benzo(a)pyrene. These are substances whose source is mainly low emission and their increased concentration levels pose a serious threat to human health. The drawings of average annual concentrations of suspended particulate matter PM2.5 and benzo(a)pyrene were not included in the article due to editorial limitations. It should be noted, however, that the increased concentration levels of the presence of the indicated substances are very close to the average annual levels of PM10, as shown in fig. 1.

The level of emissions in the district of Nowa Sól is also affected by the emissions that come from Germany (fig. 3). In this part of Poland it is particularly important due to prevailing in this part of the country the directions of winds that usually blow from the west (fig. 4). However, the values shown in fig. 3 indicate that emissions from abroad are not dominant and mostly local emitters of pollutants are responsible for the poor air quality in the district of Nowa Sól.

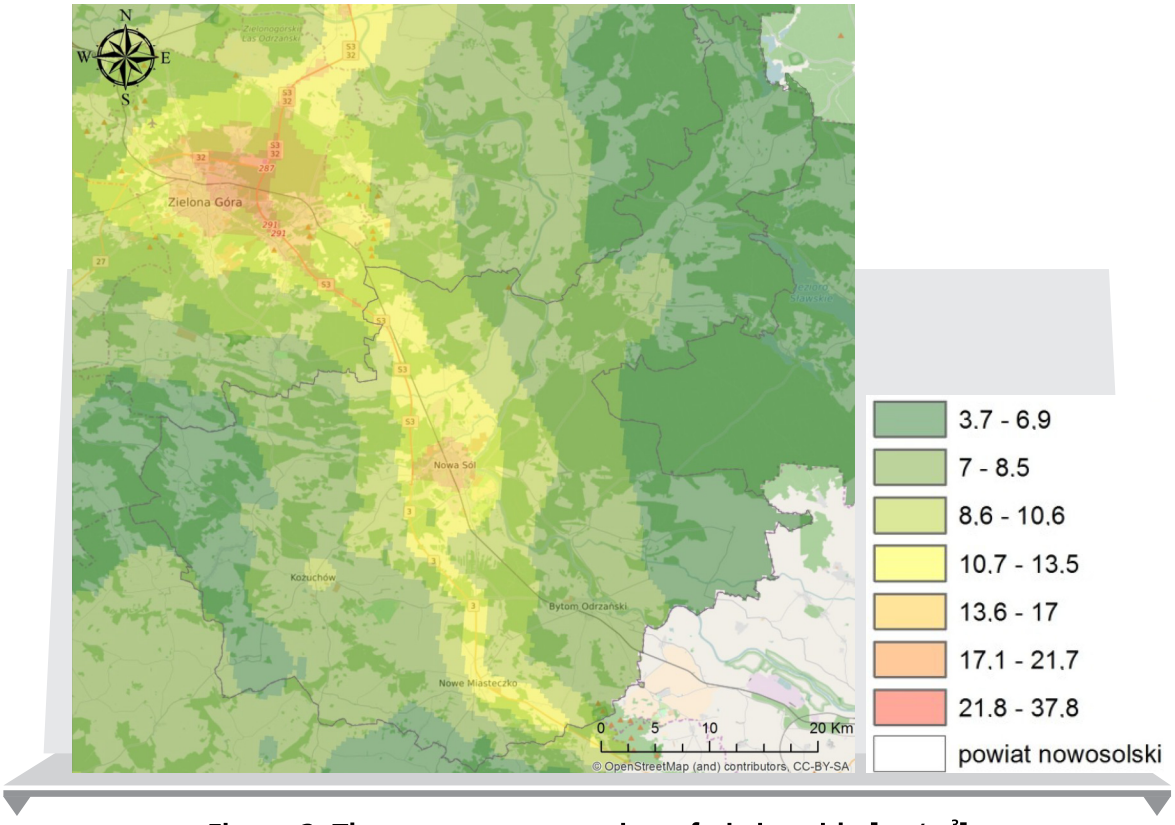

Figure 2. The mean concentration of nitric oxide [µg/m^3] in the Nowa Sól district in 2015

Source: Informacja o stanie środowiska w powiecie nowosolskim na tle wyników badań kontrolnych i monitoringowych przeprowadzonych w 2015 r. w województwie lubuskim, Wojewódzki Inspektorat Ochrony Środowiska w Zielonej Górze, Zielona Góra 2016, p. 32

Analysing the records contained in the document of Low Carbon Economy Plan for Nowa Sól Functional Area it should be noted that their implementation may not be sufficient to achieve dramatic reductions in the levels of concentrations of harmful substances to the environment and human health. The document rightly points to a number of actions that will help to some extent reduce low emission, according to the authors, however, they do not eliminate this problem satisfactorily. Low Carbon Economy Plan indicates, among other things: increasing the production of renewable energy, energy efficiency, promoting energy efficiency in enterprises. Low Carbon Economy Plan also indicates the sources of funding of the established ventures and they are: Operational Programme Infrastructure and Environment for 2014-2020,

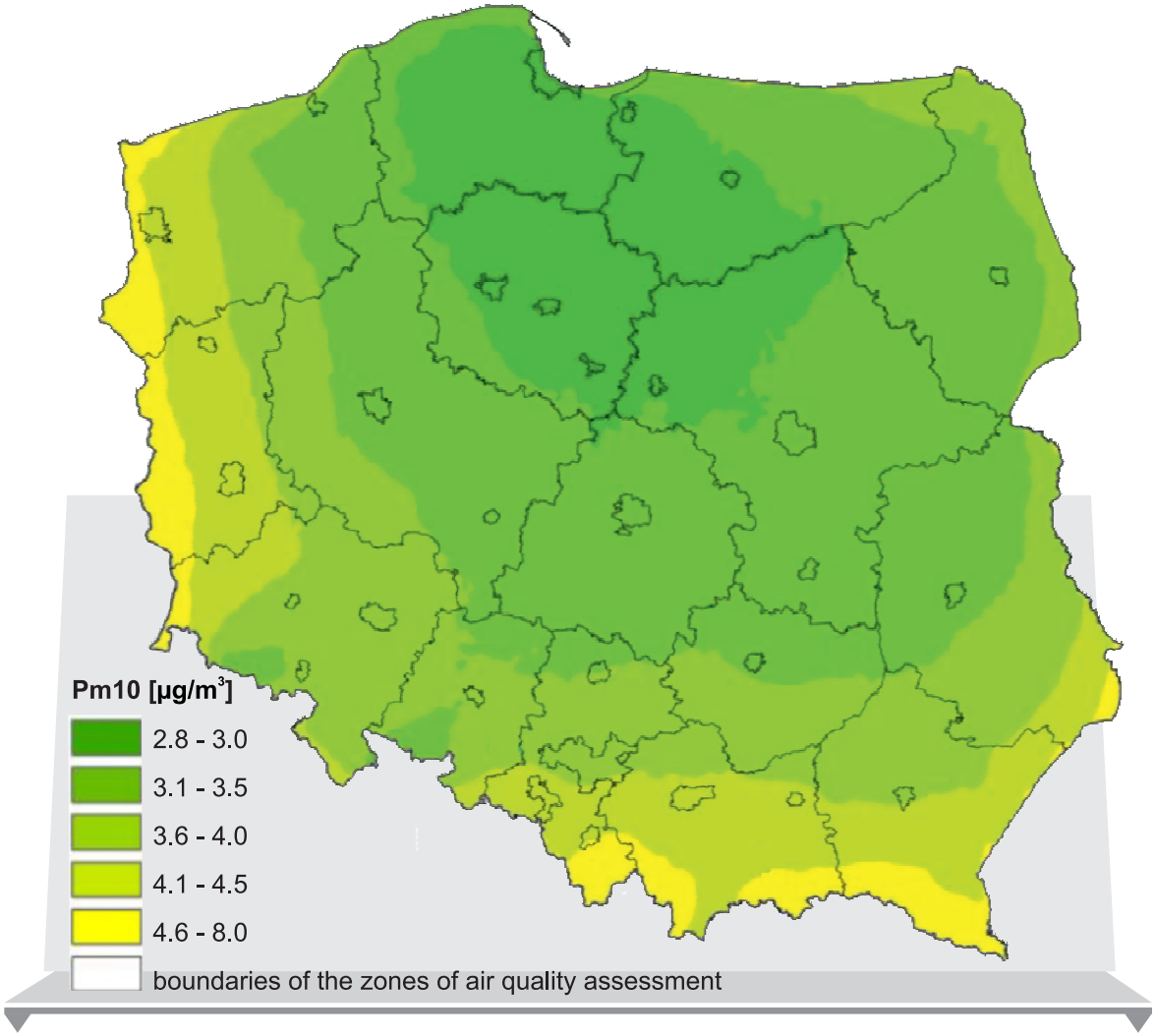

Figure 3. Emissions of PM10 from neighboring countries in 2015

Source: Kobus D., Iwanek J., Kostrzewa J., Mitosek G., 2016. Ocena jakości powietrza w strefach w Polsce za rok 2015. Instytut Ochrony Środowiska - Państwowy Instytut Badawczy, Warszawa, pp. 67

Regional Operational Programme - Lubuskie 2020 and the National Fund for Environmental Protection and Water Management (Plan Gospodarki Niskoemisyjnej dla Nowosolskiego Obszaru Funkcjonalnego, 2015). The description of planned activities in the analysed document is presented in very general terms and the established rates to achieve will slightly help to reduce the low emission of the Nowa Sól district.

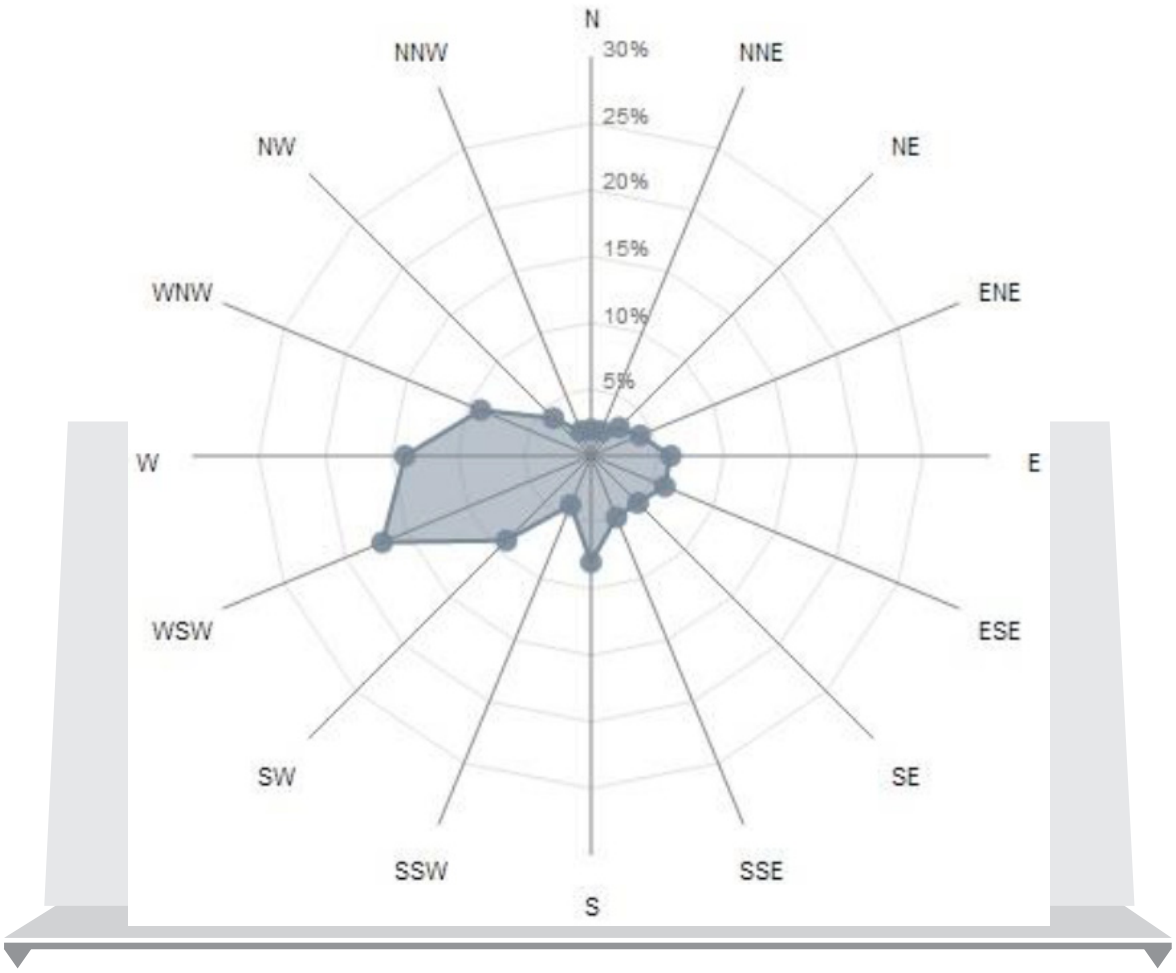

Figure 4. The distribution of wind directions [%] in Zielona Gora in 2015

Source: M. Krauze-Biernaczyk, P. Czarniecka, E. Kociołek: Roczna ocena jakości powietrza w województwie lubuskim, Wojewódzki Inspektorat Ochrony Środowiska w Zielonej Górze, Zielona Góra 2016, p. 15

Although the solution to the problem of low emission in the district of Nowa Sól will be linked to the higher costs incurred by the local community for heating homes, it should be noted that there is a growing public support for pro-ecological solutions. Including far-reaching solutions. An example of this might be a decision taken on 23 January 2017 by the councillors of the Malopolska Province. They took unanimously an anti-smog resolution, which is valid across the whole region of Malopolska. According to the resolution in mid-2017 there will be a total ban on burning silt, carbon fleets and wet wood

in boilers (with humidity above 20%) throughout the province. In addition, there will be a ban on the installation of boilers and fireplaces that do not meet environmental standards. Presently use of inefficient energy boilers of the old type are to be replaced by 2022. In the case of boilers that meet the emission requirements of at least grade 3, however, the replacement is to take place by the end of 2026 years. The resolution was adopted without violent social protests and was preceded by long months of consultations with the residents of the province of Malopolska. Nevertheless, the passed resolution has caused the concern of the municipalities on the economic impact for residents. The resolution assumes that the newly installed boilers and fireplaces will not be allowed to emit more than 40 mg/m^3 of dust.

Although the resolution taken by the council of Malopolska contains provisions that are the most stringent and any other province in Poland has not introduced this type of solutions, it should be noted that it will not apply in Kraków, because in this area the council of Kraków has adopted more far reaching regulations. The anti-smog resolution concerning Kraków implies a total ban on the use of coal and wood boilers, stoves and fireplaces from 1 September 2019.

4. Conclusions

Due to the fact that the household boilers have the largest share in total low emission taking place in the district of Nowa Sól, a special attention should be paid to this problem. In an effort to reduce low emission it should be carried out thermo-modernization of residential buildings with the replacement of old boilers with solid fuels. Due to the fact that a significant number of people living in the district of Nowa Sól does not have financial resources to carry out this type of investment, it is necessary to focus on activities that will be able to bring the biggest environmental effect in relation to the involved financial resources. Furthermore, it is necessary to enter all sorts of financial incentives for residents to persuade them to replace outdated heating equipment with newer and more environmentally friendly. In parallel, it should be considered the restrictions that will apply to the energy class of boilers used in the district of Nowa Sól. Moreover, the regions with the highest concentrations of harmful substances in the air should consider prohibiting the use of certain solid fuels, especially in terms of lower-quality coal.

A separate issue is pollution from road transport. Some of the possible measures to introduce is within the responsibility of local authorities and it is

necessary to consider undertaking them. Leading the prudent management of traffic on densely populated areas it is possible to significantly reduce emissions from road transport. The first step to reduce low emission from road transport could be the exclusion of city centres from traffic.

Actions undertaken so far to reduce low emissions have been insufficient. Unfortunately, the planned activities are also failing to ensure the improvement of air quality. In order to reduce the level of harmful substances in the air, apart from educational activities, a number of regulations should be implemented to force the inhabitants of the Nowa Sól district into ecological attitudes. It turns out that this is possible without the radical opposition of citizens. Although residents will have to pay higher costs associated with heating of apartments or car transport. An example may be the implementation of radical legal solutions in Kraków, which were preceded by an information campaign on the impact of bad air quality on human health.

It should be emphasized that it is necessary to continue to monitor the measures to reduce emissions low in the Nowa Sól district. It should also be undertaken to analyze the work to reduce low emissions in terms of their effectiveness and consider the possibility of implementing solutions, which gave the desired effect in other parts of the Middle Odra and Poland.

Summary

The social aspects of low emission management in the Nowa Sól district

The article shows the problem of excessive low emission in the district of Nowa Sól and points to the social issues that can affect a delay in the introduction of specific environmental actions. The article also identifies the main sources that contribute to the formation of low emission in the district of Nowa Sól. Moreover, it noted the actions planned to be taken in the area of the Nowa Sól district to reduce low emission and their evaluation has been made. There has been also pointed to the direction of the management of low emission, which will have to be taken in order to significantly reduce the low emission of the analysed area and the solutions, already introduced in Poland without a public outcry, have been identified. At the end of the paper the conclusions have been presented.

Keywords: *low emissions, economy, ecology, heat energy.*

Streszczenie

Społeczne aspekty zarządzania niską emisją na terenie powiatu nowosolskiego

W artykule przedstawiono problem występowania nadmiernej niskiej emisji na terenie powiatu nowosolskiego oraz wskazano na kwestie społeczne, które mogą wpływać na opóźnienie wprowadzenia określonych działań proekologicznych. W artykule wskazano również na główne źródła, które przyczyniają się po powstawania niskiej emisji w powiecie nowosolskim. Ponadto wskazano na działania, które planuje się podjąć na obszarze powiatu nowosolskiego w celu ograniczenia niskiej emisji oraz dokonano ich oceny. Wskazano również na kierunki zarządzania niską emisją, które będą musiały być podjęte w celu znaczącego ograniczenia niskiej emisji na analizowanym obszarze oraz wskazano rozwiązania, które zostały już wprowadzone na terenie Polski bez protestów społecznych. Na zakończenie przedstawiono wnioski.

Słowa kluczowe: *niska emisja, ekonomia, ekologia, energia cieplna.*

References

1. Adamczyk J., Dzikuć M. (2014), *The analysis of suppositions included in the Polish Energetic Policy using LCA technique - Poland case study*, Renewable and Sustainable Energy Reviews, Vol. 39.
2. Central Statistical Office of Poland www.stat.gov.pl (10.01.2017 – date of access).
3. *Dyrektywa 2008/50/WE z dnia 21 maja 2008 r. w sprawie jakości powietrza i czystszego powietrza dla Europy*, Dz.U. L 152 z 11.6.2008, pp. 1-44.
4. Dzikuć M., Adamczyk J. (2015), *The ecological and economic aspects of a low emission limitation: a case study for Poland*, International Journal of Life Cycle Assessment, Vol. 20, No. 2.
5. Dzikuć M., Adamczyk J., Piwowar A. (2017), *Problems associated with the emissions limitations from road transport in the Lubuskie Province (Poland)*, Atmospheric Environment, Vol. 160.
6. Dzikuć M., Łasiński K. (2014), *Technical and economisc aspects of biomass co-firing in coal-fired boilers*, International Journal of Applied Mechanics and Engineering, Vol. 19, No. 4.
7. European Commission (2017), *Commission refers POLAND to the Court of Justice of the EU over poor air quality* http://europa.eu/rapid/press-release_IP-15-6225_en.htm (12.01.2017 – date of access).

8. Generalna Dyrekcja Dróg Krajowych i Autostrad http://www.gddkia.gov.pl/ (21.12.2016 – date of access).
9. *Informacja o stanie środowiska w powiecie nowosolskim na tle wyników badań kontrolnych i monitoringowych przeprowadzonych w 2015 r. w województwie lubuskim*, Wojewódzki Inspektorat Ochrony Środowiska w Zielonej Górze, Zielona Góra 2016 r. p. 32.
10. Kobus D., Iwanek J., Kostrzewa J., Mitosek G. (2016), *Ocena jakości powietrza w strefach w Polsce za rok 2015*. Instytut Ochrony Środowiska - Państwowy Instytut Badawczy, Poland, Warszawa, pp. 67.
11. Krauze-Biernaczyk M., Czarniecka P., Kociołek E. (2016), *Roczna ocena jakości powietrza w województwie lubuskim*, Wojewódzki Inspektorat Ochrony Środowiska w Zielonej Górze, Zielona Góra, p. 15.
12. Piwowar A., Adamczyk J., Dzikuć M. (2016), *Agricultural biogas plants in Poland - selected technological, market and environmental aspects*, Renewable and Sustainable Energy Reviews, Vol. 58.
13. Piwowar A., Dzikuć M. (2016), *Outline of the economic and technical problems associated with the co-combustion of biomass in Poland*, Renewable and Sustainable Energy Reviews, Vol. 54.
14. *Plan Gospodarki Niskoemisyjnej dla Nowosolskiego Obszaru Funkcjonalnego*, Pracownia Projektowa ARCHIDROG, Poznań 2015, pp. 27-82.
15. Susek P. (red:), *Stan środowiska w województwie lubuskim w latach 2013 - 2014*, Wojewódzki Inspektorat Ochrony Środowiska w Zielonej Górze, Zielona Góra 2015, p. 45.
16. Talbi B. (2017), *CO_2 emissions reduction in road transport sector in Tunisia*, Renewable and Sustainable Energy Reviews, Vol. 69.
17. Urban S., Dzikuć M. (2013), *Wpływ na środowisko wytwarzania energii elektrycznej w elektrowniach opalanych węglem kamiennym*, Ekonomia i Środowisko, No. 2.
18. Zarębska J. (2013), *Ekologiczne i ekonomiczne aspekty gospodarki odpadami opakowaniowymi w województwie lubuskim*, Oficyna Wydawnicza Uniwersytetu Zielonogórskiego, Zielona Góra.
19. Zarębska J., Dzikuć M. (2013), *Determining the environmental benefits of life cycle assessment (LCA) on example of the power industry*, Scientific Journals Maritime University of Szczecin, Vol. 34.