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Low Emission Zones in Municipal Adaptation Plans as an Example of Local Adaptation to Climate Changes

Introduction

The climate changes that have taken place since the mid-twentieth century, such as the increasing temperature of the atmosphere and oceans, the diminishing mass of snow and ice, have been unprecedented for millennia.¹ The effects of climate changes include: rising sea levels; acidification of oceans; diminishing extents of components of our cryosphere, particularly glaciers, permafrost, Greenland's ice sheet, and the ice cap of Antarctica; changing distributions of fresh and saltwater; changes in size and distribution of habitats (shrinking for native species and growing for invasive species); the spreading of diseases that have been limited by climate conditions in the past; destabilization of ecological systems, particularly the loss of coral reefs; mismatches between soils and climates, hydrological patterns, plant and animal life, weather processes, and seasonality, thus undermining global and local food production; and changing patterns of hazards related to and linked to all of these impacts that will dislocate and force the relocation of human populations, causing further tumult.² Some of these effects are global in scale (acidification of seas), others affect agriculture in particular (e.g. droughts, changes in farming structure), others still are experienced in urban centres (heat waves, flash floods). Nowadays, municipalities have an important role to play in both mitigating and adapting to changes in their local environment. This is so not only because of the concentration of population and economic assets in urban areas, but also because local authorities perform key functions that are central

¹ W. Szymański, A. Kasenberg, E. Świerkula, *Poradnik adaptacji miasta do zmiany klimatu*, Instytut na rzecz Ekorozwoju, Warszawa 2019, p. 12.

² J.P. Tiefenbacher, "Introductory Chapter: Climates, Change, and Climate Change" [in:] *Global Warming and Climate Change*, ed. John P. Tiefenbacher, IntechOpen 2020, <https://www.intechopen.com/books/global-warming-and-climate-change/introductory-chapter-climates-change-and-climate-change> [accessed: 2021.01.28].

to climate adaptation, such as land use regulation or emergency planning,³ as well as implementing climate change adaptation policies.⁴

Owing to the fact that currently more than 50% of the world's population live in cities and that this number will reach 66% in the latter half of the twenty-first century,⁵ we focus our attention here on the adaptation to climate changes in urban areas. In this context, the actions pertaining to the paradigm shift in spatial planning, development of green and blue infrastructure, and investments in public transportation are commonly mentioned; the relationship between effects of the climate changes experienced in cities and air pollution is less well-known. The specialist literature confirms the relation between emissions of VOCs, CO₂, as well as other chemical compounds, and the increase of temperature in cities. This is manifested in the phenomenon called the urban heat island (UHI), which, for the authors of this paper, signifies that reducing emissions may result in a synergy effect between combating climate changes on a local scale, improving air quality, and bolstering resistance of cities to climate changes.

Our goal is to verify the existence of the awareness of the relation between the reduction of air pollution and the resistance of cities to climate changes, on the grounds of the analysis of municipal adaptation plans for climate changes (MAPs) adopted within the framework of the "Wczujmy się w klimat" (let's feel the climate) project implemented in the years 2017–2019 by the Polish Ministry of the Environment for forty-four cities with a population exceeding 100,000 residents. We conduct these studies from the perspective of the inclusion of low emission zones (LEZs) in the adopted MAPs, which constitute an instrument projected in the Act on electromobility and alternative fuels. We assume that establishing a LEZ may constitute one of the adaptation actions improving the resistance of cities to climate changes, because a LEZ is established "in order to prevent adverse influence on health and environment related to the emission of transportation-related pollution,"⁶ and thus may result in reducing emission levels and contribute to decreasing the UHI nuisance and heat stress of the residents.

The following study utilizes the dogmatic-legal method (logic-language) as well as the teleological and synthesis methods. The findings of studies other than legal studies were also utilized to the extent of their usefulness in augmenting the argumentation concerning the relation between the local effects of the urban heat island and air quality. The justifications incorporated into the first LEZ in Poland (Kraków) were also used, as well as the statements of the authorities formulating and executing environment protection laws – in relation to researching the goals of legal regulations. Soft

³ *Urban adaptation in Europe: How cities and towns respond to climate change*, EEA Report 2020, No. 12, p. 9.

⁴ M. Araos, L. Berrang-Ford, J.D. Ford, S. Austin, R. Biesbroek, A. Lesnikowski, "Climate change adaptation planning in large cities: A systematic global assessment", *Environmental Science & Policy* 2016, vol. 66(C), p. 376.

⁵ World Cities Report 2016: *Urbanisation and Development – Emerging Futures*, UN-Habitat 2016, p. III.

⁶ Art. 39, section 1 of the Act of 11 January 2018 on electromobility and alternative fuels (Journal of Laws 2021, item 110).

law studies were also taken into account: communications and guidelines of the European Union institutions, national and foreign legal studies (doctrinal research), as well as other studies such as the reports created by non-governmental organizations and EU agencies. In the area of non-legal sources we worked on the basis of the forty MAPs prepared and accepted within the framework of the "Wczujmy się w klimat" project through the use of the contents analysis method, understood as a research technique for objective, comprehensive, and quantitative description of the public contents of statements.⁷

1. Adaptation to climate changes and air pollution

The legal instruments realizing the political goals targeted at limiting the effects of climate changes, jointly referred to as climate protection law or climate law, cover two principal groups of instruments: mitigation measures and adaptation measures. For a long time the former were assigned greater importance under the assumption that humanity is able to limit the human influence on the condition of the climate. However, over time (beginning with the Paris agreement which concluded the 2015 United Nations Climate Change Conference) a greater importance began to be assigned to adaptation actions, probably as a result of the belief that stopping climate changes will be impossible and that, thus, also adaptation measures have to be taken.⁸ Therefore, nowadays adaptation has been widely recognized as an equally important and complementary response to greenhouse gas mitigation.⁹ According to the IPCC, adaptation in human systems is the process of adjustment to actual or expected climate change and its effects, in order to moderate harm or exploit beneficial opportunities; in natural systems, adaptation is the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to the expected climate.¹⁰

According to the OECD, cities are facing the greatest challenges related to adapting to climate changes.¹¹ Cities are directly threatened by three phenomena in particular:

⁷ K. Szczepaniak, "Zastosowanie analizy treści w badaniach artykułów prasowych – refleksje metodologiczne", *Acta Universitatis Lodzensis, Folia Sociologica* 2012, No. 42, p. 84.

⁸ I. Przybojewska, "Międzynarodowe rozwiązania dla kwestii klimatycznej sprzed porozumienia w Paryżu" [in:] *Problemy pogranicza prawa administracyjnego i prawa ochrony środowiska*, eds A. Kaźmierska-Patrzyzna, P. Korzeniowski, M. Stahl, Warszawa 2017, p. 245.

⁹ S. Agrawala, M. Carraro, N. Kingsmill, E. Lanzi, M. Mullan, G. Prudent-Richard, *Private Sector Engagement in Adaptation to Climate Change: Approaches to Managing Climate Risks*, OECD Environment Working Papers, No. 39, OECD Publishing, Paris 2011, p. 11, <http://dx.doi.org/10.1787/5kg221jkf1g7-en> [accessed: 2021.01.28].

¹⁰ IPCC, "Summary for Policymakers" [in:] *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation, Special Report of the Intergovernmental Panel on Climate Change*, eds C.B. Field, V. Barros, T.F. Stocker et al., Oxford University Press 2012, p. 5, https://www.ipcc.ch/site/assets/uploads/2018/03/SREX_Full_Report-1.pdf. [accessed: 2021.01.28].

¹¹ *Integrating Climate Change Adaptation into Development Co-operation*, Policy Guidance, OECD Paris 2009, pp. 4–20; see also: *Urban Adaptation in Europe: How Cities and Towns Respond to Climate Change*, EEA Report 2020, no. 12.

the intensification of the urban heat island phenomenon, the major torrential rains resulting in flooding, and droughts, which contribute to water deficits in cities.¹² The literature emphasizes that the scale and the area of influence of the phenomena indicated above are directly dependent on the size of a city, its internal urban structure, and the number of its residents, as well as on the extent of their activity; from among these phenomena the so-called urban heat island (UHI) is considered to be the most characteristic and is the best researched feature of the urban climate.¹³ In general terms, a UHI is an increase in the ambient city temperature in comparison to the surrounding areas as a result of anthropogenic modification of land surfaces, urban expansion, population growth, energy use, and its consequent generation of waste heat which causes alarming effects in many metropolitan areas.¹⁴ This phenomenon is further bolstered by increasing temperature, which contributes to thermal stress, stagnation of air over a city, increased concentration of air pollution, including free-floating particulate matter and smog.¹⁵ According to the European Environment Agency (EEA), "air pollution in urban areas not only places additional stress on humans, but some pollutants synergize with heat. Hot weather exacerbates air pollution through increased formation of ground-level ozone and, because hot periods usually coincide with dry periods, more particulate matter remains in the air".¹⁶ Thus, the organisms weakened by sustained heat waves react more strongly to pollutants in air.¹⁷ This relationship is the object of analysis by both the World Health Organization (WHO)¹⁸ and the domestic subject literature.¹⁹ Moreover, temperature is clearly not the only predictor of

¹² Polish National Strategy for Adaptation to Climate Change by 2020 with the perspective by 2030, p. 31.

¹³ K. Fortuniak, *Miejska Wyspa ciepła. Podstawy energetyczne, studia eksperymentalne, modele numeryczne i statystyczne*, Łódź 2003, p. 14, http://meteo.geo.uni.lodz.pl/kf/publikacje_kf_PDF/r2003_Miejska_Wyspa_Ciepła.pdf [accessed: 2021.01.27].

¹⁴ Y. Lee, M. Fadhil, P. Mohanadoss, Z. Z. Noor, K. Iwao, S. Chelliapan, "Overview Of Urban Heat Island (UHI) Phenomenon Towards Human Thermal Comfort", *Environmental Engineering and Management Journal* 2014, No. 16(9), p. 2098.

¹⁵ Polish National Strategy..., p. 31.

¹⁶ *Challenges and Opportunities for Cities Together with Supportive National and European Policies*, EEA Report 2012, No. 2, p. 30, <https://www.eea.europa.eu/publications/urban-adaptation-to-climate-change> [accessed: 2021.01.21] See also: Q.H. Weng, S.H. Yang, "Urban Air Pollution Patterns, Land Use, and Thermal Landscape: An Examination of the Linkage Using GIS", *Environmental Monitoring and Assessment* 2006, No. 117, p. 463; see also: L.W. Lai, W.L. Cheng, "Air Quality Influenced by Urban Heat Island Coupled with Synoptic Weather Patterns", *Science of the Total Environment* 2009, No. 407(8), p. 2724.

¹⁷ Z.M. Karaczun, W. Michalak, *Wpływ zmiany klimatu i zanieczyszczenia powietrza na zdrowie mieszkańców Warszawy*, Warszawa 2019, p. 22.

¹⁸ *Improving Environment and Health in Europe: How Far Have We Gotten?*, WHO Regional Office for Europe, Copenhagen 2015, pp. 28–34.

¹⁹ Z. Cichocki, M. Hajto, A. Romańczak, M. Sadowski, "Wrażliwość miasta Kalisza na zmiany klimatu – studium przypadku", *Inżynieria Ekologiczna/Ecological Engineering* 2016, No. 49, p. 12; J. Nidzgorska-Lenciewicz, A. Mąkosza, "Specyficzne cechy klimatu miasta w aspekcie zdrowia człowieka", *Kosmos* 2016, No. 4, p. 638; see also: B. Degórska, "Wrażliwość i adaptacja dużych miast do zmian klimatu w kontekście wzrostu temperatury powietrza", *Biuletyn KPZK PAN* 2014, No. 254, p. 39, and *eadem*, M. Degórski, *Influence of Climate Change on Environmental Hazards and Human Well-Being in the Urban*

ground-level ozone concentration. The main drivers behind this phenomenon are the concentrations of ozone precursors: NO_x and volatile organic compounds (VOCs). NO_x is emitted during fuel combustion, for example by road transport and industrial facilities. VOCs are emitted from a large number of sources including paint, road transport, refineries, dry-cleaning, and other solvent uses.²⁰

The results of the EEA report indicate the existence of a synergy effect between climate change effects and air pollution, as well as between the increase of temperatures in cities and the increased level of NO_x and VOCs. This correlation allows us to recognize the air protection instruments as a principal adaptation tool alongside green and blue infrastructure.²¹

The air protection instruments covering the command-and-control tools (emission permits) which constitute the foundation of the so called emission law,²² exposure concentration obligation, and the strategic documents (air protection programmes including a low emission component, short-term action plans, and so-called anti-smog acts – acts introducing bans or restrictions concerning exploitation of fuel-burning installations²³) together constitute the quality protection system for this component of the environment.²⁴ The latest constituents of this system are the instruments incorporated in Directive 2009/33/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of clean and energy-efficient road transport vehicles.²⁵

All the air quality protection instruments listed above may support developing the resistance of cities to the effects of climate changes. The authors believe that reaching goals in the field of adaptation to climate changes in terms of reducing UHI and thermal stress through the reduction of air pollution may be achieved through the use of the Low Emission Zone (LEZ) instrument. Our goal is to verify whether such an approach was included in the municipal adaptation plans adopted within the framework of the “Wczujmy się w klimat” project; until now this issue has not yet become a subject of analysis in the domestic subject literature.

Areas — Warsaw Case Study Versus General Problems [in:] *Climate Change, Extreme Events and Disaster Risk Reduction: Towards Sustainable Development Goals*, eds S. Mal, R.B. Singh, Ch. Huggel, Sustainable Development Goals Series, Springer International Publishing 2018, pp. 43–57.

²⁰ *Challenges and Opportunities for Cities...*, pp. 30–31.

²¹ Polish National Strategy..., pp. 32–33.

²² P. Korzeniowski, “Standardy emisyjne jako instrument prawa emisyjnego” [in:] *Standardy współczesnej administracji*, eds Z. Duniewska, M. Stahl, A. Rąbiega-Przyłęcka, Warszawa–Łódź 2019, p. 594.

²³ See more: J. Lemańska, “Uchwały ‘antysmogowe’” [in:] *Problemy pogranicza prawa administracyjnego i prawa ochrony środowiska*, eds M. Stahl, P. Korzeniowski, A. Kaźmierska-Patrzyzna, Warszawa 2017.

²⁴ M. Górski, “Prawna ochrona jakości środowiska jako element działań na rzecz rozwoju zrównoważonego (na przykładzie przepisów o ochronie jakości powietrza)” [in:] *Międzynarodowe prawo ochrony środowiska XXI wieku*, eds Z. Galicki, A. Gubrynowicz, Warszawa 2013, p. 234.

²⁵ OJ L 120, 15.5.2009, pp. 5–12 with amendments.

2. The concept of clean transportation and LEZs as an air protection instrument

The issue of clean, low emission transportation has long since been the object of interest of the European Union. Within the framework of the European policies, the Commission has established the main goals for sustainable EU transportation indicating that these goals must satisfy the economic, social, and environmental needs of society.²⁶ They also serve to secure mobility, environmental protection, and increasing innovation, and through ensuring these goals they place the EU as a leader in the field of sustainable technical solutions for transportation.²⁷

The premises of the EU transportation policy concerning low emission transport in the field of land transportation are focused on technical aspects related to determining the production and exploitation requirements for means of transportation (maximum standards for CO₂ emission), particularly for passenger cars and heavy goods vehicles. The activity of the Commission in this field has been reflected in a number of documents among which we can list, for example, A European Strategy for Low-Emission Mobility²⁸ which indicates the necessity of further changes in the Union legal framework which will increase the effectiveness of the transportation system through popularizing alternative energy sources in transport. Importantly, in the document referred to above the Commission deems actions undertaken by local authorities,²⁹ including actions targeted at promotion of active means of mobility or the use of public transport, to be an indispensable component of any policy aiming at clean, low emission transport. This approach corresponds with the premises of the CAFE directive,³⁰ which puts forward local, regional, and national air protection plans, i.e. "measures to limit transport emissions through traffic planning and management (including congestion pricing, differentiated parking fees or other economic incentives; establishing low emission zones)".³¹

One of the ways to reach the goals indicated above is low-emission zones (LEZs), the establishing and functioning of which may combine all of the aforementioned principles. By limiting the movement of vehicles equipped with conventional drives in designated urban areas (usually in city centres), low emission zones result not only in

²⁶ Communication from the Commission to the Council and the European Parliament – Keep Europe moving – Sustainable mobility for our continent Mid-term review of the European Commission's 2001 Transport White Paper {SEC (2006) 768 } /* COM/2006/0314 final */.

²⁷ *Ibidem*, p. 4.

²⁸ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, A European Strategy for Low-Emission Mobility (SWD(2016) 244 final).

²⁹ As the main platforms for exchange of good practices in the field of promoting clean, low emission transport we can list actions taken within the framework of the Urban Development Network, Smart Cities, and the Mayors' Climate and Energy Protection Agreement.

³⁰ Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe, OJ L 152, 11.6.2008, pp. 1–44, hereinafter as CAFE Directive.

³¹ CAFE Directive, Annex XV, point B 3d.

an improved quality of air but also in changes in the habits of residents and tourists by enforcing the necessity to choose alternative (low emission) means of transportation. This is particularly significant due to the fact that "light-duty vehicles are significant contributors to urban air quality issues, especially for pollutants that form in the atmosphere such as ozone and secondary PM".³²

Under the Polish legal system, the detailed framework regulating the grounds for the functioning of LEZs was set out in the Act of 11 January 2018 on electromobility and alternative fuels.³³ The legislator defined a low emission zone as an area of roads administered by a municipality with restricted access for vehicles other than vehicles powered by electricity, hydrogen, or natural gas. An owner of a vehicle powered by natural gas may exercise his/her right to enter a LEZ upon presenting a proper vehicle marking.³⁴ A Low Emission Zone is established in order to "prevent the adverse influence of transport pollution emissions on people and environment", and, thus, it may constitute an adaptation action by virtue of limiting the increase of temperature in a UHI by reducing the emission of pollutants produced by means of transport.

LEZs may be established in cities with a population exceeding 100,000 residents, a fact which perfectly corresponds with the criterion for adopting MAPs for Polish cities within the framework of the ministerial programme "Wczujmy się w klimat".

Putting aside technical issues (vehicles using hydrogen as a fuel in appropriate energy-producing cells are in effect powered by electric engines), the cited regulations should be recognized as appropriate and compliant with the premises of the policy of supporting electromobility within the context of the environmental goals. Such an LEZ model enables and promotes converting transport in city centres to low-emission means, where the risk of air pollution is particularly high. However, a requirement for reaching the goals adopted by the legislator is the appropriate construction of the regulations establishing LEZs on the level of local law, which elaborates on and specifies the framework defined in the Act on Electromobility. To this end, a municipal council defines, by way of a resolution constituting an act of local law, the boundary lines for an LEZ, the manner of organizing restricted access to the zone, and additional measures for publicly disclosing the contents of the act on establishing such a zone.

Regarding the boundary lines for such a zone, according to art. 39, section 1 of the Act on Electromobility, an LEZ may be established in a municipality with a population exceeding 100,000 residents for the buildings located in the city centre forming a densely developed city-centre grouping of buildings determined in the local spatial development plan or, in the case of the lack of such a plan, in studies of conditions and

³² Jo.D. Miller, C. Façanha, *The State of Clean Transport Policy – A 2014 Synthesis of Vehicle and Fuel Policy Developments*, International Council on Clean Transportation, Washington 2014, p. 14.

³³ Journal of Laws 2020, item 908, as amended, hereinafter the Act on Electromobility.

³⁴ The required markings for a vehicle powered by natural gas (an appropriate sticker) were determined in the ordinance of the Minister of Infrastructure and Construction concerning registering and marking of vehicles and requirements for licence plates of 11 December 2017 (Journal of Laws 2017, item 2355, as amended).

directions of spatial development for a municipality.³⁵ The contents of the regulations referred to here clearly indicate that the main premise for the introduction of technical regulations consists of goals related to the protection of the environment, particularly with regard to the reduction of vehicle emissions in densely developed areas,³⁶ although the goals related to conservation of monuments and relics, or goals related to achieving an appropriate tourist value, are also of importance.

Because of the need to maintain safety requirements as well as the practical aspects of the lives of those permanently residing within the area of low emission zones, the legislator devises two types of exemptions. These are the statutory exemptions defined in art. 39, section 3 of the Act on Electromobility, which cover, for instance, service vehicles, but also zero-emission buses or school buses. They also include exemptions which can be adopted by a municipal council – with no restrictions regarding the subject of the exemption. This fact generates certain doubts and reservations of a legal nature. As far as it is justified, or even desirable, for municipality councils to exempt bicycles – which were not covered with a statutory right to enter LEZs because of (it appears) an error on the part of legislator³⁷ – from the ban on entering LEZs,³⁸ the lack of a restriction or a limitation of any kind regarding the material scope for the exemptions may make attempts at reaching the goals of establishing such zones futile.

In summary, the idea of clean, low emission transport focusing on the technical aspects (the standards of emission for vehicles) was supplemented with an instrument supporting the local restriction on pollution emissions in the form of LEZs. It is worth emphasizing that studies undertaken in foreign urban centres that have introduced LEZs over the span of the last dozen or so years indicate that the effectiveness of this method in reducing the level of particulate matter in the air is low. According to descriptive statistics, an LEZ has decreased the concentration of PM10 in London by 2.46% – 3.07% because the majority of the vehicles “already meet the minimum criteria established by the LEZ”.³⁹ German researchers analyzing the influence of LEZs on decreasing air pollution in the cities where LEZs were established, in comparison to cities where such zones were not formed, arrived at a similar conclusion: “The results indicate that the introduction of LEZs has brought positive effects on reducing air pollutant concentrations. But the potential of further reduction by an additional LEZ in Germany without further development of this measure seems to be small”.⁴⁰

³⁵ Art. 39, section 1 of the Act on Electromobility.

³⁶ Justification of the draft – Sejm paper no. 2147, www.sejm.gov.pl [accessed: 2021.01.28].

³⁷ S. Urban, “Commentary to art. 29” [in:] *Act on Electromobility and Alternative Fuels. A Commentary*, eds K. Kokocińska, J. Pokrzywniak, Warszawa 2020, Legalis.

³⁸ P. Otawski “Commentary to art. 29” [in:] *Act on Electromobility and Alternative Fuels. A Commentary*, ed. M. Swora, Warszawa 2019, Legalis.

³⁹ M. Percoco, *Environmental Effects of the London Congestion Charge: A Regression Discontinuity Approach*, https://transp-or.epfl.ch/heart/2015/abstracts/hEART_2015_submission_114.pdf [accessed: 2021.01.19], pp. 12–13.

⁴⁰ W. Jiang, M. Boltze, S. Groer, D. Scheuevens, “Impacts of Low Emission Zones in Germany on Air Pollution Levels”, *Transportation Research Procedia* 2017, No. 25, p. 3370.

These findings allow us to ascertain that implementing a clean, low emission transport policy in urban centres in Great Britain and Germany does not produce an effect in terms of reducing particulate matter pollution; however, these results cannot be unconditionally transferred to Poland. This is so because the statistical data indicates that in 2018 there were 32 million registered vehicles in Poland (this number has been steadily increasing, and since 2000 a twofold increase has been noted), out of which 76% are passenger cars. More than 58% of all the registered passenger cars are more than fifteen years old and nearly 16% are cars are thirty-one years old or older.⁴¹ Furthermore, the studies referred to here do not include instances of research directly verifying the effectiveness of implementing LEZs in relation to ozone precursors emission, and this compound in particular, as indicated above, influences any increase in the UHI effect.

3. Low emission zones in Polish Municipal Adaptation Plans

The “Wczujmy się w klimat” project initiated by the Ministry of the Environment and implemented in years 2017–2019 constituted the foundation for our research, the results of which we present in this section. The project’s goal was to create climate change adaptation plans for the largest Polish cities. Its goal was to assess the vulnerability of forty-four Polish cities to climate changes and to plan adaptation actions adequate to the identified threats. Under the auspices of the Institute of Environmental Protection, the National Research Institute, the Institute of Meteorology and Water Management, the Institute of Ecology of Industrial Areas, and the Arcadis company, MAP projects were developed for selected cities with a population exceeding 100,000 residents. Warsaw, the capital of Poland, was not covered by the studies, as the MAP for Warsaw was prepared within the framework of a separate project entitled ADAPTCITY, financed from the funds of the LIFE+ programme.⁴²

The “Wczujmy się w klimat” project has its own website: <http://44mpa.pl/miejskie-plany-adaptacji/> where the premises and stages of the project, an educational panel, and good practices are presented. However, the project did not include the list of the adopted MAPs which were searched for in provincial Official Journals and, by means of an internet search query on the basis of the list of cities included in the project, available at <http://44mpa.pl/partnerzy-projektu/address>. Ultimately, over the course of the research, the adoption of forty documents and four projects (Czeladź, Dąbrowa Górnicza, Sopot, and Tychy) was discovered. Each accepted MAP was subsequently verified through the use of the “search” command (CTRL + F) and the subject entry “Low emission zone”. Importantly, for the purpose of our results, the authors were not searching for such types of adaptation actions that fit in with the notion of low emis-

⁴¹ Statistics Poland, *Environment 2020*, <https://stat.gov.pl/en/topics/environment-energy/environment/environment-2020,1,12.html> [accessed: 2021.01.21].

⁴² <https://www.pine.org.pl/adaptcity/> [accessed: 2021.01.28].

sion transportation (such as electric car recharging stations, interchange stations, or other solutions from the field of public transportation), but were rather searching for the term "low emission zone" within legal language used.

After an analysis of the forty MAPs adopted within the framework of the project, any reference to establishing a low emission zone as an adaptation action was discovered only in a single MAP, that is one adopted for the city of Bytom. In accordance with Action no. 5 of this MAP – "The modification of the system of traffic organization for internal combustion powered vehicles by 2030" – it was ascertained that this action covers: "closing selected streets in the city centre to traffic; **introduction of clean, low emission transport zones** (bold face print added by the authors of this article); limiting traffic of heavy goods vehicles in the city centre; introduction of a so called 'green wave'; introduction of solutions facilitating municipal public transport (e.g. relocating parking spaces located in the vicinity of bus stops, designating lanes for use by buses and emergency vehicles); erecting interchange stations; creating new parking lots (including underground and overground parking lots); development of rail transportation, tram transport in particular [...] as well as building ring roads and by-passes [...]. In spatial terms these actions concern the area of the Old Town, and in broader terms the entirety of the city centre". In the context of the cited actions, the goals of adaptation were determined to be: "reducing the emission of pollutants into the air, particularly in the instances of episodes of increased concentration of pollutants, decongesting vehicle traffic, facilitating movement of municipal public transport vehicles, emergency vehicles and bikes, facilitating pedestrian traffic", and their implementation was recognized as the trigger for reaching the strategic MAP goals for Bytom, i.e. increasing the city's resistance to the negative effects of the concentration of air pollutants⁴³.

4. Summary

The research conducted allows us to ascertain that for actors involved in preparing thirty-nine out of the forty effective MAPs, establishing an LEZ does not constitute an instrument supporting adaptation to climate change. There are at least several causes for such a state of affairs.

Firstly, the literature emphasizes the political nature of MAPs and their low correlation with other urban social policy documents,⁴⁴ as well as the low sense of political responsibility of the policymakers for implementation of adaptation actions.⁴⁵ As

⁴³ <https://www.bytom.pl/miejski-plan-adaptacji-do-zmian-klimatu> [accessed: 2021.01.06]. Translation by the authors of the present article.

⁴⁴ Y. Abunnasr, E.M. Hamin, E. Brabec, "Windows of Opportunity: Addressing Climate Uncertainty through Adaptation Plan Implementation," *Journal of Environmental Planning and Management* 2015, No. 58, p. 17. See also: P. Legutko-Kobus, "Adaptacja do zmian klimatu jako wyzwanie polityki rozwoju miast w kontekście krajowym i europejskim", *Biuletyn KPZK PAN* 2017, No. 268, p. 90.

⁴⁵ A. Gendźwił, "Zdecentralizowana adaptacja? Opinie władz lokalnych o zmianach klimatu i lokalnej polityce adaptacji do zmian klimatycznych", *Studia Regionalne i lokalne* 2017, No. 68, p. 40.

a result, policymakers may not be keen on becoming involved in proposing solutions which could subsequently adversely affect their political support.

Secondly, the concept of LEZs is rather new; this term was already a subject of legal regulation when the MAPs were being developed, but the results of our research indicate that it was rather unknown to creators of individual adaptation plans.

The results of the research also indicate a low awareness of the correlation between air quality and the UHI phenomenon in the context of climate change adaptation. This conclusion is confirmed by the fact that establishing LEZs became for certain cities the subject of regulation within the framework of the air protection programme for Małopolskie province (Kraków, Tarnów), despite the goal of establishing LEZs not being introduced into the MAPs for these cities.

For these reasons, we suggest adopting MAPs with the greatest possible participation, in cooperation with both local communities and experts.⁴⁶ Indeed, it is to be expected that the latter will play a significant role in introducing the most effective solutions into MAPs, not only from the perspective of the needs of contemporary residents, but also for the benefit of the humanity as a whole, including future generations. This is particularly significant in the context of the fact that at present for the local community "restricting access to a selected area or an individual street is perceived as an assault on the interests of motor vehicle users and transforming the area of a street combined with reducing the number of parking spaces is perceived as an assault on the interests of local residents".⁴⁷ MAPs are also an interesting field presenting an opportunity for utilizing new tools for controlling the effectiveness of administrative policy.⁴⁸ The 5th IPCC Report also emphasizes the necessity for inclusion of all groups of participants in adaptation actions, particularly entrepreneurs representing the private sector.⁴⁹ Similarly, the parties to the Paris agreement identify "civil society, the private sector, financial institutions, cities and other subnational authorities" as key agents in relation to climate changes. This premise is also confirmed by the example of Kraków, a city which was the first (and as of now, the only) Polish city to adopt an

⁴⁶ J. Klein, M. Araos, A. Karimo *et al.*, "The Role of the Private Sector and Citizens in Urban Climate Change Adaptation: Evidence from a Global Assessment of Large Cities", *Global Environmental Change* 2018, No. 53 p. 127. See also: J. Sroka, J. Podgórska-Rykała, "Deliberacyjne metody współdecydowania i niedeliberacyjne metody zasięgania opinii mieszkańców: ujęcie praktyczne", *Samorząd Terytorialny* 2020, No. 11; P. Legutko-Kobus, "Partycypacja jako element programowania rozwoju lokalnego", *Studia z Polityki Publicznej* 2018, No. 3; and Z. Kędzia, "Zmiany klimatu a perspektywa praw człowieka" [in:] *Wokół kryzysu praworządności, demokracji i praw człowieka. Księga jubileuszowa Profesora Mirosława Wyrzykowskiego*, eds A. Bodnar, A. Płoszka, Warszawa 2020.

⁴⁷ A. Brzeziński, "Czym może być zrównoważony transport miejski" [in:] *Miasto idealne—miasto zrównoważone. Planowanie przestrzenne terenów zurbanizowanych i jego wpływ na ograniczenie skutków zmian klimatu*, eds A. Brzeziński, A. Kalinowska, Warszawa 2015, pp. 56–57. Translation by the authors of this article.

⁴⁸ K. Olejniczak, K. Śliwowski, D. Wojtowicz, "Projektowanie rozwiązań publicznych na ludzką miarę – behavioral insights", *Samorząd Terytorialny* 2019, No. 10.

⁴⁹ *Climate Change 2014: Synthesis Report, Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, eds R.K. Pachauri and L.A. Meyer, IPCC, Geneva, 2014, p. 127.

LEZ, simply to subsequently alleviate (in essence, cancel) the ban on entering the LEZ because of protests by residents, restaurant owners, and delivery personnel.⁵⁰ Inclusion of all groups of participants in the procedures of developing adaptation solutions is, thus, a legitimate demand, even more so due to the fact that the latest draft for the amendment to the Act on Electromobility assumes compulsory establishment of LEZs in all cities with a population exceeding 100,000 by 2030.⁵¹

In summary, we acknowledge that in the acts examined, awareness of the influence of establishing an LEZ on the effectiveness of adaptation to climate changes is exceptionally low. This conclusion leads us to an assertion regarding the need for taking wide-reaching educational actions that promote knowledge pertaining to the correlation between the UHI phenomenon and air pollution, and the possible tools producing a synergy effect for air protection and climate changes adaptation.

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⁵⁰ M. Grochowicz, "Konflikty przestrzenne wokół Placu Nowego na krakowskim Kazimierzu" [in:] *Współczesne problemy i kierunki badawcze w geografii – tom 7, Instytut Geografii i Gospodarki Przestrzennej*, eds Ł. Fiedor, K. Anielska, Kraków 2019, p. 97.

⁵¹ The plan of the act on changing the Act on Electromobility and certain other acts of 10 November 2020.

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Summary

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Low Emission Zones in Municipal Adaptation Plans as an Example of Local Adaptation to Climate Changes

In the fight against climate changes, both adaptation and mitigation measures are treated as equally significant instruments. Mitigating climate changes on a local scale has garnered interest in the context of the challenges for urban planning, transport systems, and developing green and blue infrastructure. The relationship between adaptation to climate changes and reduction of air pollution is less well-known. Studies prove the existence of a direct correlation between the emission of NO_x and volatile organic compounds (VOCs), CO₂ and other chemical compounds, and the growth of an urban heat island, which means that the reduction of emissions may produce a synergy effect between adaptation to climate changes and the vulnerabilities of cities. Our goal is to verify the presence of this concept in Polish urban adaptation plans

in the context of the latest instrument affecting the quality of air, which is the low emission zone (LEZ), adopted in cities with a population exceeding 100,000 residents on the basis of the Act of 11 of January 2018 on electromobility and alternative fuels. Studies indicate that from among the forty urban adaptation plans adopted by co-authors and policymakers in thirty-nine cities, the issue of establishing a low emission zone is not recognized as a tool supporting adaptation to climate changes, which indicates a low level of the awareness of the relationship between air pollution and climate protection on a local level. The authors assess the causes of such a state of affairs on the basis of the relevant literature and formulate requirements for changes, particularly in the field of wider participation in the process of adopting public policy acts concerning air protection and climate changes adaptation.

Keywords: low emission zone; municipal adaptation; plan adaptation; climate change; urban heat island; Act on Electromobility.

Streszczenie

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Strefa czystego transportu w miejskich planach adaptacji jako przykład lokalnej adaptacji do zmian klimatu

W walce ze zmianami klimatycznymi zarówno mitygacja, jak i adaptacja są traktowane jako instrumenty o równie istotnym znaczeniu. Łagodzenie zmian klimatycznych na skalę lokalną zyskało zainteresowanie zarówno w kontekście wyzwań dla urbanistyki, systemów transportowych, jak i tworzenia niebiesko-zielonej infrastruktury. Mniej znany jest związek między adaptacją do zmian klimatu a redukcją zanieczyszczeń powietrza. Badania dowodzą istnienia bezpośrednich zależności pomiędzy emisją NO_x i lotnych związków organicznych (LZO), CO₂ oraz innych związków chemicznych a wzrostem miejskiej wyspy ciepła, co oznacza, że redukcja emisji może wywołać efekt synergii w adaptacji do zmian klimatycznych i wrażliwości miast. Naszym celem jest weryfikacja obecności powyższej koncepcji w miejskich planach adaptacji w Polsce w kontekście najnowszego instrumentu wpływającego na jakość powietrza, jakim jest strefa czystego transportu, przyjmowana w miastach powyżej 100 tys. mieszkańców na podstawie ustawy z dnia 11 stycznia 2018 r. o elektromobilności i paliwach alternatywnych. Z badania wynika, że spośród 40 przyjętych miejskich planów adaptacji dla współautorów i decydentów w 39 miastach kwestia stworzenia strefy czystego transportu nie jest rozpoznana jako narzędzie wspierające adaptację do zmian klimatu, co wskazuje na niską świadomość związku zanieczyszczeń powietrza z ochroną klimatu na poziomie lokalnym. Autorzy oceniają przyczyny takiego stanu rzeczy na podstawie piśmiennictwa i formułują postulaty zmian, zwłaszcza w zakresie szerszej partycypacji w procesie akceptacji aktów polityki publicznej dotyczącej ochrony powietrza i adaptacji do zmian klimatu.

Słowa kluczowe: adaptacja do zmian klimatu; miejski plan adaptacji; strefa czystego transportu.