

## Low- and zero-emission zones and social equity: Supporting the urban transition to zero-emission vehicles and alternative transport modes

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### Introduction

Low-emission zones (LEZs) and zero-emission zones (ZEVs)<sup>1</sup> in cities can enable the shift to alternative transport modes such as public transport, walking, and cycling and promote cleaner, healthier, more livable cities. For those who depend on a vehicle, they can also facilitate the transition to lower- and zero-emission cars. LEZs favor access to low- and zero-emission motorized vehicles—from two-wheelers to trucks—to certain areas ranging from single streets to entire urban areas. They have been adopted by more than 300 cities across 16 countries in Europe.<sup>2</sup> Increasingly, there are efforts to move to ZEVs, which allow access to vehicles with zero tailpipe emissions. Based on current technology, zero-emission vehicles (ZEVs) include battery electric vehicles (BEVs) and fuel cell electric vehicles (FCEVs).<sup>3</sup> Mounting evidence shows that cities with LEZs and ZEVs see positive environmental and public health benefits. Those benefits include reduced transport-related air pollution, carbon dioxide (CO<sub>2</sub>) emissions, traffic congestion, and noise.<sup>4</sup>

From a social perspective, there is evidence that LEZs help reduce health-related inequities.<sup>5</sup> Decreasing health inequities through LEZs could also benefit particularly

- 1 Other vehicle access regulation schemes include clean air zones (CAZs), ultra-low emission zones (ULEZs), zero-emission areas (ZEAs), congestion charging zones (CCZs) and urban road tolls, limited traffic zones (LTZs), Emergency Air Pollution schemes, and pedestrian zones (also called car-free zones). They sometimes are used in combination. Depending on context, some terminologies (e.g., ZEVs, ZEAs, and pedestrian zones) may be used interchangeably.
- 2 European Commission, "Urban Access Regulations in Europe," accessed October 10, 2023, <https://urbanaccessregulations.eu/>.
- 3 Sandra Wappelhorst and Hongyang Cui, *Update on Zero-Emission Zone Development Progress in Cities*, (Washington, DC: ICCT, 2022), <https://theicct.org/publication/update-on-zero-emission-zone-progress-aug22/>.
- 4 Nico Pestel and Florian Wozny, *Low Emission Zones for Better Health: Evidence from German Hospitals*, (Bonn, Germany: IZA Institute of Labor Economics, 2019), <https://docs.iza.org/dp12545.pdf>. See also Rohit Nepali, Kaylin Lee, Yoann Bernard, and Jakob Schmidt, *Impacts of a Low-Emission Zone on Air Pollutant and Greenhouse Gas Emissions in Warsaw*, (Washington, DC: ICCT, 2023), <https://theicct.org/publication/true-warsaw-lez-oct23/>.
- 5 Inequity generally means differing access to resources or opportunities among different groups arising from social, economic, environmental, or structural disparities. T.R. Campbell and N.J. Roberts, "The impacts low emission zones have on improving health and decreasing health inequalities," *Thorax* 74, no. 2 (2019): A171-A172, <http://dx.doi.org/10.1136/thorax-2019-BTSabstracts2019.292>.

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marginalized populations (i.e., people or groups at higher risk of being excluded from society due to factors including but not limited to economic status, access to education, ethnicity, age, gender, disability, or geographic locality),<sup>6</sup> because those populations often live in or travel to urban areas with high levels of air pollution caused by motorized traffic.<sup>7</sup> But social equity as it relates to LEZs and ZEZs goes beyond the potential to reduce health inequities. It should also be considered in planning and making decisions related to LEZs/ZEZs (including their design, their implementation and monitoring schemes, and the adoption of supplementary policies) with a strategic focus on marginalized populations.

This study describes supplementary financial support measures for planned and implemented LEZs/ZEZs provided by local and regional governments with the strategic focus on marginalized populations. This study first defines key terms and concepts related to LEZs/ZEZs and equity. Next, we examine three European capitals (Brussels, Paris, and London) with planned and implemented ZEZs/LEZs and describe the supplementary financial support measures aimed at helping groups facing financial hardship to afford low- and zero-emission vehicles or alternative transport modes. We then analyze the effects of those measures. This study concludes with key findings.

## Equity and policy focus

This section defines key terms and concepts related to LEZs/ZEZs and equity. This study only considers permanent LEZ and ZEZ schemes (as opposed to those introduced temporarily as emergency measures during times of high pollution). However, some permanent schemes might not be in effect all the time (for example, some permanent LEZs are only in effect on weekdays).

This study also only considers financial measures that directly relate to supporting LEZs/ZEZs.<sup>8</sup> We assess only the financial support measures provided by local or regional governments; accordingly, this study highlights the role of those governments in planning, implementing, and operating LEZs/ZEZs. Table 1 outlines these financial support measures.

**Table 1.** Financial support measures considered in this study.

<b>Scrappage</b>	Permanently removes a non-zone compliant vehicle from the fleet. The term disposal can be used interchangeably.
<b>Replacement</b>	Replaces a non-zone compliant vehicle with a zone-compliant version.
<b>Scrappage/shift to alternative transport modes</b>	Scraps a vehicle from the fleet and shifting mobility to alternative transport modes like walking, cycling, shared mobility services (e.g., bike or car sharing), or public transport.
<b>Deregistration/shift to alternative transport modes</b>	Temporarily surrender a non-zone-compliant vehicle's license plate while testing alternative transport modes. This does yet not imply the permanent removal from the vehicle fleet; the vehicle could be sold or re-registered.
<b>Retrofitting</b>	Modifies a vehicle's diesel emission system to reduce emissions, typically by adding engine exhaust aftertreatment hardware (e.g., diesel particulate filters, selective catalytic reduction, crankcase emission control devices, etc.).
<b>Repowering</b>	Removing a vehicle's original engine and replacing it with a new engine or power source (such as an electric drive system). <sup>9</sup>

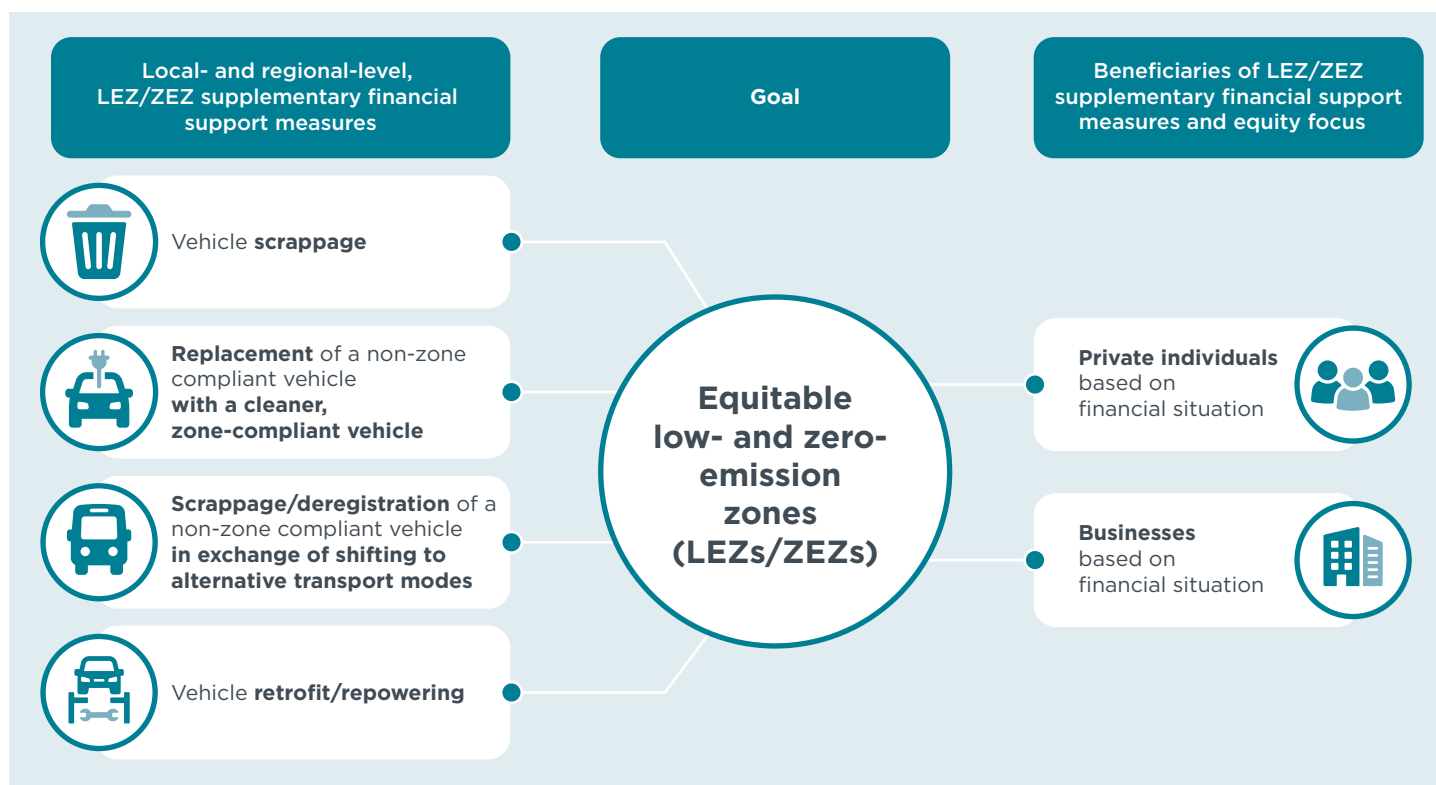
6 "Marginalized groups," European Institute for Gender Equality, accessed October 10, 2023, <https://eige.europa.eu/thesaurus/terms/1280>.

7 Michelle Meyer and Tim Dallmann, *Exposure to Air Pollution from Diesel Trucks in New York City*, (Washington, DC: ICCT, 2022), <https://theicct.org/publication/fs-true-diesel-trucks-nyc-apr22/>.

8 Access exemptions for certain groups (e.g., those with disabilities) are not considered.

9 Kay Kelly and John Gonzales, "What Fleets Need to Know About Alternative Fuel Vehicle Conversions, Retrofits, and Repowers" (U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy, 2017), [https://afdc.energy.gov/files/u/publication/afv\\_conversions\\_retrofits\\_repowers.pdf](https://afdc.energy.gov/files/u/publication/afv_conversions_retrofits_repowers.pdf).

Next, this study considers marginalized populations as term which can cover a variety of sociodemographic factors. This analysis examines groups (including people and businesses) in most financial need. Income and availability of financial resources can impact the accessibility and affordability of zone-compliant vehicles and alternative transport. In this study, the income levels of private individuals are reflected by their annual taxable per capita household income. Exact income categories and thresholds are defined by relevant local policies. In addition, if income thresholds are not defined, they can also relate to private individuals receiving some form of national low-income support (this also implies financial hardship and limited financial resources). The incomes of businesses are based on business type including charities, sole traders, and micro-, small-, and medium-sized enterprises (SMEs). The European Commission defines SMEs by their size and annual turnover and/or balance sheet: micro-businesses employ fewer than 10 persons and have an annual turnover and/or balance sheet total not exceeding €2 million; small businesses employ fewer than 50 persons and have an annual turnover and/or annual balance sheet total not exceeding €10 million; medium businesses employ fewer than 250 persons with an annual turnover not exceeding €50 million and/or an annual balance sheet total not exceeding €43 million.<sup>10</sup> Figure 1 depicts the financial support measures considered in this study in the context of equitable LEZs and ZEZs, and their beneficiaries.



**Figure 1.** Overview of supplementary financial support measures along LEZs/ZEZs targeted at private individuals and businesses in most financial need covered in this paper.

<sup>10</sup> Commission Regulation (EU) No 651/2014 of 17 June 2014 declaring certain categories of aid compatible with the internal market in application of Articles 107 and 108 of the Treaty (Text with EEA relevance) of the European Commission, Official Journal of the European Union, June 26, 2014, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R0651&from=HR>.

## Case studies

From a social equity perspective, supplementary financial support measures targeted at those in most financial need are important when establishing LEZs/ZEZs for two reasons. First, cities that wish to encourage retainment of movement and economic activity generally prefer not to exclude anyone who depends on a vehicle and needs to enter a LEZ/ZEZ for private or business purposes. Second, support measures can increase the acceptance of LEZs/ZEZs. For example, a 2023 consultation about LEZs in France revealed that 86% of private individuals and 79% of companies oppose the establishment of LEZs out of the fear of widening social inequities. The main obstacle cited by 77% of private individuals who responded and 58% of companies are the high costs of purchasing a clean vehicle.<sup>11</sup>

The following sections examine selected cities with implemented and planned LEZs/ZEZs and with local or regional supplementary financial support measures. For our descriptive analysis, we choose Brussels, Paris, and London, because their:

- » Zones affect all motorized vehicle types (leaving aside exemptions).
- » Zones cover the entire build up area of the city, partially beyond including metropolitan areas (Paris, Brussels).
- » Access regulations have been regularly and gradually tightened in recent years with the aim to move to ZEZs in the future.
- » Respective governments provide LEZ/ZEZ supplementary financial support measures based on income and financial resources of private individuals and businesses.

Additional cities with implemented or planned LEZs in France and the United Kingdom (UK) also provide supplementary financial support measures based on income and the financial situations of private individuals and/or businesses; they are mentioned but not described in detail.<sup>12</sup> The following sections are structured alphabetically by country. Policies and scheme designs are described as of October 2023.

## Belgium

In Belgium, the introduction of LEZs and their respective regulations are different for the three regions of the Brussels Capital Region, Flanders, and Wallonia. Permanent LEZs adopted so far exist in the Brussels Capital Region (since 2018) and in Flanders (in Antwerp since 2017 and Ghent since 2020).<sup>13</sup>

## Brussels

The Brussels LEZ covers the Capital Region (encompassing 19 municipalities) with the exemption of the Ring (a 75-km urban motorway around Brussels) and certain routes to transit parking lots.<sup>14</sup> The aim of the LEZ is to improve urban air quality and public health. It regulates cars, vans, minibuses, and buses based on Euro emission standards and fuel type. Beginning in 2025, the zone will also affect mopeds, motorcycles, and trucks. The city plans to gradually tighten restrictions to only allow ZEVs starting with motorized two- and three-wheelers beginning in 2028, followed by cars, vans,

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11 République Française, “Consultation sur la qualité de l’air: une majorité contre les zones à faibles émissions (ZFE) [Consultation on air quality: A majority against low emission zones (ZFE),” May 26, 2023, <https://www.vie-publique.fr/en-bref/289581-consultation-une-majorite-de-non-aux-zones-faibles-emissions-zfe>.

12 Most other European cities with planned or implemented LEZs/ZEZs do not offer local financial support for those most in financial need. However, cities often have other types of support policies; these are not the focus of this paper.

13 Filip Verhelst, “Zones de basses émissions en Belgique: que faut-il savoir? [Low emission zones in Belgium: what do you need to know?],” *Touring blog*, May 22, 2023, accessed June 18, 2023, <https://www.touring.be/fr/articles/zones-basses-emissions-que-devez-vous-savoir>.

14 City of Brussels, “Low Emission Zone,” accessed October 10, 2023, <https://www.brussels.be/lez>.

motorcycles, motor tricycles, and quadricycles in 2035, and minibuses in 2036. No schedule for buses or vehicles that transport heavy goods has been defined yet. Owners of non-LEZ compliant vehicles can purchase day passes to enter the LEZ; they cost between €20–€50 depending on vehicle type. A maximum of 24 day passes per vehicle per year can be purchased. Supplementary financial measures to support the switch to zone-compliant vehicles and alternative transport are available for private individuals and businesses.

In March 2022, Brussels re-launched its Brussels Air Bonus (Prime Bruxell’Air), a mobility budget for residents to deregister cars in favor of alternative transport modes created in 2006 to improve local air quality. Bonus amounts were adjusted as part of the re-launch and a social equity component was added, differentiating bonus amounts by household income and disability status. Private individuals in the Brussels Capital Region benefit from the mobility budget for 2 years when deregistering private cars in favor of alternative transport modes. The re-registration of cars is not allowed for at least 1 year; cars to be deregistered must have been registered for at least 2 years and deregistration must have taken place a maximum of 6 months before applying for the mobility budget. With the mobility budget, individuals and households can test and combine different alternative transport modes for free.<sup>15</sup> A Mobility Coach is available to offer guidance on mobility options. Grant amounts and mobility budget services are listed in Table 2.

**Table 2.** Brussels (Belgium) LEZ supplementary financial support measures by local government.

		Private individuals living in the Brussels Capital Region with a yearly taxable income of		
		< €37,600 (single person) or < €52,600 (cohabitant/couple) or person with a disability, regardless of income	€37,600 – €75,100 (single person) or €52,600 – €90,100 (cohabitant/couple)	> €75,100 (single person) or > €90,100 (cohabitant/couple)
<b>Car replacement with alternative modes of transportation</b>				
<b>Step 1</b>	<b>Deregistration</b> of a private car	<b>Yes</b>		
<b>Step 2</b>	<b>Mobility budget which can be spent on services by third parties supporting mode shift</b> including subscriptions for public transport and vouchers for TaxiBus, purchase of bike and bike equipment, coupons for a bike sharing system, subscriptions for (electric) carsharing, and coupons to access Mobility as a Service system	<b>€900</b>	<b>€700</b>	<b>€500</b>
		Minimum amounts to be spent on each service depending on the relevant third party offers		

Note: Aid amounts reflect maximum values; grant amounts applicable if applying for a grant between 2023 and 2024.

For businesses, there is financial aid to switch from non-zone compliant light commercial vehicles (vans) to zone-compliant vans or quadricycles for the transport of goods.<sup>16</sup> Aid is targeted at SMEs. To qualify, businesses must be in the Brussels Capital Region and be active in certain sectors (e.g., waste management, water sanitation, building, motor vehicle/motorcycle repair, or accommodation/catering).

<sup>15</sup> “La prime Mobilité Bruxell’Air, pour se déplacer autrement à Bruxelles [The Brussels Air Mobility bonus, to get around Brussels differently],” environnement.brussels, September 18, 2023, accessed October 10, 2023, <https://environnement.brussels/citoyen/services-et-demandes/primas-et-aides-financieres/prime-bruxellair>.

<sup>16</sup> Arrêté du Gouvernement de la Région de Bruxelles-Capitale relatif à l’aide pour la mise en conformité aux normes de la zone de basses émissions [Decree of the Government of the Brussels-Capital Region relating to aid for compliance with the standards of the low emission zone] of the Brussels Capital Region, accessed October 10, 2023, <http://www.ejustice.just.fgov.be/eli/arrete/2021/11/25/2021022555/moniteur>.

Businesses must also own at least one van which will not be allowed to drive in the LEZ in subsequent years. Maximum grant amounts and limits within certain percentages depend on whether the new or secondhand purchased/leased or retrofitted/repowered vehicle runs on gasoline or liquefied or compressed natural gas (CNG) or is electric. If applying for grants between 2023–2024, non-compliant vehicles include vans less than Euro 5 for diesel (typically registered before 2011) and less than Euro 2 for gasoline/gas vehicles (typically registered before 1997). Table 3 summarizes the highlighted aid to businesses.

**Table 3.** Brussels (Belgium) LEZ supplementary financial support measures by local government.

		Businesses operating or active in the Brussels Capital Region		
		Micro businesses (less than 10 employees, annual turnover max. €2 million or balance sheet max. €2 million)	Small businesses (less than 50 employees, annual turnover max. €10 million or balance sheet max. €10 million)	Medium businesses (less than 250 employees, annual turnover max. €50 million or balance sheet max. €43 million)
<b>Van replacement with a cleaner van or quadricycle model</b>				
<b>Step 1</b>	<b>Scrapping</b> of a non-LEZ compliant <b>gasoline, natural gas, or diesel van</b>	<b>Yes</b>		<b>Yes</b>
<b>Step 2</b>	<b>Replacement</b> with a new or second-hand LEZ-compliant <b>van (gasoline or natural gas)</b>	<b>€3,000</b>		<b>€2,000</b>
	<b>Replacement</b> with a new or second-hand LEZ-compliant <b>van or quadricycle (electric)</b>	<b>€15,000</b> (including <b>€1,000</b> for a <b>charging station</b> )		<b>€10,000</b> (including <b>€1,000</b> for a <b>charging station</b> )
<b>Van retrofit/repowering to an electric version</b>				
	<b>Repowering</b> of a non-LEZ compliant <b>gasoline, natural gas, or diesel van to a BEV or FCEV</b>	<b>€7,500</b> (including <b>€1,000</b> for a <b>charging station</b> )		<b>€5,000</b> (including <b>€1,000</b> for a <b>charging station</b> )

Note: Aid amounts reflect maximum values; grant amounts applicable if applying for a grant between 2023 and 2024.

## France

The national legal framework enabling the introduction of LEZs in France is the 2015 Energy Transition for Green Growth Law.<sup>17</sup> Based on the 2019 Mobility Orientation Law, French cities must implement so-called “LEZs for mobility (LEZ-m)” if they fail to meet defined air quality standards.<sup>18</sup> The 2021 Climate and Resilience Law makes the establishment of LEZs mandatory before December 2024 in the country’s 43 agglomerations with more than 150,000 inhabitants.<sup>19</sup>

### Paris

In 2017, Paris introduced the first permanent LEZ in France to address transport-related air pollution. It covers the city center inside the 35-km ring road (Boulevard périphérique). The city’s other permanent LEZ, introduced in 2019, covers the Greater Paris Metropolitan Area, including almost 80 communities in all or part of the second 79-km ring road. While stricter regulations exist for the former, both aim to gradually

17 Loi no 2015-992 du 17 août 2015 relative à la transition énergétique pour la croissance verte (1) [Law no. 2015-992 of 17 August, 2015 relating to the energy transition for green growth (1)] of the République Française, August 18, 2015, accessed October 10, 2023, <https://www.legifrance.gouv.fr/loda/id/JORFTEXT000031044385>

18 Loi no 2019-1428 du 24 décembre 2019 d’orientation des mobilités (1) [Law no. 2019-1428 of December 24, 2019 on the orientation of mobility (1)] of the République Française, December 20, 2019, accessed October 10, 2023, <https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000039666574>

19 Loi no 2021-1104 du 22 août 2021 portant lutte contre le dérèglement climatique et renforcement de la résilience face à ses effets (1) [LAW no. 2021-1104 of August 22, 2021 on the fight against climate change and strengthening resilience to its effects (1)] of the République Française, accessed October 10, 2023, <https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000043956924>

tighten access regulations to only allow BEVs and FCEVs beginning in 2030, affecting all vehicle types. The purpose is to protect populations in the most polluted, high-density areas (i.e., improving air quality to benefit public health is a priority).<sup>20</sup> To support the switch in a socially equitable way, the Greater Paris Metropolitan Area and the Ile-de-France Region offer LEZ supplementary financial aid measures for private individuals based on their financial situation (see Table 4).<sup>21</sup>

The Greater Paris Metropolitan Area aid scheme “Métropole Roule Propre!” (Metropolis Rolls Clean!) targets private individuals in the area to scrap older gasoline or diesel cars or vans based on Euro emission standards in favor of cleaner, zero- and low-emission vehicles. People in lower-income groups benefit from aid in two ways (Table 4). First, cars or vans to be scrapped can be newer for people in lower income groups. Second, people in lower-income groups receive higher aid amounts when replacing older vehicles with “clean” vehicles including BEVs, FCEVs, plug-in hybrid electric vehicles (PHEVs) with a battery electric range of more than 50 km, hybrids, or CNG vehicles. Since 2022, CO<sub>2</sub> emissions limits are set based on the Worldwide Harmonized Light Vehicles Test Procedure (WLTP) standard at no more than 127 g of CO<sub>2</sub>/km for new vehicles and 137 g of CO<sub>2</sub>/km for second-hand vehicles. Aid amounts for the scrapping of older vehicles to be replaced with cleaner vehicles is based on four income brackets. Maximum aid amounts relate to the purchase price of a vehicle including tax and excluding deductions for options and state aid, whereby the purchase price cannot exceed €50,000.

**Table 4.** Greater Paris Metropolitan Area (France) LEZ supplementary financial support measures for individuals by local government.

		Private individuals living in the Greater Paris Metropolitan area with a yearly per capita reference taxable income of			
		€0 - €6,300	€6,301 - €13,489	€13,490 - €35,052	above €35,052
<b>Car or van replacement with cleaner car or van model</b>					
Step 1	Scrapping of a gasoline or diesel car or van registered before 2006 or 2011 respectively	Yes	Yes	No	No
	Scrapping of a gasoline or diesel car or van registered before 1997 or 2006 respectively	No	No	Yes	Yes
Step 2	Replacement with a new or second-hand car or van (BEV, FCEV, PHEV with a battery electric range more than 50 km, hybrid, or CNG vehicle)	€6,000	€5,000	€3,000	€1,500
<b>Car, van, 2- or 3-wheeler replacement with cleaner 2- or 3-wheeler, or quadricycle model</b>					
Step 1	Scrapping of a gasoline or diesel car or van registered before 1997 and 2006 respectively, or a gasoline or diesel 2-/3-wheeler registered before 2000	Yes	Yes	Yes	Yes
Step 2	Replacement with a new or second-hand 2- or 3-wheeler, or quadricycle (electric)	€1,400	€1,100	€900	€600

Note: Aid amounts reflect maximum values; the reference taxable income considers all income of tax and is calculated from the taxable income; BEV = Battery electric vehicle, FCEV = Fuel cell electric vehicle, PHEV = Plug in hybrid electric vehicle, CNG = Compressed Natural Gas

Another LEZ supplementary financial support measure by the Greater Paris Metropolitan Area for private individuals is targeted at the acquisition or lease of a new or second-hand electric two- or three-wheeler, an electric quadricycle, or the

<sup>20</sup> Métropole du Grand Paris, “Qualité de l’air - Zone à Faibles Emissions métropolitaine [Air Quality - Metropolitan Low Emission Zone]”, accessed October 10, 2023, <https://www.metropolegrandparis.fr/fr/ZFE>.

<sup>21</sup> “Métropole Roule Propre [Clean Rolling Metropolis]”, Métropole du Grand Paris, accessed October 10, 2023, <https://metropolegrandparis.fr/fr/metropole-roule-propre-0>.

purchase of a new electrically assisted bicycle with two or three wheels (Table 4).<sup>22</sup> The precondition is the scrapping of a gasoline car or van registered before 1997, a diesel car or van registered before 2006, or a gasoline or diesel, two- or three-wheeler registered before 2000. Lower-income people again benefit from higher aid amounts.

The Île-de-France Region also offers income-based incentives targeted at private individuals for the scrapping of a private car and its replacement with a BEV or FCEV. The car to be scrapped must be a diesel Euro 2, 3, or 4 (first registered between 1997 and 2010), gasoline Euro 2 or 3 (first registered between 1997 and 2005), or unclassified (registered in 1996 or earlier). Beneficiaries are private individuals living in defined municipalities who do not benefit from the incentives provided by the Greater Paris Metropolitan Area and who work in a municipality of the LEZ. Aid amounts and income brackets are the same as the ones listed in Table 4 for the car replacement, ranging between €1,500 and €6,000, with a vehicle's price cap at €40,000 including tax.<sup>23</sup>

Small businesses with up to 50 employees and an annual turnover of 10 million can also receive financial aid for the purchase of a clean vehicle (BEV, FCEV, or natural gas vehicle) from the Île-de-France Region, but this aid is not directly tied to the LEZ.<sup>24</sup>

## Other cities in France

Beyond the permanent LEZs in Paris and the Greater Paris Metropolitan Area, 10 other French cities provide LEZ supplementary financial support measures for private individuals and businesses depending on their incomes and financial situations: Aix-Marseille,<sup>25</sup> Grenoble,<sup>26</sup> Lyon,<sup>27</sup> Montpellier,<sup>28</sup> Nice,<sup>29</sup> Reims,<sup>30</sup> Rouen,<sup>31</sup> Saint-Étienne,<sup>32</sup>

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- 22 "Règlement d'attribution de la subvention de la Métropole du Grand Paris pour l'acquisition d'un deux-roues, d'un trois-roues, d'un quadricycle électrique, ou d'un vélo à assistance électrique « Métropole Roule Propre ! » En vigueur à compter du 1er juillet 2019 [Regulations for the award of the Grand Paris Metropole subsidy for the acquisition of an electric two-wheeler, a three-wheeler, quadricycle, or an electric assistant bike « Métropole Roule Propre! » Effective July 1, 2019], Métropole du Grand Paris', July 1, 2019, accessed October 10, 2023, [https://www.metropolegrandparis.fr/sites/default/files/media/document/Règlement%20R%203R%20quadri%20VAE%2001%2007%202019\\_O\\_O.pdf](https://www.metropolegrandparis.fr/sites/default/files/media/document/Règlement%20R%203R%20quadri%20VAE%2001%2007%202019_O_O.pdf).
  - 23 "Aides régionales et appels à projets [Regional aid and calls for projects], Île-de-France Regional Council, accessed October 10, 2023, <https://www.iledefrance.fr/remplacement-des-voitures-des-particuliers-par-des-vehicules-propres>.
  - 24 "Aides régionales et appels à projets [Regional aid and calls for projects], Île-de-France Regional Council, accessed October 10, 2023, <https://www.iledefrance.fr/acquisition-de-vehicules-propres-par-les-professionnels-franciliens>.
  - 25 "Zone à faibles émissions mobilité (ZFE-M) [Mobility Low Emission Zone (LEZ-M)], La Métropole Aix-Marseille-Provence, accessed October 10, 2023, <https://ampmetropole.fr/missions/strategie-environnementale/qualite-de-lair/zone-a-faibles-emissions-mobilite-zfe-m/>.
  - 26 "Changer mon véhicule pour un véhicule moins polluant [Change my vehicle for a less polluting vehicle], Grenoble Alpes Métropole, accessed October 10, 2023, <https://www.grenoblealpesmetropole.fr/116-choisir-un-vehicule-moins-polluant.htm>.
  - 27 "Particulier [Individual], Métropole Grand Lyon, accessed October 10, 2023, <https://zfe.grandlyon.com/particulier/>; "Professionnel [Professional], Métropole Grand Lyon, accessed October 10, 2023, <https://zfe.grandlyon.com/professionnel/>.
  - 28 "ZFE: Les aides prévues pour changer de véhicule [LEZ: Aid provided for changing vehicles], Montpellier Méditerranéenne Métropole, accessed October 10, 2023, <https://www.montpellier3m.fr/zfe-les-aides-prevues-pour-changer-de-vehicule>.
  - 29 "Zone à faibles émissions [Low Emission Zone], Mairie de Nice, accessed October 10, 2023, <https://www.nice.fr/fr/environnement/zone-a-faibles-emissions>.
  - 30 "Zone à Faibles Mobilité (ZFE<sub>m</sub>) du Grand Reims [Low Emission Mobility Zone (LEZ<sub>m</sub>) of Grand Reims] <https://www.grandreims.fr/cadre-de-vie-et-environnement/developpement-durable/zone-a-faibles-emissions-mobilite-zfem-du-grand-reims>," Grand Reims Communauté Urbaine, accessed October 10, 2023,
  - 31 "Mieux respirer au sein de la Métropole Rouen Normandie, un objectif partagé [Breathe better within the Rouen Normandy Metropolis, a shared objective], Métropole Rouen Normandie, accessed October 10, 2023, <https://zfe.metropole-rouen-normandie.fr/>.
  - 32 "Zone à faibles émissions - mobilité [Low emission zone - mobility], Saint-Étienne la Métropole, accessed October 10, 2023, <https://www.saint-etienne-metropole.fr/preserver-recycler/qualite-de-lair/zone-faibles-emissions-mobilite>.



Strasbourg,<sup>33</sup> and Toulouse.<sup>34</sup> Each city has an individual aid scheme and provides different amounts by varying bands, all depending on their local LEZ policies and vehicles affected. While Saint-Étienne targets professionals only, all others aim at private individuals and businesses. Toulouse has adopted a variety of measures to support the switch to cleaner vehicles and alternative transport modes as well, but they are not LEZ-supplementary specifically. Strasbourg's residents can also benefit from a mobility budget worth up to €2,500 to use public transport or other alternative modes of transportation when they resell or scrap non-LEZ-compliant cars.

## United Kingdom

In the UK, there are permanent LEZs in 12 cities, eight in England (Bath, Birmingham, Bradford, Bristol, London, Newcastle, Portsmouth, and Sheffield) and four in Scotland (Aberdeen, Dundee, Edinburgh, and Glasgow). Most have been launched since 2021, but a grace period exists until their final implementation.<sup>35</sup> These zones are typically referred to as Clean Air Zones (CAZs) outside London. Some allow LEZ-non-compliant vehicles to pay a charge for access. The legal frameworks enabling cities to restrict traffic to certain areas and vehicle types vary by region.<sup>36</sup> The relevant legislation in England (outside of London) and Wales is the Transport Act of 2000,<sup>37</sup> amended by the 2008 Local Transport Act.<sup>38</sup> The relevant legislation in London is the Greater London Authority Act of 1999,<sup>39</sup> amended by the 2008 Local Transport Act. In Scotland, legislation is based on the 2001 Transport (Scotland) Act.<sup>40</sup> UK cities outside of London are obligated to implement LEZs to meet air quality limits. Local authorities are responsible for the implementation of the zones themselves. Once approved, local authorities can receive funding to help set up the zone.

## London (England)

London has various zone schemes regulating access for high-emitting vehicles. This includes the ultra-low emission zone (ULEZ) which was first introduced in April 2019 in the center of the city. The key aim of the ULEZ is to improve London's air quality and public health. Vehicles affected include cars, vans, motorcycles, specialist vehicles, and minibuses.<sup>41</sup> The ULEZ was first expanded in October 2021 to cover 3.8 million people in inner London. In August 2023, the ULEZ was expanded 18-fold to cover all Greater London's 33 local government districts with about 9 million inhabitants.<sup>42</sup>

In January 2023, the Mayor of London relaunched scrappage schemes to prepare for the last extension of the ULEZ. These schemes, worth £110 million (€124 million) targeted private individuals and businesses. One scheme helps private individuals who receive

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33 "Aides à la conversion [conversion aids]", Ville et Eurométropole de Strasbourg, accessed October 10, 2023, <https://www.strasbourg.eu/aides-conversion>; "ZFE-M: Pour les professionnels [LEZ-M: For professionals]", Ville et Eurométropole de Strasbourg, accessed October 10, 2023, <https://www.strasbourg.eu/zfe-professionnels>; "Le compte mobilité [the mobility account]", Ville et Eurométropole de Strasbourg, accessed October 10, 2023, <https://www.strasbourg.eu/compte-mobilite>.

34 "Demander la prime véhicule + propre [Apply for the vehicle + own bonus]", Toulouse Métropole, accessed October 10, 2023, <https://metropole.toulouse.fr/demarches/demander-la-prime-vehicule-propre>.

35 "Urban Access Regulations in Europe," European Commission, accessed October 10, 2023, <https://urbanaccessregulations.eu/countries-mainmenu-147/united-kingdom-mainmenu-205>.

36 "Research Briefing Low Emission Zones," UK Parliament, November 23, 2015, accessed October 10, 2023, <https://commonslibrary.parliament.uk/research-briefings/cbp-7374/>.

37 Transport Act 2000 of the Parliament of the United Kingdom, 2000, accessed October 10, 2023, [https://www.legislation.gov.uk/ukpga/2000/38/pdfs/ukpga\\_20000038\\_en.pdf](https://www.legislation.gov.uk/ukpga/2000/38/pdfs/ukpga_20000038_en.pdf).

38 Local Transport Act 2008 of the Parliament of the United Kingdom, November 26, 2008, accessed October 10, 2023, <https://www.legislation.gov.uk/ukpga/2008/26>.

39 Greater London Authority Act 1999 of the Parliament of the United Kingdom, November 11, 1999 accessed October 10, 2023, <https://www.legislation.gov.uk/ukpga/1999/29>.

40 Transport (Scotland) Act 2001 of the Scottish Parliament, December 20, 2000, accessed October 10, 2023, <https://www.legislation.gov.uk/asp/2001/2>.

41 "Paying the ULEZ charge," Transport for London, accessed October 10, 2023, <https://tfl.gov.uk/modes/driving/ultra-low-emission-zone/ulez-payments>.

42 "ULEZ expansion 2023," Transport for London, accessed August 29, 2023, <https://tfl.gov.uk/modes/driving/ultra-low-emission-zone/ulez-expansion-2023>.

some form of national benefit with the switch to ULEZ-compliant cars, motorcycles, and wheelchair accessible vehicles. The “ULEZ car and motorcycle scrappage scheme” (which previously ran from October 2019 to late 2021) targets Londoners on certain national low-income benefits (e.g., income support and housing allowance) living in one of the 32 London boroughs or the City of London.<sup>43</sup> The scheme offers various grant payment options depending on if non-ULEZ compliant cars, motorcycles, or wheelchair accessible vehicles are scrapped altogether or exchanged in favor of the use of alternative transport modes or if non-ULEZ compliant wheelchair accessible vehicles are retrofitted and adapted to ULEZ standards (see Table 5).

**Table 5.** London (England, UK) ULEZ supplementary local financial support measures for private individuals.

		Private individuals living in the 32 London boroughs or the City of London
		Recipient of national low-income benefits
<b>Car, motorcycle, and wheelchair accessible vehicle scrappage</b>		
<b>Scrappage of a non-ULEZ compliant gasoline and diesel car</b>		<b>£2,000 (€2,300)</b>
<b>Scrappage of a non-ULEZ compliant gasoline and diesel motorcycle</b>		<b>£1,000 (€1,200)</b>
<b>Scrappage of a non-ULEZ compliant gasoline and diesel wheelchair accessible vehicle</b>		<b>£5,000 (€5,800)</b>
<b>Car, motorcycle, and wheelchair accessible vehicle scrappage in exchange of shifting to alternative modes of transport</b>		
<b>Step 1</b>	<b>Scrappage of a non-ULEZ compliant gasoline and diesel car</b>	<b>£1,600 (€1,800)</b>
<b>Step 2</b>	Application of 1 adult-rate Annual Bus & Tram Pass	<b>£932 (€1,100)</b>
<b>Step 1</b>	<b>Scrappage of a non-ULEZ compliant gasoline and diesel car</b>	<b>£1,200 (€1,400)</b>
<b>Step 2</b>	Application of 2 adult-rate Annual Bus & Tram Pass	<b>£1,864 (€2,100)</b>
<b>Step 1</b>	<b>Scrappage of a non-ULEZ compliant gasoline and diesel motorcycle</b>	<b>£600 (€700)</b>
<b>Step 2</b>	Application of 1 adult-rate Annual Bus & Tram Pass	<b>£932 (€1,100)</b>
<b>Step 1</b>	<b>Scrappage of a non-ULEZ compliant gasoline and diesel motorcycle</b>	<b>£200 (€200)</b>
<b>Step 2</b>	Application of 2 adult-rate Annual Bus & Tram Pass	<b>£1,864 (€2,100)</b>
<b>Step 1</b>	<b>Scrappage of a non-ULEZ compliant gasoline or diesel car, motorcycle, or wheelchair accessible vehicle</b>	<b>£1,000, £2,000, or £5,000 (€1,200, €2,300, or €5,800)</b>
<b>Step 2</b>	<b>Financial offers by third parties supporting mode shift</b> including discounts/reductions/time-limited use/free tests for services such as the hire or subscription of an (electric) bike and electric scooter; purchase of an (electric) bike or (electric) cargo bike; membership and credits for car and van clubs; incentives for car and van rental; discounts for electric motorcycle parts and accessories; car, van, and minibus finance or subscription	<b>Exact amount depending on offer</b>
<b>Wheelchair accessible vehicle retrofit/repowering</b>		
<b>Retrofit of a non-ULEZ compliant to an ULEZ compliant gasoline or diesel wheelchair accessible vehicle</b>		<b>£5,000 (€5,800)</b>

Note: Aid amounts reflect maximum values.

Businesses in London also benefit from scrappage scheme incentives (see Table 6). The “ULEZ van and minibus scrappage scheme” was relaunched in January 2023 (the previous scheme ran from February 2019 to August 2020). It targets micro businesses (up to 10 employees), sole traders, and charities in the 32 London boroughs and the City of London. The grants incentivize various options: the scrappage of a van, the scrappage of a minibus, the scrappage and replacement of a van or minibus with a

<sup>43</sup> “Scrappage scheme,” Transport for London, accessed October 10, 2023, <https://tfl.gov.uk/modes/driving/ultra-low-emission-zone/scrappage-schemes?cid=scrappage-scheme>.

fully electric vehicle, and the retrofit of certain vans and minibuses. As with private individuals, eligible businesses that have scrapped non-ULEZ compliant vehicles can benefit from exclusive offers from third parties to facilitate the switch to alternative transport modes.

**Table 6.** London (England, UK) ULEZ supplementary local financial support measures for businesses.

		<b>Businesses</b> owning and operating a business or are active within the 32 London boroughs or the City of London
		<b>Sole traders, micro businesses (up to 10 employees), and charities</b>
<b>Van or minibus scrappage</b>		
<b>Scrappage</b> of a non-ULEZ compliant <b>gasoline or diesel van</b>		<b>£5,000 (€5,800)</b>
<b>Scrappage</b> of a non-ULEZ compliant <b>gasoline or diesel minibus</b>		<b>£7,000 (€8,100)</b>
<b>Van or minibus replacement with a cleaner van or minibus model</b>		
<b>Step 1</b>	<b>Scrappage</b> of a non-ULEZ compliant <b>gasoline or diesel van</b>	<b>Yes</b>
<b>Step 2</b>	<b>Replacement</b> with a <b>van (BEV, FCEV)</b>	<b>£7,500 (€8,700)</b>
<b>Step 1</b>	<b>Scrappage</b> of a non-ULEZ compliant <b>gasoline or diesel minibus</b>	<b>Yes</b>
<b>Step 2</b>	<b>Replacement</b> with a <b>minibus (BEV, FCEV)</b>	<b>£9,500 (€11,000)</b>
<b>Van or minibus scrappage in exchange for shifting to alternative modes of transport</b>		
<b>Step 1</b>	<b>Scrappage</b> of a non-LEZ compliant <b>gasoline or diesel van or minibus</b>	<b>£5,000 or £7,000 (€5,800 or €8,100)</b>
<b>Step 2</b>	<b>Financial offers by third parties supporting mode shift</b> including the hire or subscription of an (electric) bike and electric scooter; purchase of an (electric) bike or (electric) cargo bike; membership and credits for car and van clubs; incentives for car and van rental; discounts for electric motorcycle parts and accessories; car, van, and minibus finance or subscription	<b>Exact amount depending on offer</b>
<b>Van or minibus retrofit/repowering</b>		
<b>Retrofit</b> of a non-ULEZ compliant to an ULEZ compliant <b>gasoline or diesel van or minibus</b>		<b>£5,000 (€5,800)</b>

Note: Aid amounts reflect maximum values

## Other UK cities

A few other UK cities provide LEZ supplementary financial support for private individuals and businesses in the most financial need. In Aberdeen, Dundee, Edinburgh, and Glasgow, the Scottish Government provides support schemes for non-LEZ compliant car scrappage and the use of alternative modes of transportation.<sup>44</sup> Beneficiaries are private individuals who receive governmental benefits (e.g., income support, income-based job search allowance, employment and support allowance, disability living allowance) and businesses (sole traders and micro-businesses).

Bristol, England, introduced a combined LEZ and charging scheme in parts of the inner-city area in November 2022. Private cars, taxis, vans, trucks, buses, and coaches are affected (motorbikes are excluded). LEZ-compliant vehicles include BEVs, FCEVs, gasoline vehicles Euro 4, 5, and 6 (registered from around 2006 onwards), diesel vehicles Euro 6 (registered from around 2015 onwards), and retrofitted vehicles. To comply with the zone and avoid daily charges, the city provides financial support (in the form of a grant and/or financing) for the replacement of non-LEZ compliant

44 "Grants and loans - Low Emission Zone Support Fund for households," Energy Saving Trust, accessed October 10, 2023, <https://energysavingtrust.org.uk/grants-and-loans/low-emission-zone-support-fund-for-households/>; "Grants and loans - Low Emission Zone Support Fund for businesses," Energy Saving Trust, accessed October 10, 2023, <https://energysavingtrust.org.uk/grants-and-loans/low-emission-zone-support-fund-for-businesses/>.

vehicles with the replacement of new or used LEZ-compliant vehicles.<sup>45</sup> Priority is given to private individuals whose gross annual income is less than £30,000 (€35,000) and who work in the LEZ and to self-employed people and small and medium-sized businesses up to 250 employees with a defined maximum annual turnover and balance sheet and based on working in the zone.

## Summary of financial supports

Table 7 summarizes the various supplementary financial support measures adopted in the selected cities of Brussels, Paris, and London targeted at those most in financial need. Brussels offers the free test of alternative transport modes for private individuals when (temporarily) deregistering private cars; businesses benefit from financial support schemes for vehicle replacement with zone-compliant vehicles and retrofitting/repowering options. Paris offers income-based, LEZ supplementary support measures for private individuals only to replace older vehicles with cleaner versions (including cars and vans but also motorized two- and three-wheelers). London has various support schemes in place, ranging from vehicle scrappage to the replacement with alternative modes of transportation and retrofitting/repowering, targeting private individuals and businesses alike.

In Brussels and Paris, financial support schemes for private individuals are not limited to people in lower-income groups; reduced aid amounts are also available for those in the higher income brackets. London does not specify income brackets but makes aid dependent on various national low-income support benefits.

**Table 7.** Local supplementary financial support measures targeted at the groups most in financial need by city.

<b>Supplementary financial support measures by local/regional governments</b>	<b>Private individuals</b>	<b>Businesses</b>
<b>Vehicle scrappage</b>	London	London
<b>Replacement of non-zone compliant vehicles with zone-compliant vehicles</b>	Paris	Brussels London
<b>Replacement of non-zone compliant vehicles with shift to alternative transport modes</b>	London	London
<b>Deregistration of a non-zone compliant vehicle with shift to alternative transport modes</b>	Brussels	—
<b>Vehicle retrofit/repowering</b>	London	Brussels London

While this study focuses on local-level LEZ-supplementary measures for private individuals and businesses most in financial need, there are also notable national activities. For example, since June 2023, the French government has provided interest-free loans for cars or vans emitting 50 g of CO<sub>2</sub>/km or less or vehicle repowering. Beneficiaries are private individuals and businesses living or doing business in or near an LEZ.<sup>46</sup> To be eligible for a loan, an individual's yearly household reference tax

45 "Clean Air Zone financial support," Bristol City Council, accessed October 10, 2023, <https://www.bristol.gov.uk/residents/streets-travel/bristols-caz/financial-support>.

46 Arrêté du 12 juin 2023 relatif aux modalités de justification des conditions d'éligibilité à l'expérimentation d'un prêt ne portant pas intérêt pour financer l'acquisition d'un véhicule dont les émissions de dioxyde de carbone sont inférieures ou égales à 50 grammes par kilomètre ou la transformation d'un véhicule léger à motorisation thermique en véhicule à motorisation électrique [Order of June 12, 2023 relating to the procedures for justifying the conditions of eligibility for the experimentation of an interest-free loan to finance the acquisition of a vehicle whose carbon dioxide emissions are less than or equal to 50 grams per kilometer or the transformation of a light vehicle with internal combustion engine into an electric vehicle] of the République Française, June 17, 2023, accessed October 10, 2023, <https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000047692277>.

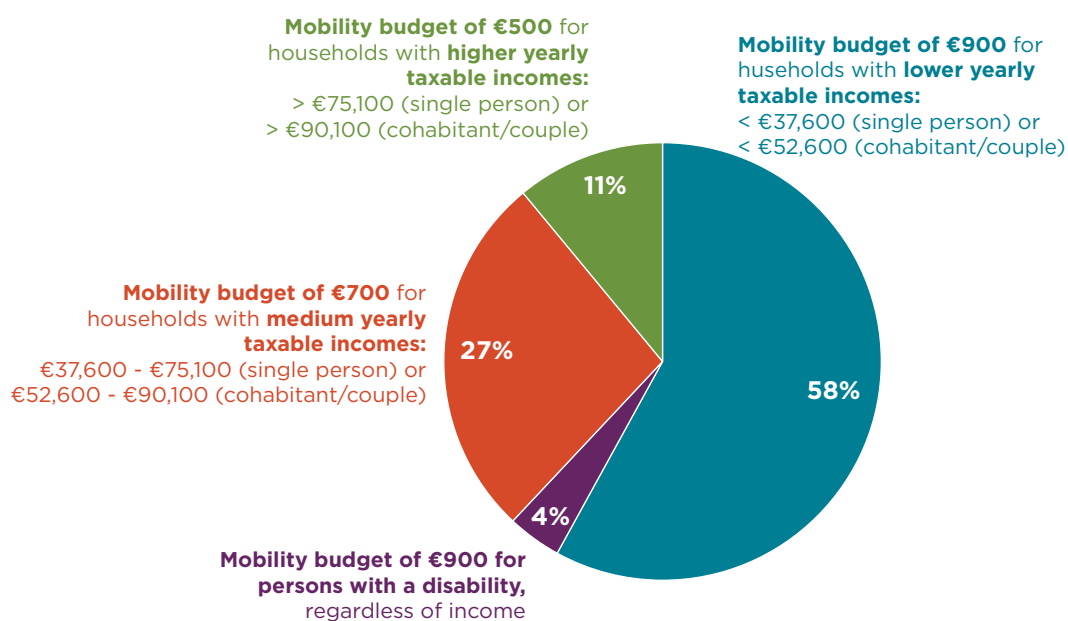
income per capita must be €14,089 or less<sup>47</sup> and businesses must be micro-businesses with fewer than 10 employees and annual turnover and/or annual balance sheet totals under €2 million.<sup>48</sup>

## Effects of local supplementary financial support measures for those most in financial need

The previous section shows the variety of approaches that cities with implemented and planned LEZs/ZEZs have chosen to financially support private individuals and businesses in most financial need. There are also indications of the positive effects these approaches have for social equity lens, particularly in analyses of Brussels and London.

### Brussels

The re-launch of the Brussels Air Bonus in 2022 included a social equity component that makes aid for private individuals dependent on household income and disability status. Since its re-launch, the number of applicants has markedly increased. Between 2018–2021, there were between 700–1,300 applicants annually. There were more than 2,000 applicants in 2022. Of those, 58% lived in households who received the maximum aid of €900 (i.e., those in the lowest eligible income groups with yearly taxable income of less than €37,600 for single persons or less than €52,600 for cohabitants/couples) (see Figure 2).<sup>49</sup>



**Figure 2.** Share of recipients of the Brussel Air Bonus by aid amount and eligibility in 2022.

47 Décret no 2022-615 du 22 avril 2022 relatif à l'expérimentation d'un prêt ne portant pas intérêt pour financer l'acquisition d'un véhicule dont les émissions de dioxyde de carbone sont inférieures ou égales à 50 grammes par kilomètre [Decree No. 2022-615 of April 22, 2022 relating to the experimentation of an interest-free loan to finance the acquisition of a vehicle whose carbon dioxide emissions are less than or equal to 50 grams per kilometer] of the République Française, April 24, 2022, accessed October 10, 2023, [https://www.legifrance.gouv.fr/loda/article\\_lc/LEGIARTI000047517682](https://www.legifrance.gouv.fr/loda/article_lc/LEGIARTI000047517682).

48 Commission Regulation (EU) No 651/2014 of 17 June 2014 declaring certain categories of aid compatible with the internal market in application of Articles 107 and 108 of the Treaty (Text with EEA relevance) of the European Commission, Official Journal of the European Union, June 26, 2014, accessed October 10, 2023, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R0651&from=HR>.

49 "La prime Bruxell'Air, pour mieux respirer en ville – rapport annuel 2022 [The Bruxell'Air bonus, to breathe easier in the city – annual report 2022]," environment.brussels, May 9, 2023, accessed October 10, 2023, <https://environnement.brussels/citoyen/la-prime-bruxellair-pour-mieux-respirer-en-ville>.

## London

London published an evaluation report about the scrappage schemes that had been introduced by the city along with the introduction of the ULEZ in April 2019.<sup>50</sup> From February 2019, three scrappage schemes were launched by the Mayor of London (with similar conditions as the current schemes re-launched in January 2023). These included schemes for vans and minibuses, cars and motorcycles, and heavy vehicles. The durations of the schemes varied.

The evaluation highlighted the effects of the three schemes such as travel behavior changes, estimations of local pollutant emission benefits, and the number of grant payments issued. The following key aspects can be highlighted from the study, focusing on the results for the car and motorcycle scrappage scheme which was specifically targeted at people with lower incomes or with a disability:

- » More than 9,800 grant payments were issued to scrap non-ULEZ compliant cars (with no replacement mandate). The study shows that more grant payments were made to residents in areas of multiple deprivation, an index combining measures of deprivation based on 37 separate indicators including income, employment, health, education, crime, housing, and living environment. The five London boroughs with the highest average levels of multiple deprivation (Barking and Dagenham, Hackney, Islington, Newham, and Tower Hamlets) account for 15% of the Greater London population; about 2,500 grants were issued in these boroughs (-25% of all grant payments). In contrast, the five boroughs with the lowest average levels of multiple deprivation (Bromley, Kingston upon Thames, Merton, Richmond upon Thames, and Sutton) account for 13% of the Greater London population; about 480 grants were issued in these boroughs (-5% of all grant payments).
- » Of the five boroughs with the highest levels of multiple deprivation, four are inside the current ULEZ boundaries (Inner London boundary from October 2021 to August 2023); Barking and Dagenham is outside. The five boroughs with the lowest levels of multiple deprivation are mostly outside the ULEZ (35% of the borough of Richmond upon Thames is within the ULEZ). However, as the study points out, results are neighborhood averages and do not speak to individuals, their exact sociodemographic backgrounds, or other deprivation variables.
- » In terms of travel behavior change, results show two-thirds of grant recipients bought a ULEZ-compliant vehicle. The remaining third used grants on something else. The study also suggests travel behavior changed with increased walking (+22%), public transport use (+17%), and cycling (+5%); car use decreased 2%.

## Key Findings

This study describes supplementary financial support measures provided by local and regional governments with planned and implemented LEZs/ZEZs. The equity focus is on groups most in financial need. These include helping private individuals and businesses who might be facing social inequities entering the zone due to financial hardship (e.g., low/no income and financial resources) to switch to a zone-compliant, low- or zero-emission vehicle or switch to alternative modes of transportation. Based on the descriptions of the schemes, we provide the following high-level findings, targeted at local and regional governments with planned and implemented LEZs/ZEZs:

**Supplementary local financial measures in Brussels, Paris, and London aid individuals and businesses in most financial need.** This could include financial aid for the scrappage of non-zone compliant vehicles, the replacement of non-zone compliant

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<sup>50</sup> "Mayor's schemes successful in taking polluting cars off the streets and reducing toxic emissions," Mayor of London and London Assembly, November 18, 2022, accessed October 10, 2023, <https://www.london.gov.uk/media-centre/mayors-press-releases/mayors-schemes-successful-taking-polluting-cars-streets-and-reducing-toxic-emissions>.

vehicles with compliant versions, the scrappage or deregistration of non-zone compliant vehicles in exchange for using alternative transport modes, and retrofit/repowering of non-zone compliant vehicles to be able to access the zone. Cities such as Brussels, Paris, and London with implemented LEZs and ambitions to move to ZEZs provide all or a selection of those measures specifically targeted to help those in most financial need to access the zone if required. Vehicles affected range from two- and three-wheelers to heavy-duty vehicles. While Brussels and Paris also offer reduced grants for people in the higher income brackets, London financially supports only those in the lowest income groups as defined by various national low income and disability support measures rather than income thresholds.

Aid amounts vary and depend on financial support measures, vehicle types, and beneficiaries. Accordingly, supplementary aid programs are not directly comparable. For example, in Brussels, the maximum aid is €900 for private individuals in the lowest income groups who deregister private cars in favor of a mobility budget for the use of alternative transportation. In Paris, private individuals in the lowest income brackets can receive up to €6,000 to replace non-LEZ compliant cars or vans with new or second-hand cars or vans which must be a BEV, FCEV, PHEV with a battery electric range more than 50 km, hybrid, or CNG vehicle. Micro- and small businesses in Brussels can receive up to €15,000 to replace non-LEZ compliant gasoline, natural gas, or diesel vans with new or second-hand LEZ-compliant vans or electric quadricycles. The aid amount includes aid for a charging station. In London, sole traders, micro-businesses, and charities can receive a maximum of €11,000 for scrapping and replacing non-ULEZ compliant gasoline or diesel minibuses with BEV or FCEV minibuses. In contrast, in Paris, the measures in place for businesses are not tied to LEZs.

**Local measures targeting groups in most financial need can enhance equitable outcomes of LEZs/ZEZs.** The examples of Brussels and London suggest positive effects of supplementary financial aids from a social equity perspective. In the five London boroughs with the highest average levels of multiple deprivation, 25% of all grant payments were issued, compared to 5% in the five boroughs with the lowest average levels of multiple deprivation. In Brussels, households in the lowest income brackets made up the highest share of those deregistering private cars in favor of a mobility budget (58%).

The example cities presented can serve as case studies for cities planning or in the process of implementing LEZs or ZEZs. To avoid leaving anyone behind, equity measures through supplementary financial measures by local governments for those most in financial need can help to achieve more socially equitable LEZs and ZEZs.