

# Breathe Warsaw Low Emission Zone Assessment Summary

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06 September 2023

# Contents

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Introduction

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Air quality model inputs & behavioral assumptions

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Air quality modelling results

---

Economic and health impact assessment

---

Discussion

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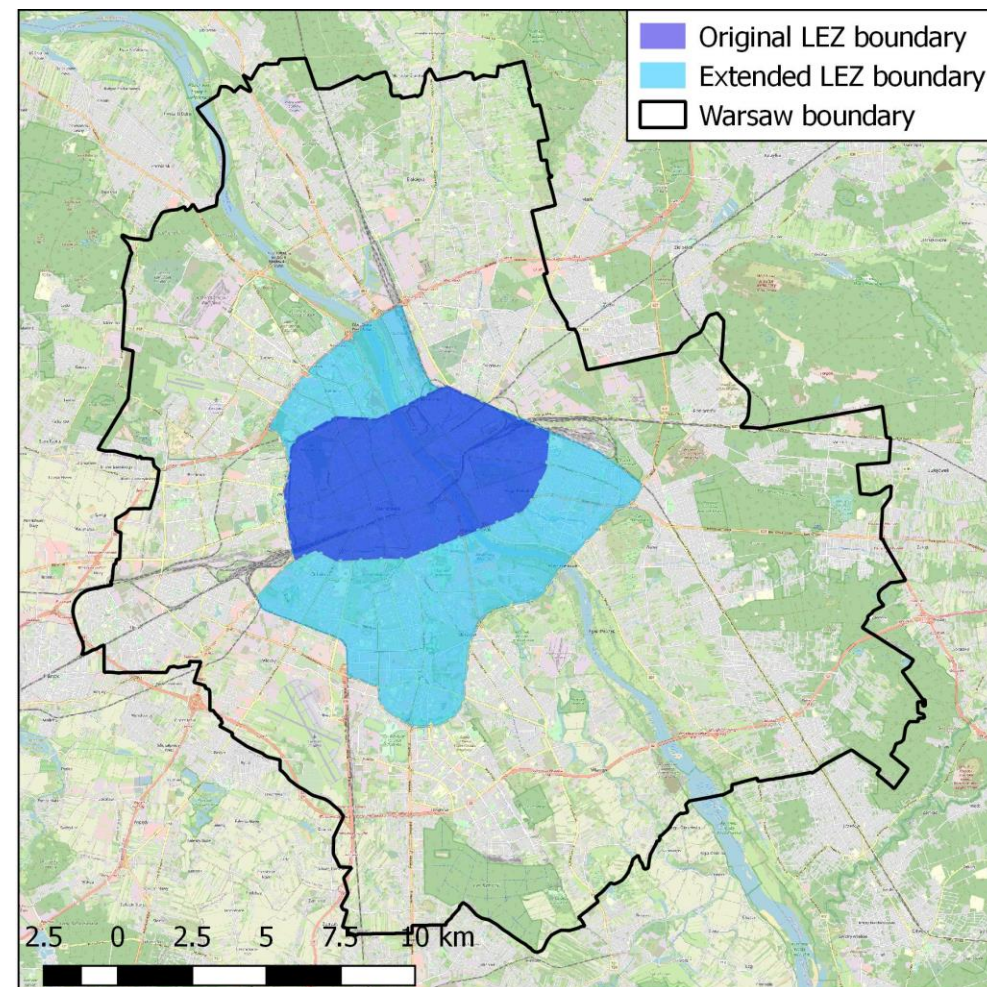
# Modelled scheme options

## Scenarios

We have provided NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> annual mean concentration outputs for:

- **2019 base year** for model validation against monitored data
- **2026 Baseline** future scenario against which to compare the LEZ scenarios
- **2026 Phase 2** – Euro 3 Petrol, Euro 5 Diesel
- **2026 Phase 2A** (extended zone with exemptions) – Euro 3 Petrol, Euro 5 Diesel
- **2026 Phase 3** – Euro 4 Petrol, Euro 6 Diesel
- **2026 Phase 3A** (extended zone) – Euro 4 Petrol, Euro 6 Diesel

Rok wdrożenia	2024	2026	2028	2030	2032
Pojazd z silnikiem	Etap 1	Etap 2	Etap 3	Etap 4	Etap 5
Benzynowym	Euro 2	Euro 3	Euro 4	Euro 5	Euro 6
	max. 27 lat	max. 20 lat	max. 17 lat	max. 15 lat	max. 13 lat
Diesla	Euro 4	Euro 5	Euro 6	Euro 6dT	Euro 6d
	max. 18 lat	max. 11 lat	max. 9 lat	max. 9 lat	max. 9 lat
% aut wg CEPIK 2021*	13,20%	32,40%	48,90%	69,40%	76,80%
% aut wg pom. ICCT**	2%	9%	16%	23%	27%
Spadek emisji NOx	-11%	-27%	-55%	-74%	-80%
Spadek emisji PM	-20%	-55%	-66%	-68%	-69%



# Behavioural response assumptions

The following behavioural response assumptions were applied to assess the impact of the LEZ scheme and were split between activity within the LEZ and that outside the LEZ:

## Vehicles within LEZ:

- Travel behaviour response - we first removed the following percentage of non-compliant vehicles before applying the upgrade response to account for vehicles potentially diverting, cancelling their trip or changing mode:

Vehicle type	Cars	Vans	HGVs	City buses	Other buses
Remove AADT (LEZ only)*	29%	16%	8%	0%	10%

- Upgrade response - percentage of the non-compliant fleet that upgrade to a compliant vehicle:

Vehicle type	Cars	Vans	HGVs	City buses	Other buses
Fleet upgrade*	90%	76%	90%	100%	89%

## Vehicles outside LEZ:

- Travel behaviour response - we did not apply any travel behaviour response as these are uncertain
- Upgrade response - we have assumed that **19% (35% extended LEZ) of non-compliant vehicles will see an upgrade response**. This is because the transport model shows that an average of 19% (35%) of trips that start outside of the LEZ end in the LEZ

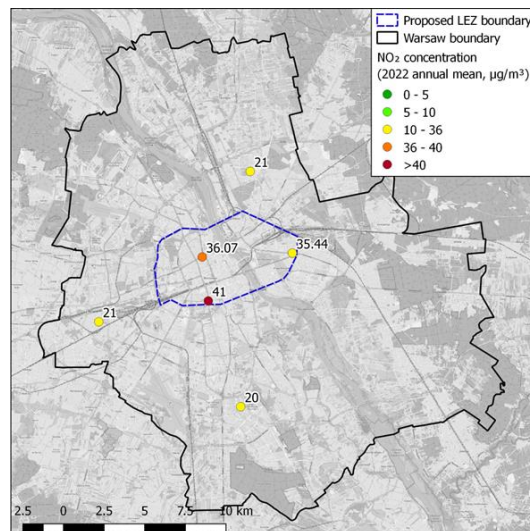
## Scheme exemption for residents living in the zone :

- The transport model shows that 38% of passenger cars start or end their journey at 'home' inside the extended LEZ. The percentage of these vehicles that do not meet the LEZ restrictions were assumed as being exempt from the scheme

# Model inputs

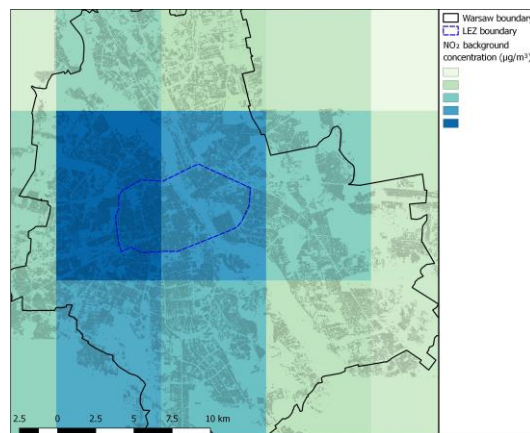
- **Air quality monitoring data**

- Monitoring data provides annual mean concentrations of  $\text{NO}_2$ ,  $\text{PM}_{10}$  &  $\text{PM}_{2.5}$  at points across the city
- Applied to model validation and locations used for reporting of results



- **Background concentrations**

- Non-road transport emission sources estimated using satellite data and background monitoring sites



- **Street canyons**

- Determined using building heights data

- **Road gradients**

- Determined using satellite data

- **Traffic activity and speed data**

- Local traffic model data provided by the City
- Traffic count data

- **Vehicle fleet composition**

- Vehicle age (Euro class) and fuel splits for the different vehicle types were compiled using local (ANPR) and national data

- **Emission factors**

- Warsaw real-world emissions data provided by TRUE / ICCT were applied to adjust COPERT emissions factors for nitrogen oxides (NO<sub>x</sub>)

- **Vehicle fleet projections**

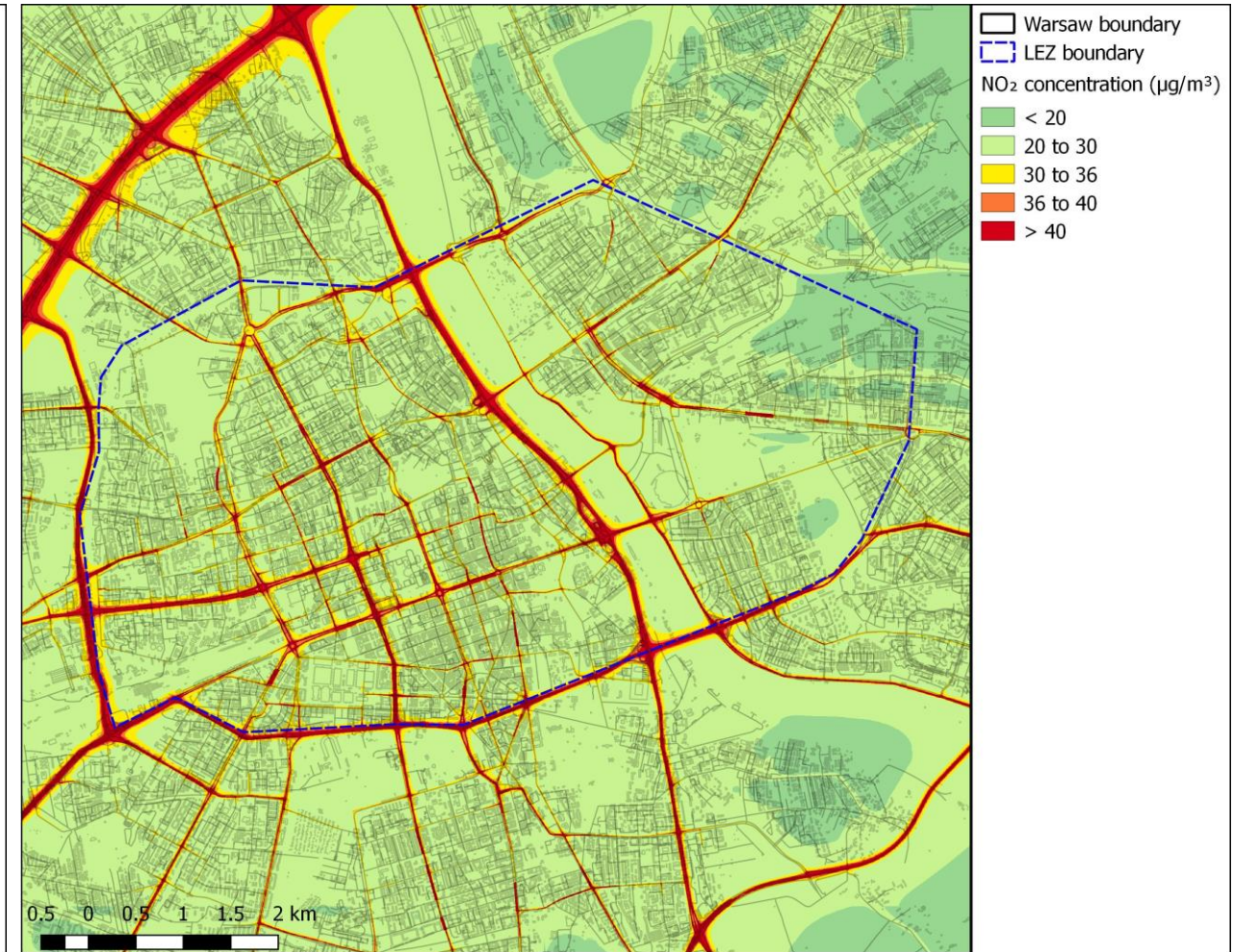
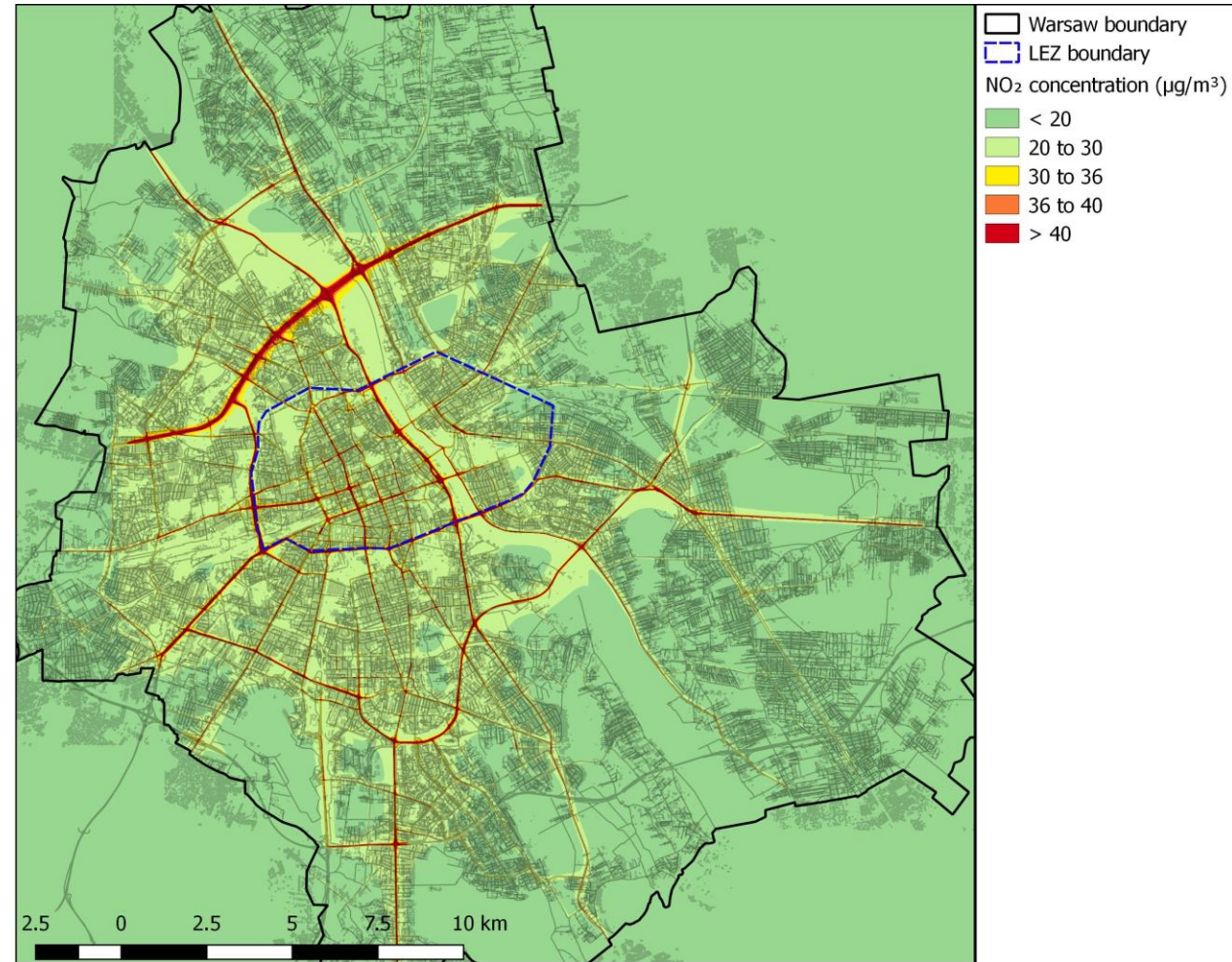
- Vehicle fleets were projected to be representative of the 2026 Baseline using data obtained from TRUE / ICCT and bus fleet upgrade schedule

# Air quality modelling NO<sub>2</sub> results

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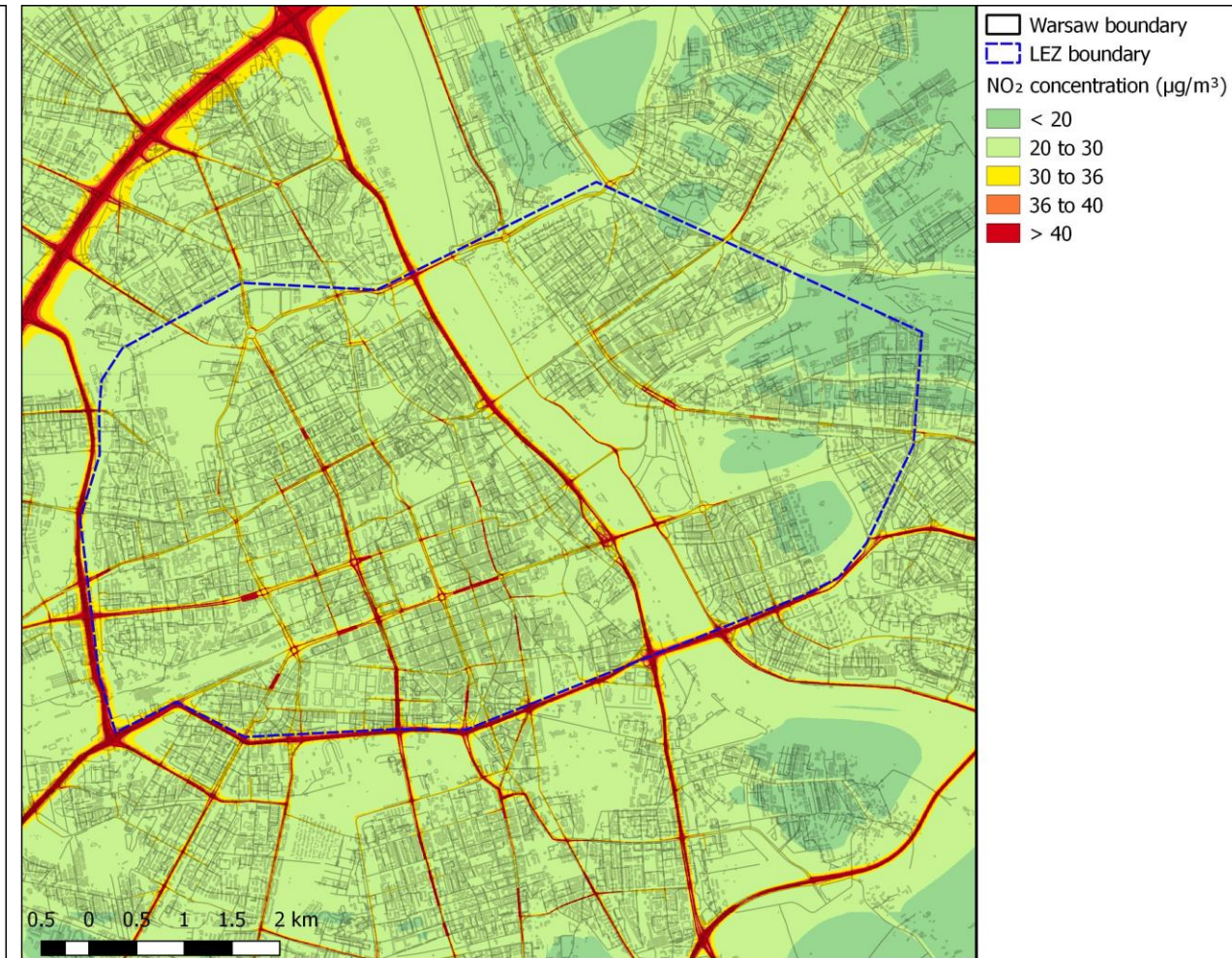
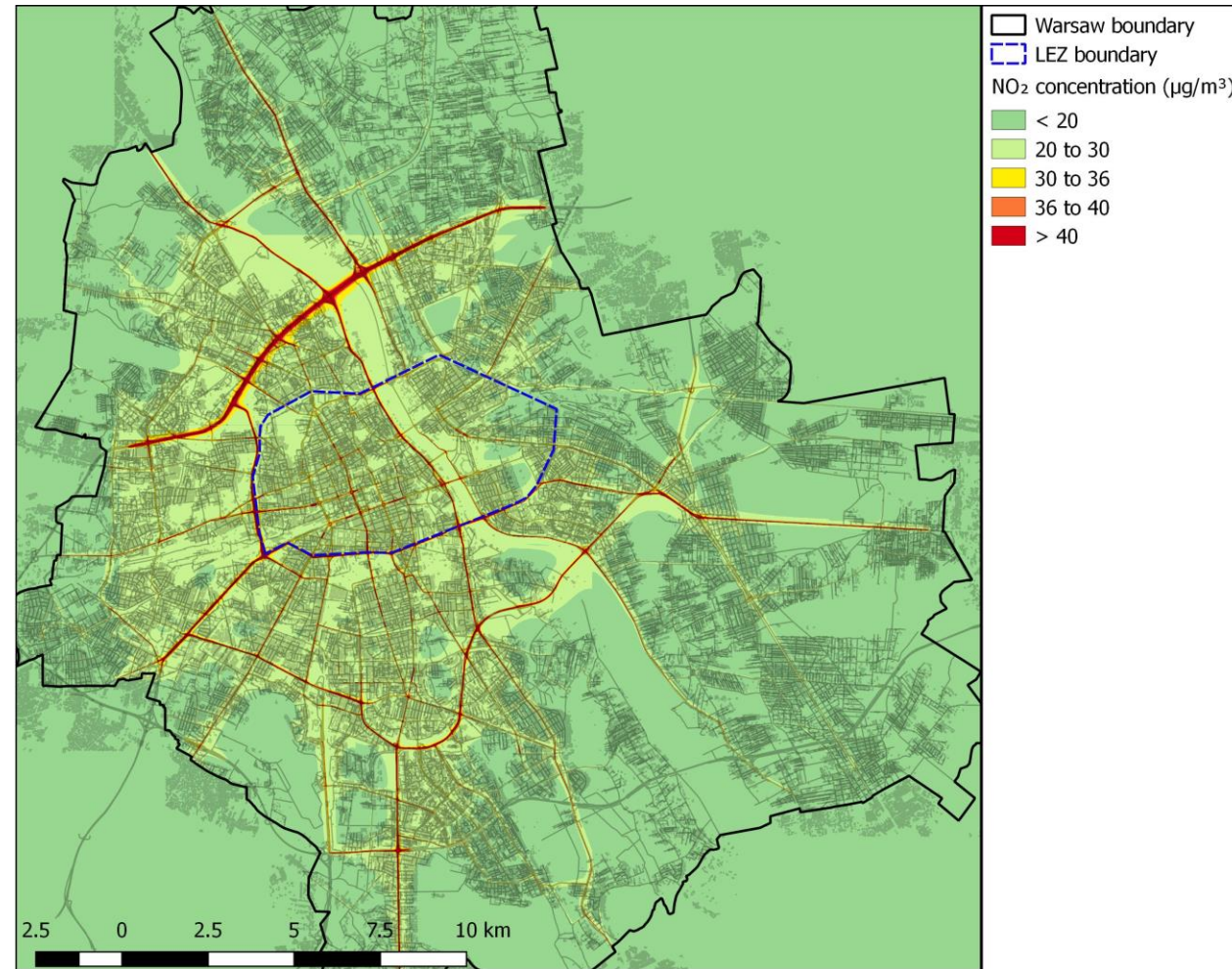


# 2026 Baseline NO<sub>2</sub> concentration



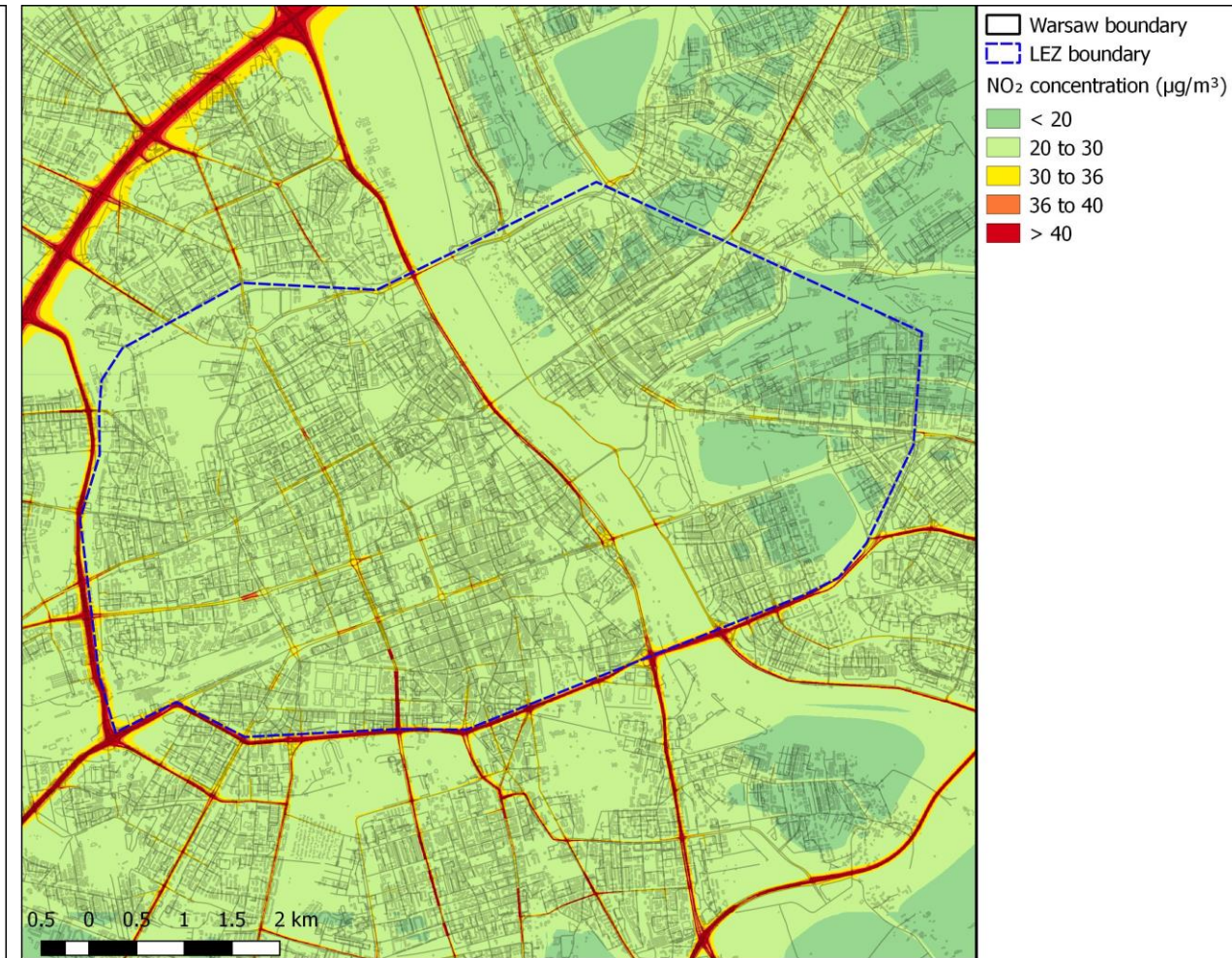
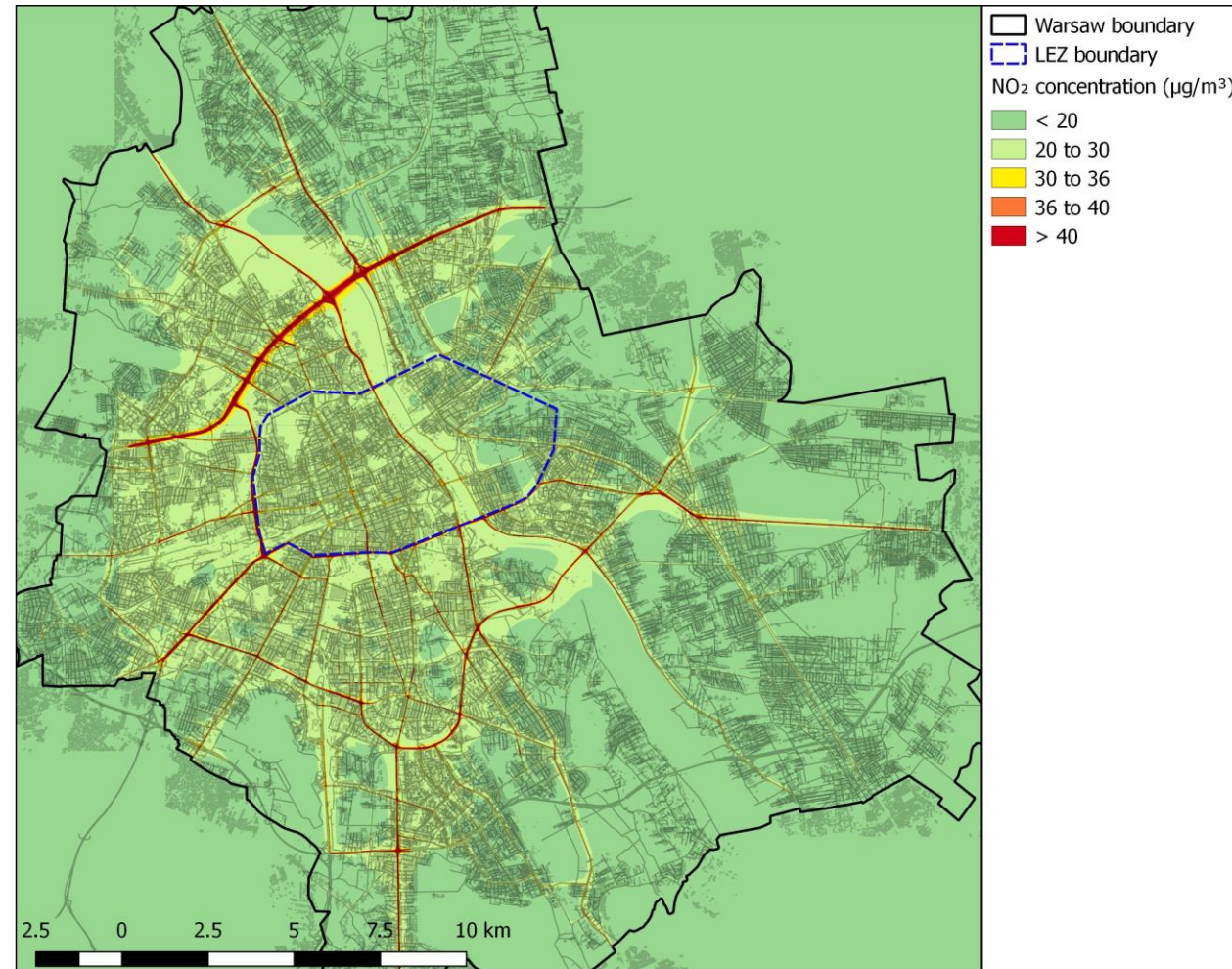


# 2026 LEZ Phase 2 (with TB) NO<sub>2</sub> concentration





# 2026 LEZ Phase 3 (with TB) NO<sub>2</sub> concentration



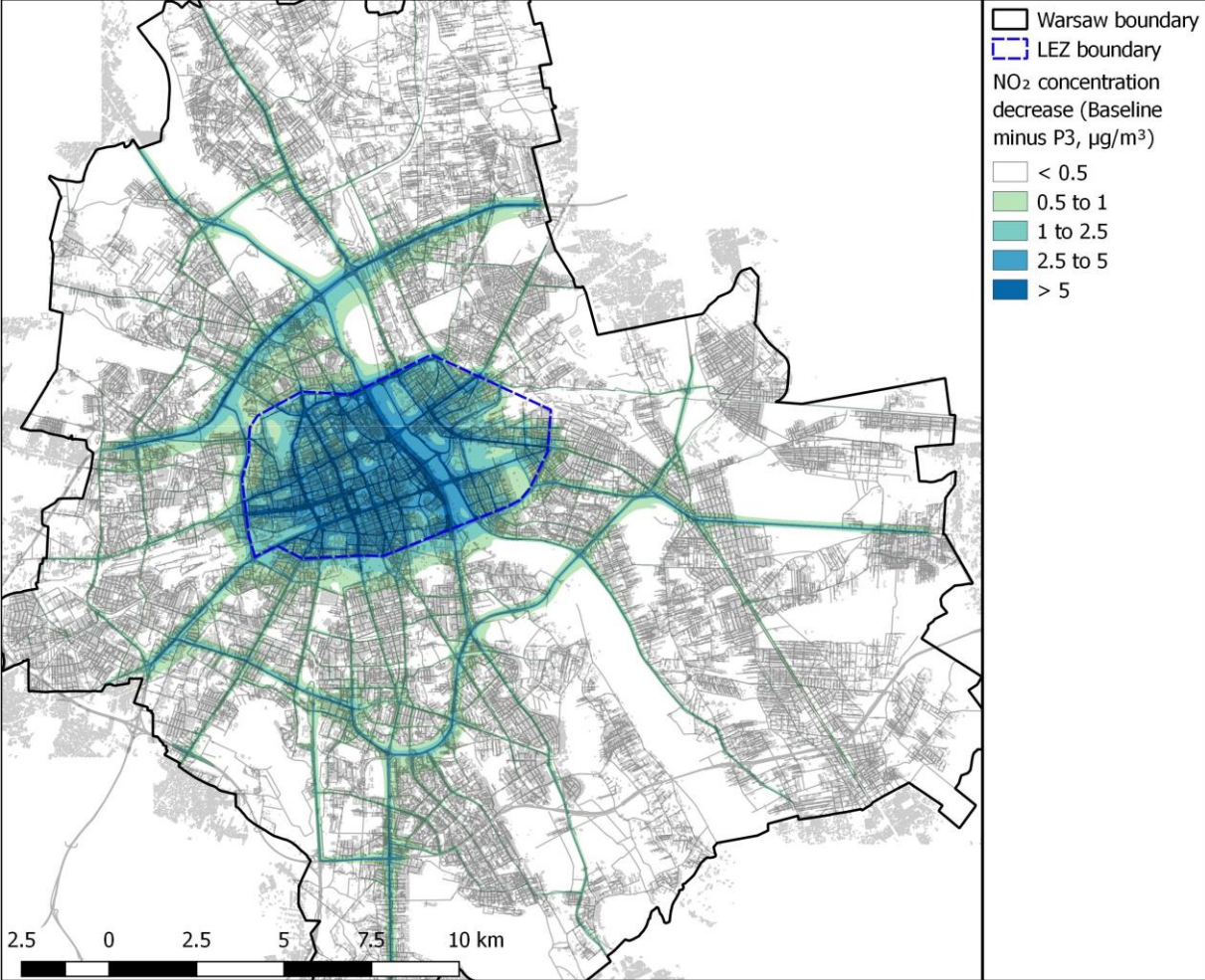


# NO<sub>2</sub> concentration decrease as a result of LEZ implementation

Phase 2



Phase 3



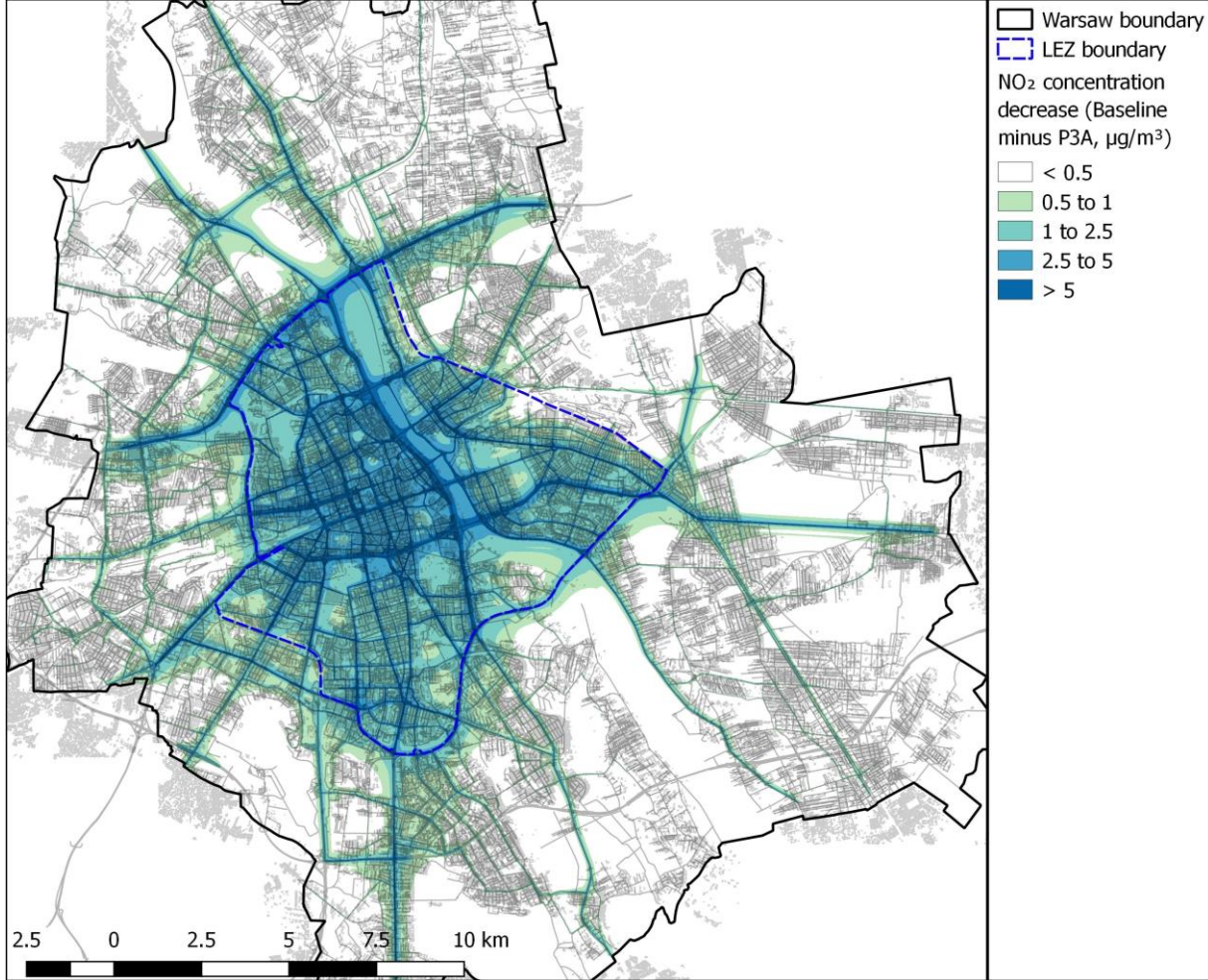


# NO<sub>2</sub> concentration decrease as a result of LEZ implementation

### Phase 2A



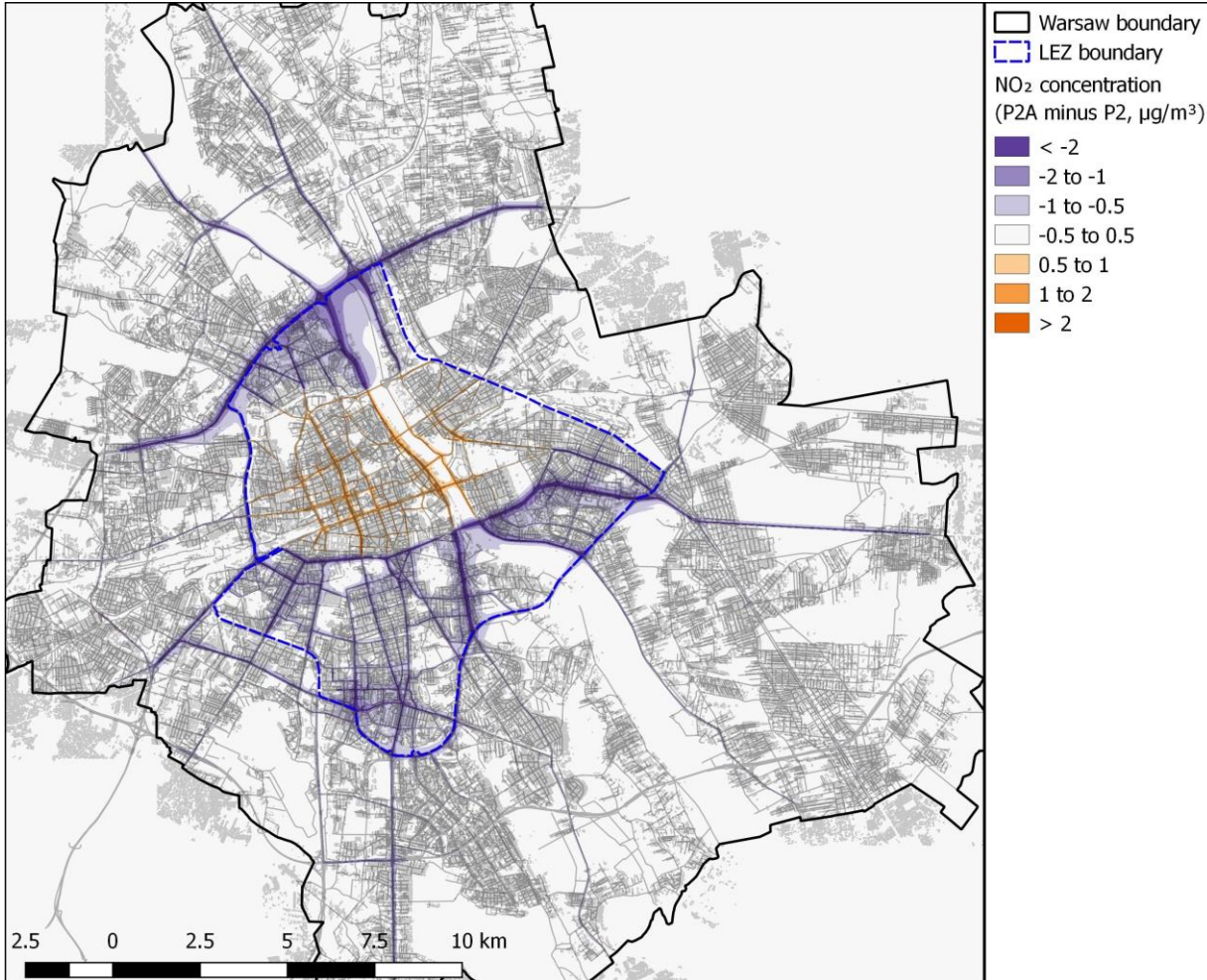
### Phase 3A



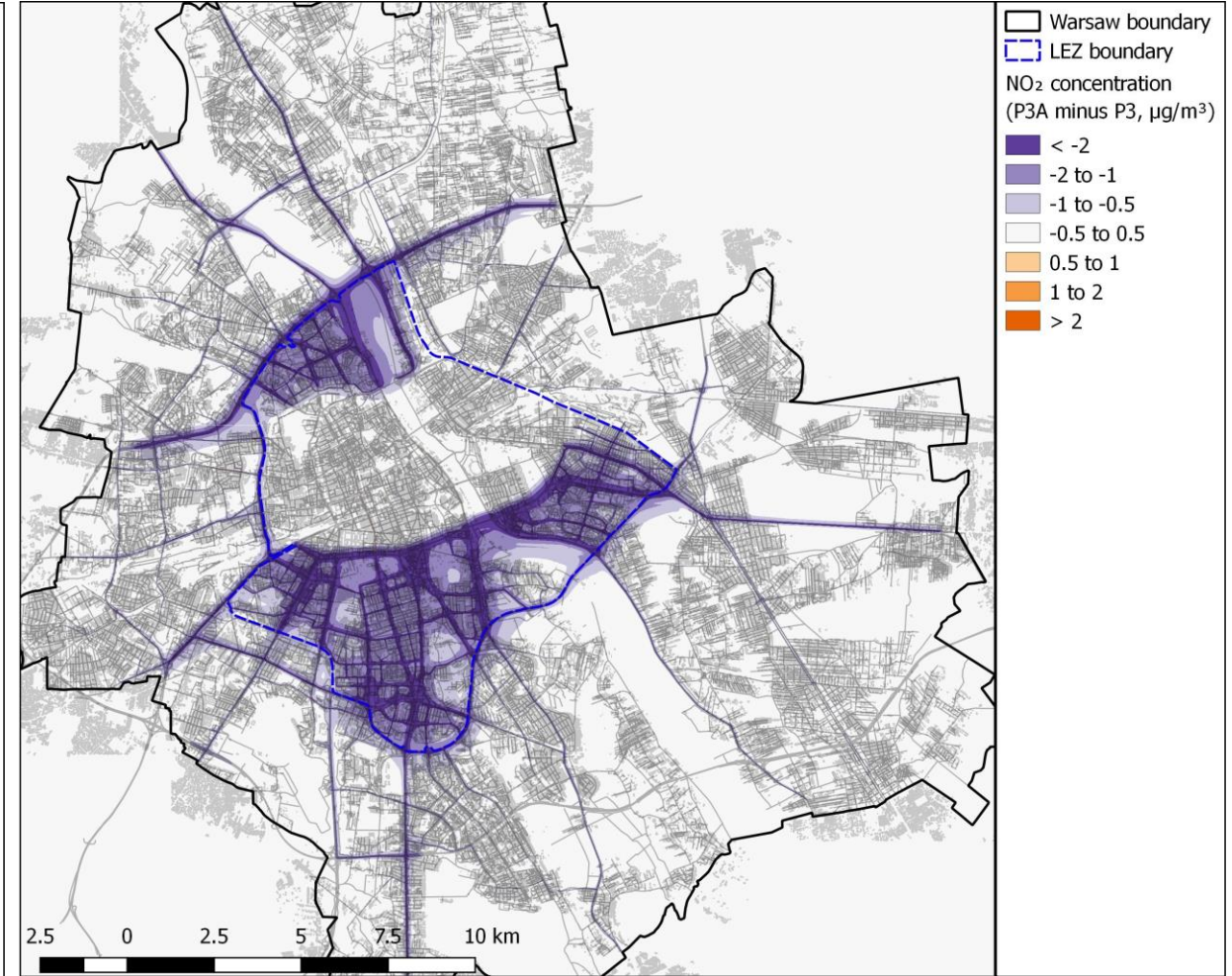


# NO<sub>2</sub> concentration: Comparison of original and extended LEZ

## Phase 2A – Phase 2



## Phase 3A – Phase 3



# Economic and health impact assessment

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# Health impact assessment (HIA) – overall monetised impacts

- HIA captures a range of different health impact pathways, including both mortality and morbidity effects
- Approach follows methodology and assumptions used in EU assessments
- Captures: savings in healthcare costs, avoidance of lost productivity, and value that placed on own good health and wellbeing
- **Value of air pollution benefit on human health** could range from **EUR 45m – 156m per annum for Phase 2A**, and from **EUR 95m – 338m pa for Phase 3A** under an extended LEZ
  - *This compares to EUR 31m – 108m and EUR 57m – 197m under Phase 2 and 3 respectively, under a smaller Low Emission Zone*

## PHASE 3A – ‘Attributable’ health effects

92 fewer deaths per annum / 950 life-years saved

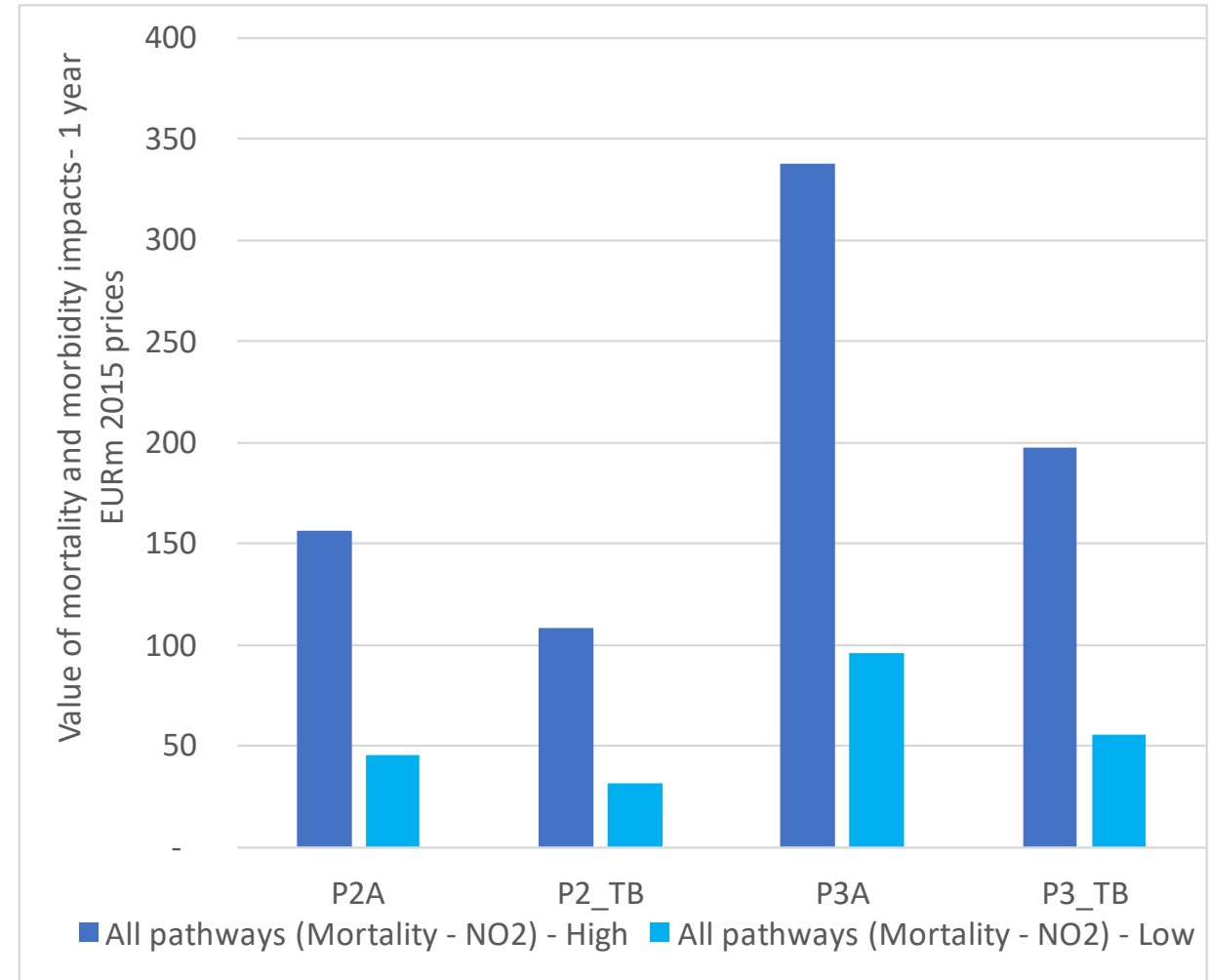
8 fewer new cases of chronic bronchitis in adults, 23 fewer bronchitis episodes in children

11 less hospital admissions each year for respiratory or cardio-vascular complaints

18,200 fewer restricted activity days

8,500 fewer work days lost

5 less new stroke cases, 15 less myocardial infarctions, 3 fewer new cases of lung cancer





## Cost benefit analysis – updated results

### Comparison of updated results

- **Larger zone Phase 2A/3A have larger positive NPV compared with smaller zone options**
  - i.e. they would deliver a larger overall benefit to society than smaller zone options
- **BCR of the larger zone are broadly similar to those for the smaller zone, and do not decrease**
  - i.e. the return / extra benefit achieved for each additional zloty invested in a large zone, is similar to the payback on each zloty invested in a smaller zone
  - Car exemption for 2A does not seem to have a large effect on overall BCR
- Phase 2A and 3A are estimated to deliver a net benefit to society valued at 2.6bn and 5.2bn zloty respectively (11% and 20% of the City's annual budget)
- GHG emission reductions of 391kt for P2A and 692kt for P3A

Results (Million zloty)	Smaller zone		Extended zone	
	Phase 2	Phase 3	Phase 2A	Phase 3A
Health impacts	793	1,430	1,140	2,460
Vehicle upgrade costs	-753	-1,087	-1,330	-1,990
Residual value of scrapped vehicles	-14.9	-48.2	-23.6	-88.3
Change in fuel use	1,260	2,121	2,180	3,880
Change in non-fuel vehicle operating costs	240	297	439	543
Welfare impacts of cancelled trips	-28.9	-59.4	-33.1	-81.5
Change in travel time	-50	-102	-59.6	-136
GHG Emissions	201	335	346	612
Implementation costs	-10.8	-10.8	-19.7	-19.7
<b>Benefit:Cost ratio</b>	<b>2.91</b>	<b>3.20</b>	<b>2.80</b>	<b>3.24</b>
<b>Net present value</b>	<b>1,630</b>	<b>2,880</b>	<b>2,640</b>	<b>5,180</b>

Note: green text signifies a benefit, red text signifies a cost

# Distributional analysis – Focus on impacts on businesses

- Businesses could be affected either: directly, indirectly or both. Businesses both inside and outside the proposed LEZ could be affected and across a wide range of sectors, including: taxi drivers and operators, bus and coach operators, logistics, refuse and waste collection and operations, etc.
- But not all businesses and trips would be affected (e.g. 0-24% under Phase 2 smaller zone, and 0-38% under Phase 3 smaller zone, depending on vehicle type)

## Costs and affordability risks

- **Some businesses will face a cost to comply with the LEZ** (i.e. those operating non-compliant vehicles). **Size of impact and risk to business will also depend on a number of other variables**, relating to their vehicle ownership and use, response to the zone, and wider operation
- **Smaller firms are more likely to face greater affordability risks** due to a number of factors
- Hence should a LEZ be taken forward, **mitigation measures could also be considered** for those negatively affected and most at risk. Several potential measures were highlighted in the stakeholder survey and workshop in the first project phase, including:
  - financial subsidy for the purchase of new vehicles/retrofit/alternative means of transport, improvements of the public transport and cycling network, derogations for certain vehicles, and amending taxi licencing conditions.

## Positive effects for businesses

- **For some businesses there will be positive effects**: e.g. those operating cleaner fleets or modes of travel may see an increase in demand for their services. Also businesses (in particular retail and cultural operators) may benefit from the cleaner, safer environment in the city centre.
- Through the engagement activities, **many stakeholders highlighted the potential benefits of a LEZ in Warsaw**. E.g. in the Workshop:
  - All participants agreed on the need to improve air quality in Warsaw and that a low emissions zone could be helpful, in particular where combined with additional measures around public and active travel which could increase promotion of a healthy and environmentally friendly lifestyles
  - Most businesses noted they could/would upgrade vehicles in response, and noted city centre parking was more of an issue
- Furthermore, **40 local businesses have signed a letter supporting a LEZ in Warsaw**. They suggest:
  - *[translated Polish to English] Examples from European cities show that Clean Transport Zones and activities limiting car traffic translate into greater activity of residents in urban space, which has a positive impact on local business.*
  - *Clean air, less traffic jams, less noise and more space for people are a necessary direction in the development of the capital if we want it to be a city friendly to its inhabitants and attractive to tourists.*

# Discussion

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