



Social aspects of low emission zones: Warsaw case study

This is one of a set of five city case studies prepared as part of a study by the Institute for European Environmental Policy for the Clean Air Fund. The study investigates the social impacts of low emission zones (LEZ) and looks at how they can be deployed in a socially acceptable way, gathering support from the local population. The other case studies cover Milan, the Brussels-Capital Region, Stockholm and Sofia.

About Warsaw City

Warsaw is the Capital of Poland, located in Eastern Europe, close to the centre of the country. Warsaw covers an area of around 517 km² and has a population of 1.8 million (Statistical Office in Warsaw, December 2023). According to the same statistics, the population density is 3,599 per km². Concerning relevant sociodemographic characteristics, 19% of Warsaw's population is aged 0-19, 39.3% is between 20 and 44 years old, 33% is 45-74 and 8.3% is over 75 years old. The unemployment rate in Warsaw is 1.4%, decreasing compared to the previous year, while the average monthly gross salary in 2022 was PLN 8493.86 (EUR 1,976.44) (ibid.) In 2021, the value of GDP per inhabitant in the Warsaw region was 98% of the EU-27 average, slightly increasing to 99% in 2022 (Eurostat, 2024).

Publication date:

July 2024

Author:

Chiara Antonelli

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About the Low Emission Zone

Poland has been flagged as a pollution “hotspot” in Europe, having 36 of the 50 EU cities with the lowest air quality in its territory (World Bank, 2019) and seventh highest among EU countries for vehicle ownership per capita (EUROSTAT, 2024). Here, Warsaw is no exception: air pollution is driven by road transport, particularly in central areas and congested roads (Chlebowska-Styś, 2019). According to a study by the Real Urban Emissions (TRUE) Initiative, based on results of the International Council on Clean Transportation (ICCT) in 2020, implementing a vehicle access restriction policy, such as the proposed clean transportation zone based on vehicle age or emission standards, would effectively eliminate the most polluting passenger cars from the Warsaw vehicle fleet (Kaylin Lee and Yoann, 2023). Passenger cars in Warsaw showed real-world emission levels are high and elevated levels of nitrogen oxides (NO_x) emissions may be attributable to the old age and high mileage of the vehicles, which can cause deterioration of emission control systems (Kaylin Lee and Yoann, 2023). Age also matters. In 2020, Poland's average age of in-use passenger cars was over 14 years old, while the European average was below 12 years. In addition to that, there is a high number of imported second-hand vehicles, being one-third of the fleet and producing notably higher emissions than domestic vehicles (Lee, 2022).

Thus, in 2020, the Masovian Voivodeship (the administrative region in which Warsaw sits) adopted a new Air Protection Program¹ - a local law developed due to exceedances of air quality standards. The program includes specific corrective actions, the implementation of which will likely translate into improved air quality. All voivodeships were required to prepare and adopt a new air protection program following the 2018 judgment of the EU Court of Justice and the continuing poor air quality (European Commission v Republic of Poland, 2018). The same act foresaw that the capital city of Warsaw would take actions aimed at modernising the public transport fleet, developing tram transport and preparing low-emission zones in pilot and target versions, i.e. introducing limited transport zones by 2026². Consequently, Warsaw is implementing the necessary measures to combat air pollution and improve air quality. One such measure is the establishment of The Clean Transport Zone (SCT), a Low Emission Zone (LEZ) system which could effectively reduce traffic-related NO_x and particulate matter (PM) tailpipe emissions, which are damaging to human health.

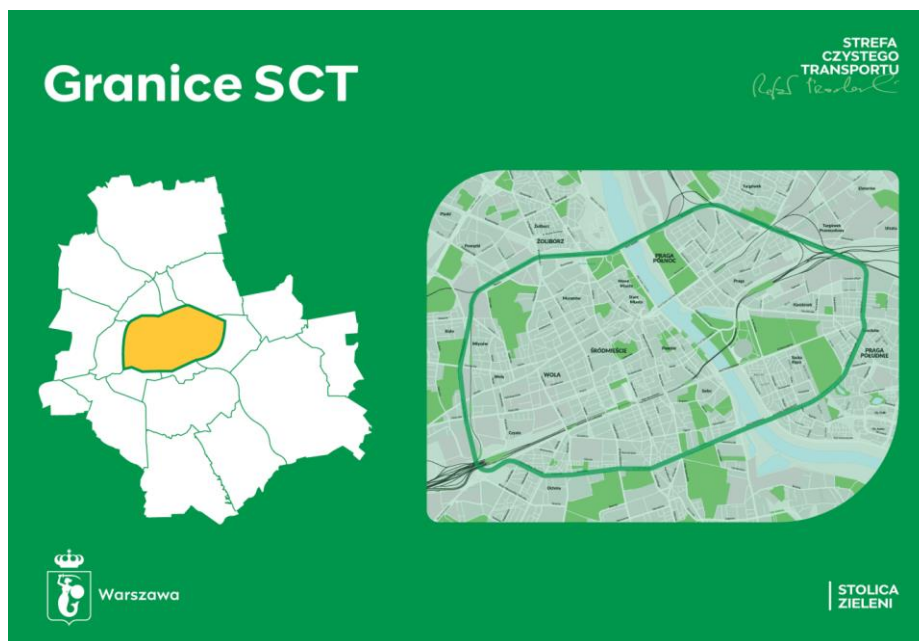
The SCT is a designated area in Warsaw where only vehicles that meet the appropriate exhaust emission standards can drive, including petrol, diesel, hybrid and LPG vehicles. In December 2023, the City Council of Warsaw discussed and approved a resolution to introduce the SCT³. According to the resolution, the SCT will cover 37 km², including the central district and parts of surrounding districts representing about 7% of Warsaw's total territory. The area covered by the SCT is illustrated in Figure 1.

¹ DZ. URZ. WOJ. 2020.9595, available here <https://edziennik.mazowieckie.pl/legalact/2020/9595/>

² Introduction of the new Air Protection Programme, information available [here](#)

³ Resolution no. XCI/2974/2023 of the Capital City of Warsaw. December 7, 2023. Available [here](#)

Figure 1 Warsaw maps and SCT boundaries (Urząd m.st. Warszawy, 2024)



Starting from 1 July 2024, the SCT will be implemented in 5 stages over eight years, with tightening of vehicle access until 2032. Each phase progressively excludes access to older and more polluting vehicles (Dombi, 2024), as described in Table 1 below.

By 2032, vehicles will need to meet Euro 6 standards for petrol engines and Euro 6d standards for diesel engines or be manufactured within specified years ranging from 2014 to 2020. The new project introduces exemptions for residents, who will have four years to adapt to its requirements. An additional exemption applies to senior citizens if they own their vehicles before 1 January 2024.

In addition to legal requirements imposed by the Voivodeship Act, the creation of the SCT by the Warsaw authorities is a response to grassroots pressure by residents, social movements and green NGOs to improve air quality and quality of life in the city (Szybisty, 2024). Moreover, Warsaw authorities were also inspired by examples of Western European cities (such as London and Paris) that engaged in similar green policies in the area of smart and sustainable mobility (Szybisty, 2024).

Table 1 Key design features of the Warsaw LEZ

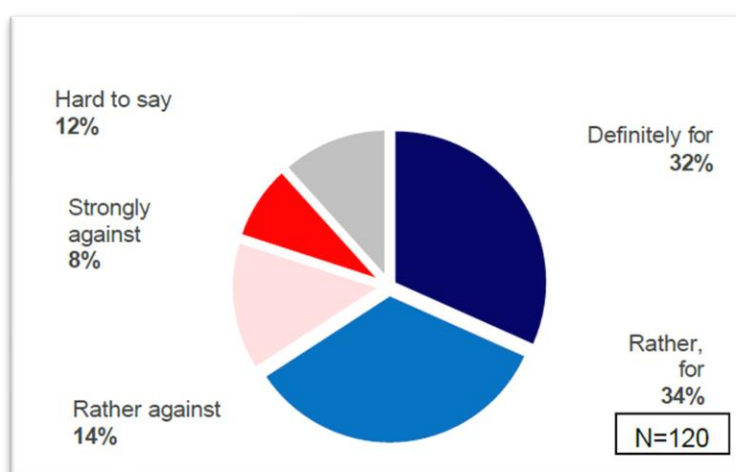
Warsaw City	
Date of implementation and changes	Introduced on 1 July 2024. Planned timeline of gradually more stringent restrictions, based on Euro emissions standards, with changes every 2 years (see 'Requirements' below).
Exemptions	People residing in Warsaw and paying taxes in Warsaw are exempted until December 2027. After this, access requirements will apply differently (see exemptions list in Annex 1). Additional exception for people who are 70 by the end of 2023, provided they owned their vehicles before 1 January 2024. Full list of exemptions in Annex 1.
Access requirements	<p>The SCT will be implemented in 5 stages:</p> <p>1. From 1 July 1 2024, vehicles allowed into the SCT are: Vehicles with a gasoline engine with a minimum Euro 2 standard or manufactured no earlier than 1997; Vehicles with a diesel engine with a minimum Euro 4 standard or manufactured no earlier than 2005.</p> <p>2. From 2026 Vehicles with a gasoline engine with a minimum Euro 3 standard or manufactured no earlier than 2000; Vehicles with a diesel engine with a minimum Euro 5 standard or manufactured no earlier than 2009.</p> <p>3. From 2028 Vehicles with a gasoline engine with a minimum Euro 4 standard or manufactured no earlier than 2005; Vehicles with a diesel engine with a minimum Euro 6 standard or manufactured no earlier than 2014.</p> <p>4. From 2030 Vehicles with a gasoline engine with a minimum Euro 5 standard or manufactured no earlier than 2009; Vehicles with a diesel engine with a minimum Euro 6d standard or manufactured no earlier than 2017.</p> <p>5. From 2032: Vehicles with a gasoline engine with a minimum Euro 6 standard or manufactured no earlier than 2014; Vehicles with a diesel engine with a minimum Euro 6d standard or manufactured no earlier than 2020.</p>
Projected estimated costs	The estimated cost so far is around EUR 1 million, including expenses for signage, compliance systems and administrative costs (Dombi, 2024). The overall estimated cost has been reduced from earlier projections due to changes in national regulations on car stickers granting access to the SCT, thus reducing the related expenses.

Social Aspects – Investigations and Stakeholder Consultations

In recent years, Warsaw has seen rising interest and substantial involvement in discussions around the potential implementation of a LEZ. Results from surveys, research analyses, and stakeholder consultations shed light on Warsaw's steps toward creating and implementing the SCT.

A nationwide and city-specific survey in July 2022. Following a campaign⁴ which led to the launch of the TRUE report on real emissions in Warsaw (Lee, 2022), in July 2022 the Research Collective agency, on behalf of Profeina PR Agency, conducted both a nationwide survey and dedicated surveys in four Polish cities, including Warsaw (Research Collective, 2022). According to the results, inhabitants in the largest cities in Poland, including Warsaw, were most concerned about air quality and traffic congestion, and therefore had a more positive attitude towards the creation of LEZs (Research Collective, 2022). It is worth noting that in Warsaw, the interviewed residents were more in favour of investing in public transport compared to the national average. 66% supported the creation of a clean transport zone, compared to 58% at the national level (see Figure 3).

Figure 3 Acceptance of introduction of a LEZ in Warsaw (Collective Research, 2022)



The research showed noticeable awareness of air quality and transport: 77% of Warsaw residents monitored air quality by phone, 43% noticed deteriorated air quality over summer, 47% recognised transport as the main cause of air pollution in Warsaw (contrary to other major cities), and a higher portion of residents (37%) chose public transport over driving (19%) than in other cities (Research Collective, 2022). The survey also highlighted the use of additional measures to tackle car traffic and broad support for road safety regulation (Research Collective, 2022). While Warsaw citizens recognised the need for concrete actions for clean air, only 3%

⁴ Profeina campaign on SCT from 2021 to 2024, available here: <https://profeina.pl/pl/pr-dla-stref-czystego-transportu/>

stated they had substantial knowledge of a Clean Transport Zone and were interested in having one. Additionally, 81% of the interviewees agreed that the city should introduce compensatory measures (e.g. free parking at zone borders and discounted public transport tickets) for drivers affected by the implementation of clean transport zones (Research Collective, 2022).

A second round of surveys was held in winter 2024, when the resolution concerning the SCT was already approved. Over that period, Warsaw citizens became more aware of the concept of LEZ: 84% claimed to know what an SCT was (compared to 72% in 2022) whilst 56% had some knowledge (compared to 45%) (Szybisty, 2024). It is worth noting, though, that the support for LEZ decreased from 66% to 56%, although it was still higher than the national average level (48%) (Szybisty, 2024). Overall, the survey underscored a proactive approach among Warsaw residents towards sustainable transport, with a willingness to embrace alternative modes of travel and support policies to improve air quality and reduce traffic congestion. Warsaw citizens also perceive transport as the most important source of air pollution (41%), rather than household heating (28%) - unlike the rest of the country (Szybisty, 2024).

Survey by the Foundation for the Promotion of Electric Vehicles (FPPE) in December 2022. In December 2022, research conducted by the FPPE, in cooperation with the Warsaw City Hall and the Lata Twentieth agency, examined the potential implementation of Sustainable Clean Transport (SCT) measures in Warsaw (FPPE, 2023)⁵. Following discussions and meetings with Warsaw representatives, the results of the survey were presented in March 2023. The survey used a representative sample of 512 Warsaw residents who were unaware of any specific clean transport zone initiatives proposed by the city authorities or any other SCT projects at the time of the study (FPPE, 2023).

The findings revealed significant support among residents for establishing a clean transport zone in Warsaw, with notable agreement on the expected benefits. 87% of respondents agreed that Warsaw authorities needed to address cleaner air in the city, while 76% believed that it was crucial to introduce a restricted access area for the most polluting vehicles (FPPE, 2023). The survey helped identify socio-demographic characteristics of supporters and “brakemen” (cit.) of the implementation of an SCT. Support for measures aimed at reducing car traffic and enhancing air quality was notably stronger among pedestrians, cyclists, and public transport users, as well as individuals over 50 years old and those who infrequently or never use personal vehicles – collectively representing a majority of Warsaw residents. On the contrary, individuals who commute by car daily over longer distances, those who frequently leave the city, parents of school-age children, and those who own multiple vehicles were less keen on the implementation of an SCT (FPPE, 2023).

⁵ This research was part of the awareness campaign “Clean transport zone”, organised by FPPE which created a specific webpage to inform, raise awareness and share knowledge on the implementation of an SCT in Warsaw and its implications.

Box 1: Benefits and challenges of implementing SCT

Cleaner air was identified by most respondents (59%) as the reason to implement an SCT, followed by a healthy environment (39%) and improving the quality of life in the city (30%), and it was also reflected in the considerations regarding their own and their families' benefits (FPPE, 2023). However, numerous respondents (46%) shared concerns regarding potential overcrowding with reduced travel comfort on public transportation and an increase in time spent travelling (29%), anticipating increased usage due to the implementation of an SCT. On their personal and families' matters, Warsaw residents interviewed were concerned about changing daily plans (24%) and habits (23%) and visiting other neighbourhoods less frequently (22%). A few concerns were also raised on social justice, fearing that SCT might discriminate against less wealthy people, those unable to afford to buy fewer polluting cars and the deterioration of social relations.

The survey also shed light on **how to encourage residents to support the implementation of an SCT**. The results were focused on residents' openness to introducing the SCT in Warsaw, the positive perceptions and the benefits associated with SCT and provided some recommendations to successfully introduce SCT in Warsaw. Citizens offered several suggestions on incentives and compensation. One suggestion was to encourage the use of **free public transport rides** at the weekend, discounts on tickets, and bike and car rentals. Others favoured **financial incentives** as compensatory measures, such as free or discounted attractions in the city (theatres, cinemas, sports activities). A third suggestion was to **improve education**, creating a space to inform citizens on benefits, environmental impacts, and rules and advice on the scrapping of old vehicles. This suggestion was closely related to a fourth one, which encouraged **transparent dialogues** with citizens. Further feedback specifically addressed the need to **improve infrastructure and urban transport** and subsidise the replacement of private cars (FPPE, 2023). As the multi-step implementation was discussed with interviewees, the respondents were in favour of gradual implementation, in terms of both time and geographical extension.

Overall, the above survey and studies supported two decisive lines of action:

- **The first** calls for clear communication based on three pillars: health concerns, quality of life, and smart, comfortable mobility.
- **The second** promotes concrete actions to take when dealing with public concerns, particularly on changing habits, social justice and the risk of deterioration of social relations.

Public consultations from January to April 2023. The next step was the official consultations to implement the SCT in Warsaw. According to the National Act on Electromobility and Alternative Fuels, local governments implementing a resolution are obliged to consult with the city's inhabitants for a period not shorter than 21 days, before establishing the SCT⁶. Warsaw municipality set **3 months for stakeholder consultation** on the drafted SCT⁷, with the public

⁶ Art. 40 of the ACT of January 11, 2018 on electromobility and alternative fuels, available [here](#)

⁷ Clean Transport Zone in Warsaw - Requirements and area, Warsaw municipality [website](#)

consultations starting with the presentation of the first draft proposal for the SCT in January 2023. The Warsaw City Council prepared an extensive engagement strategy with citizens through online forms, online meetings, setting up consultation points in different parts of the city and working group sessions (Foundation for European Studies (FEPS), 2023). The primary purpose of the consultation was to collect opinions and comments on the area, timeline and technical requirements to implement the SCT. This process was also used to enhance citizens' understanding of transportation and communication requirements within Warsaw. Participants were **encouraged to exchange insights and observations through the consultations, three online meetings and five consultation points**, where experts and representatives of the Traffic management office answered questions. **Comments could also be sent via email** and through an **online form**.

Entrepreneurs were particularly urged to contribute, to share their perspectives on how their businesses might respond to the program. The municipality invited medicine professors to council meetings to inform people about the public health benefits of the LEZ (Dombi, 2024). Over 2,500 forms and 410 messages were collected during the consultation. Many people met at consultation points, submitting 111 written comments, and over 1,600 people viewed the online meetings (Foundation for European Studies (FEPS), 2023). Overall, the consultation received over 3,000 comments on the proposed solutions. Many comments, reported in the Annexes to the report summarising the consultation results, were published and specifically addressed (in some cases even partially or fully included in the second draft), showing the influence of citizens on the first draft of SCT in the capital.

The reactions were lively and diverse (see also Table 2). While most comments were in favour of an SCT covering only the city centre and/or busy streets, there was also a second group advocating abandoning the project altogether, and a third one advocating for an SCT covering most or the entire city, as was the case for the initial project in Krakow (Foundation for European Studies (FEPS), 2023). Concerns were raised also by small businesses (e.g. haulage firms, transport companies, couriers) and small business owners commuting from suburbs and other regions of Poland to work in Warsaw (Szybisty, 2024). It is worth noting that, among the comments received, several respondents, particularly **those living on the outskirts of the potential SCT, advocated for an extension of the established area**. This aspect was driven by their fear of increased emissions "in the periphery" of the SCT, creating informal "parking lots" for vehicles not meeting the SCT access criteria (FEPS, 2023). These reactions suggest that a Not in My Backyard (NIMBY) attitude, which creates social resistance to pollution in one's proximity, could however generate an incentive for citizens to live in a greener, healthier area by actually having their neighbourhoods included in the SCT perimeter.

Table 2 Preferences asked and raised in the opinion survey (FEPS 2023)

Preferences asked and raised in the opinion survey	
Coverage area	<ul style="list-style-type: none"> • 24% were in favour to cover the entire city (as was the case in Krakow). • 34% preferred a minimalist option limited to the central area of Warsaw. • Others advocated for intermediate variants including Śródmieście and parts or all of the surrounding densely populated districts, being concerned about the effectiveness of a too-small SCT and underlining the right to clean air (especially for areas dedicated to children). • Important caveats were also flagged to grant access to key facilities such as hospitals, rail stations, schools and tourist attractions. This point was linked to further concern raised on the economic situation and potential impacts on businesses in the designated area (Foundation for European Studies (FEPS), 2023).
Rules	<ul style="list-style-type: none"> • Issues with exemptions and vehicle requirements were particularly evident. • Groups of residents advocated for strict access rules. • Others thought differently, especially for cars of residents already living in the designated area, large families and elderly people (Foundation for European Studies (FEPS), 2023).
Standards access	<ul style="list-style-type: none"> • On health, a majority were in favour of granting adequate access to hospitals, people with disabilities and veterinarians in the SCT, regardless of the requirements. • On fuels, some groups advocated including alternative fuels (LPG, CNG, hybrid and plug-in hybrid) in the SCT. In contrast, others wanted to restrict access to only emergency vehicles and city service vehicles, whilst also gradually banning access to mopeds and scooters. • Controls and enforcement were identified as potential issues that could undermine the effectiveness of the area (FEPS, 2023).
The timeline	<ul style="list-style-type: none"> • Certain groups proposed to accelerate the process and implement the SCT as soon as possible, with complete implementation by 2028 (Foundation for European Studies (FEPS), 2023). • Other comments referred to economic issues as a rationale for staggering the process and introducing individual stages every 3 or 4 years, instead of 2, with a longer <i>vacatio legis</i> (FEPS, 2023). • Car categories and types of fuels were also highly debated in the timeline and standard process⁸.

As a result of the consultation, the traffic management office planned to make changes to the first draft resolution to take into account the economic concerns, special situations for people with disabilities, the elderly, and specific cultural events, and make it easier for residents to make their cars SCT compliant. Also, to maintain the overarching goal of improving air quality, the SCT area was modified to be enlarged.

Opinion survey in April 2023. After the announcement of the SCT project, an opinion survey was conducted on a representative group of 1,020 residents by PBS at the request of the

⁸ It is worth noticing that advocating to wait for living conditions in Poland to improve before implementing the SCT, generates the risk of creating a vicious loop which asks to improve conditions without supporting a measure (SCT) crucial to improving those said conditions.

Warsaw City Hall (PBS, 2023). According to the survey results, the majority of people (from 51 to 77%, varying depending on age) agreed on the implementation of an SCT in Warsaw. Noticeably, the rate of respondents strongly disagreeing is higher than those in mild disagreement. This may be interpreted as an indication that opinions are quite polarised. Results also showed higher rates of approval among older people. Also, smaller households are more likely to favour banning old cars. Unsurprisingly, higher reluctance rates to implement an SCT arise from individuals owning old (over 19 years old) cars and those with internal combustion engines (PBS, 2023).

The consultation also investigated why individuals supported or opposed the SCT. Interestingly, while the four most-cited favourable answers were environment-related, the four most common objections were mainly socially related. More specifically, reasons to be in favour included clean air, pollution reduction, positive health impacts and less traffic congestion. On the contrary, 19% of people against the SCT mentioned financial difficulties for residents to change or adapt their cars. They also mentioned the limitation of residents' rights (11%) and the exclusion of owners of old cars (12%). Thus, linking the SCT implementation to social and financial exclusion (PBS, 2023).

Moreover, when looking at health and social justice, respondents mostly agreed on the environmental, health, and social aspects in such order. Four in ten Varsovians believe that SCT must be introduced in a year or less. Those who mildly agree with its implementation suggest that more time is required (PBS, 2023). Warsaw residents also generally believe that the city centre must be covered by the SCT.

Among the mostly common justifications for owning a car, respondents indicated the need for independence, comfort, and an easier daily life. This utilitarian approach was mostly consistent among households with children, whereas youngsters would rather mention that a car adds nuance and responsibilities.

The survey showed that almost 70% of adult residents of Warsaw (including 66% of drivers declaring they drive cars regularly) supported the introduction of SCT. People aged 70 and older are more likely than others to believe that Warsaw residents would be healthier thanks to SCT (PBS, 2023). This opinion was also more common among people who do not have a car in their household.

Following the consultation and the public survey, the city collaborated with experts to conduct an additional study evaluating the expected health and environmental impacts of the SCT in Warsaw (Ricardo, 2023). The study predicted SCT's effectiveness at improving air quality by reducing emissions from major pollutants related to road transport, with the overall benefits (notably health impacts) outweighing the costs of implementation (mostly associated with vehicle upgrades) (Ricardo, 2023).

While the councillors ultimately approved a reduced zone covering 7% of Warsaw territory with higher exemptions, the awareness, consultation and engagement process has impacted the final resolution. The exemptions were initially limited to citizens over 70 years old but were

further extended to all residents in the first two implementation phases, contrary to the initial inclusion of only the inhabitants of the SCT (Dombi, 2024). As an additional support measure, Warsaw municipality would improve public transport alternatives to the use of private vehicles, in particular for those most affected by the SCT restrictions.

Public campaign and information through the official website. The information ran (and runs) through easily accessible and transparent official websites. Warsaw municipality's website has a dedicated section providing residents with information on requirements, the final area covered, legal regulations envisaged, and a comparative section with good practices from the EU. There is also a Q&A section⁹ discussing broad aspects of SCT and social impacts, including impacts on households, and noting that the responses to public consultations were considered whenever possible when creating the final version of the SCT project¹⁰.

On the risk of social exclusion, when asked whether the existence of such a zone would favour "wealthy people", the municipality made it clear that The Clean Transport Zone is not intended to discriminate but rather to improve the air quality in the city for everybody. The schedule for introducing the next stages of SCT implementation also gives tips on which more polluting vehicles not to buy, giving the chance to plan the replacement of old vehicles. On compensation, the municipality stated that it aims to enhance its public transport services, with the metro and tram systems steadily extending to additional districts, and more parking facilities located near transportation hubs.

Overall, the SCT in Warsaw received more public and media attention than similar projects in Krakow and Wrocław. It is now expected that the process that occurred in Warsaw will likely have an impact on other Poles' perception of LEZs (Szybisty, 2024).

During the evaluation period and the consultations, media attention, political and public reactions were rising¹¹. On one hand, some social groups including health experts and environmental organisations advocated for the SCT, highlighting the public health benefits. The link between air pollution and respiratory diseases was particularly emphasised, calling for an SCT also as a public health measure (Szybisty, 2024) (Dombi, 2024). On the other hand, political opposition sparked among certain groups who argued that restrictions were an unfair burden on some social groups and raised doubts about the effectiveness of the initiative, adding to some scepticism that transport is not a major source of air pollution (Szałański, Mizak, & Różyk, 2023).

Data gaps can exacerbate public doubts since the limited infrastructure for measuring transport emissions (at the time of the interview, there was one station in Warsaw) does not allow for comprehensive data collection (Szałański, Mizak, & Różyk, 2023). More generally, accurate emission measurements are critical for demonstrating the effectiveness of LEZs and raising awareness based on scientific evidence. This is coupled with a need for extensive and

⁹ <https://um.warszawa.pl/SCT>

¹⁰ <https://transport.um.warszawa.pl/pytania-i-odpowiedzi-sct>

¹¹ <https://eurocities.eu/latest/eastern-european-cities-welcome-first-low-emission-zones/>

more harmonised pollution measuring infrastructure across Europe (Szałański, Mizak, & Różyk, 2023). Public attention was still high during the last months of the electoral campaign in 2024, a few weeks before the implementation of the SCT in July 2024^{12,13}. During pre-election debates in Warsaw and Krakow, candidates agreed on several environmental policies but strongly disagreed on LEZs, showing polarisation on this measure (Szybisty, 2024).

While the city has recently begun to implement the SCT, there is the perception that cities are becoming increasingly problematic to navigate and eventually, only wealthier social groups will be able to afford car ownership, whereas others will be at risk of transport poverty and exclusion (Szybisty, 2024). Thus, **substantiated effort is needed to reinforce a positive narrative and underpinning actions**, keeping transparent information and communication high on the agenda and disseminating accurately the aspects which ensure a fair and just transition in the implementation of a LEZ (Linares, 2024).

Transferable lessons and recommendations

Overall, when considering the implementation of a LEZ, it is important to combine a comparative analysis of already-established LEZs with investigations on city-specific social impacts. This should be followed by constant monitoring and evaluation over time, to be ready to adapt transport policies based on updated data and new public engagement.

The key lessons and recommendations emerging from the Warsaw case study with regard to the social impacts and social acceptability are as follows:

1. Improve data availability and utilization

- a. In Warsaw, as in other cities, **a comprehensive data monitoring system is needed**. Building also on other case studies such as Stockholm (Bergeling, 2024), Brussels (Watkins, 2024) and Milan (Marchetti & Antonelli, 2024), more data can adequately monitor health, pollution and social impacts, which are essential for policymakers and citizens' access to information.
- b. To do so, it is crucial to **ensure continuous modelling and data analysis** (Szałański, Mizak, & Różyk, 2023). As such, time-series data are needed in Warsaw as in other cities aiming to implement a LEZ.

2. Foster inclusive communication

¹² <https://sct.prowly.com/205880-mieszkancy-warszawy-chca-strefy-czystego-transportu-badanie>

¹³ <https://www.bankier.pl/wiadomosc/Warszawa-na-ostatniej-prostej-do-strefy-czystego-transportu-Straz-miejska-z-gotowymi-bloczkami-8771646.html>

- a. **Creating a coherent plan and communicating it is essential.** Communication should continuously be ensured, to maintain a high level of engagement and to debunk fake news and miscommunication.
- b. **Social acceptability runs through transparent and public consultations.** Stakeholders should be consulted from the beginning of the process to the final approval, and awareness and social impacts monitored on an ongoing basis. This entails collecting and utilising opinions to create a truly bottom-up approach to local decision-making. **Thorough qualitative research** could also support identifying potential problems in advance and already contemplating related solutions (Szybisty, 2024).
- c. **To raise awareness, educational campaigns are crucial.** These should sufficiently address environmental, health and social effects, but also compliance requirements and alternative mobility solutions (public transport, smart mobility).

3. Carefully plan mitigation strategies for socio-economic impacts

- a. **Setting well-designed compensatory measures is key to increasing social acceptability.** This means putting in place financial incentives and compensatory measures to address fairness concerns, for instance: setting free or discounted parking at zone borders or main public transport stations to enter the LEZ; offering discounted public transport tickets and fiscal or non-fiscal incentives to change vehicles; and subsidising smart mobility.
- b. Together with compensatory measures, it is necessary to **carefully design the policy measure (LEZ) to take into consideration the effects on different income groups**, particularly those who cannot afford cleaner vehicles. Granting access to important facilities such as hospitals and schools is also essential.

4. Secure collaboration and support

- a. A relevant lesson learned in Warsaw is to **engage with social groups and local NGOs**. Local organisations, associations and representatives should be engaged from the beginning and involved in creating workshops, activities and awareness campaigns. This can create a stronger sense of trust and legitimacy of the project among citizens and encourage them to engage further in bottom-up processes.
- b. Where and whenever possible, **external funding and support should be considered**. As was the case in Warsaw, further research analysis, air quality and traffic monitoring tools can be funded, as well as skillshares or best practice-sharing. This can boost the successful implementation of a LEZ.

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Annex 1

Additional exemptions to the SCT (as reported by the Resolution no. XCI/2974/2023 of the Council of the City of Warsaw, December 7, 2023.)

1. From July 1, 2024 to December 31, 2025, motor vehicles:
 - 1) with spark-ignition engines with a permissible gross vehicle weight of up to 3.5 t that meet at least the requirements of the European Euro 2 emission standard or were manufactured no earlier than 1997;
 - 2) with spark-ignition engines buses and trucks and tractors with a gross vehicle weight of more than 3.5 tons that meet at least the requirements of the European Euro 2 emission standard or were manufactured no earlier than 1997;
 - 3) with compression-ignition engines with a maximum permissible gross vehicle weight of up to 3.5 t that meet at least the requirements of the European Euro 4 emission standard or were manufactured no earlier than 2005;
 - 4) with compression-ignition engines buses and trucks and tractors with a gross vehicle weight of more than 3.5 tons that meet at least the requirements of the European Euro IV emission standard or were manufactured no earlier than 2005.
2. From January 1, 2026 to December 31, 2027 motor vehicles:
 - 1) with spark-ignition engines with a permissible gross vehicle weight of up to 3.5 t meeting at least the requirements of the European Euro 3 emission standard or manufactured no earlier than 2000;
 - 2) with spark-ignition engines buses and trucks and tractors with a gross vehicle weight of more than 3.5 t that meet at least the requirements of the European emission standard Euro III or were manufactured no earlier than 2000;
 - 3) with compression-ignition engines with a maximum permissible gross vehicle weight of up to 3.5 t that meet at least the requirements of the European Euro 5 emission standard or were manufactured no earlier than 2009;
 - 4) with compression-ignition engines buses and trucks and tractors with a gross vehicle weight of more than 3.5 tons that meet at least the requirements of the European Euro V emission standard or were manufactured no earlier than 2008.
3. From January 1, 2028 to December 31, 2029 motor vehicles:
 - 1) with spark-ignition engines with a permissible gross vehicle weight of up to 3.5 t meeting at least the requirements of the European Euro 4 emission standard or manufactured no earlier than 2005;
 - 2) with spark-ignition engines buses and trucks and tractors with a gross vehicle weight of more than 3.5 t that meet at least the requirements of the European Euro IV emission standard or were manufactured no earlier than 2005;

- 3) with compression-ignition engines with a maximum permissible gross vehicle weight of up to 3.5 t that meet at least the requirements of the European Euro 6 emission standard or were manufactured no earlier than 2014;
 - 4) with compression-ignition engines buses and trucks and tractors with a gross vehicle weight of more than 3.5 tons that meet at least the requirements of the European emission standard Euro VI or were manufactured no earlier than 2010.
4. From January 1, 2030 to December 31, 2031 motor vehicles:
- 1) with spark-ignition engines with a permissible gross vehicle weight of up to 3.5 t meeting at least the requirements of the European Euro 5 emission standard or manufactured no earlier than 2009;
 - 2) with spark-ignition engines buses and trucks and tractors with a gross vehicle weight of more than 3.5 t that meet at least the requirements of the European Euro V emission standard or were manufactured no earlier than 2008;
 - 3) with compression-ignition engines with a maximum permissible gross vehicle weight of up to 3.5 tons meeting at least the requirements of the European Euro 6dT emission standard or manufactured no earlier than 2017;
 - 4) with compression-ignition engines buses and trucks and tractors with a gross vehicle weight of more than 3.5 tons that meet at least the requirements of the European Euro VI emission standard or were manufactured no earlier than 2012.
5. From January 1, 2032 indefinitely motor vehicles:
- 1) with spark-ignition engines with a permissible gross vehicle weight of up to 3.5 t meeting at least the requirements of the European Euro 6 emission standard or manufactured no earlier than 2014;
 - 2) with spark-ignition engines buses and trucks and tractors with a gross vehicle weight of more than 3.5 t that meet at least the requirements of the European emission standard Euro VI or were manufactured no earlier than 2012;
 - 3) with compression-ignition engines with a maximum permissible gross vehicle weight of up to 3.5 t meeting at least the requirements of the European Euro 6d emission standard or manufactured no earlier than 2020;
 - 4) with compression-ignition engines buses and trucks and tractors with a gross vehicle weight of more than 3.5 tons that meet at least the requirements of the European Euro VI emission standard or were manufactured no earlier than 2012.
6. Motor vehicles classified as motorcycles and motor vehicles other in the classification of vehicles outlined in Annex No. 6 to the Regulation of the Minister of Infrastructure of August 31, 2022, on the detailed activities of the authorities in matters related to the admission of the vehicle to traffic and specimens of documents in these matters (Journal of Laws 2022, item 1849, and 2023, item 1208).

7. Special motor vehicles, understood by the definition outlined in Article 2 item 36 of the Law of June 20, 1997. - Road Traffic Law, by Appendix No. 6 to the Regulation of the Minister of Infrastructure of August 31, 2022, on the detailed activities of the authorities in matters related to the admission of the vehicle to traffic and specimens of documents in these matters.
8. From July 1, 2024, to December 31, 2027, motor vehicles, other than those listed in paragraphs 1- 7, for which the following conditions are jointly met:
 - 1) the date of the vehicle's last registration with the last registration authority is earlier than January 1, 2024, excluding a change in the license plates not resulting from a transfer of ownership of the vehicle or excluding a change in the vehicle owner's data in item C of the registration certificate as a consequence of an assignment after the termination of a loan agreement or a lease agreement effective from a date earlier than January 1, 2024;
 - 2) the vehicle is owned, co-owned, or remains in use on the basis of a paid civil law transaction or a lending agreement, by a natural or legal person who, in the year preceding the inspection, settled PIT or CIT income tax in the city of Warsaw, indicating as the place of residence or place of business an address located in the city of Warsaw, which is documented by submitting for inspection or providing a digital copy of one of the listed documents:
 - a) the first page of the PIT or CIT tax return for the previous year certified by the competent tax office in the city of Warsaw (bearing the presentation of the tax office where the return was filed),
 - b) in the case of tax settlement by means of electronic communication, a printout of the first page of the PIT or CIT return for the previous year with the generated document number, consistent with the UPO document identifier, and a printout of the Official Confirmation of Receipt (UPO),
 - c) a certificate issued by the tax office, confirming the submission of a PIT or CIT return for the previous year, indicating the city of Warsaw as the place of residence or place of business and submission of the tax return;
 - 3) listed in item C of the registration certificate, the owner, at least one of the co-owners or the person owning the car under a lease or loan agreement, is registered for permanent or temporary residence at an address located on the territory of the capital city of Warsaw or, in the case of a legal entity, has its registered office on the territory of the capital city of Warsaw.
9. As of July 1, 2024, indefinitely, motor vehicles, other than those listed in paragraphs 1- 7, for which the following conditions are jointly met:
 - 1) the date of the vehicle's last registration with the last registration authority is earlier than January 1, 2024, except a change in license plates not resulting from a

- transfer of ownership of the vehicle or except a change in the vehicle owner's data in item C of the registration certificate as a consequence of a transfer of ownership upon termination of a loan or lease agreement effective as of a date earlier than January 1, 2024;
- 2) the vehicle is owned or co-owned by an individual who is 70 years of age or older in 2023, at the latest, as of December 31, 2023;
 - 3) the person mentioned in point 2 is driving the vehicle or is a passenger in it;
 - 4) The person mentioned in point 2 may designate not more than one vehicle for exemption.
10. Motor vehicles other than those listed in paragraphs 1-7 indicated by persons for whom a European parking card has been issued, in accordance with the Law of June 20, 1997. - Traffic Law, for the period of validity of the aforementioned card, whereby the cardholder may designate no more than one vehicle for exemption.
 11. Historic motor vehicles as defined in Article 2(1)(11) of the Act of May 22, 2003 on Compulsory Insurance, the Insurance Guarantee Fund and the Polish Motor Insurers' Bureau (Journal of Laws of 2023, item 2500). For vehicles listed in Article 2, paragraph 1, item 11, letter c. of the aforementioned Act, a copy of the opinion of an appraiser included in the list of automobile appraisers maintained by the minister in charge of transportation in accordance with Article 79 a(6) of the Act of June 20, 1997, shall be submitted. - Traffic Law.
 12. Motor vehicles other than those listed in paragraphs 1-7 that are involved in or used in:
 - 1) Assembly organized by the provisions of the Law of July 24, 2015. - Law on Public assemblies (Journal of Laws 2022, item 1389),
 - 2) cultural event - notified by the schedule provided by the organizer, for its duration and a maximum of one day before and after the planned gathering or event, not more than 10 days in a calendar year.
 13. All motor vehicles not listed in paragraphs 1-12 not more than 4 days per calendar year.



This work has been produced with financial support from the Clean Air Fund.



This work has been produced with the financial support of the LIFE Programme of the European Union. The paper reflects only the views of its authors and not the donors.

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