POLICY BRIEF

Healthy cities, healthy people

Evidence on the benefits of low emission zones from Antwerp and Brussels

onafhankelijke ziekenfondsen / mutualités libres

HEAL HEALTH AND ENVIRONMENT ALLIANCE

Summary

More than 300 cities across Europe have established low emission zones (LEZs) to curb air pollution from urban traffic. While more and more studies demonstrate the effectiveness of LEZs in cleaning up the air and thus preventing ill-health, the need for such zones is increasingly being questioned by the public policy-makers.

This policy brief by Independent Health Insurance Funds (Mutualités Libres) and the Health and Environment Alliance (HEAL) shows that the Belgian LEZs in Brussels and Antwerp have led to tangible air quality improvements in a period of only five years, with reductions of NO_2 pollution of 30% in Antwerp and 37% in Brussels. For the first time, Belgian cities with an LEZ were compared to 17 Belgian cities without an LEZ. The study population comprised 420,000 individuals living inside the low emission zone, in seventeen control cities or adjacent areas of these cities.

Contrary to popular belief, the Brussels Low Emission Zone has brought benefits, especially for people in the deprived inner-city area, where air pollution has declined more steeply, from 33,44 ug/ m^3 to 21,69 ug/ m^3 for NO_2, and black carbon pollution has almost halved.

As cities across Belgium and the other EU member states prepare to implement more health-protective clean air standards, low emission zones are an essential tool for reaching the new objectives for 2030 set in the new EU's Ambient Air Quality Directives.

The continued implementation and tightening of LEZs is also key for advancing the transition to more sustainable and health-promoting urban transport systems.

1. Background: Urban air pollution, socio-economic inequalities and people's health

Air pollution, especially from households and transport, is a major and persistent challenge in urban environments.[1] A study from the Barcelona Institute for Global Health, covering more than 850 cities in Europe found that traffic remains the largest contributor to pollution from nitrogen dioxide (NO_2) and particulate matter (PM) combined in cities[2]. In the overwhelming majority of cities in the EU, including Belgium, air quality is worse than what the World Health Organization (WHO) recommends[3].

Relentless air pollution from PM, NO_2, and ozone (O_3) impacts city residents' physical and mental health. The body of evidence on how air pollution harms health is robust and keeps growing, demonstrating health impacts at even very low levels, beyond current clean air standards.[4]

Short and long-term exposure to air pollutants increases the risk of cardiovascular and heart disease, stroke, asthma, chronic obstructive pulmonary disease, and lung cancer. Poor air quality is also linked to reduced lung function, impacts on the developing brain and central nervous system, increased risk of preterm birth, and reduced birth weight. New studies underline a higher risk of diabetes[5], obesity, and dementia[6].

Children, the elderly, and those already suffering from chronic disease are particularly at risk.

Health impacts are not evenly distributed across a city. Considering 19 inequality indicators, the WHO confirmed that socially disadvantaged population subgroups are most affected by environmental hazards, carrying a disproportionate environmental burden.[7] The evidence base has particularly increased for cities in Western Europe: recent studies from Paris[8], Barcelona[9], Ghent[10], and Dublin[11] underline that people living in socio-economically deprived areas are more exposed to air pollution and therefore experience greater health harm compared to people living in affluent areas.[12,13]

Climate change leads to more frequent and more intense heatwaves which also influence air quality. New evidence from the EU-funded Exhaustion project[14] shows that the combined exposure to heat and air pollution in cities increases mortality for people with heart and respiratory disease.

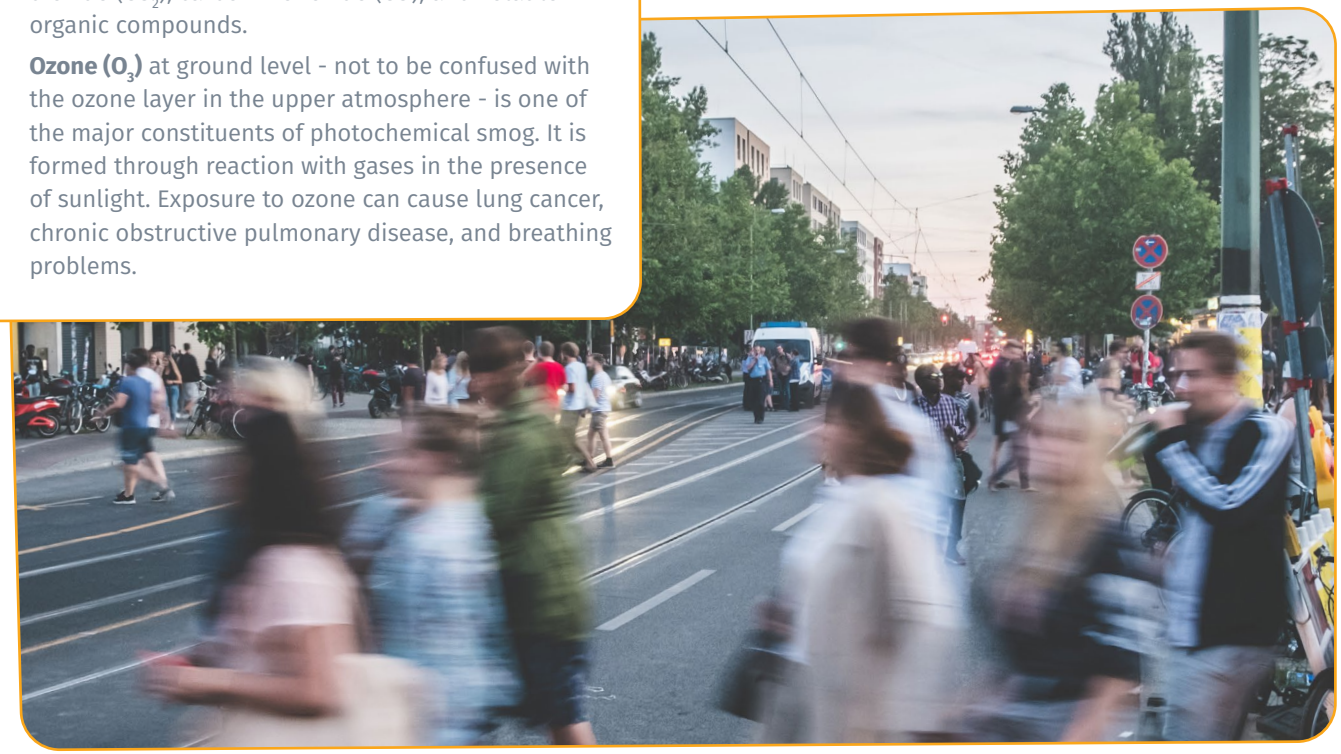
Key air pollutants for health in a nutshell[15]

Particulate matter (PM) are pollutants with a mixture of solid particles and liquid droplets, in different sizes. The major components of PM are sulfates, nitrates, ammonia, sodium chloride, black carbon, mineral dust, and water. Particulate matter can take different sizes: PM_{10} refers to particles with a diameter of 10 micrometers and smaller, and $PM_{2.5}$ are particles with a diameter of 2.5 micrometers or smaller. $PM_{2.5}$ are of the greatest concern to health, as they are so small that they can enter the bloodstream and pass the blood-brain barrier. $PM_{2.5}$ particles have also been found in the placenta. $PM_{2.5}$ leads to the greatest health burden, including respiratory disease (asthma, chronic obstructive pulmonary disease, lung cancer); cardiovascular disease (cardiac arrhythmias, acute myocardial infarction, congestive heart failure); or nervous system impacts (ischemic stroke).

Nitrogen Dioxide (NO_2) is a gas that is commonly released from the combustion of fuels in the transport and industrial sectors. It can cause or exacerbate several diseases such as asthma, chronic obstructive pulmonary disease, stunted lung development, cardiac arrhythmias, and ischemic stroke.

Black carbon (BC), commonly known as soot, is a component of fine particulate air pollution ($PM_{2.5}$). It is formed by the incomplete combustion of wood and fossil fuels, a process which also creates carbon dioxide (CO_2), carbon monoxide (CO), and volatile organic compounds.

Ozone (O_3) at ground level - not to be confused with the ozone layer in the upper atmosphere - is one of the major constituents of photochemical smog. It is formed through reaction with gases in the presence of sunlight. Exposure to ozone can cause lung cancer, chronic obstructive pulmonary disease, and breathing problems.



2. Better air quality through science-based clean air standards

Cities across the European Union have a legal requirement for clean air under the EU's Ambient Air Quality Directives (AAQD). In December 2024 a revised AAQD, Directive 2024/2881, entered into force.[16] This law sets stricter maximum concentrations for the main air pollutants including PM_{10}, $PM_{2.5}$ and NO_2, for daily and annual averages. An annual concentration limit of 10 µg/m³ for $PM_{2.5}$ and an annual average of 20 µg/m³ for NO_2 will become legally binding as of 2030. These new standards are more closely aligned to the 2021 WHO Air Quality Guidelines, which recommend a yearly maximum concentration of 5 µg/m³ for $PM_{2.5}$, and 10 µg/m³ for NO_2.

Comparison of EU limit values and WHO recommendations for selected pollutants (in µg/m³)

Pollutant	EU limits by 2030		WHO recommendations	
	24 hour	Annual*	24 hour	Annual*
PM_{10}	45	20	45	15
$PM_{2.5}$	35	10	15	5
NO_2	50	20	25	10

* On up to 18 days in a calendar year these limits can be exceeded.

Annex VIII of the AAQD includes a list of measures and instruments which city authorities have to consider when drawing up air quality plans to meet the 2030 clean air standards. Low and zero emission zones, low-traffic neighbourhoods, and school streets are part of the toolbox listed in this annex. City authorities will have to provide explanations if they don't choose these measures.

Health organisations consider that this new law has significant potential for cleaning up the air across the EU, resulting in a reduced health economic cost and contributing to disease prevention.

> *"The adoption of this revised directive is a milestone for people's health across the EU. Member states must act decisively to transpose the directive in time, and then meet these new standards by 2030. The swift implementation of the revised Ambient Air Quality Directive will lead to immediate improvements in air quality and health benefits, including a much-needed reduction in the staggering costs associated with air pollution."*
>
> **Anne Stauffer, HEAL Deputy Director**

3. Low emission zones

3.1. Low emission zones across Europe

Achieving clean air in cities is increasingly recognised as a priority for urban decision-makers and city residents and a range of measures for emission reductions in different sectors have been initiated. Low emission zones manage traffic entering cities by granting access only to vehicles meeting certain emission standards. The number of LEZs has been steadily growing: as of 2022, 320 LEZs have been established across Europe.[17] One of the most widely known is London's Ultra Low Emission Zone (ULEZ).[18]

Assessments by city authorities or researchers confirm that among others, LEZs have contributed to improving air quality in London[19], Rome[20], Lisbon[21], Madrid[22], Amsterdam[23], and Berlin[24].

3.2. The Belgian low emission zones

Belgium is home to three low emission zones:

- **Brussels**[26]: in place since January 2018, this LEZ covers all 19 municipalities of the Brussels-Capital Region. Currently, diesel cars and buses with Euro 0, Euro 1, Euro 2, Euro 3, and Euro 4 emission standards cannot enter the LEZ, neither can petrol cars with Euro 0 and 1 emission standards. In 2022, an average of 364,468 vehicles entered the LEZ each day, 87.2% of which were cars.[27]The LEZ implements a gradual phase-out of diesel cars from 2030 and petrol vehicles from 2035.
- **Antwerp**[28]: in place since February 2017, the LEZ covers the entire city centres of Antwerp and Linkeroever. Diesel vehicles with Euro 0, Euro 1, Euro 2, and Euro 3 emission standards are not allowed to enter the city but can get an exemption through the LEZ day pass. Diesel vehicles with the Euro 4 standard can enter after payment. Petrol Euro 0 and 1 standard vehicles cannot enter the city either, but are eligible through the purchase of an LEZ day pass. The number of day passes per year that can be granted to cars that are not entitled to admission is limited.
- **Ghent**[29]: in place since January 2020, the LEZ is applied in the inner city (the area within the ring road). The same requirements as in Antwerp apply.

In autumn 2024, public and policy discussions on the next phase of the Brussels LEZ intensified: under the existing LEZ, a tightening of access initially foreseen for Euro 5 diesel and Euro 2 petrol vehicles was postponed by two years to 1 January 2027.

Socio-economic arguments played a key role in the debate and decision, with some decision-makers arguing that many people in Brussels living on tight budgets couldn't afford to buy a car with lower emission standards.

In an open letter, the Independent Health Insurance Funds, together with BRAL, Les Chercheurs d'Air, and many health professionals argued that the two-year postponement was a disservice to Brussels residents suffering from respiratory problems, whose quality of life and freedom to travel the city has been constrained by air pollution.[30] Earlier in 2024, more than 140 doctors and health experts had urged for decisive measures to cut air pollution in the Belgian capital.[31]

> *"2024 regional and municipal elections, to commit clearly and firmly to fighting air pollution at the local level during your mandate if you were to be elected. This fight must go through strict maintenance of the Low Emissions Zone (LEZ) timeframe, namely an exit from diesel engines by 2030 and thermal engines by 2035 at the latest throughout the territory of the Brussels Region. The LEZ is, to date, the most effective tool to combat air pollution in the city."*
>
> **Open letter of 140 doctors and health experts**

EU policy-making and city-level healthy mobility efforts

Although the EU doesn't have the competence to set laws for cities, the urban level is an important part of EU policymaking, many EU laws apply at the urban level and cities play a key role in the implementation of EU policies. The 2016 Pact of Amsterdam has set the framework for the multilevel cooperation between EU and city decision-making. The EU Cities Mission also provides a funding instrument to deliver 100 climate-neutral cities by 2030.

In the 2024-2029 EU policy cycle, the city level is recognised at several junctures[25]: the EU's Executive Vice-President for Cohesion and Reform is tasked with putting forward an ambitious policy agenda for cities, including climate action, mobility, social inclusion, and equality. The mandate of the EU Commissioner for Transport and Tourism includes making European transport more sustainable, addressing the social dimensions of mobility, and addressing issues relating to transport poverty.

4. New evidence on the clean air and health benefits of the LEZs in Antwerp and Brussels

In 2023/24 Independent Health Insurance Funds (Mutualités Libres/Onafhankelijke Ziekenfondsen) carried out an analysis using data from reimbursements of medical care (2014 – 2023) from 420,000 people living within or close to the LEZs in Antwerp, Brussels and Ghent, as well as from 17 control cities.[32] Health outcomes and air quality were studied in the top 20 Belgian cities based on population size, with three LEZ cities and 17 control cities, including 10 in Flanders. Data from the Belgian IRCELINE was used to map air pollution across Belgium, broken down to city and street level. For socio-economic mapping, the Belgian Index of Multiple Deprivation was used.[33]

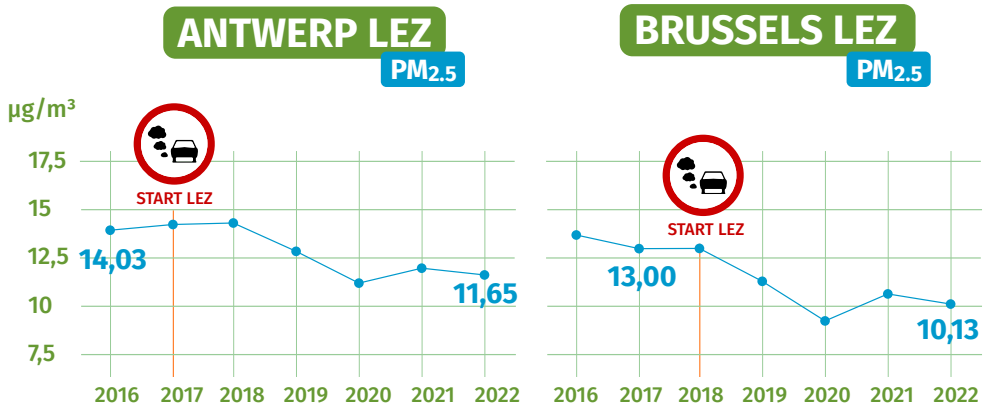
Key findings:

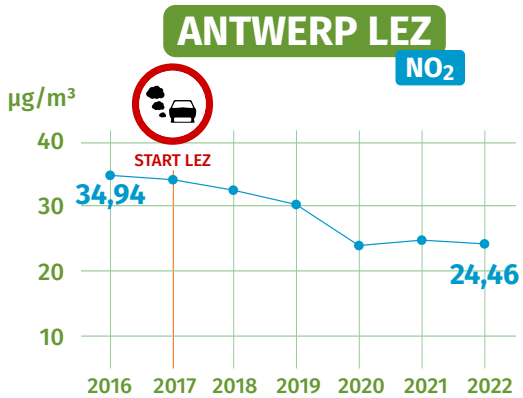
4.1. The LEZs in Brussels and Antwerp have improved air quality more rapidly compared to other Belgian cities

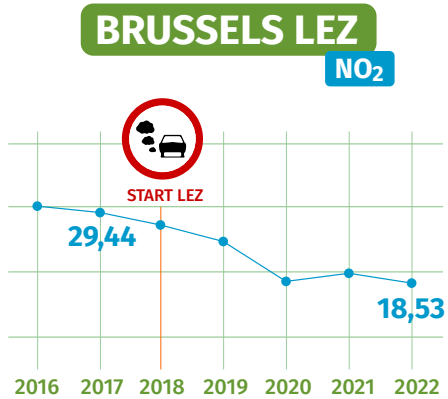
The 560.000 residents of Antwerp and the 1.2 million residents of the Brussels capital region were exposed to higher levels of air pollution compared to other Belgian cities before LEZs were introduced in 2017 and 2018 respectively, highlighting the need to introduce measures.

Residents in Antwerp and Brussels then profited from a greater improvement in air quality compared to other cities without an LEZ. In Antwerp, NO_2 levels decreased from 34,94 µg/m³ in 2016 (the year before the introduction of the LEZ) to 24.46 µg/m³ in 2022, or a reduction of 30%. In Brussels, NO_2 levels decreased from 29,44 µg/m³ in 2017 (the year before the introduction of the LEZ) to 18,53 µg/m³ in 2022, or a reduction of 37%. The improvement was not limited to the LEZ - up to 5km around the LEZs in Antwerp and Brussels air quality also improved.

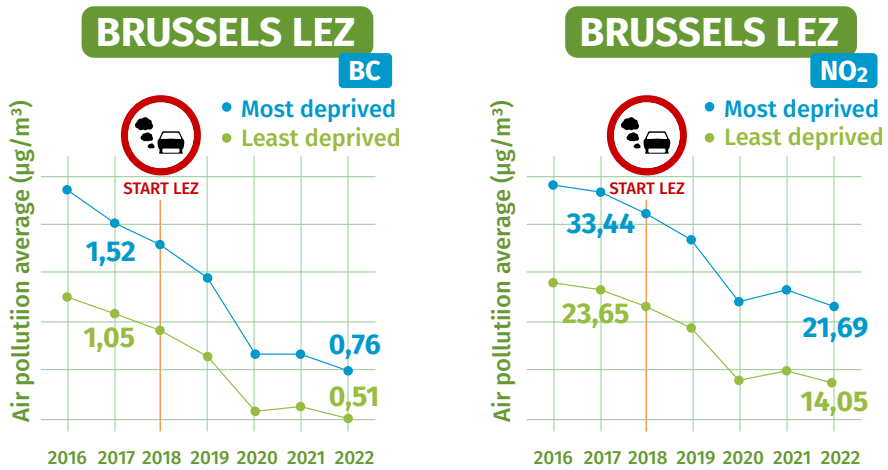
Average annual residential exposure to $PM_{2.5}$ and NO_2 for individuals living within the Antwerp and Brussels low emission zones: evolution 2016-2022







Average annual residential exposure to BC and NO_2 for individuals living within the Brussels low emission zone: evolution 2016-2022



4.2. Brussels' deprived inner city areas saw the greatest improvement in air quality

In Brussels, the most socio-economically deprived areas are in the city centre. There is also a marked difference in access to vehicles, with people living in the central areas of the Brussels capital region having only minimal access to vehicles, compared to people in suburban areas.[34]

All residents in Brussels breathe cleaner air since the implementation of the LEZ,but the most deprived neighbourhoods in the Brussels-Capital Region continue to bear the heaviest burden of air pollution.

Before and after the introduction of the LEZ, the more socio-economically deprived neighbourhoods experienced the highest levels of air pollution. In 2022, the most deprived areas had an average NO_2 concentration of 21,69 µg/m³ (down from 33,44 µg/m³ in 2017), while in the most affluent areas, the level was 14,05 µg/m³, (down from 23,65 µg/m³ in 2017).

Because of the LEZ, the most deprived neighbourhoods saw a faster improvement in air quality for black carbon and NO_2 pollution.

NO_2 levels in the most deprived areas decreased by 35% between 2017 and 2022 (from 33,44 µg/m³ to 21,69 µg/m³), while black carbon pollution almost halved. $PM_{2.5}$ levels in these neighbourhoods saw a decrease of 21% (from 13,53 µg/m³ to 10,65 µg/m³ in 2022).

In affluent areas, NO_2 levels decreased from 23,65 µg/m³ to 14,05 µg/m³, and for $PM_{2.5}$ from 12,11 µg/m³ to 9,19 µg/m³ over the same period.

4.3. New LEZ results add to growing evidence of health benefits and point to long-term disease prevention potential

While there is a large body of evidence on the health impacts of air pollution, fewer studies trace tangible improvements in health from a range of policy (and behavioural) interventions, including LEZs. However, all existing studies show small to moderate improvements in people's health.

A 2023 review in the Lancet[35] analysing evidence on the health benefits of low emission and congestion charging zones found improvements for cardiovascular health especially, in 5 out of 16 studies considered. The low emission zones included several German cities, as well as LEZs in Tokyo, Milan, and London. For some of these LEZs, a reduction in mortality and hypertension was also found. For the tightening of the London LEZ, one study also found that fewer breathing-related problems were reported. The authors conclude that ongoing evaluation of these interventions is necessary to understand longer-term health effects.

The study considering the health benefits of the Antwerp and Brussels LEZs underlines that tangible air quality improvements have been achieved in Antwerp and Brussels. For both cities, the clean air improvements reached over a 4-5 year period led to a reduction in the use of antidiabetic medication. This initial evidence underlines that LEZs are a key instrument to tackle air pollution in cities, and can be especially beneficial for people living in socio-economically deprived areas.

There is a large body of evidence on the health impacts of air pollution. The highest health burden of air pollution is through long-term exposure. Considering that LEZs help to reduce pollution from transport in the long-term, further research is needed on a long-term scale to determine the range of health benefits achieved by LEZs, as part of a shift to more sustainable, cleaner transport systems in cities.

An integrated approach to urban planning, transport pollution and health

To strengthen health protection in urban environments, city planning should integrate health, environmental sustainability, and social equity concerns. This is the conclusion of a review of over sixty large-scale studies (covering at least 90 cities) that considered urban planning, transport systems, environmental planning and health[36]. City residents' health is significantly shaped by the environment in which they live. Despite this, there is often a siloed approach to city planning and urban design. The science review also underlines that cities designed around car use have considerable environmental and health impacts.

5. Policy recommendations

5.1. For Belgian and other national/regional policymakers

- Do not delay or slow down the implementation of a low emission zone (LEZ). LEZs improve air quality in a city and are a key component for healthier, more sustainable cities. LEZs are key in the shift from personal vehicle use to active mobility - walking and cycling - and public transport. Provide the necessary financial support for this shift.
- Swiftly implement the revised EU clean air standards (for 2030) to clean up the air in cities in collaboration with federal and regional authorities. Use LEZs as a measure to reach these new clean air standards.
- Find inspiration in the wealth of good practices on LEZs and healthy urban transport from cities across the European Union. Connect with other city authorities and decision-makers to identify those measures with the largest health benefits in the short and long term.
- Consult, involve and inform residents and civil society representatives in the setting up and implementation of healthy and sustainable transport measures, especially for an LEZ. This will help to increase public support and buy-in.
- Take an integrative approach to urban planning, cleaning up transport pollution and sustainability. An integrative approach will help to protect city residents' health and also strengthen climate resilience.
- Use the Just Transition Mechanism (JTM) and the Social Climate Fund as a lever to ensure a fair transition for the more deprived citizens, leaving no one behind.
- Promote active mobility modes such as walking and cycling, by investing not only in cycling infrastructure but also in green zones.

5.2. For European policymakers

- Provide EU financial support to cities for the transition to healthier, more sustainable urban transport systems, including the setting up and enforcement of LEZs (for example through the EU Mission: Climate Neutral and Smart Cities).
- Swiftly review and strictly control air quality action plans for the inclusion of LEZs and compliance with the requirements set forward in the new AAQD (Annex VIII).
- Support the sharing of good practices on LEZs and healthy, sustainable transport systems between cities, including evidence brought forward by civil society organisations.
- Make sure that sufficient budget is available in the coming years to finance a just and social transition, notably through the Social Climate Fund and Just Transition Fund.

The Just Transition Mechanism and the Social Climate Fund

The Just Transition Mechanism (including a Just Transition Fund) is a European instrument to ensure that the transition towards a climate-neutral economy and society happens fairly, and to alleviate the socio-economic impact of the transition. Member states can receive access to financial support by preparing Just Transition plans (up to 2030). These plans should also address social, economic and environmental challenges. Investing in public and sustainable transport falls under the scope of the Just Transition Mechanism. The programme has a budget of over 1.6 billion EUR in 2025.[37]

The Social Climate Fund is another European initiative to ensure that the most affected vulnerable groups, such as households in energy or transport poverty, are directly supported. Member states may use the financial support to invest in zero and low emission mobility solutions. It can also be used for temporary direct income support. Member states need to submit Social Climate Plans by June 2025. The Social Climate Fund will represent a budget of over 86 billion EUR over the 2026-2032 period.[38]

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About this publication

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