LOW EMISSION ZONE ASSESSMENT

2023 REPORT
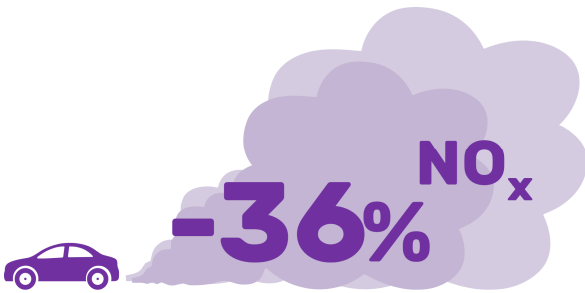
99,3%

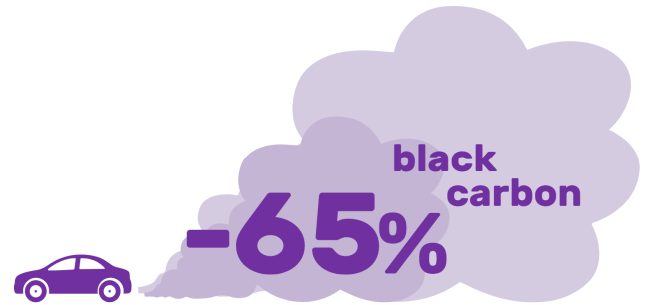Mid 2024, **99.3%** of vehicles **met** the LEZ access criteria

68% 26% 7%

Mid-2024, the car fleet consisted of
68% petrol, 26% diesel, 7% electric vehicles

-36% NO$_x$
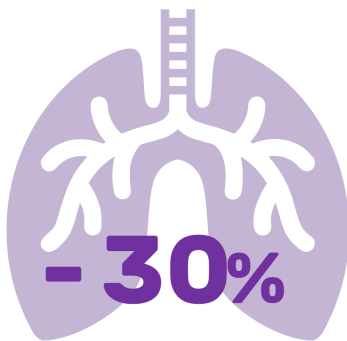
The change to the fleet made it possible to reduce **nitrogen oxide** (NO$_x$) emissions by **36%** between 2018 and the end of 2023

-65% black carbon
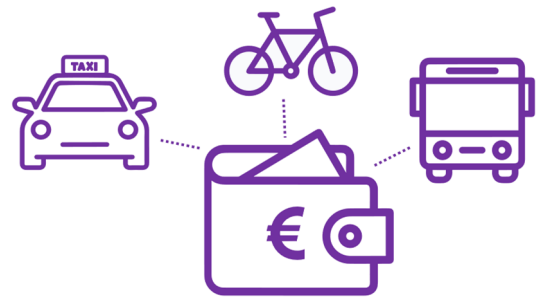
The change to the fleet made it possible to reduce **black carbon** emissions by **65%** between 2018 and the end of 2023

-30%

The change to the fleet made it possible to reduce the **NO$_2$ concentration** by **30%** along the most heavily travelled roads since 2018

€

1,203 Bruxell'Air premiums were awarded to Brussels residents in 2023

5117

0

2018   2023
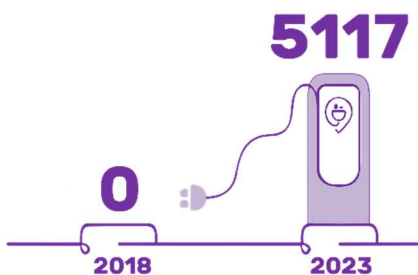
At the end of 2023, Brussels had **5,117** publicly accessible **recharging points**
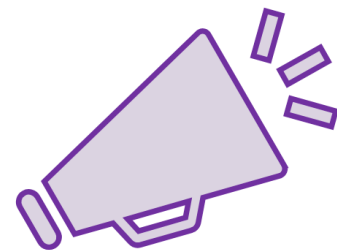
In 2023, the new communication strategy **"Laissons Bruxelles Respirer"** (Let Brussels Breathe Again) was launched

Contents

Introduction

Air pollution has major negative impacts on the health of the people of Brussels. Exposure to pollutants, particularly fine particles (PM) and nitrogen dioxide (NO_2), is responsible for premature deaths, illnesses (respiratory and cardiovascular diseases, asthma, etc.) and significant economic costs to society (medication, hospitalisation, absenteeism from work, etc.)[1].

According to the latest report (2023) from the European Environment Agency, air pollution was causing more than 5,000 premature deaths a year in Belgium in 2021: 5,100 are linked to emissions of fine particles (PM_{10} & $PM_{2.5}$), 1,400 to emissions of nitrogen dioxide (NO_2) and 310 to exposure to ozone (O_3). In the Brussels-Capital Region (BCR), it is estimated that exposure to $PM_{2.5}$, NO_2 and ozone (O_3) in the air caused 400, 179 and 180 premature deaths respectively during the year 2023[2]. To tackle this public health issue, the European Union has recently tightened the air quality standards to be met by 2030. The Brussels Region must therefore continue and step up its efforts to achieve these objectives.

Road transport is the main source of emissions of nitrogen oxides (NO_x), and the second contributor of fine particle emissions in the BCR. That's why, in 2018, the Low Emission Zone (LEZ) was introduced across the whole of the BCR. It is designed to gradually ban the most polluting vehicles (cars, vans and buses) from driving in the Region. As required by the legislation, each year Brussels Environment publishes a report assessing compliance with and the impact and relevance of the LEZ in the BCR. This current report takes stock of the LEZ in 2023. The reports for 2018 to 2022 are available at www.lez.brussels.

In 2023, no new milestones came into force, and the Region worked to strengthen supporting measures to better inform and support people experiencing difficulties with the LEZ in order to prepare for the entry into force of the upcoming milestones. For example, the government introduced new exemptions for people with disabilities and for caregivers with social security rights. These will come into force from January 2025. A new communication strategy, "Laissons Bruxelles Respirer" (Let Brussels Breathe Again), was also rolled out to better communicate the health benefits of the LEZ.

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[1] VITO, 2021: https://document.environnement.brussels/opac_css/elecfile/RAPP_VITO_Health_Impact_Thermic_Ban_FR.pdf

[2] IRCELINE 2024. It is important to note that some premature deaths are linked to exposure to several pollutants, and that the three figures are not cumulative. The new relative risks in the WHO global air quality guidelines for 2021 have been used in recent health impact calculations. In this respect, they may differ from previous calculations of health impact.

Impact of the LEZ on the vehicle fleet

1. Data from ANPR cameras

In 2023, the number of cameras remained similar to previous years. Some 363 Automatic Number Plate Recognition (ANPR) cameras were used to monitor compliance with the LEZ. The Region's network of cameras makes it possible to identify vehicles that have driven within the LEZ. The number plates of the detected vehicles are sent daily to Brussels Taxation, which checks the technical characteristics of the vehicles (category, fuel, Euro standard, etc.) on the basis of data from the DIV (Vehicle Registration Service). To produce this assessment report, the data is anonymised and the plate numbers encrypted before being sent to Brussels Environment.

Deployment of the ANPR network (number of cameras)

211 272 353 363

2019   2021   2023
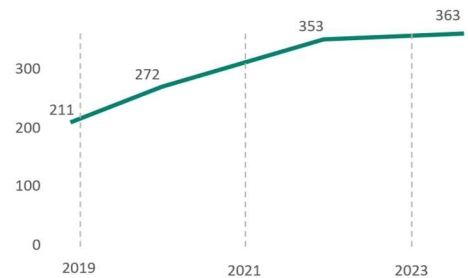
95% of vehicles on the road in Brussels are Belgian

95,2%

4,8%
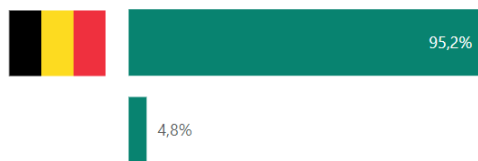
In 2023, as in the previous year, around 95% of the vehicles detected on an average day in Brussels were registered in Belgium. The technical characteristics of foreign vehicles, although subject to the LEZ, are not known to the DIV. With the exception of the Netherlands, for which the technical data is available in open data, foreign-registered vehicles must therefore register online to be able to drive in the LEZ.

Of the Belgian-registered vehicles on the road on an average day in the LEZ, almost half (47.9%) are registered in Brussels, 34.6% in Flanders and 10.6% in Wallonia. In terms of categories, 87.4% of these vehicles are cars (class M1), 10.5% are vans (category N1), 1% are heavy goods vehicles (N2 and N3), 0.4% are (mini-)buses and coaches (M2 and M3) and 0.4% are two-wheelers, three-wheelers and four-wheelers (L).

In 2023, half the vehicles on the roads in Brussels on an average day are registered in Brussels

47,9 %

34,6 %

10,6 %
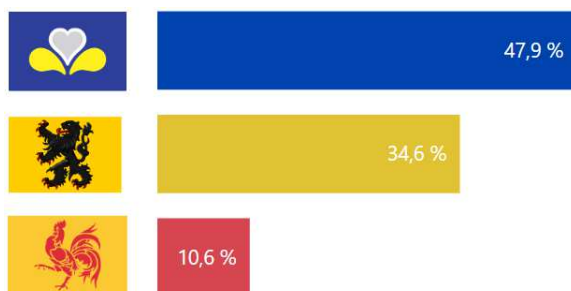
Cars and vans account for most of the vehicles on the road in Brussels in 2023

Cars	87,4%
Vans	10,5%
HGV	0,8%
Buses & coaches	0,4%
2-wheelers, 3-wheelers, 4-wheelers	
Others	
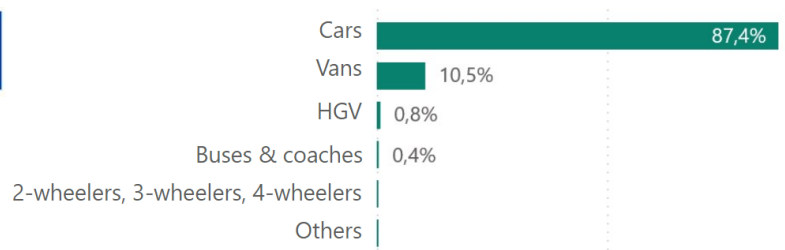
In 2023, ANPR cameras detected an average of 358,315 unique vehicles per day in the LEZ (all categories combined). The busiest days of the week are Thursdays and Fridays. The least busy day is Sunday.

2. Impact of the LEZ on the composition of the vehicle fleet on the road

2.1. LEZ access criteria

Access to the LEZ depends on the category of vehicle, its fuel and its Euro standard. The detailed access criteria can be found on the www.lez.brussels website, where you can also use a simulator designed to check whether or not a vehicle is authorised to be on the road. To do this, simply enter the number plate and the dates of the first and last registrations.

99,3%

Mid-2024, 99.3% of vehicles affected by the LEZ (categories M1, M2, M3, N1) that had driven in the zone were compliant or covered by an exemption or the purchase of a day pass.

2.2. Agenda for the low-emission zone

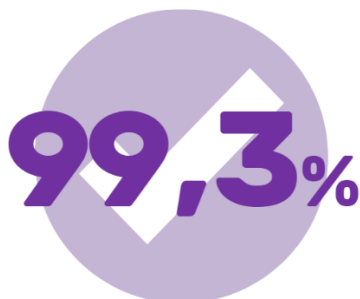In 2022, the LEZ agenda was drawn up until 2036 for all vehicle categories, to give a clear view of how the gradual phase-out of combustion engines will take place. On 4 October 2024, the Brussels Parliament decided to postpone by two years the driving ban that was due to come into force on 1 January 2025. The 2025 milestone is replaced by a new milestone in 2027 in the table below. The next stages of the LEZ, as set in 2022, remain unchanged.

- **For cars and vans**, the ban on diesel engines is scheduled for 2030, and petrol, LPG and CNG engines for 2035.
- **The largest vans (category N1 class II and III) and minibuses** with combustion engines (petrol and diesel) will be phased out up until 2035, with progressive restrictions over the years. In 2027, diesel vehicles will have to be at least Euro 6; in 2028, Euro 6d-TEMP and in 2030 Euro 6d/6e.
- **Heavy goods vehicles (HGVs)** will be affected by the LEZ from 1 January 2027, the date from which diesel HGVs will have to meet at least Euro VI standards to be able to drive in the Region.
- **Motorised two-wheelers, quad bikes and other "licence-free cars" (category L)** will also have to comply with certain access criteria, depending on their Euro standard, fuel and vehicle model, from 2027. Diesel cars will be banned from 2027. For petrol vehicles, the LEZ agenda should be consulted, as separate milestones are set according to the type of vehicle in category L.

Agenda for the low emission zone

Vehicle	Fuel	2022	2027	2028	2030	2035	2036
Car (M1) Van (N1, Class I)	Diesel/hybrid	≥ Euro 5	≥ Euro 6	≥ Euro 6d	⊘	⊘	⊘
	Petrol/hybrid/CNG/LPG	≥ Euro 2	≥ Euro 3	≥ Euro 4	≥ Euro 6d	⊘	⊘
Minibus (M2) Van (N1, Class II, III)	Diesel/hybrid	≥ Euro 5	≥ Euro 6	≥ Euro 6d-TEMP	≥ Euro 6d	⊘	⊘
	Petrol/hybrid/CNG/LPG	≥ Euro 2	≥ Euro 3	≥ Euro 4	≥ Euro 6d	⊘	⊘
Bus (M3, Class I, II, A)	Diesel/hybrid	≥ Euro V	≥ Euro VI	≥ Euro VI	≥ Euro VI	≥ Euro VId	⊘
	Petrol/hybrid/CNG/LPG	≥ Euro II	≥ Euro III	≥ Euro IV	≥ Euro VI	≥ Euro VId	⊘
Coach (M3, Klasse III, B)	Diesel/hybrid	≥ Euro V	≥ Euro VI	≥ Euro VI	≥ Euro VI	≥ Euro VId	≥ Euro VIe
	Petrol/hybrid/CNG/LPG	≥ Euro II	≥ Euro III	≥ Euro IV	≥ Euro VI	≥ Euro VId	≥ Euro VIe
Moped (L1-L2)	Diesel/hybrid	Alle	⊘	⊘	⊘	⊘	⊘
	Petrol/hybrid/CNG/LPG	Alle	Alle	≥ Euro 5	⊘	⊘	⊘
Motorbike (L3-L5)	Diesel/hybrid	Alle	⊘	⊘	⊘	⊘	⊘
	Petrol/hybrid/CNG/LPG	≥ Euro 2	≥ Euro 3	≥ Euro 4	≥ Euro 5	⊘	⊘
Four-wheeler (L6-L7)	Diesel/hybrid	Alle	⊘	⊘	⊘	⊘	⊘
	Petrol/hybrid/CNG/LPG	Alle	Alle	≥ Euro 4	≥ Euro 5	⊘	⊘
HGV (N2-N3)	Diesel/hybrid	≥ Euro VI	≥ Euro VI	≥ Euro VI	≥ Euro VId	≥ Euro VIe*	≥ Euro VIe*
	Petrol/hybrid/CNG/LPG	≥ Euro III	≥ Euro III	≥ Euro IV	≥ Euro VId	≥ Euro VIe*	≥ Euro VIe*

* Only for N2 whose reference mass is greater than 2610 kg and for N3

LEZ milestones: age of cars (M1) at the time of the ban

	2027		2028		2030		2035	
	Standard	Age	Standard	Age	Standard	Age	Standard	Age
Diesel	Euro 5	> 11 ½	Euro 6, 6dtemp	> 8,5 > 8	Euro 6d Euro 6e	> 6 ½ > 2	Ø	Ø
Petrol	Euro 2	> 27	Euro 3	> 23	Euro 4, Euro 5, Euro 6, 6dtemp	> 20 >14,5 > 10,5 > 10	Euro 6d Euro 6e	> 11 ½ > 7

2.3. Vehicles affected

2.3.1. Past milestones

Since the introduction of the LEZ, the various milestones have continued to be well respected. For example, Euro 4 diesel cars, which accounted for almost 14% of the car fleet on the road in Brussels at the start of the LEZ, represent just 0.3% in 2024. As a result, the cars affected by the LEZ have all but disappeared from the Region's roads. This has led to a significant improvement in air quality in Brussels.

The proportion of cars (M1) on the road fell sharply before the application of the various milestones for 2019, 2020, 2022 and 2027

2019		
1,0 %	0,2 % 0,1 % 0,1 % 0,1 %	0,1 % 0,1 % 0,1 % 0,3 % 0,3 % 0,3 %

2020		
4,5 % 3,5 % 2,5 %	0,7 % 0,2 % 0,1 %	0,1 % 0,1 % 0,0 % 0,0 %

2022		
13,9 % 12,9 % 11,5 % 12,0 %	8,6 % 6,4 % 3,0 % 0,9 %	0,5 % 0,4 % 0,3 % 0,3 %

2027		
21,6 % 19,9 % 18,6 % 19,1 %	17,5 % 16,3 % 15,6 % 14,2 %	11,8 % 10,0 % 8,3 % 6,9 %

Number of fines issued
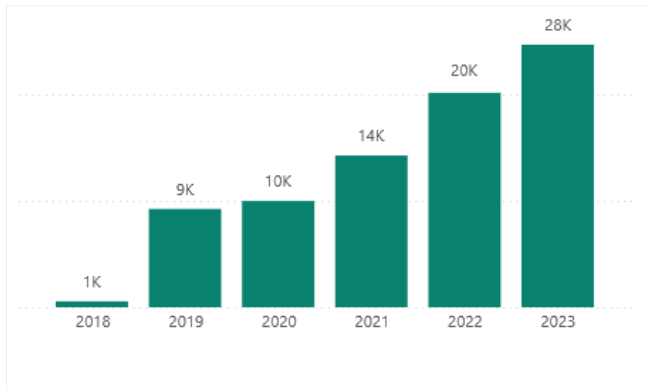
The number of fines issued was higher in 2023 than in 2022. This difference can be explained by the fact that fines for newly affected vehicles only began to be issued in July 2022 (a transitional period of 6 months having been set following the entry into force of the 2022 milestone), whereas, in 2023, fines were issued throughout the year. 19% of the fines issued between 2018 and 2023 relate to vehicles registered in Brussels, 43% to vehicles registered in Wallonia and 38% to vehicles registered in Flanders.

The trend is similar for vans (N1). As a result, the proportion of vehicles targeted by the 2022 milestone has fallen from over 20%, when the LEZ was first rolled out, to 1% in 2024. The LEZ scheme therefore remains highly effective in influencing the vehicle fleet on the road in the BCR.

The proportion of Euro 4 diesel vans (N1) in circulation has been gradually reduced following the application of the 2022 milestone. However, a significant number of vans targeted by the 2027 milestone are still in the fleet.
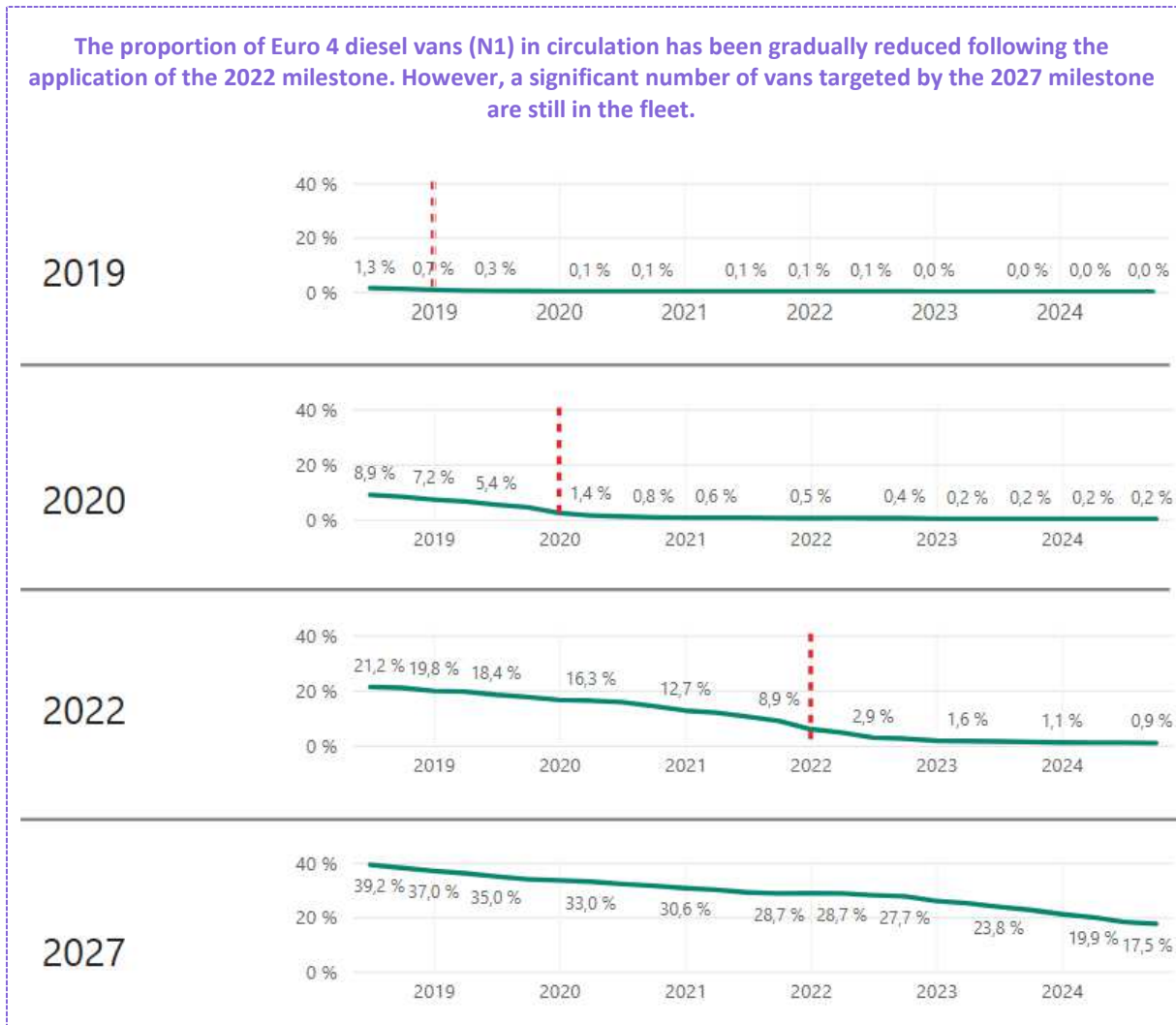
2.3.2. 2027 milestone

The LEZ decree published on 11 July 2022 introduced new restrictions from 2025. These will not come into force until January 2027, following the postponement voted by the Brussels Parliament on 4 October 2024.

The new vehicle categories affected in 2027 are as follows:

- Euro 5 diesel and Euro 2 petrol cars, vans, mini(buses) and HGVs (M1, M2, M3 and N1, N2, N3);
- Diesel mopeds and scooters (L1, L2);
- Euro 2 diesel and petrol motorbikes (L3, L4 and L5);
- Diesel light four-wheelers (L6, L7).

At the end of 2023, 88.7% of vehicles on the road were already compliant with the 2027 milestone (and earlier), compared with 86.3% at the start of the year. This figure rose to 91.5% in the third quarter of 2024. The compliance rate is therefore gradually increasing, and should improve further by the time the 2027 milestone comes into force.

However, there are differences between vehicle categories. For category L (which accounts for 0.4% of traffic), the compliance rate already stood at 96.5% at the end of 2023. For cars (87% of the fleet), the figure is 89.3%, and for buses 91.2%. However, for vans (N1), the compliance rate is 75.8% and for heavy goods vehicles (N2 and N3) 81.2%.

With the application of the 2027 milestone, it is expected that:

- NO_x emissions will be reduced by around 40% for both diesel and petrol cars;
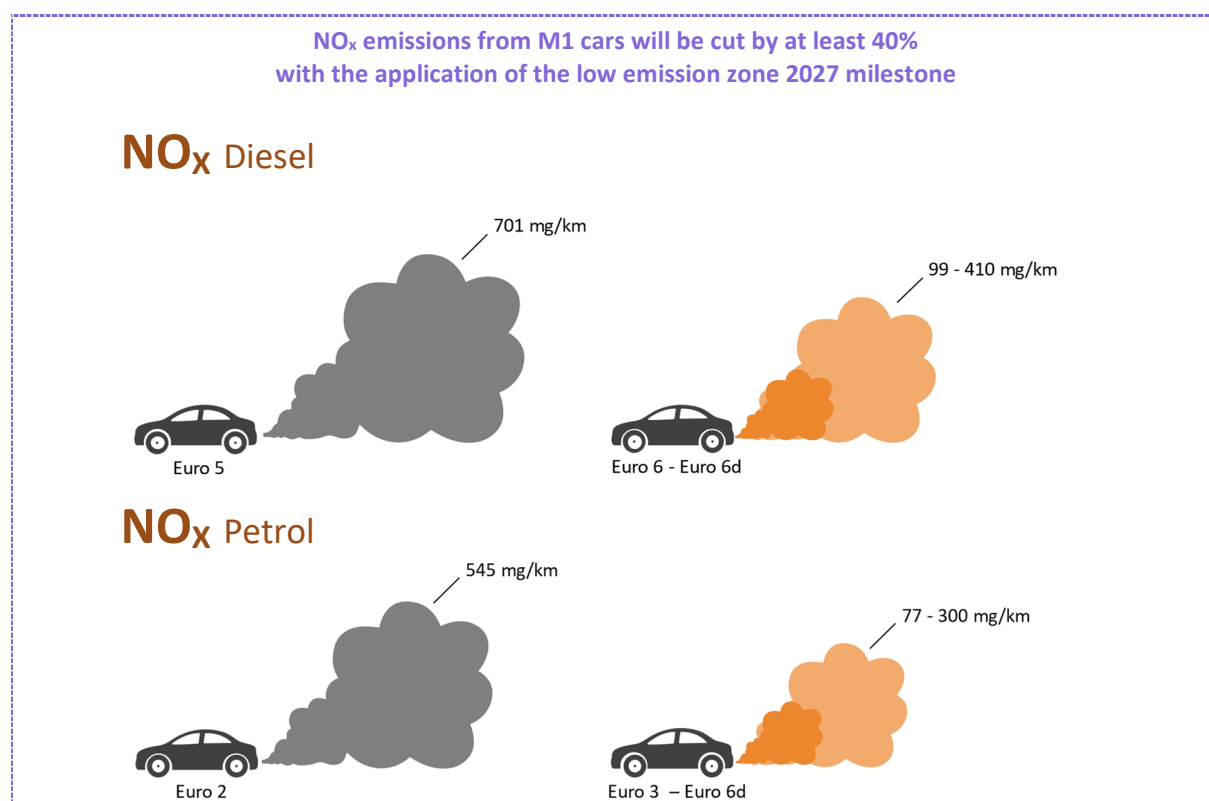
Source: "Tailpipe NO_X and PM emissions (g/km) from all passenger cars measured by remote sensing in European cities and regions (Brussels, Flanders, Krakow, London, Paris, Warsaw, Zurich) between 2017 and 2021." The Real Urban

- Particle emissions are almost halved for diesel cars. For petrol cars, which emit far fewer particles than diesel cars, there will be little difference.

Fine particle emissions from M1 cars cut by up to 50% with the application of the low emission zone 2027 milestone

PM Diesel

4,9 mg/km

Euro 5

2,3 – 2,6 mg/km

Euro 6 - Euro 6d

PM Petrol

3,9 mg/km

Euro 2

2,1 - 4,9 mg/km

Euro 3 – Euro 6d

Source: "Tailpipe NO$_X$ and PM emissions (g/km) from all passenger cars measured by remote sensing in European cities and regions (Brussels, Flanders, Krakow, London, Paris, Warsaw, Zurich) between 2017 and 2021." The Real Urban Emission database.

2.4. Shifting trends in engine types

2.4.1. Cars (M1)

Thanks in particular to the LEZ, in recent years there has been a shift from diesel to petrol and hybrid engines, and also to electric vehicles.

In the graph below, hybrid vehicles are listed in the diesel or petrol category, depending on the fuel used by their internal combustion engine. Under the LEZ scheme, these vehicles follow the agenda according to their internal combustion engine. A number of observations can be made:

- the share of diesel has fallen sharply since the introduction of the LEZ in 2018 (from 62.4% to 25.8%);
- petrol engines are moving in the opposite direction (37.3% to 67.6%);
- as for the share of electric vehicles, it is growing fast and will pass the 6% mark in 2024. The Region is working to encourage the use of electric vehicles by continuing its plan to roll out recharging infrastructure (see *5*. Electrify: a plan, a call for projects and a website).

Petrol has been the most popular fuel for cars (M1) since 2022, with electricity growing strongly
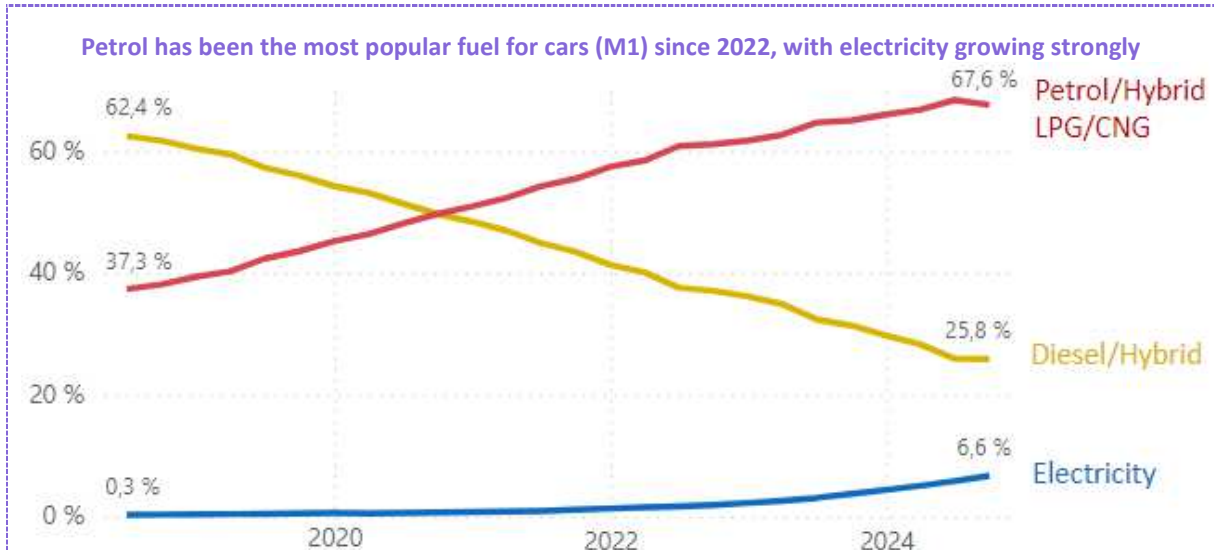
In 2023, on average, hybrid vehicles accounted for 9.4% of all class M1 vehicles on the road each day in Brussels. Of these, 11.1% were petrol hybrids and 1.6% were diesel hybrids.

2.4.2. Vans (N1)

As far as vans are concerned, diesel continues to dominate, with petrol and CNG/LPG vans accounting for just 7% of the fleet. Electric vans are arriving on the market and will account for 1.4% of the fleet in 2024.

Alternatives to diesel are still not widely used for vans (N1)
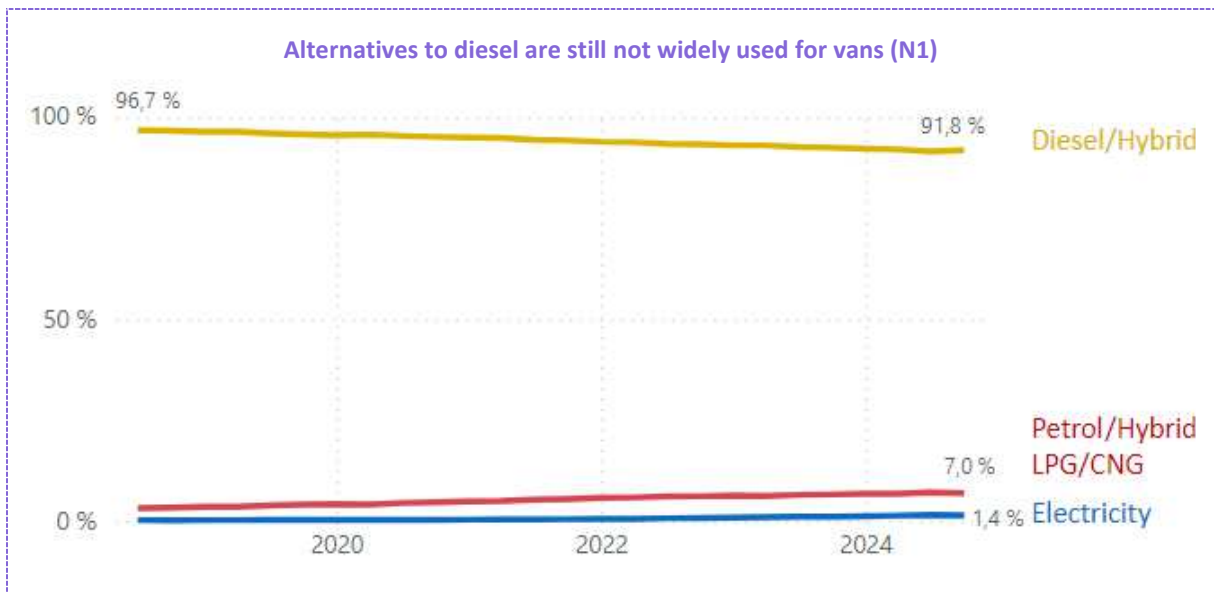
2.5. Exemptions

The law provides for a number of exemptions to the driving ban. These exemptions are granted automatically if they relate to a category identified by the DIV (caravans, vintage vehicles over 30 years old, etc.) or at the owner's request (for example, for vehicles adapted for transporting people with disabilities).

According to the latest available data[3]:

- The number of vehicles not complying with the LEZ that are eligible for an exemption is relatively low: around 0.1% of traffic[4].

- Most of the exemptions have been requested for vintage vehicles over 30 years old. The second reason concerns priority vehicles (including ambulances).

In 2025, new exemptions will be introduced:

- For holders of a parking card for people with disabilities, the exemption can also be applied for without benefiting from the increased healthcare allowance, and if the card is for a disabled child living with one of the parents, the exemption can be applied for by both parents,
- For caregivers with social security rights.

From 2027, when heavy goods vehicles will be affected, new exemptions will apply to this category of vehicle (cranes and exceptional transport). To find out more, please visit the lez.brussels website.

2.6. Day pass

Under the legislation, vehicles that do not meet the access criteria can drive in the LEZ as long as they purchase a €35 day pass. The maximum number of one-day passes authorised is 24 per year. The number of passes purchased rose sharply in 2022 and 2023:

- in 2023, 67,225 passes were purchased, for 32,107 unique vehicles;

- between the start of the LEZ and the end of 2023, 135,963 passes had been purchased.

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[3] Data for 2022. The statistical data for the 2023 cameras relating to the exemption was temporarily unavailable for the 2023 report. These data should once again be available for future LEZ reports.

[4] Approximately 500 vehicles per day out of the 364,000 that travel through the LEZ every day in 2022.

Strong growth in the number of day passes purchased in 2022 and 2023

67K

48K

11K

7K

3K

0K

2018   2019   2020   2021   2022   2023
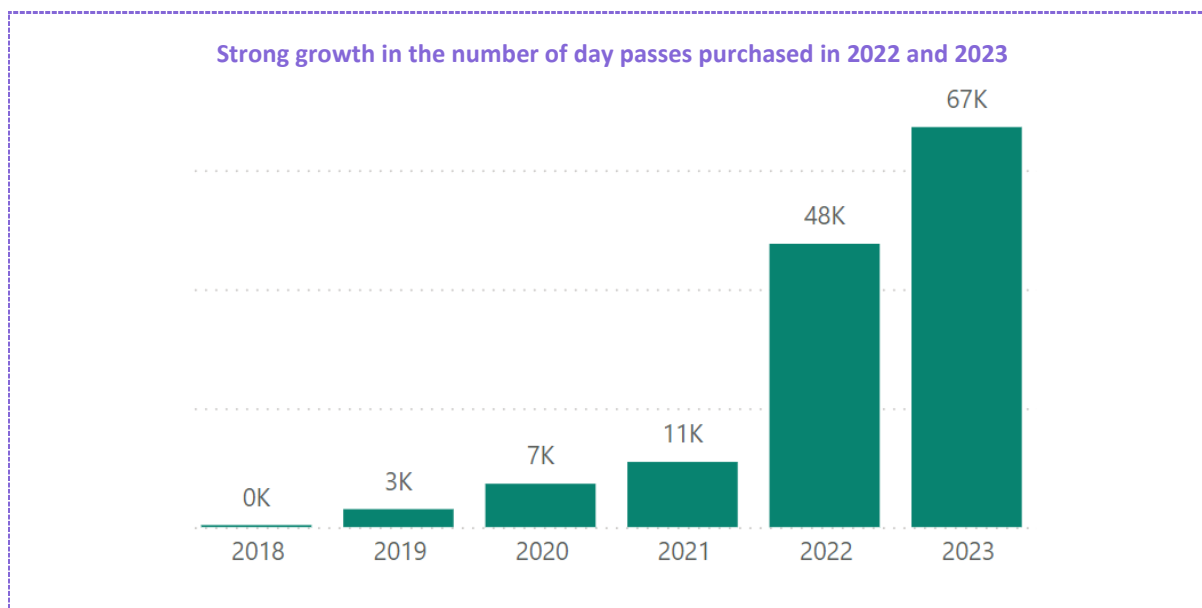
This support measure therefore seems to be bearing fruit. It allows certain motorists to travel around the Region on an occasional basis, in a flexible way and without undermining the environmental objectives of the measure.

2.7. Vehicles registered abroad

ANPR camera data can be used to determine the country of registration of a vehicle on the road. We therefore know the proportion and origin of foreign-registered vehicles on the road in the LEZ, even if we do not know their technical characteristics, unlike vehicles registered in Belgium. This is why the legislation stipulates that cars, vans, (mini)buses and coaches registered abroad must register before driving in the LEZ, with the exception of vehicles registered in the Netherlands, as the technical data for Dutch registrations is available in open data.

In 2023, 215,971 new foreign vehicles had registered for the LEZ[5]. The vast majority of registrations concern vehicles registered in France (58%) or Germany (23%).

The Brussels Region continues to argue in favour of a European legislative framework that would allow the authorities to access technical information on vehicles from third countries in order to monitor compliance with the LEZs. This framework would make it possible to waive the registration requirement, as is already the case for vehicles from the Netherlands. The Region is actively involved in a number of initiatives in this area[6]. In the meantime, the Region intends to implement new means of controlling foreign-registered vehicles: in 2021, the government mandated Brussels Mobility, in collaboration with Brussels Taxation, to set up a mobile team responsible for controlling foreign-registered vehicles travelling in the LEZ. This project is currently underway.

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[5] It is not known how many of these vehicles actually travelled within the LEZ. The statistical data from the cameras linked to the registrations was temporarily unavailable at the time of writing the 2023 report. These data should once again be available for future LEZ reports.

[6]The Benelux Working Group, the POLIS and Eurocities networks of cities, the "UVAR Box" and "UVAR Exchange" projects launched by the European Commission (https://uvarbox.eu/), etc.

In 2023, the European Commission published a proposal to revise the Directive on the cross-border exchange of information on road safety offences[7]. In 2024, the European Council and the European Parliament agreed on a text enabling the exchange of data on clearly and visibly demarcated access restrictions for road safety purposes. Pedestrian zones, school zones and cycle paths are clearly targeted, while low-emission zones are excluded, contrary to the wishes of certain Member States such as Belgium. A review clause provides for a reassessment of the scope of the Directive within 3 years of its transposition.

How does the LEZ impact emissions and air quality?

1. Emissions

1.1. Modelling changes in traffic emissions

Transport emissions in the BCR

In 2022, road transport was the main source of emissions of nitrogen oxides (NO_x) in Brussels, accounting for 47% of total emissions[8]. It was also the second largest source of $PM_{2.5}$ emissions, contributing to almost a quarter (23%) of total emissions. Lastly, it accounted for almost a third of the Region's black carbon (BC) emissions (36%).
Road transport is also the Region's second largest source of CO_2 emissions, accounting for around 24% of total emissions in 2022.
Within road transport emissions, cars are the biggest contributors, followed by vans, HGVs, buses and motorised two-wheelers.

The change in the composition of the vehicle fleet, driven by the LEZ, has had a significant impact on reducing NO_x, black carbon and fine particle emissions from transport. On a constant mileage basis, we can see that total emissions from the vehicle fleet on the road saw a significant and almost linear reduction between 2018 and 2023 since the implementation of the LEZ:

- 36% reduction in NO_x ;
- 65% reduction in black carbon;
- 20% reduction in PM_{10} ;
- 31% reduction in $PM_{2.5}$.

For the first year, a slight reduction is observed in CO_2 emissions from the vehicle fleet on the road (-2% between 2018 and 2023), again assuming constant mileage. This reduction is set to increase with the phasing out of combustion engines by 2035/2036.

The graphs below show that, as far as nitrogen oxides (NO_x) are concerned, the fall in emissions is smaller for vans (-7%) than for cars (-49%). This is because the transition to petrol, CNG or electric power is slower for vans than for cars, with diesel vehicles still accounting for 92.5% of vans on the

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[7] Directive (EU) 2015/413.

[8] Inventories of the Region, 2024 figures.

road.

Emissions of NOₓ, black carbon and fine particles from road traffic have fallen sharply since the introduction of the LEZ (2018 emissions for all vehicles = 100)

NOₓ

Black Carbon

PM₁₀

PM₂.₅

Emission reductions are highest for NOₓ and black carbon.

CO_2
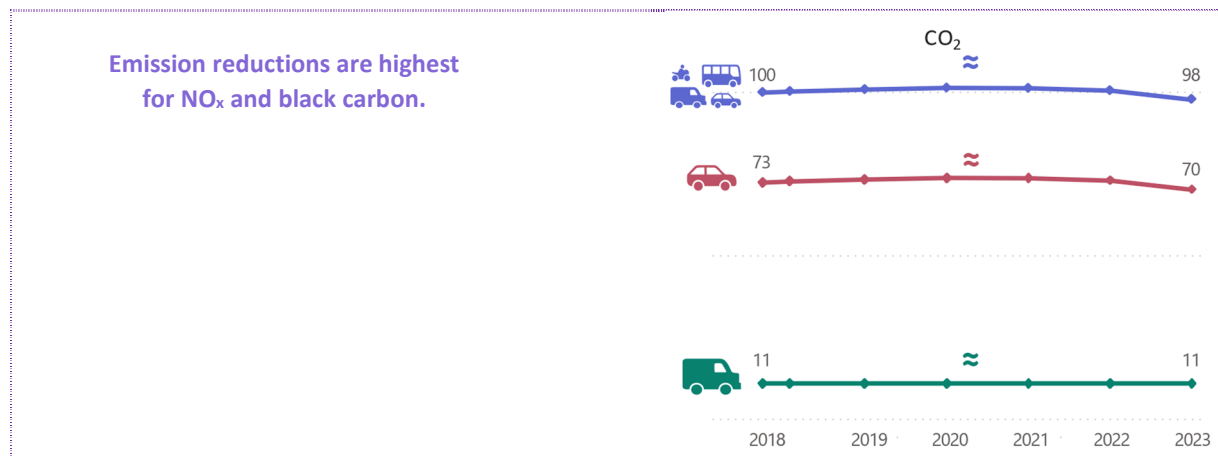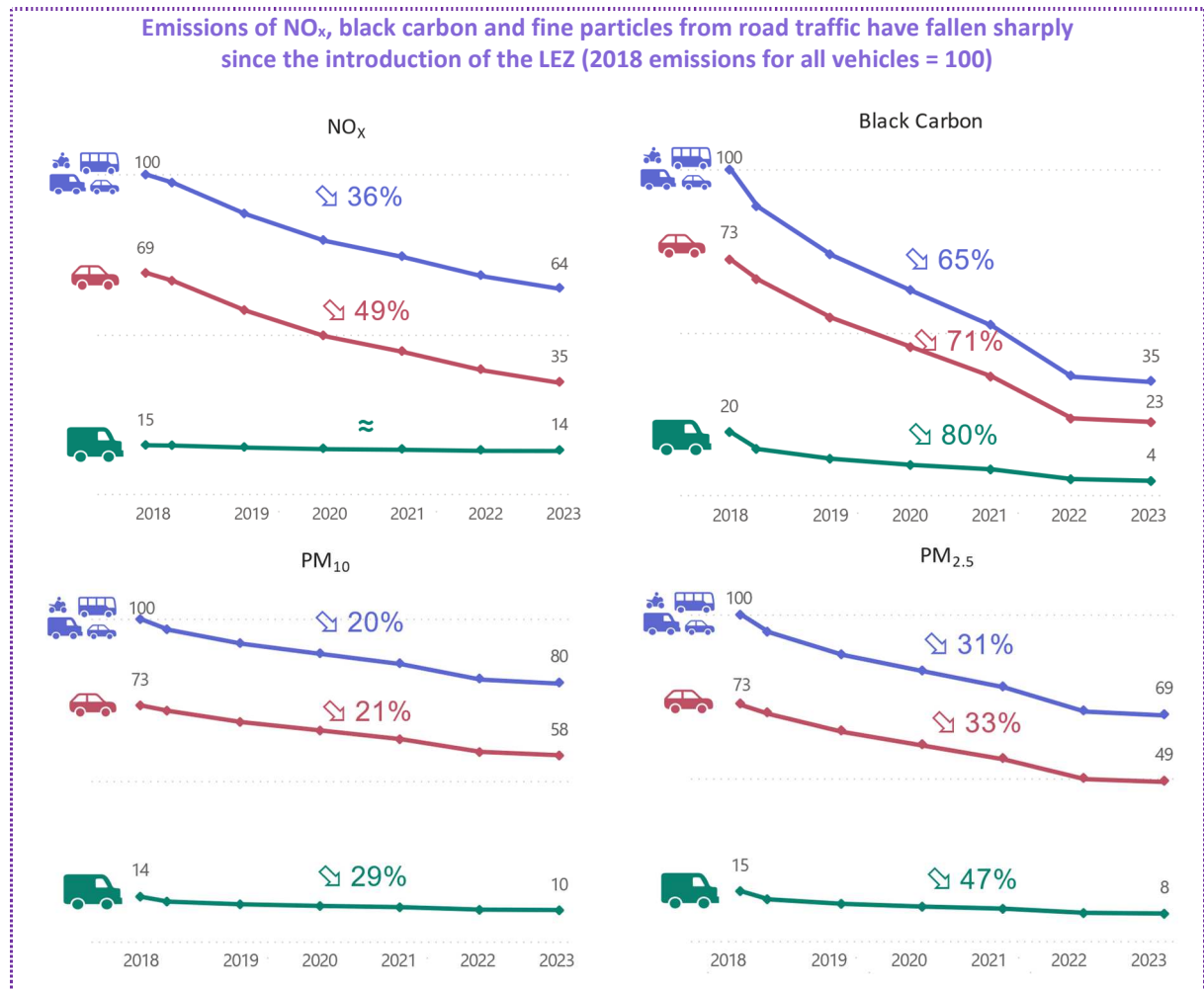
Finally, the LEZ is thought to have an impact on modal shift in the Brussels Region, but this is difficult to quantify. The banning of a vehicle and the accompanying measures introduced by the Region (Bruxell'air premium in particular) encourage people to rethink their professional and personal mobility habits, which also has a positive impact on reducing transport emissions.

1.2. Methodology

As in previous reports, the information provided by the ANPR cameras has been used to calculate changes in air pollutant and CO_2 emissions from vehicles on the road in the LEZ. These data are supplemented by the technical characteristics associated with the vehicles (fuel, Euro standard, category) which come from the DIV.

The composition of the fleet in week 25 of 2018 (end of June) is used as a basis for comparison and represents the pre-LEZ situation (before the first fines were issued). Each year thereafter, week 40 (early October) is selected as the reference week. This week has been chosen because it is representative, falls outside school holiday periods and is not influenced by other events likely to disrupt mobility in Brussels.

After adding emission factors (emissions/km) and the average annual distance travelled by each type of vehicle, the model provides a year-on-year variation in emissions of the various pollutants.

In this calculation, the composition of the fleet captured by the ANPR cameras is the only variable: the emission factors applied to each type of vehicle remain constant, as does the total distance travelled by the entire fleet. This total distance is then divided between the different types of vehicle on the basis of the average annual distance travelled by each type of vehicle.

2. Air quality measurements

The information and infographics presented in this section are taken from the annual report on air quality in the Brussels-Capital Region, available on the Brussels Environment website.

2.1. Nitrogen dioxide (NO_2) concentrations

Nitrogen oxides (NO_x) are chemical compounds made up of oxygen and nitrogen. In the air, nitric oxide (NO) is less toxic than nitrogen dioxide (NO_2), but it can quickly be transformed into the latter. NO_2 is dangerous for the respiratory tract, especially for people with asthma and chronic lung disease, who are exposed to high concentrations over the long term. NO_2 is also a precursor of ozone and fine particles. The main sources of NO_x emissions are space heating and road transport.

In 2023, NO_2 concentrations continued to fall. They were down by around 10% on average compared with 2022. Concentrations have thus returned to levels comparable to those seen in 2020, an exceptional year due to the lockdown.

For the fourth year running, all measuring stations complied with the annual European standard of 40 µg/m³ (indicated by the red line in the graph below), even with the opening of two new stations heavily influenced by road traffic. These results are very encouraging, but more needs to be done to protect public health. The new European Air Quality Directive approved by the Parliament and Council in 2024[9]

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[9] https://data.consilium.europa.eu/doc/document/PE-88-2024-INIT/en/pdf

will impose an annual limit of 20 µg/m³, to be reached by 2030. In 2023, only 5 out of 13 measuring stations complied with this new standard (red dotted line).

Furthermore, none of the stations complied with the World Health Organisation's recommended value of 10 µg/m³ (blue dotted line). Despite the progress that has been made, this threshold is still difficult to achieve in urban environments, even at the stations least exposed to traffic.

The graph below shows the average annual NO_2 concentrations of all the stations for the BCR over the last ten years (µg/m3). The red line indicates the European annual limit value of 40 µg/m3. The dotted red line indicates the future European limit of 20 µg/m3. The annual WHO recommended value of 10 µg/m3 is indicated by the blue dotted line.

Annual average NO_2 concentrations at all stations for the BCR, 2014–2023 (µg/m3)
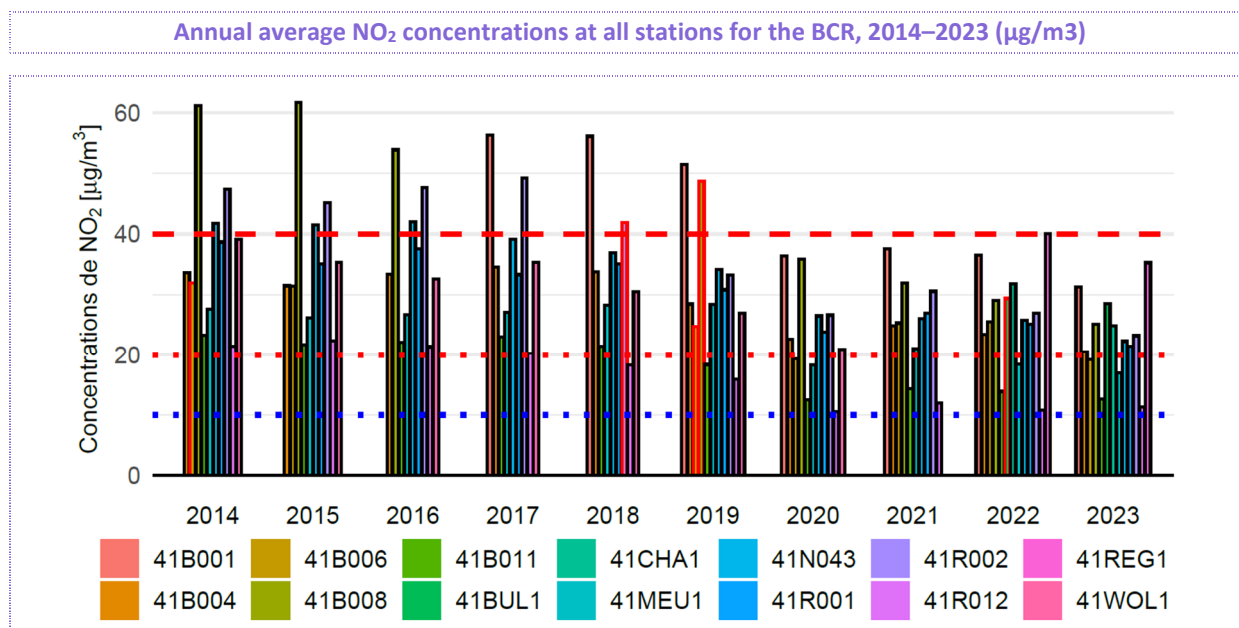
This table shows the corresponding station codes:

41B001	Arts-Loi	41MEU1	Neder-Over-Heembeek
41B004	Sainte-Catherine	41N043	Haren
41B005	Eastman	41R001	Molenbeek-Saint-Jean
41B006	EU Parliament	41R002	Ixelles
41B008	Rue Belliard	41R012	Uccle
41B011	Berchem-Sainte-Agathe	41WOL1	Woluwe-Saint-Lambert

To ensure even closer monitoring of air quality, in 2023 the Region set up a new secondary measurement network for NO_2 in collaboration with the BRAL association[10]. This network consists of 29 measurement points chosen at 24 sites among those most exposed to traffic emissions[11]. NO_2 measurements are carried out using passive tubes, which are easy to install and offer satisfactory accuracy on an annual scale.

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[10] https://bral.brussels/nl

[11] The measurement points are located at 24 sites shown on the map. Some sites have several measurement points.

Further information: https://bral.brussels/fr/artikel/resultats-officiels-dexpair-il-faut-etre-plus-ambitieux-pour-ameliorer-la-qualite-de-lair

Secondary NO₂ measurement network (ExpAIR project)[12]
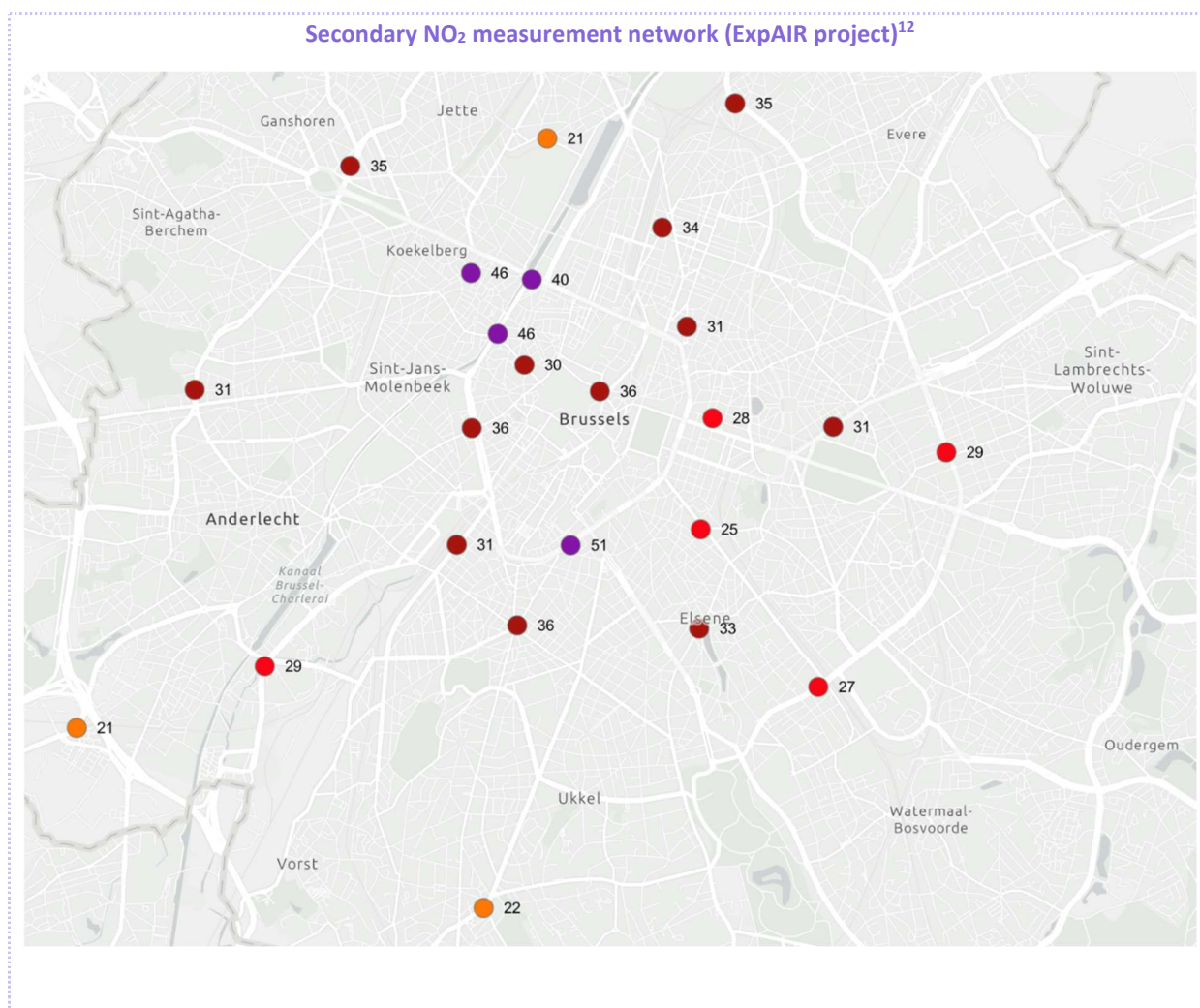
The results obtained between June 2023 and July 2024 show that some sites with heavy traffic still exceed the current annual limit value of 40 µg/m³ in some areas. This is the case for Avenue de la Toison d'Or, which runs alongside the Inner Ring Road, Porte de Flandre and Rue Piers. At these sites, NO₂ concentrations will have to be at least halved by 2030 to comply with the future limit of 20 µg/m³. All the other sites have annual concentrations in excess of 20 µg/m³, underlining the scale of the efforts required to comply with the new Directive.

2.2. Black carbon (BC) concentrations

In 2023, black carbon concentrations continued to fall, confirming that despite the resumption of activity after the post-Covid period, air quality in Brussels is gradually improving. Since 2020, average annual concentrations of black carbon have been low (around 1 µg/m³ or less). The main reason for this is that black carbon is mainly emitted by diesel engines, which have accounted for an increasingly smaller share of the Brussels car fleet in recent years.

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[12] The numbers on the map indicate the average annual NO₂ concentration measured (µg/m³).

Annual average BC concentrations at all BCR stations (µg/m3)
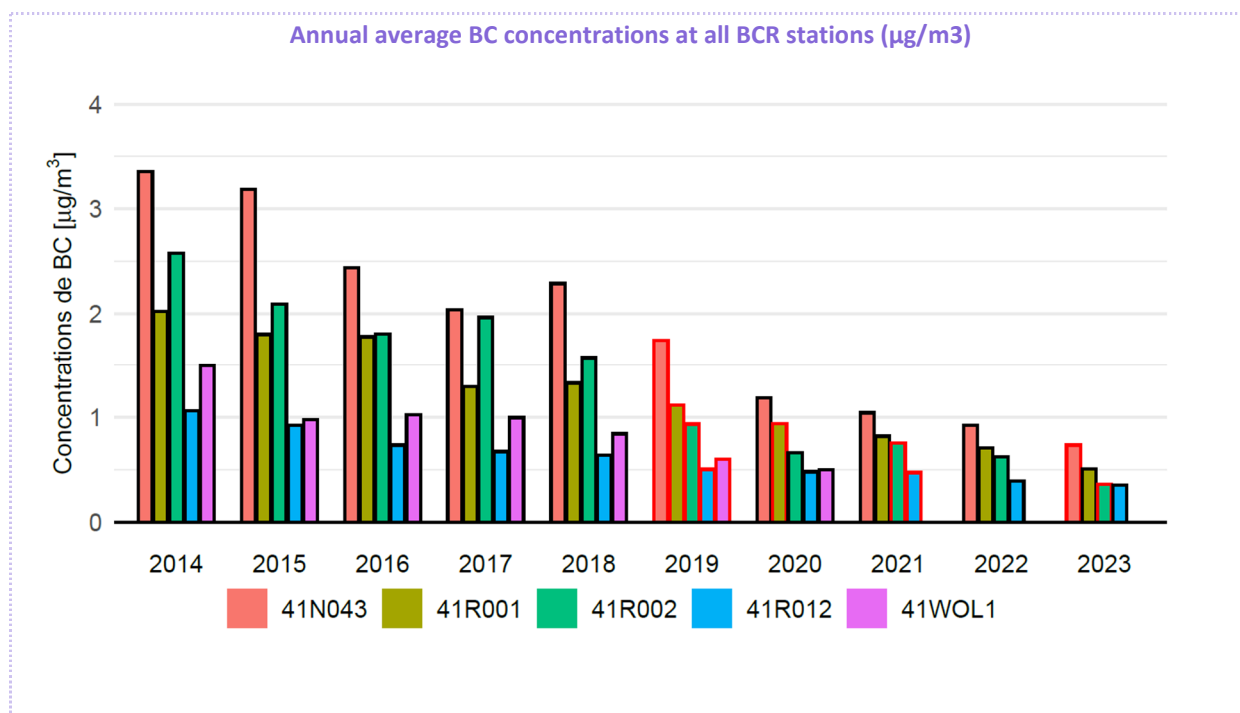
Black carbon is made up of fine carbon particles resulting mainly from combustion processes such as vehicle engines and heating systems. These particles have diameters ranging from 10 nm to 500 nm and can penetrate deep into the lungs and blood because they are so small. They are associated with health risks, including cancer, cardiovascular disease and other respiratory problems.

3. Air quality modelling

3.1. Improvement in concentrations since 2018

3.1.1. Results

Air quality modelling makes it possible to isolate and therefore assess the impact of changes in the vehicle fleet – linked to the LEZ – on concentrations of pollutants breathed in the capital.

This modelling exercise, carried out using the SIRANE model as part of a project by the Université Catholique de Louvain funded by Bloomberg Philanthropies, shows that changes in the composition of the vehicle fleet have a significant impact on air quality in the capital. In the areas most affected by air pollution (the busiest routes, such as the ring road, the entrances to the city, the inner and outer ring roads and Rue de la Loi and Rue Belliard), changes to the vehicle fleet reduced NO_2 concentrations by around 30% between June 2018 (before the introduction of the LEZ) and October 2023.

It should be noted that, for this exercise, we have only compared the impact on air quality of the change in the types of vehicles on the road between 2018 and 2023, assuming constant mobility (the same number of kilometres travelled each year) and similar weather conditions and background pollution. The impact of other mobility measures (or the Covid effect) is therefore not taken into account.

Source: SIRANE model as part of a project by the Université Catholique de Louvain funded by Bloomberg Philanthropies (2023)
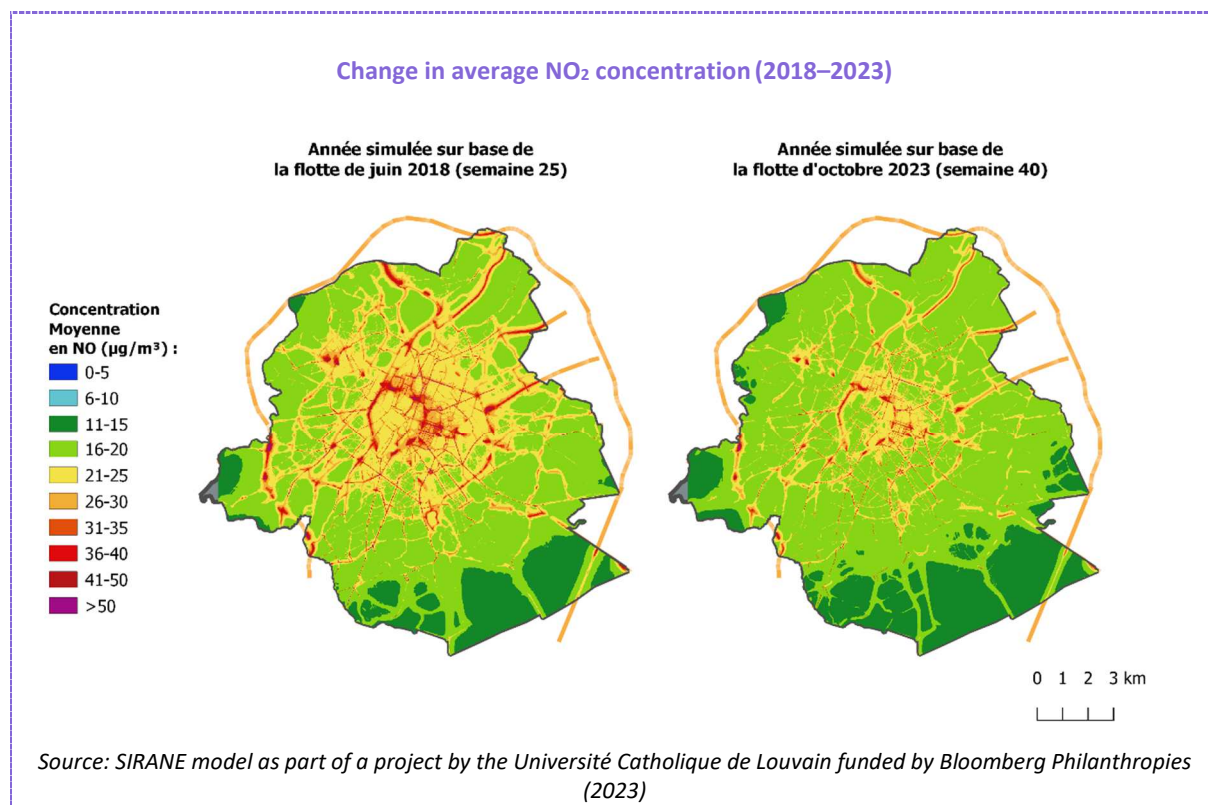
Over the coming years, the expected evolution of the car fleet should enable this positive impact to be greatly accentuated, thanks in particular to the ban on Euro 5 and Euro 6 diesel vehicles, which have particularly high NO_x emissions.

1.1.1. Methodology

The simulation of dispersion and average NO_2 concentrations over the region (week 40 years 2018 to 2023) was carried out on the basis of one-week emissions calculated at *1 Emissions* and on the basis of the topology of the region's road network. Before simulating each of these situations, the model's performance was tested in the reference year (2022), to ensure that the simulated data matched the measured data.

The only factor that changes from one simulation to the next is the estimate of NO_x emissions, which varies according to the composition of the vehicle fleet. In this way, we can isolate the effect of changes in fleet composition on the spatial distribution of the NO_2 concentration.

The maps have changed since those published in the previous year's report due to refinements made to the SIRANE model. Emissions have been broken down specifically for each type of road, to take better account of cold starts in residential areas and heavy goods vehicles on main roads. There is therefore a difference in the distribution of emissions and simulated concentrations, leading, for example, to slightly higher concentrations on secondary roads. With the updated model, the reductions in concentrations modelled stand at around 25% between 2018 and 2022 and around 30% between 2018 and 2023.

1.1.2. Study by the independent mutual insurance companies (Mutualités Libres)

The impact of the Brussels LEZ on air quality has also been the subject of a study by the *Mutualités Libres* in collaboration with the KU Leuven, HEAL (Health and Environment Alliance), CELINE (Cellule Interrégionale de l'Environnement) and VITO[13]. The study compares the effect of the LEZ in Brussels and Antwerp and compares the air quality in these 2 cities with that of 17 other Belgian cities without a LEZ[14].

The study concludes that:
- In Belgium, few people live in an area where the standards recommended by the WHO are respected. Only 1.5% of the 2.3 million members of the *Mutualités Libres* live in an area where the $PM_{2.5}$ concentration is less than 5 µg/m³.
- Brussels and Antwerp observed a greater reduction in air pollution (BC, NO_2 $PM_{2.5}$) than in the 17 cities without a LEZ between 2017 and 2022.
- According to the study, the concentration of NO_2 in Brussels fell from 29.44 µg/m³ to 18.53 µg/m³ between 2017 and 2022, a decrease of 37%. This fall is around 10% higher than in cities without a LEZ in Wallonia and Flanders.
- It is in the poorest neighbourhoods that people are most at risk. It is also in these neighbourhoods that the reduction in pollutants has been the fastest[15].
- The LEZ also has an impact on air quality in the vicinity of Brussels, up to 5 km away[16].

3.2. Improvements expected by 2035

The impact of the LEZ on annual NO_2 concentrations in Brussels between 2022 and 2035 was modelled as part of a dissertation project carried out in collaboration with Brussels Environment[17]. The study uses the SIRANE model to assess spatialised NO_2 concentrations, with projections of NO_x emissions from traffic as input data under three scenarios:

- BASE scenario: business as usual, or the natural evolution of the fleet;
- WEM scenario: implementation of the LEZ for the period 2025–2036 (before postponing the 2025 milestone by 2 years);
- WAM scenario: implementation of the LEZ and a reduction in km travelled as a result of the rollout of the Good Move plan.

The study shows that:

- On average, from 2022 to 2035, the LEZ is expected to reduce NO_2 concentrations by 1.18 µg/m³ (24% if background concentrations are excluded), with the greatest impact on heavily trafficked roads.

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[13] https://www.mloz.be/fr/documentation/zone-basses-emissions-ameliore-qualite-de-lair

[14] The study explains that it is too early to make the same observation for Ghent, as the LEZ is more recent.

15 Between 2017 and 2022, Brussels recorded a reduction of 0.76 µg/m³ in soot and 11.75 µg/m³ in nitrogen dioxide in the most disadvantaged neighbourhoods, compared with 0.54 µg/m³ and 9.6 µg/m³ in the most prosperous neighbourhoods.

[16] Measurements beyond the city, up to 5 km away, showed a 40% reduction in nitrogen dioxide and even a 50% reduction in soot between 2017 and 2022, a greater reduction than on the outskirts of cities without a LEZ in Wallonia and Flanders.

[17] Mégane Pourtois and Clément Thiry, Evaluating traffic policies on NO_2 pollution in Brussels: Impact of the Low Emission Zone and the Good Move Plan, 2022–2035. Faculty of Bioengineering, Université catholique de Louvain, 2024. http://hdl.handle.net/2078.1/thesis:46489

- The years in which the reduction is greatest are 2025 (now 2027, following the 2-year postponement voted by Parliament), 2028, 2030 and 2035, which correspond to the years of the future LEZ milestones.
- The greatest expected reduction is that resulting from the implementation of the 2025 milestone (now the 2027 milestone). This should enable a reduction in NO_2 concentration of 13.5% compared with 2024. These results are therefore expected in 2027, following the postponement.
- The LEZ should probably make it possible to meet the new European annual standard of 20 µg/m³ for NO_2 over the whole territory in 2030 (WEM scenario in the graph below) provided that the milestones of 2028, 2030 and 2035 do not change.

Length of road network (distance and %) exceeding the new annual standard of 20 µg/m³ for NO_2, according to the different road transport emission scenarios in the Air Climate Plan
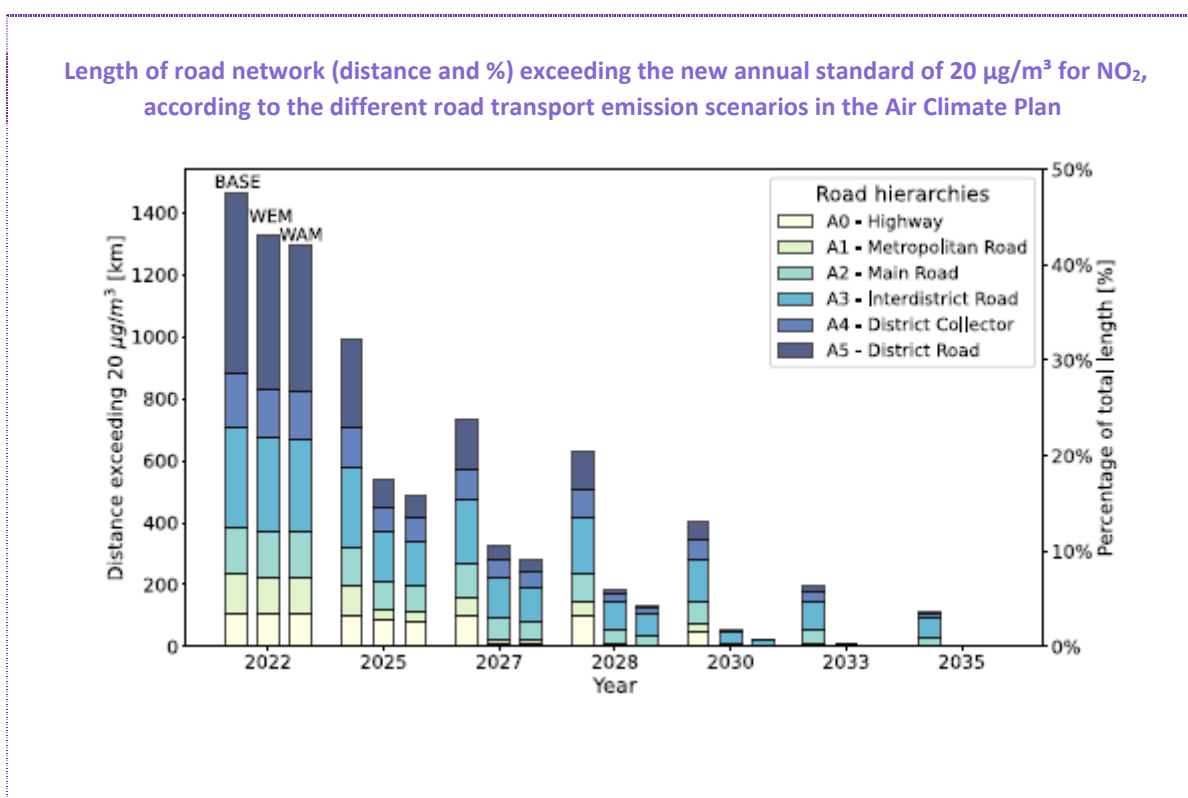
Source: Pourtois & Thiry. Study conducted before the decision to postpone the 2025 milestone by 2 years

Supporting measures

1. Communication

Every year, significant efforts are made to communicate on the existence of the LEZ, its supporting measures and the vehicles covered by this measure. In 2023, a 3-year communication strategy was developed. In order to harmonise all communications around the LEZ and to highlight all the actions taken to prepare for the phasing out of combustion engines, new branding and a new signature were developed: "Laissons Respirer.brussels" ("Let Brussels Breathe Again"). The aim is to explain the reasons for the LEZ (the effects of pollution on health, the need to phase out fossil fuels in order to meet the region's climate commitments), and to win public support.

Communication actions carried out in 2023:

- LEZ awareness campaign "Laissons Respirer.brussels" in April and relaunch in autumn: the aim was to introduce the new "Laissons Respirer.brussels" branding, to raise awareness of the importance of air quality in Brussels and to provide in-depth information on the reasons for the LEZ. The campaign was resoundingly positive, focusing on the positive results already achieved since the introduction of the LEZ in 2018. Several communication channels were used: posters, radio, cinema, social networks, local TV and bannering.
- Mobility Coach campaign in June and September: the aim was to inform Brussels residents about the support services offered by the Mobility Coach. The campaign linked to the website and encouraged the public to book a coaching session. Communication channels: local billboards, bannering, Brussels Environment's own channels.
- Electrify.brussels campaign in October: digital communication campaign aimed at the residents of Brussels to continue promoting the website containing all the information on the location and deployment of the electric vehicle charging infrastructure in the Brussels-Capital Region. The focus was on electrification guides for private individuals, businesses and condominiums. Target audiences were invited to download the guides directly.
- First anniversary of the Bruxell'Air premium through a press release and a cross-media Bruxell'Air premium campaign in June/July. The main aim of the 2023 campaign was to "convert" the target audience: to encourage Brussels residents who had given up their car to fill in the premium application form. Media used: radio commercials, outdoor digital advertising, social media, bannering, Google ads.

2. Mobility Coach

For the past 4 years, the Region's "Mobility Coach" service has been offering personalised support to people affected by the LEZ. Its main aim is to provide comprehensive information to encourage people to travel in Brussels without using their private car. The Mobility Coach also aims to promote alternatives such as walking, cycling, public transport and car-sharing among this audience. Since 2022, the Mobility Coach has played a key role in the Bruxell'Air premium scheme: it helps citizens apply for the premium, providing assistance with the application process and/or advising applicants on the choice of mobility services according to their needs.

- In 2023, 874 people enlisted the services of the Mobility Coach (by e-mail, videoconference, face-to-face meetings and telephone).

- o Exchanges mainly concerned premium mobility services (49%), the application procedure (43%) and access to the LEZ (15%)[18].
  - o 93 face-to-face meetings were held. These meetings related to the Bruxell'Air premium.
- In addition to its individual support services, the Mobility Coach offers "Mobility Tests", enabling people to test an electrically-assisted bicycle or scooter free of charge for a fortnight. In 2023, 24 Mobility tests were carried out.
- In 2023, 8 Mobility Visits (visits with a group of 8 to 15 participants) and 12 Mobility Vans (attending events or business locations) were also organised.

# 3. Bruxell'Air premium for individuals

The Bruxell'Air premium is designed to encourage modal shift. It is the fruit of collaboration between Brussels Environment, Brussels Mobility, Paradigm, the STIB and Pro Velo, and is funded by the European Union's Recovery and Resilience Facility. Introduced in 2006, a new version of this premium was relaunched in 2022. It encourages Brussels' drivers to give up their car in favour of more sustainable modes of transport. It varies according to the income of the applicant's household and now gives access to more mobility options, including: the bike allowance, bike-sharing (Villo), car-sharing (Poppy and Cambio), taxis (Victor Cab), public transport (STIB) and the Modalizy MaaS.

Special attention is paid to people with disabilities: if the household has a parking card for a disabled person, the applicant is eligible for the higher amount of the subsidy, and specific mobility services are available for this group: the purchase of a bicycle/adapted cycling equipment via the bike allowance, the STIB Taxibus service and PRM taxi services from Victor Cab, for example.

The graph below shows the trend in the number of applications for premiums since the start of the LEZ.

- In the early years of the LEZ (2018–2019), applications for Bruxell'Air premiums (under the old system) increased continually.
- 2020 saw a reduction in applications, partly due to the absence of a milestone in 2021 and partly due to the effects of COVID-19.
- In 2022, the number of premiums awarded (2,102) was exceptionally high. This can be explained in particular by:
  - o the 2021 delay that had to be made up due to the closure of the counter (between 1/10/2022 and 7/03/2022, it was not possible to apply for a premium, while the switch to the new platform took place);
  - o the effect of the LEZ 2022 milestone: at the end of December 2021, approximately 5% of the Brussels fleet did not comply with the access criteria;
  - o the announcement/communication effect of the new premium.

- In 2023, 1,203 Bruxell'Air premiums were granted. A breakdown of premiums by category shows that the premium primarily benefits socio-economically vulnerable households and/or households with a disabled person (62%).

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[18] The total is actually more than 100% because one interaction can cover several subjects.

Number of Bruxell'Air premiums granted each year
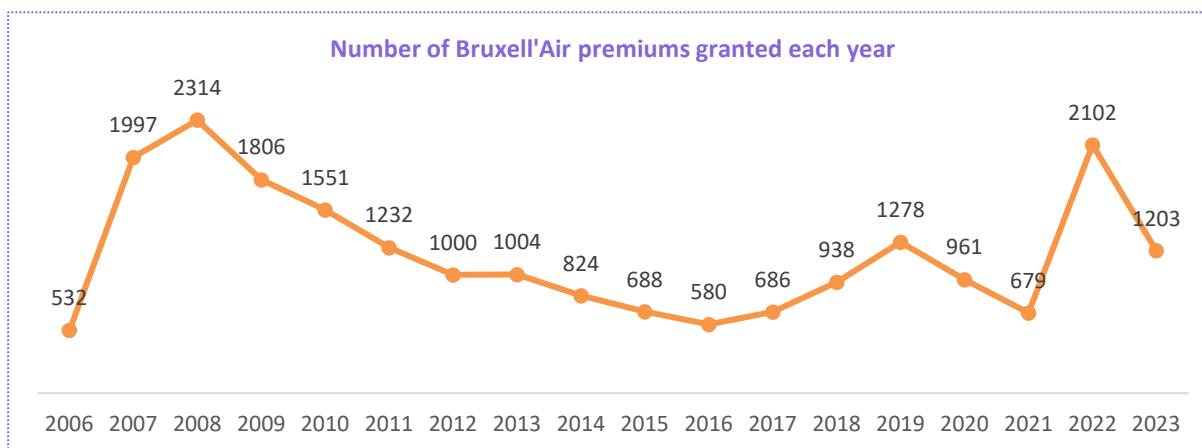
- A breakdown by operator shows that the most popular suppliers are: the bike allowance, STIB, Cambio and Modalizy.

- A breakdown by product shows that the services most ordered under the Bruxell'Air premium are:
  - The bike allowance, with an average allowance of €707.
  - The Modalizy allowance, with an average allowance of €588.
  - Cambio START 2-year subscription with an average allowance of €571.
  - The Poppy allowance, with an average allowance of €418.

In terms of both the number of products ordered and the amount allocated, the bike allowance in particular and the Modalizy Flex allowance are by far the most popular products chosen by applicants.

4. LEZ premium for professionals

Since 1 December 2018, micro and small businesses in Brussels have been able to receive financial assistance to replace their light commercial vehicles subject to the ban on driving in the LEZ. In 2021, Brussels Economy and Employment overhauled this premium to make it more attractive and better adapted to the needs of Brussels businesses. A number of changes have been made since January 2022:

- The bonus is now available to medium-sized companies.
- The amounts and ceilings have been increased from a maximum of €3,000 to up to €15,000.
- The maximum number of premiums per company per calendar year has been increased to 3.
- The support extends to the purchase and installation of charging points for electric vehicles.
- Businesses that buy or lease a replacement commercial vehicle, can also receive a premium for installing a charging point.
- The prior authorisation requirement has been abolished: companies now only need to submit one application to qualify for the premium.

In 2023, a total of 14 premiums were awarded, totalling €162,796. Of these 14 premiums, one had been applied for under the old premium system, while 13 fell under the new system introduced in 2021. Of these premiums, only one was for the installation of a recharging point. The breakdown of beneficiaries was as follows: 9 micro-businesses, 4 small businesses and one medium-sized business. These companies represented various sectors: 5 in trade, 1 in the HoReCa sector, 1 in transport and

storage, 5 in construction, 1 in professional, scientific and technical activities and one in administrative and support services.

In 2024, the system of premiums for professionals was again reviewed in depth in order, among other things, to make them more attractive with a view to the 2027 milestone. Brussels Economy and Employment now offers three types of premiums for low-emission mobility[19] :

- The Cargo Bike or Trailer Premium, which can cover up to 70% of the purchase of a cargo bike or bike trailer, up to €4,000 for a cargo bike and €2,000 for a trailer;
- The Electric Light Commercial Vehicle Bonus and Retrofit Bonus, which subsidise the replacement or conversion of a vehicle covered by the LEZ by an electric light commercial vehicle, covering 40% of the investment and with a maximum subsidy of up to €16,000 per electric light commercial vehicle (including the installation of a recharging point).

All information about these subsidies is available on the Brussels Economy and Employment website.

5. Electrify: a plan, a call for projects and a website

In parallel with the implementation of the Low Emission Zone, and in order to gradually phase out internal combustion vehicles, the Region is also implementing a number of measures to support the infrastructure needed for zero emission vehicles.
In 2022, the Brussels Government adopted its plan to roll out a recharging infrastructure for electric vehicles – Electrify.brussels – which aims to ensure the installation of 22,000 publicly accessible recharging points for electric vehicles (on and off-street) by 2035.
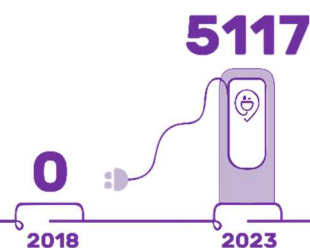
The adoption of this deployment plan and the implementation of its many measures have enabled the installation of charging points for electric vehicles in the Brussels Region to take off. Both on- and off-street, numerous recharging solutions already exist in Brussels:

- At the end of 2023, 5,117 charging points were accessible to the public, of which 1,228 charging points were installed in 2023;
- Since 2024, every household in Brussels has had a charging point within 150 metres of their home.

5.1. electrify.brussels website

The Brussels deployment strategy is broken down into several pillars. A legislative framework has been adopted to impose and regulate the installation of charging points in off-street car parks in Brussels. This sets out safety rules and a minimum number of charging points to be installed in car parks by 2025. At the same time, the government has tasked Sibelga with coordinating the installation of a close-meshed network of on-street charging points, in order to offer visible, local solutions to everyone.

The electrify.brussels website has been launched to publicise these efforts, answer questions and provide support. This site serves as a centralised platform for all questions relating to recharging

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[19] https://economie-emploi.brussels/primes-mobilite-basses-emissions

https://economie-werk.brussels/premies-mobiliteit-lage-uitstoot

electric vehicles in the Brussels-Capital Region, and offers a number of support services, such as an interactive map enabling users to locate all the recharging points available to the public and check their availability in real time. It therefore serves as an entry point and a major source of information for all Brussels stakeholders interested in the electrification of transport in Brussels.

In 2023, guides to installing electric charging points for individuals, businesses and condominiums in Brussels were published. The aim is to facilitate the deployment of recharging points for all these audiences.

At the same time, a free facilitator service is available to answer questions from all Brussels residents (public, private or business) about the installation of recharging infrastructure.

5.2. "Electrify.brussels' call for projects

In parallel with the measures to deploy on-street charging points and the legislative framework to accelerate the installation of off-street charging points, in 2022 and 2023 Brussels Environment also launched a call for projects to provide financial support for reinforcing or adapting the electricity network for the installation of publicly accessible off-street charging points, and to support the electrification of specific sectors such as urban logistics, the taxi sector and shared passenger transport.

In total, a budget of €500,000 has been made available for each of the two years of this initiative, which has supported around twenty projects, including fast-charging facilities accessible to the public, a taxi depot, logistics sites, supermarket car parks, etc.

Conclusion

The LEZ is continuing to change the composition of the vehicle fleet on the road in the Brussels-Capital Region. As a result, the last diesel cars not systematically fitted with a particulate filter[20] fell from 10% of the fleet on the road in 2022 to 0.3% in 2024. These vehicles, which emitted up to 6 times more fine particles than those still allowed on the road[21], have virtually disappeared from the road.

Changes to the fleet, encouraged by the LEZ, are helping to reduce emissions of atmospheric pollutants from road transport. Between June 2018 and October 2023, assuming a constant volume of traffic, the change in the composition of the vehicle fleet on the roads in Brussels will have reduced road transport emissions by 36% for nitrogen oxides (NO_X), 31% for fine particles ($PM_{2.5}$) and 65% for black carbon.

This reduction in emissions from the car fleet has a direct positive impact on air quality in Brussels. According to the modelling carried out by Brussels Environment, the change in the composition of the fleet made it possible to reduce NO_2 concentrations on the busiest traffic routes by 30% between 2018 and 2023, assuming a constant mileage[22].

The network of air quality monitoring stations confirms these findings. In 2023, for the fourth year running, all the measurement stations complied with the annual European standard of 40 μg/m³ for NO_2.

Nevertheless, the secondary measurement network is still exceeding this threshold at very local levels, and compliance with the future standard of 20 μg/m³ under the new European Air Quality Directive will require further reductions in car pollution emissions. In fact, in 2023, only 5 of the 13 measuring stations complied with this new European standard. The concentrations measured also remain well above the value of 10 μg/m³ recommended by the World Health Organisation (WHO). For all these reasons, we need to continue our efforts to reduce traffic emissions, in particular through the implementation of the LEZ.

The 2027 milestone will be particularly important for reducing NO_2 concentrations and putting Brussels on the right track for meeting future obligations. The vehicles that will be banned account for over 40% of NO_X emissions from transport, and a significant quantity of fine particles. This stage will therefore have a significant impact in terms of improving air quality.

By 2035, all vehicle categories except HGVs and coaches will have to become zero-emission vehicles, in line with the LEZ agenda set by the Brussels government in 2022. In this way, the LEZ should help accelerate the transition to a low-carbon housing stock and meet the Region's targets for reducing greenhouse gas emissions (-47% by 2030).

This decarbonisation remains a major challenge, especially for passenger cars, where electric cars are making less headway than company cars.

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[20] Euro 4 diesel cars, banned from driving in the LEZ from 1 January 2022.

[21] Source: "Tailpipe NOx and PM emissions (g/km) from all passenger cars measured by remote sensing in European cities and regions (Brussels, Flanders, Krakow, London, Paris, Warsaw, Zurich) between 2017 and 2021." The Real Urban Emission database.

[22] A reduction of around 25% between 2018 and 2022 according to the model that has been updated since the publication of the previous annual report.

Finally, while the figures for 2023 once again confirm the effectiveness of the LEZ in improving air quality, the LEZ also has socio-economic consequences for the owners of the vehicles affected. These impacts were the main motivation behind the postponement of the milestone voted by the Brussels Parliament in October 2024. It is therefore crucial to continue the efforts already made to better inform and support the public affected by the LEZ. Consideration will also need to be given to new ways of reconciling socio-economic issues with health and climate protection.