TRANSFORMING URBAN MOBILITY AND RESPONDING TO THE CLIMATE CRISIS

THE DEVELOPMENT OF MUNICH'S MOBILITY POLICIES IN A MULTI-LEVEL-CONTEXT

Policy Brief No. 1

M Cube
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CLUSTERS 4 FUTURE
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SUMMARY & RECOMMENDATIONS

1 **Fulfilment of climate targets not on track.** The EU, Germany, Bavaria and Munich have all set ambitious climate change targets but must do more to achieve a low-carbon transport system if these targets are to be met. The German Federal Ministry for Digital and Transport has continuously failed to meet the targets for the transport sector set in the German Climate Change Act.

2 **Prioritize alternatives to car-based mobility.** The governments of Munich, Bavaria, and Germany should do more to reduce private vehicle use by prioritizing public transportation and equal rights for all road users. This is important to respond to public demand, enhance safety, and meet environmental and climate goals.

3 **A more rapid and comprehensive transition to electric mobility should be prioritized.** The ongoing war in Ukraine, German (and European) dependence on fossil fuel imports, climate change, and air pollution point to the many problems associated with dependence on fossil fuels. Munich has made some progress in rolling-out the infrastructure for electric vehicles but the trend is slowing and much more needs to be done to end dependence on conventional motors.

4 **Supporting active mobility leads to many win-wins.** Active mobility (walking, bicycling) can enhance accessibility, equity, and health, and help to protect the environment. The implementation of policy measures for improved walking and cycling infrastructure should be prioritized to achieve faster change.

5 **Step-up efforts for expanded and more inclusive public transportation.** Munich has taken important steps towards strengthening its public transport network and the *Deutschlandticket* makes public transport more affordable and convenient across Germany. Yet, delays in the implementation of investments in infrastructure, like Munich's suburban system, jeopardize the future capacity of Munich's public transport which is essential for an inclusive and environmentally sustainable mobility system.

6 **Munich needs a common vision of sustainable urban mobility.** Munich's decision-makers should continue efforts in creating inclusive and appealing visions for a more sustainable mobility system and building broader coalitions for putting these visions into action.

7 **More power for local measures and experimentation.** In Germany, there is an urgent need for transferring more authority to the local level in urban mobility politics in order to spur innovations and allow for context-tailored measures.

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INTRODUCTION: WHY ARE SUSTAINABLE URBAN MOBILITY SYSTEMS CENTRAL TO ADDRESSING SOCIO-ENVIRONMENTAL CHALLENGES?

The Intergovernmental Panel on Climate Change's (IPCC) Sixth Assessment Report leaves no doubt that if global warming is to be limited to below 1.5°C and even to below 2°C, deep cuts in greenhouse gas (GHG) emissions must be achieved within this decade.[1] While the necessary technological solutions and scientific expertise are largely available, mobilizing political will and designing successful policy strategies remain key challenges to effective and inclusive climate mitigation efforts. Despite declining trends in GHG emissions across most major sectors in both Germany and the European Union (EU), insufficient progress has been achieved in the transport sector.[2] Emissions from road traffic are significantly higher today than they were in the 1990s.[3] In the EU, road traffic overall accounts for almost 30% of GHG emissions while in Germany the transport sector is responsible for 20% of emissions of which 95% comes from road traffic.[4]

In addition to its substantial contribution to global warming, motorized vehicles are a cause of air pollution, noise, traffic-related deaths and injuries. The building of roads and highways has been a major factor in the loss of natural areas and contributes to the fragmentation of ecological systems. It is time to use our creativity and human ingenuity to reimagine our mobility systems to be more community-oriented, high-quality, inclusive, environmentally clean, healthy, and affordable. Doing so will be critical both for Munich's medium- to long-term economic health, but also to its quality of life. By transforming our mobility systems to be we can achieve multiple co-benefits.

The important and necessary decision to end reliance on Russian fossil fuels in view of Russia's illegal war against Ukraine has been technically challenging and economically painful. In responding to the war, Germany and Europe have, however, shown that rapid change is possible and that multiple issues can be addressed simultaneously. Major steps have been taken to promote energy savings and energy efficiency, and to speed up the development of renewable energies and the electrification of the transport sector. Transitioning the mobility sector in new more sustainable directions – both technologically and conceptionally – is critical for achieving a zero-emissions society, but also for strengthening resilience against future system shocks, remaining economically competitive, and making our communities more efficient, attractive and liveable.

Cities are pivotal in driving the transition towards zero-emission mobility.[5] They are responsible for a high level of energy consumption and account for around 70% of global GHG emissions.[6] Well over 70% of the populations of Germany and the EU as a whole live in cities. It is thus especially important that cities rapidly switch to sustainable mobility systems. The city of Munich, among the richest and

largest cities within Europe with a population of about 1.5 million, is a good case to examine how a major metropolitan region can become climate-neutral, including in the transportation sector.

Munich aims to become a showcase of sustainable urban mobility with a target of climate neutrality by 2035. It has further highlighted its seriousness on climate action by joining the European Union's Climate-neutral and Smart Cities mission, with a goal of delivering 100 climate neutral and smart cities by 2030. Munich is a vibrant, hi-tech and multicultural European city with global technological and academic reach. It is home to BMW, one of the leading global car manufacturers and boasts two of the world's highest-ranked universities. Indeed, it has the highest share of workers with a university degree among all German cities.[7] As a political and economic hub, it attracts over 400,000 daily commuters (2020).[8] The MCube project is working with the city of Munich and relevant stakeholders to develop innovative sustainable mobility solutions which can serve not only to help Munich achieve its climate goals, but can serve as a model and ideas developer for other urban areas.

In this policy brief, we take stock of the latest policy developments in the field of sustainable mobility in Munich within the EU multi-level governance context. The policy brief introduces the main climate goals related to transportation in Munich as well as at the regional, national and EU levels. It then introduces the most important developments in Munich's policy goals and measures in four mobility transition areas: car traffic reduction, electric vehicles, active mobility and public transportation.

BACKGROUND: POLICIES AND TARGETS FOR A DECARBONED MOBILITY

The **European Union** aims to be a global leader in clean energy development and climate mitigation and adaptation. It has set increasingly ambitious targets and made important strides in raising public awareness, changing public and industrial behavior, and researching, developing, and implementing technological breakthroughs. The political support for climate results from mounting scientific warnings about the dangers linked to a warming climate, the demands of environmental movements, including Fridays for Future, and the growing recognition of many businesses that to remain competitive, they must invest in new technologies, energy efficiency, and circular economy concepts. In 2019, the European Commission announced the European Green Deal strategy, which sets out a transformative framework for the future.[9] The European Green Deal sets targets to achieve climate neutrality by 2050 and to reduce GHG emissions by 55% relative to 1990 levels by 2030.[10] By 2050, the European Green Deal envisages the reduction in GHG emissions in the transport sector by 90% relative to 1990. In reaction to Russia's invasion of Ukraine, the European Commission published the REPowerEU strategy in May 2022 which calls for a faster reduction of fossil fuel consumption and accelerated roll-out of renewable energy sources.[11]

Achieving European goals and targets means that member states must transpose EU directives and regulations into national laws and programs. Implementation paths are largely at the discretion of the member states although coordination and cooperation on many levels is also required. The EU and national governments have the authority to set broader targets and measures tied to mobility (e.g. highways, long-distance rail, and low-carbon emission targets), whereas regional and municipal authorities take on greater responsibility when it comes to questions of urban planning, street and road planning, bicycle lanes, and local public transportation. Nevertheless, the EU does promote comprehensive sustainable urban mobility planning. Cities are encouraged to develop strategies that will stimulate the shift towards cleaner, smarter and resilient modes of transport, including walking, cycling, public transport and shared mobility.[12] Sustainable Urban Mobility Plans often embrace multiple goals, such as meeting peoples' mobility needs while increasing the overall quality of urban life. In November 2021, the European Commission launched the Cities Mission Climate and Smart Cities initiative aiming to select 100 cities to become carbon neutral by 2030. In April 2020, the list of cities awarded support was published and Munich is among them. The Cities Mission is part of the EU's Horizon Europe program which funds research and innovation. For the period 2021-2023, EUR 359.3 million has been dedicated to the Climate-neutral and Smart Cities Mission under which regular public calls are announced for the provision of technical, regulatory and financial support for urban low-carbon initiatives.[13]

While **Germany** has driven much EU climate policy change, this has not always been the case in the transport sector. The German transport sector has often been pressured by other EU member states and the European institutions to do more to curb air pollutants and greenhouse gas

emissions. This is particularly visible in the transport sector where German emission targets have often not been in the lead Europe-wide and where Germany has been required to take on standards opposed by powerful domestic industries. The sector's image has also suffered after it was revealed that for years Volkswagen had cheated emission tests with manipulated software.[14]

Clean energy and climate goals have climbed much higher on the political agenda in Germany in recent years in response to scientific warnings indicating a rapidly warming planet, public concern about climate change, the need to respond to scandal, and growing economic competition from China and elsewhere that could dent the country's technological leadership and weaken major industries. The German government enacted the Federal Climate Change Act in 2019 setting a series of energy efficiency and renewable energy targets. These were subsequently amended upwards in response to a critical ruling by the Constitutional Court in a case brought against the government by climate activists. The Constitutional Court found that the government was not being fair to younger generations with its climate targets and policies which left too much climate action for the post-2030 period, disproportionally burdening the young and future generations.[15]

The Climate Change Act as amended in 2021 now sets a GHG emission reduction target of 65% by 2030 relative to 1990 levels (up from the previous 55% target).[16] By 2045, Germany now aims to be climate-neutral, five years earlier than the target set in 2019. Targets, however, are only a first step. Effective regulations and policies must be developed and their implementation assured. The German Council of Experts on Climate Change sees room for improvement. The climate targets for 2022 have only partially been achieved.[17] While emissions decreased from 760 to 746 million tons CO_2 equivalent between 2021 and 2022 this may have been a temporary response to the sharp rise in energy prices caused by the Russian war on Ukraine and subsequent Western boycotts of Russian supplies. Emission reductions in the transport sector, moreover, were below target. The German Climate Change Act defines annual GHG emission limits for all sectors including transportation. In 2022, the transport sector in Germany was responsible for 148 million tons of CO_2 equivalent; this was 9 million tons higher than the cap established for this year.[18] The Climate Change Act requires responsible ministries to outline plans for how they will come into compliance when annual emission reduction targets are not met. The Transport Ministry presented a plan delineating how it would reduce these excess emissions.[19] The Council of Experts on Climate Change criticized this plan as insufficient.[20]

Political tensions among the government's coalition parties in terms of how best to address the climate crisis and the transport sector's failures led to calls to reform the Climate Change Act's requirement that each sector on its own be responsible for meeting a sector-specific emission reduction target. At the end of March 2023, the government announced it would modernize planning in the areas of climate protection and transport infrastructure projects.[21] One of the key elements of the reform is a change in requirements in cases where a sector exceeds its emission targets. Instead of sector-specific plans to reduce excess emissions immediately, excess emissions in individual sectors are now to be compensated for with improvements in other sectors.[22] The Council of Experts on Climate Change has complained that this softening of this control mechanism increases the danger of remaining in traditional technological paths and thus delaying the switch to

solutions that are necessary from a climate policy perspective, especially in the transport sector.[23] Overall, the planned reform could increase the risk that Germany will fail to meet the greenhouse gas reduction targets set by the amended Federal Climate Change Act.

One of the most important mechanisms for achieving overall climate targets is pricing. In 2021, the German carbon pricing system for the heating and transport sectors entered into force.[24] The initial price was set at 25 Euros per ton of carbon dioxide. This price will gradually increase to 55 Euros per ton of carbon dioxide by 2025. The purpose of this measure is to discourage the consumption of fossil fuels and secure additional funds for financing the net zero-emission transition.

Bavaria is Germany's largest state by territory and home to over 13 million people.[25] It is the third richest German state when measured on a per capita basis.[26] The transport industry is large and powerful in Bavarian politics. In 2021, the Bavarian government introduced the Bavarian Climate Protection Act setting a series of climate goals. Following the ruling of the Federal Constitutional Court, Bavaria also amended its Climate Protection Act. The amended act came into force on 1 January 2023, tightening and moving up climate goals.[27] Bavaria is now targeting climate neutrality by 2040 instead of 2050. By 2030, GHG emissions are to be reduced by 65% compared to 1990 levels, substantially more than the earlier 55% reduction target. The Bavarian government has adopted around 150 concrete measures in the Bavarian Climate Package to achieve the set CO_2 reduction targets.[28] Smart and sustainable mobility is one of the focal points of the program, with measures aimed at promoting electric mobility, public and regional transport and cycling.[29] Yet, car is still king in Bavaria. The automobile industry is immensely powerful and the image of the automobile as being linked to individual freedom is deeply anchored in both Bavaria's regional and national political culture. The lack of acceptance for a speed limit on the German Autobahn, resistance to restrict car traffic on roads, or to limit parking spaces are just some of many indications of how strong the love of the car remains.

In 2017, the **Munich** City Council adopted the goal of climate neutrality by 2050.[30] In December 2019, following the climate emergency declaration of Munich and other municipalities, the Munich City Council decided to bring forward the climate neutrality target to 2035.[31] To realize this goal, the climate package "From Vision to Mission", which includes three resolutions that form the long-term basis and financial framework for a climate-neutral Munich, was adopted in 2021.[32] As part of this, the city will invest additional EUR 500 million by the end of 2026 in measures that help regulate the city's climate, protect against extreme weather events and reduce CO_2 emissions. Another resolution as part of the climate package was adopted in 2022 including over 250 potential measures for climate change mitigation with transport as an important core area.[33] As part of the Munich Mobility Strategy 2035, the city council adopted the goal in 2021 that by 2025 at least 80 per cent of traffic in the Munich urban area will be covered by zero-emission vehicles, local public transport, walking and cycling.[34]

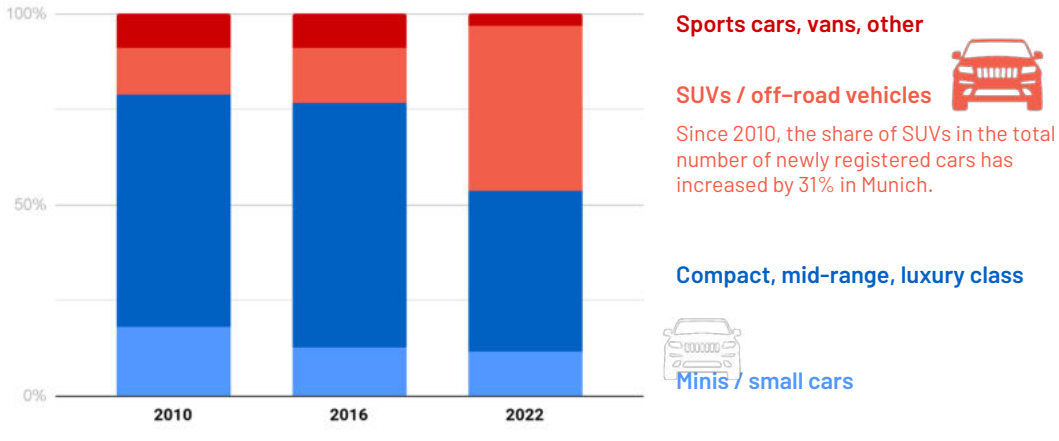
Policies for reducing car-use for higher livability and cleaner air

Policies aimed at altering and reducing car traffic are increasingly commonly seen in cities across Europe. Insofar as the legal framework allows, cities can, for example, restrict the use of certain types of vehicles due to their size or pollution levels and impose limitations to car use overall. Key policy measures in this area include car-free areas, parking management, stricter speed limits and low-emission zones. These are often used as means for improving air quality, avoiding noise, mitigating climate change, redistributing road space and improving the quality of life.

We focus on Munich's policy measures to reduce car traffic and how such measures are affected by the related legislation at higher levels. In the Bavarian Climate Programme, it is emphasized that "Bavaria is and will remain a car state".[35] At the federal level, too, the usage of cars continues to be promoted by maintaining policy measures such as tax privileges for private users of a company car.[36] From June to August 2022, the federal government had temporarily put in place a lower energy tax on transportation fuels in response to the rising fuel prices.[37] Economists considered this fuel rebate unjust because it relieved the burden on high earners, who tend to own more cars, rather than on low- and middle-income groups.[38] The planned increase of the national CO_2 price to EUR 35 per tonne in 2023 has also been suspended, which undermines the financial incentive to reduce emissions.[39] In March 2023, after lengthy discussions, the EU institutions agreed to allow only sales of zero emission vehicles from 2035.

From 2010 to 2021, the number of private cars in Munich has increased by 9% to over half a million.[40] The density of private cars per 1000 inhabitants changed from 406 to 407 between 2010 and 2021. From this stagnant car density, it can be concluded that the population and the number of private cars grew at the same rate. Of the newly registered vehicles, the share of large-volume vehicles in Munich has increased sharply from 12% to 43% between 2010 and 2022.[41]

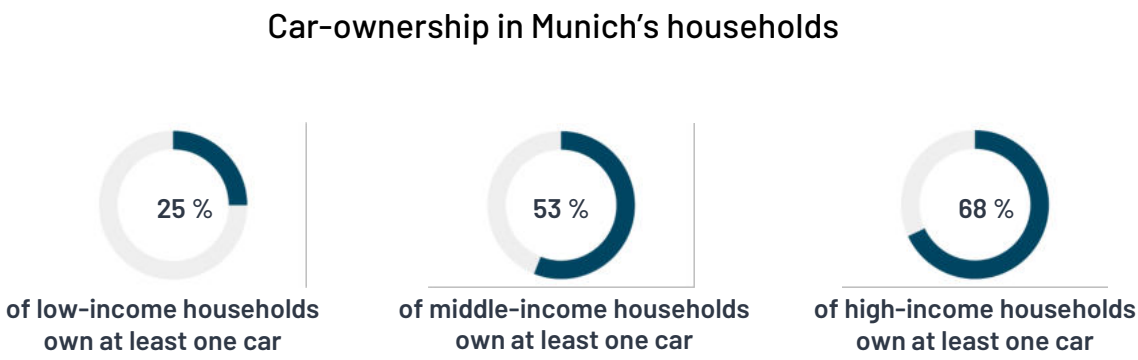
Share of vehicle types in total number of new registrations in Munich



Source: Munich Statistical Office

This is part of the general trend in the automotive industry toward wider and longer cars.[42] Larger cars pose a safety risk to pedestrians and cyclists while requiring more space for parking.[43] The increase in number and size of private cars is at odds with the vision of a space-saving and less resource-intensive mobility system.[44]

When it comes to the future role of the private car in Munich, it is important to mention that 44% of Munich households do not own a car and therefore rely on other means of transport such as public transport, cycling, walking, carpooling or micro-mobility.[45] Car ownership in Munich strongly depends on economic status.[46] A much higher 75% of low income households do not own a car, compared to 32% of high-income households.[47] Thus, economically worse-off households benefit less from policies which encourage car use while this group is disproportionately affected by the negative effects of car traffic such as noise and air pollutant emissions.[48]



People living in low-income households are less likely to have a car, yet are disproportionately affected by the negative effects of car traffic.

Source: Mobilität in Deutschland (MiD)

Reducing car traffic and repurposing public streets

In order to reduce car traffic in Munich's old town, the city council has passed a resolution for a car-free old town in 2019.[49] A city council resolution outlining the roadmap for the car-free old town is expected in 2023. The term "car-free" does not mean a uniform pedestrian zone without any traffic. Rather, it is about the vision to reduce motorized traffic and free-up public space for pedestrians, cyclists and public transport.[50] In traffic-calmed areas, all road users are allowed to use the road and vehicles must drive at walking speed.[51] The overarching goals are to enhance the city's livability, highlight the historic old town ensemble and contribute to the achievement of climate targets. Following the city council's decision, the administration was tasked with conducting a baseline study to examine the extent to which traffic-calmed areas can be introduced, parking spaces reduced and pedestrian zones extended in Munich's old town. By the beginning of 2023, a number of measures towards a car-free old town had been implemented.[52] The Mobility Department is tasked with investigating the introduction of further measures in different areas of the old town.[53] This is a challenge for traffic and urban planners alike. The German Road Traffic Regulations set various limits that problematize the introduction of car-free zones since its focus is on averting danger rather than on planning aspects or overarching urban development goals.[54] In practice, this means that motor vehicles have priority and weaker road users must adapt their behaviour. For

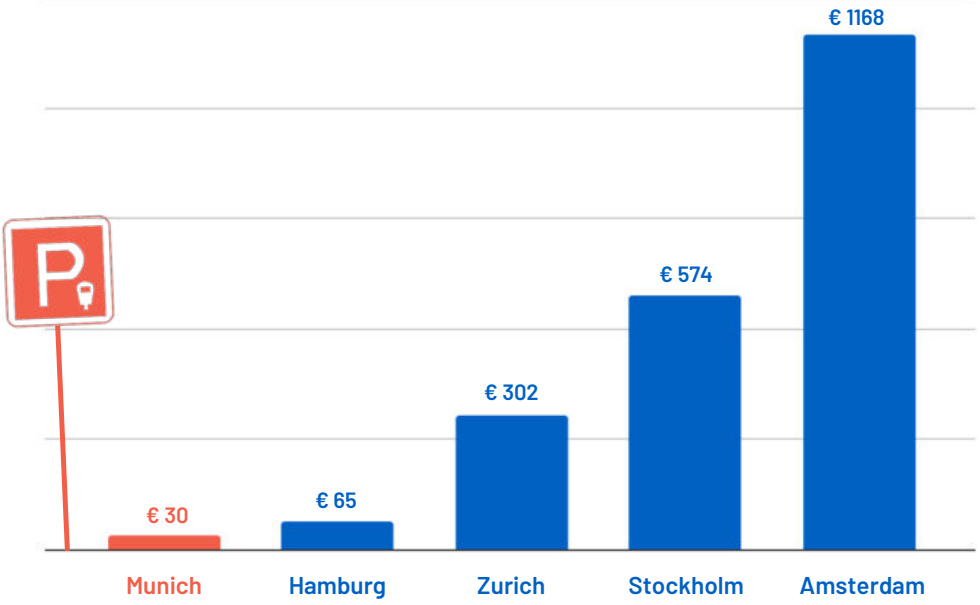
example, in traffic-calmed areas as defined by the Federal Road Traffic Regulations, car traffic still has priority over pedestrian traffic. Innovative urban planning concepts such as shared spaces, where motorized traffic does not have priority, are difficult to implement with legal certainty.[55] Munich has also repurposed and redesigned some street spaces temporarily with the aim to create more space for residents, pedestrians and bicyclists.[56] An example are the streets which in summer are turned into no- or low-vehicle-traffic-zones. While some streets are open to all road users and allow for car traffic at walking pace, others prohibit the entry of vehicles and serve as play grounds for children.[57] Following an initial pilot test, since 2020, over 32 street sections were temporarily converted.[58] In addition, some public parking spaces were converted to meeting places, green spaces, bicycle parking or playgrounds during the summer months since 2021.[59]

Changing the regulatory and economic conditions for parking

At the end of 2020 the city council introduced a new parking concept for Munich's city center. While the Mobility Department is still working on the details, the resolution sets the goal of phasing out all public parking for motor vehicles in the old town over the next five years.[60] Apart from slightly reducing the amount of parking spaces, Munich regulates parking by setting up parking management zones and charging parking fees. With regard to short-term parking, the state of Bavaria is one of only a few German states to have enacted a maximum fee limit of EUR 2.60 per hour, even in areas with enormous parking pressure.[61] In Munich, the former parking fee of EUR 1 per hour was doubled to EUR 2 in 2022. The price of a day ticket has also increased from EUR 6 to 11.[62] Illegal parking and standing means cars take up public space and cause disadvantages to others. In order to reduce this behavior, financial sanctions are needed. Since warning fines were only slightly higher than parking fees, unlawful parking was not strongly sanctioned.[63] Fines are regulated at the federal level in the Schedule of Fines. As a result of a recent amendment, significantly higher fines of up to EUR 100 have applied since 2021 for parking on bike paths and sidewalks and the unauthorized use of sidewalks by vehicles.[64]

In order to be able to charge for parking in public spaces, municipalities in Germany must first establish parking management zones.[65] According to the Federal Road Traffic Act, cities may only establish parking management zones if there is a significant shortage of parking space. This is defined as residents not having sufficient opportunity to find a parking space for their motor vehicle within a reasonable walking distance from their home. In August 2020, the federal government transferred the responsibility for setting fees for parking management zones to the federal states.[66] Bavaria is one of few German states that has not yet decided to increase parking fees. The maximum fee for long-term parking licenses amounts to only EUR 30.70 per year in Munich.[67] A look at other European cities shows that the fees for parking license areas are many times more expensive than in Munich.[68]

Maximum annual fees for parking permits for residents in European cities in 2023



With € 30 per year, residents in Munich pay significantly less for a parking license than in other European cities. At the same time, Munich is already at the upper limit for parking fees set by the state of Bavaria.

Source: Websites of municipalities

Speed limit 30 wanted by many German cities and municipalities

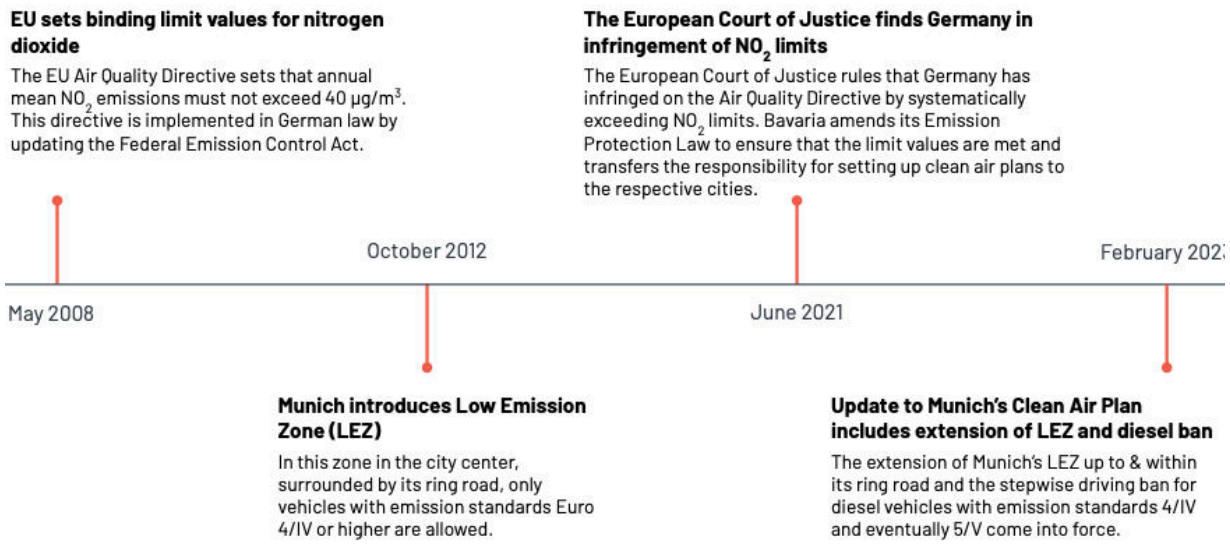
In Germany, the power of municipalities to control speed limits is primarily determined by the Federal Road Traffic Act. Changes to the valid speed limit rules by local governments are only permitted in specific circumstances and must be comprehensively justified. The debate about amending the Federal Road Traffic Act and the Road Traffic Regulation to give federal states and municipalities more decision-making rights has gained attention recently. The new federal government has promised in the coalition agreement to initiate changes to the law but no concrete steps have been taken. In July 2021 several cities in Germany launched the initiative "Livable cities with reasonable speed limits", which calls for changing the general speed limit inside cities and towns from 50 km/h to 30 km/h.[69] More than 900 cities and municipalities have joined the initiative.[70] Munich has not officially supported the initiative, but the issue has been discussed among decision-makers.[71]

Low emission zone and diesel driving ban for better air quality

Since nitrogen dioxide (NO_2) has negative effects on air quality, the EU set an annual average limit of 40 micrograms (40 µg/m^3) for NO_2 in the Directive on Ambient Air Quality and Cleaner Air for Europe in 2008.[72] Since 2010, EU member states have had to comply with this limit. This regulation was transposed into German law with the 39th Ordinance of the Federal Emission Control Act.[73] Health effects that can occur even after a short exposure to NO_2 are the aggravation of asthma, reduced lung function and even premature deaths.[74] If the EU limit values are exceeded, the responsible municipalities must adopt Clean Air Plans to reduce local NO_2 emissions.[75] Munich is among the German cities that has been exceeding the annual average limits set by the EU for more

than 10 years.[76] This relates to four hotspots in particular, all of which are located on Munich's ring road around the city center.[77] Munich has recently increased the scope of its Low Emission Zone (LEZ), that was introduced in 2012, to further drive down air pollution and protect public health. The eighth update to the Clean Air Plan, which Munich adopted in December 2022, extends the LEZ to Munich's ring road effective from February 2023.[78] Previously, the LEZ stretched over Munich's city center and neighboring urban districts through to Munich's ring road. A Low Emission Zone is an area in which only vehicles that meet certain emission standards are allowed to drive. The purpose is to reduce pollutant emissions from road traffic. Only vehicles with green stickers have been allowed to enter the areas within Munich's ring road; others are prohibited. The stickers indicate the respective pollutant group to which vehicles belong based on particle emissions. Diesel vehicles only receive a green sticker when they meet emission standards Euro 4/IV or higher and have a particulate reduction system.[79] The sticker is valid for all Low Emission Zones in Germany, not just for one city. Another key policy measure of the eighth update to the Clean Air Plan is the introduction of a three-stage diesel driving ban aimed at reducing NO_2 pollution. As part of the new driving ban for diesel vehicles, vehicles with emission standards Euro 4/IV are excluded from the LEZ from February 2023, despite having a green sticker. If this policy measure is not sufficient to comply with the NO_2 limits, the diesel driving ban will be extended to all vehicles with emission standard Euro 5/V from October 2023. Currently, residents, delivery traffic, craftsmen and taxis are exempted from the measures. If the measures taken in the first two stages prove insufficient, the third stage of the Clean Air Plan will come into force in April 2024. This means that the exemptions for residents and delivery traffic will no longer apply. Compliance with the diesel driving ban will be monitored by the police through traffic controls and, according to the catalogue of fines, a violation of the diesel driving ban will cost EUR 128.50.[80]

Main steps towards Munich's Low Emission Zone



Until 2021, the Bavarian state government was responsible for compliance with emission limits and thus also for deciding on a possible diesel driving ban. As no effective measures were adopted, the State of Bavaria was found guilty of non-compliance in several court cases.[81] The German

government was also chastised by the European Court of Justice in June 2021 for exceeding nitrogen dioxide limits - with explicit reference to Munich's exceeding legally allowable emission levels.[82] In the same month, an amendment to the Bavarian Emission Protection Law was passed, transferring responsibility for urban air quality to Munich.[83] Driven by the threat of millions in fines if the pollution limits were not met, in December 2022 Munich's city council agreed on an eighth update of its Clean Air Plan. [84]

Following the introduction of the diesel driving ban, some critics described the ban as disproportionate, as nitrogen dioxide levels have improved so that steadily more measuring points comply with the annual average EU nitrogen dioxide limits comparing the values over the last ten years.[85] Prognostic calculations for 2024 show however that the annual average nitrogen dioxide limit will still not be complied with in the four hotspot areas.[86] Generally, the EU limit of 40 µg/m^3 is low compared to the ones proposed in the guidelines of the World Health Organization (WHO). The WHO adapted its 2021 guidelines based on new scientific findings and now recommends an annual average nitrogen dioxide limit value of 10 µg/m3, which is four times lower than the EU limit value.[87]

KEY TAKEAWAYS FOR REDUCING CAR USE IN MUNICH

European cities such as Oslo, Ghent and London demonstrate that different types of urban access restrictions for cars are effective and can improve the quality of life in cities.[88] Munich has so far made limited use of measures aimed at reducing car traffic but the public debate and concrete efforts have intensified. With the 2019 decision to make its old town car-free, Munich's city council has shown courage. Well thought-out planning, early involvement of citizens and scientific support can help to overcome resistance. Testing car-free street and urban spaces for a short time, for example through summer streets and parklets, can increase acceptance among residents and business owners.[89]

The responsibility for decisions on further restrictions of car traffic also lies at the Bavarian and German level. As parking fees are relatively low compared to other European countries, an increase in the maximum fee could be an important way in which the Bavarian Free State could support Munich in parking management. At the federal level, there is a need for reforming the Federal Road Traffic Act in order to prioritize equal rights for road users.[90] With the 2020 amendment of the Federal Road Traffic Act, the Federal Ministry of Transport and Digital Infrastructure has implemented important improvements for cycling and car sharing. Further changes that enable, for instance, speed reductions are a necessary prerequisite for livable cities.

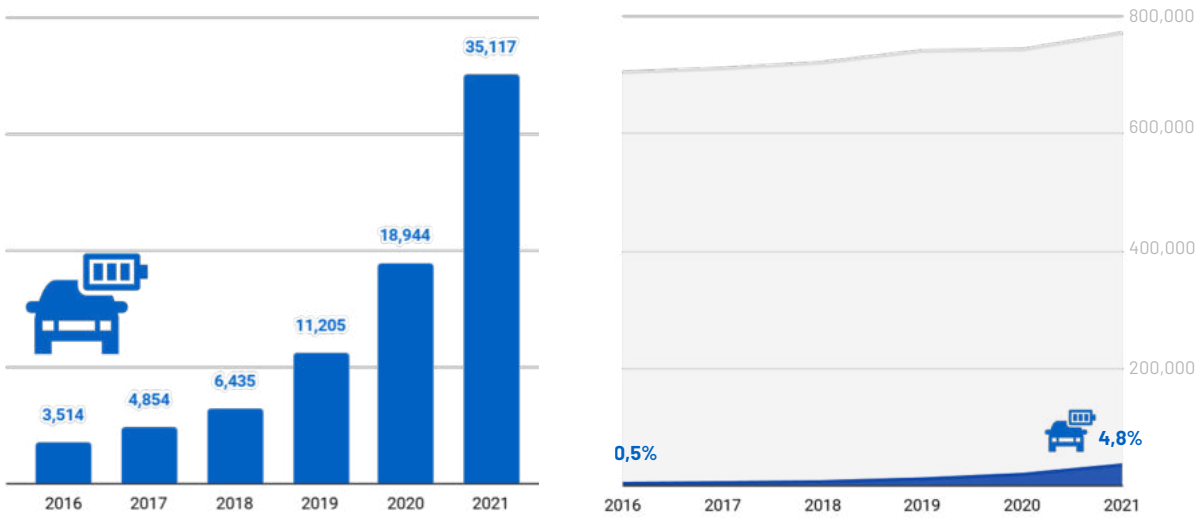
Electric vehicle policy

A rapid transition from internal combustion engine cars towards electric vehicles is central to Munich's goal of reaching at least 80% low-emission traffic by 2025 and climate neutrality by 2035. The main policy measures for the roll-out of electric vehicles include economic and non-economic incentives for the purchase and use of electric vehicles as well as the development of charging infrastructure. The metropolitan areas in Europe which have made the largest progress in the adoption of electric vehicles have typically relied on a mix of supportive policy measures including purchase incentives, parking benefits, awareness programs and public charging strategies.[91] The term electric vehicle commonly refers to two types of vehicles: battery electric vehicles (BEV) and plug-in hybrid vehicles. While BEVs are electric-only, plug-in hybrid vehicles can be run on electricity and gasoline. The trend in German government policy has been to gradually focus on BEVs as the only genuine emission-free type of vehicle.

Purchase and use of electric passenger vehicles

Munich has not adopted specific goals for electric passenger vehicles. At the national level in 2021, the SPD-FDP-Green government coalition set a target of reaching 15 million BEVs by 2030.[92] This is an upward revision from the previous goal of 10 million BEVs by 2030 adopted in 2019.[93] The European Commission set the goal of having 30 million zero-emission vehicles on the EU roads by 2030.[94] While vehicles powered by synthetic e-fuels and fuel-cells constitute potential alternatives, recent sales rates and technology forecasts clearly point towards electric vehicles as the main low-emission technology for passenger vehicles.[95] In both Munich and Germany, the sale of electric vehicles has increased substantially during 2016-2021. By the end of 2021, there were 618,460 registered BEVs on German streets alongside 565,956 plug-in hybrid vehicles.[96] Germany thus crossed in 2021 the mark of 1 million electric passenger vehicles. The total number of registered electric passenger cars in 2021 in Munich, including BEVs and plug-in hybrid vehicles, was 35,087 representing only 4.8% of all passenger vehicles in the city.[97]

Amount and share of electric vehicles in Munich from 2016 to 2021



Despite the significant increase in e-vehicles from 2016 to 2021, with almost 5% they only represent a small share of all cars in Munich.

Source: Munich Statistical Office

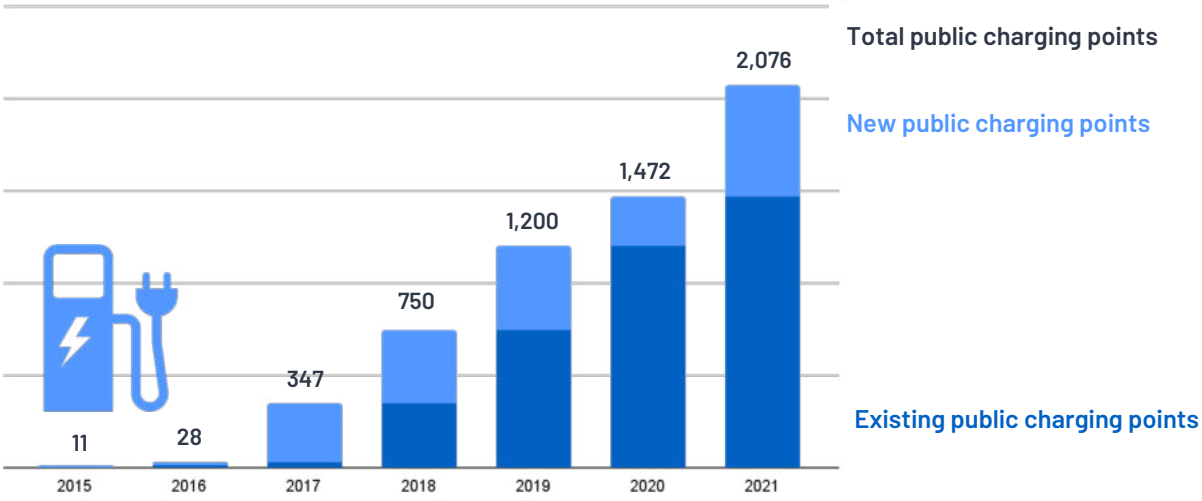
In 2016, Munich introduced purchase incentives targeting light-electric vehicles and electric passenger cars for commercial entities. The newly adopted support scheme for 2023 does not offer purchase incentives for electric passenger vehicles for either private persons or business entities.[98] The national purchase incentives for low-emission passenger vehicles were introduced for the first time in 2016 and continue to be the main driver behind the growth in the electric vehicle market in Germany. The level of support was substantially increased in 2019 and again in 2020 in response to the economic slowdown caused by the COVID-19 pandemic. In 2023 several further changes to the support scheme came into effect. The purchase incentive can now only be granted to private persons and only for BEVs and fuel-cell vehicles including new and used cars. Plug-in hybrid vehicles have been excluded from support in line with the government policy focus on BEVs. The purchase incentive continues to be financed based on equal contributions from the national government and car manufacturers. In 2023, consumers were eligible for a EUR 9,000 grant when purchasing BEVs that are worth not more than EUR 40,000 EUR and EUR 6,000 for vehicles worth between EUR 40,000-65,000. From 2024, the purchase incentive is to be reduced to EUR 6,000 and only vehicles worth less than EUR 45,000 will be eligible for support.[99] The decline in the amount of support is justified by the decline in technology costs while the focus of the government support is turning towards less expensive electric cars with an eye toward low-income and middle-income consumers.

Electric vehicles and car-sharing vehicles are partially exempted from parking fees to incentivize these forms of mobility. In all areas managed by the city of Munich, electric vehicles can park for two hours free of charge.[100] This is based on the Electric Mobility Act, which was enacted by the federal government in 2015 and allows municipalities to implement privileges for electric vehicles.[101] Electric car-sharing vehicles are completely exempted from parking fees in the city due to the Federal Car-Sharing Law that came into force in 2017.[102] This law also allows municipalities to designate public parking spaces for shared cars, which the city of Munich successfully tested in 2022. By 2026, a total of 600 separate parking spaces for shared cars are planned for public spaces throughout the city. These will soon be issued and tendered by car-sharing providers.[103]

Charging infrastructure for electric passenger vehicles

Charging stations can, in principle, be constructed on public and private property and those on private property can be publicly accessible or restricted to specific persons. In practice, there is a strong correlation between the increase in the number of publicly accessible charging stations and the sale of electric vehicles.[104] Munich has declared the vision of reaching 5,000 public charging stations with 10,000 charging points by 2030.[105] The national goal is to install 1 million charging points for electric vehicles by 2030.[106] Based on the data of the German Federal Network Agency, there were 2,076 registered publicly accessible charging points in Munich as of 1 January 2022.[107] By way of contrast, there were 55,121 public charging points installed in Germany nation-wide by this time. The European Commission envisaged that 3 million public charging points for electric vehicles will be needed by 2030.[108]

Public charging points in Munich from 2016 to 2021



In 2021, there were around 2,000 publicly accessible charging points available in Munich. By 2030, the city want to reach 10,000 charging points.

Source: Federal Network Agency

Since 2016, Munich has financially supported the construction of charging stations on private property as part of the funding scheme promoting electric mobility. By the end of 2021, more than 1,300 private charging points for electric vehicles had been funded by this program.[109] Under the conditions defined in the support scheme in 2023, 500 EUR can be granted for the construction of a normal charging point and 10,000 EUR for fast-charging points.[110] In 2020, Munich published a public tender for a company to install 2,800 charging points on public streets, but no contract had been signed based on the tender at the time of this writing. This has brought the construction of public charging points almost to a halt as the city has refused to grant permits for the construction of further charging points on public spaces before the tender process has been finalized.[111]

Several national financial support programs were put in place to facilitate the installation of publicly accessible charging stations beginning in 2017. In October 2021, the new government presented the Charging Infrastructure Masterplan II. A budget of 6.3 billion EUR was earmarked for the roll-out of charging infrastructure by 2026.[112] The Bavarian Government introduced its own complementary annual funding programs for public and private charging stations.[113] In addition, the German Developmental Bank (KfW) has subsidized the implementation of private charging stations for e-vehicles.[114] Such charging stations are often combined with rooftop solar panels. The new EU Energy Performance of Buildings Directive, which was translated into German law in March 2021, introduced mandatory requirements for charging points for electric vehicles to be installed in new and renovated residential and non-residential buildings.[115] The Directive is currently under revision at the EU level to increase its ambitiousness in line with the European Green Deal strategy. This is expected to create a strong boost to the roll-out of private charging infrastructure.

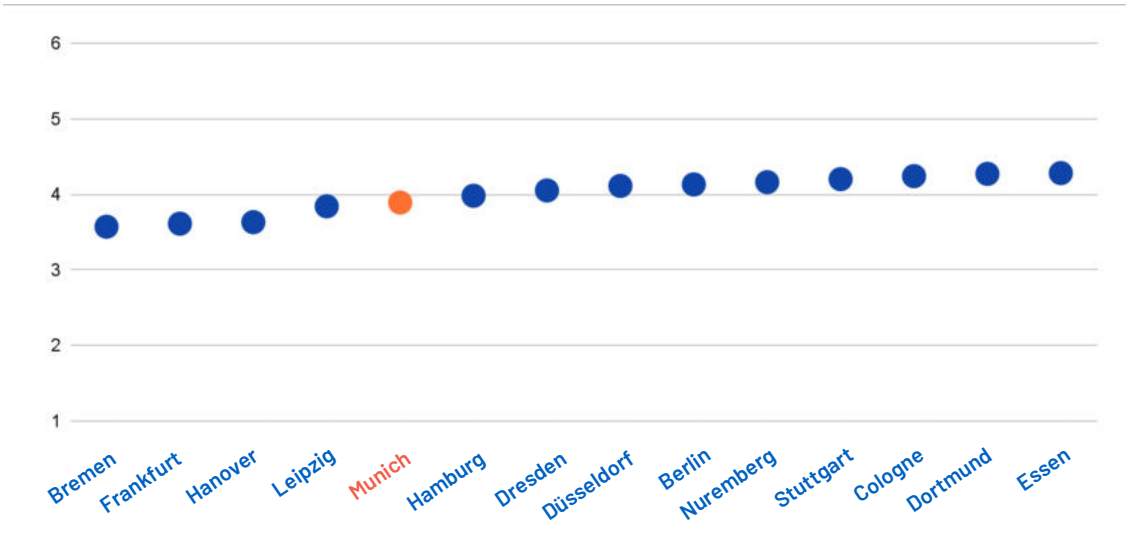
KEY TAKEAWAYS FOR PURCHASING AND CHARGING E-VEHICLES

In a recent comparison of 50 metropolitan regions in Europe, Munich is ranked in the bottom half (place 32), both in terms of the share of new electric passenger vehicles and the share of public charging points.[116] This shows that further efforts are necessary to make Munich truly attractive for electric vehicles. Although the number of electric passenger vehicles in Munich has steadily increased, their share in the total number of vehicles has remained marginal. The increase in the number of newly installed publicly available charging stations has been dynamic but unstable with a declining rate in 2022. While the purchase of electric vehicles will be dominantly driven by national government incentives, the efforts of city decision-makers should focus on streamlining the procedures for the construction of widely available charging infrastructure. In the future, the success of the transition towards electric vehicles will increasingly depend on upgrades of the electric grid and a successful integration of electric vehicles into the power supply and demand system. The availability of skilled workers will also be critical.

Policies for improving walking and cycling infrastructure

Policies to promote active mobility include redesigning urban space for better infrastructure for cyclists and pedestrians, making roads and intersections safer, building bicycle parking facilities and integrating transport modes.[117]

Munich's bike-friendliness compared to other German cities



The bike-friendliness of German cities with more than 500,000 inhabitants is given an average grade of 4.0 in 2022. (Grade 1 would be the best and 6 the worst). Munich is ranked 5th out of 14 large cities.

Source: ADFC Bike-Friendly Cities Rating

While Munich still has a great need to become more bike-friendly, more than half of Munich residents intend to cycle more often in the future, which is above the average for German cities

(42%).[118] In order to make use of this potential, Munich decided in 2019 to implement the demands made in two citizens' petitions - *Radentscheid* and *Altstadt-Radlring* - for safer, more comfortable and more attractive cycling by 2025.[119] These decisions represent a paradigm shift in Munich's traffic planning. The measures mean a massive redistribution of road space in favor of cycling, walking and public transport. They come at the expense of car lanes, parking spaces and the efficiency of car traffic - and explicitly not at the expense of pedestrians or urban green.[120] Strengthening cycling as a mode of transport in the long-term is only possible through fundamentally rethinking the role of cycling and altering the current regulatory framework. An important step is the amended Federal Road Traffic Act, which came into force in 2021 and strengthens the rights of cyclists.[121] For example, it makes it easier for municipalities to set up bicycle streets. In addition, cycling laws which promote bicycle mobility and facilitate the implementation of supportive measures are currently being discussed at the Bavarian and European policy levels.[122] For Bavaria, the initiative goes back to the *Radentscheid Bayern*, a civil society alliance that submitted a petition for a referendum for a Bavarian cycling law in early 2023.[123] In European transport policy, cycling has so far been a side issue. In early 2023, the EU Parliament called on the EU Commission to develop a European cycling strategy with the aim of doubling the number of kilometers traveled by bicycle in Europe by 2030.[124] Below the main objectives of Munich's 2019 resolutions on cycling and new or existing policy measures are discussed.[125]

The Munich City Council adopted a strategy to promote pedestrian traffic as part of its Mobility Strategy 2035 at the end of 2022.[126] Above all, crossing opportunities are to be improved, making walking safer and more barrier-free. This is particularly important for children, people with mobility impairments and other vulnerable groups. Across all political levels, there are often no dedicated responsibilities and hardly any capacities for pedestrian traffic.[127] In 2022, for example, the German Ministry for Digital and Transport allocated funds for investments in pedestrian traffic for the first time.[128]

Improving the quality of cycle paths

In five policy packages, the city council has asked the administration to develop proposals for new, wider and better marked bike lanes as well as safer intersections in over 40 streets. The majority of the measures are still in the coordination process. Before the city council decides on the redesign of the selected streets, options will be discussed with residents, tradespeople and district committees. The construction of the cycling route *Altstadt-Radlring* is another central policy measure aimed at improving bicycle infrastructure and creating a safe and continuous bicycle connection along the historic old town. People of all ages should be able to use the wide bike lanes and their design should prevent motor vehicles from entering and standing.[129]The figure below on Munich's cycling network shows, however, that as of December 2022, just under 12% of the route had been completed.[130] The citizens' initiative has calculated that, at the current rate of implementation, the project will not be completed before 2046 instead of 2025 as planned.[131]

Other measures that contribute to the quality of the bike lanes include protected bike lanes.[132] They are intended to increase cyclists' sense of safety. As part of an experiment on protected bike lanes, elements separating the roadway from the bike lane were installed on five roads for the test period

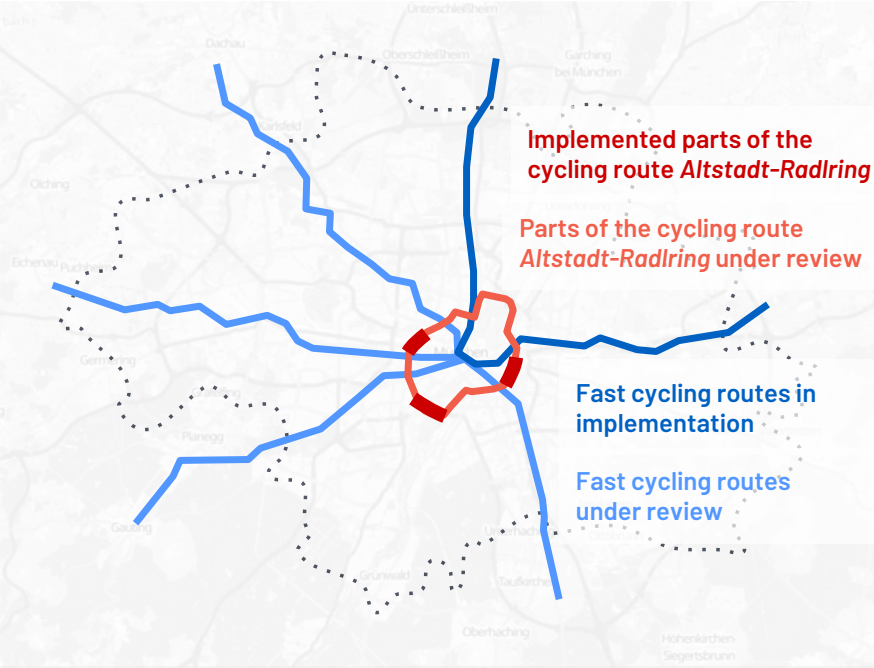
2022-2023. The experience gained from this experiment will be incorporated into a possible permanent installation of protected bike lanes.[133] To expand the bicycle network in the short term, pop-up bike lanes were installed during the COVID-19 pandemic, which were made permanent in 2021.[134] Pop-up bike lanes have been shown to generate additional bike traffic and are very inexpensive to install.[135]

Creating a bicycle priority network

The city council approved Munich's first fast cycling route in 2019, and further routes are currently under review.[136]

Map of Munich's planned cycling network

Munich is working on a comprehensive cycling network but the implementation speed is too slow to complete the Altstadt-Radlingring as planned by 2025.



Another policy measure that grants cyclists priority over other road users are bicycle streets. With 91 bicycle streets and a total length of 43 km, Munich is a self-proclaimed pioneer in Germany.[137] Although these streets are reserved for bicyclists, motor vehicles are allowed through an exemption clause for residents.[138] It was not until the end of 2022 that Munich's first exclusive bicycle street was decided upon in the district of Freiham.[139]

Safe design of intersections and junctions

A status report on the safe design of intersections and junctions is to be presented in 2023 as part of the resolution *Radentscheid*. In 2018, the strategy Vision Zero was adopted as the basis for strengthening Munich's road safety; it sets the goal of no fatalities or serious injuries in road traffic and the protection of vulnerable groups, such as school children, cyclists and pedestrians.[140] With the help of short- and long-term measures, Munich's city administration is in

the process of defusing accident-prone intersections, making right turns safer, and converting and reconstructing intersections.[141]

Vision Zero also underlies the road safety programs at the Bavarian and German policy levels.[142] Specifically for cycling, the number of cyclists killed in traffic should decrease by 40% by 2030 (compared to 2019) according to the National Cycling Plan.[143] At the EU level, the long-term goal is to reduce the number of fatalities in traffic to almost zero by 2050. A measurable target is the envisaged halving of the number of fatalities and serious injuries in traffic in the EU by 2030 (compared to 2020).[144] This shows that while the various political levels share the general vision of Vision Zero, they differ in the concrete design of the goals.

Expanding bicycle parking facilities

In 2021, Munich's building department created more than 1,500 new public bicycle parking spaces and built Bike+Ride facilities at subway stations, exceeding the city's goal of creating over 1,000 additional public bicycle parking spaces each year.[145] Four planned bicycle parking facilities for at least 3,000 bicycles are also to be built as part of the new construction of Munich's main train station.[146] Since more than 1.5 million bicycle parking spaces are lacking at train stations alone throughout Germany, a new funding program for the construction of bicycle parking with EUR 110 million until 2026 is intended to allow for more intermodal travelling via bike and train. This is an important policy measure in the context of the *49-Euro-Ticket*.[147] Munich's Statutes on Bicycle Parking which entered into force in 2020, stipulates that a sufficient number of parking spaces for bicycles must be provided on private ground.[148] In addition, the purchase of bicycle trailers, cargo bicycles and cargo pedelecs will be subsidized under Munich's amended support scheme, which will come into force in 2023.[149]

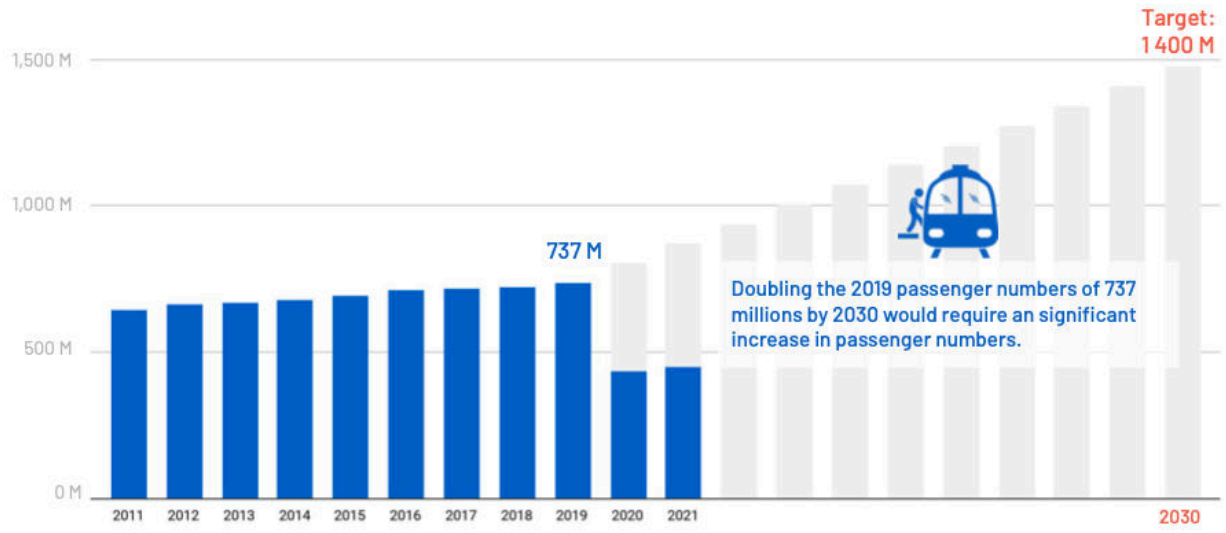
KEY TAKEAWAYS FOR WALKING AND CYCLING IN MUNICH

The case of Munich shows how important people power can be for expanding mobility options for walkers and cyclers. In response to the 2019 resolutions calling for improving the city's cycling infrastructure, Munich developed a new cycling plan. The public's concerns about climate change have led to new targets, plans, and policy making processes. What matters now is the speed and effectiveness of implementation of the targets and plans. Here the examples of pioneering cities with high cycling shares, such as Copenhagen and Amsterdam, are interesting to observe. Not only did these cities make cycling and walking integral parts of their transport planning already many decades back,[150] their successes in these areas were tied at least in part to how they changed their communication strategies. Campaigns were promoted not only to reduce car use, but to present the many benefits that can come with greater use of bicycles and walking for human health and the environment as well as accessibility and equity. Identifying and promoting such multiple benefits can help to broaden public and political support for alternatives to cars.[151]

Public transport policies

Key policy measures in this area include adding new public transportation routes, procuring zero-emission vehicles and making public transport more accessible through lower ticket prices. These measures should help to significantly boost the number of passengers using public transport. The number of public transport passengers in Munich increased to 736.7 million from 2011 to 2019, until it dropped sharply to 434.7 million due to the COVID-19 pandemic.[152] In 2021, the Conference of the Ministers of Transport[153] set a goal to double the number of passengers using local public transport by 2030 compared to 2019 numbers in order to meet the climate targets. At the end of 2022, this goal was also taken up by the Bavarian Public Transport Strategy 2030.[154] Munich supports the ambitious goal of doubling public transport passenger numbers by 2030.

Development and vision for 2030 of public transport passengers in Munich's public transport



Source: Münchner Verkehrsgesellschaft GmbH (MVG)

In a position paper released in 2021, Munich joined 115 other cities, districts and transport associations calling for an improved financial framework to support municipalities in their transport transitions. They demand for an increase in regionalization funds and better opportunities to create new sources of funding, for example through parking space management.[155]

Improving the public transport network

The Bavarian government is responsible for suburban trains and regional transportation, while the city of Munich is responsible for local public transportation. Munich has continued to expand public transport to create a long-term and attractive alternative to the private car. For subway connections, a city council resolution from 2019 spelled out further plans and priorities.[156] In addition to other expansion plans such as the extension of the line U5 to the west, an important component of Munich's future subway network is the planned U9, which will enhance the existing network between the north and south of Munich. In 2021, the city council approved the interim local transportation plan. It includes plans for seven top-priority tram lines, the extension of the subway line U4 and improvements to the links between new urban districts and the city center.[157] Concrete

planning and financing of expansion projects will be made possible by the 2021 and 2022 public transport construction programs.[158] to make busses and trams more punctual and thus more attractive, the city council has approved a total of three packages of measures with 40 individual measures, 31 of which have already been implemented.[159] A fourth package of measures is to be presented in the fall of 2023. These measures often require only small interventions, but have major effects. Measures include new bus lanes, optimizing traffic lights and designating areas where parking is prohibited to avoid bottlenecks. The Munich Transport Company is responsible for the implementation of subway and tram projects. Munich's subways and trams are already climate-neutral since they run on green electricity.[160] As part of the EU Clean Vehicles Directive, the German government has implemented that at least 45% of newly procured buses must be clean vehicles by 2025.[161]

Federal government introduces nationwide public transport

In order to reduce the financial burden on households caused by the rising fuel prices caused by the war in Ukraine, the German government introduced a 9 EUR ticket that ran from June to August 2022. The federal government fully financed the ticket with EUR 2.5 billion.[162] The ticket allowed passengers to use all local and regional public transport services (not long-distance rail services, e.g. ICE or TGV) across Germany for just 9 Euro per month. In total, 52 million tickets were sold and around 10 million additional subscribers automatically received the discounted ticket.[163] A study conducted by the TUM Think Tank found that more than half of the study participants perceived the 9 EUR ticket as a financial relief and an important measure to promote public transport. [164] The survey additionally found that not only were urbanites very interested in the 9 EUR ticket, a large number of respondents from rural areas were also very interested in it. Although it is unclear whether the 9 EUR ticket led to more people using public transportation in the long-term, the experiment revealed the problems caused by years of underfunding of public transport - overcrowded trains, a shortage of staff, malfunctioning air conditioning systems and long delays. The successor ticket to the 9 Euro ticket – the 49 EUR per month subscription *Deutschlandticket* became available in May 2023. Like the 9 EUR ticket, it will allow the use of all local and regional public transport across Germany. The uniform tariff is another major advantage of the *Deutschlandticket*. which is financed by the federal government and the federal states.[165]

KEY TAKEAWAYS FOR PUBLIC TRANSPORT IN MUNICH

The expansion of local public transport is essential for an inclusive and environmentally sustainable urban transportation system. This is reflected in the Bavarian and German governments' shared goal of doubling passenger numbers by 2030 compared to 2019. The fact that public transport in Munich is already reaching its capacity limits at peak times and at the same time the population is growing underlines the urgency of improving public transport services.[166] The sharp decline in passenger numbers during the COVID-19 pandemic and increasing energy prices pose challenges for public transport providers. To achieve their goals, cities and municipalities are calling for a further increase in funding.[167] Munich has taken important steps towards strenghtening its public transport network. The *Deutschlandticket*, which will be valid from May 2023, can make public transport more accessible and easier to use.

CONCLUSION

Environmental problems, such as air pollution and particularly climate change, have been main drivers behind government efforts to make mobility systems at all levels more sustainable. In the past few years, the EU, Germany, Bavaria and Munich have all adopted new climate protection laws and strategies tightening climate targets. Munich has accepted the challenge of becoming climate-neutral by 2035, earlier than Bavaria (2040), Germany (2045) and the EU (2050). Being selected by the European Commission as one of 100 cities that aims to become a climate neutral and smart city by 2030, suggests that Munich wishes to be a leader in this field. Concerns about traffic safety and noise and the interest in achieving a more just distribution of public space use are also increasingly shaping mobility policy in Munich, although less so than in many other European cities.

Munich has made important progress in paving the way towards more sustainable urban mobility. This includes the strengthening of the city's institutional capacities, adoption of strategic documents and implementation of concrete measures in multiple areas such as charging infrastructure of e-vehicles, expansion of Munich's bicycle network, safe design of intersections and repurposing of public streets. Still, more comprehensive and far-reaching action is necessary to fulfil the adopted targets. While the Russian invasion of Ukraine and the resulting energy crisis prompted decision-makers in Germany to strengthen support for the use of low-emission modes of transportation, the dominance of car-based mobility has not really been challenged.

Local mobility policy efforts are deeply embedded within Europe's multi-level governance system. Many policy measures enacted at the EU, national, and Bavarian levels have facilitated the mobility transition in Munich, including, for instance, the national purchase incentives for e-vehicles and the EU directive to tackle air pollution. Still, the space for action at the city level has also been heavily constrained by regional and national laws. Some notable examples are speed limit standards regulated under the Federal Road Traffic Act and parking management fees defined at the level of Bavaria. Overall, there is a pressing need for delegating more competences to the local level in the field of mobility policy in Germany in order to spur innovations and allow for context-tailored measures. At the same time, local decision-makers must step-up efforts in formulating an inclusive and appealing vision of a more sustainable mobility system and building broad coalitions for putting the vision into action.

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[31] Department for Environment and Health, "Bayerisches Versöhnungsgesetz II / Grundsatzbeschluss zur „Klimaneutralen Stadtverwaltung 2030" und weitere Maßnahmen zur Erreichung der Klimaneutralität München 2050", RatsInformationsSystem, No. 14-20 / A 05327, accessed April 12, 2023, https://risi.muenchen.de/risi/sitzungsvorlage/detail/5663322?dokument=v5780408 (Draft resolution, December 04, 2019 and https://risi.muenchen.de/risi/antrag/detail/5466815?dokument=v5822571 (Final resolution, December 18, 2019).

[32] Munich's Climate Package 2021 comprises the following resolutions, which form the structural basis and financial framework for the 2035 climate neutrality target:

Department for Climate and Environmental Protection, "Grundsatzbeschluss I", RatsInformationsSystem, No. 20-26 / V 03533, accessed April 6, 2023, https://risi.muenchen.de/risi/sitzungsvorlage/detail/6624427?dokument=v6668464 (Draft resolution, July 7, 2021) and https://risi.muenchen.de/risi/sitzungsvorlage/detail/6624427?dokument=v6737618 (Final resolution, July 28, 2021).

Department for Climate and Environmental Protection, "Einführung einer Klimaprüfung bei Beschlussvorlagen", RatsInformationsSystem, No. 20-26 / V 03535, accessed April 6, 2023, https://risi.muenchen.de/risi/sitzungsvorlage/detail/6624431?dokument=v6668544 (Draft resolution, July 7, 2021) and https://risi.muenchen.de/risi/sitzungsvorlage/detail/6624431?dokument=v6736960 (Final resolution, July 28, 2021).

Department for Climate and Environmental Protection, "Finanzrahmen für den Klimaschutz ab 2022", RatsInformationsSystem, No. 20-26 / V 03534, accessed April 6, 2023, https://risi.muenchen.de/risi/sitzungsvorlage/detail/6624429?dokument=v6668622, (Draft resolution, July 7, 2021) and https://risi.muenchen.de/risi/sitzungsvorlage/detail/6624429?dokument=v6736988, (Final resolution, July 28, 2021).

[33] Department for Climate and Environmental Protection, "Grundsatzbeschluss II Klimaneutrales München 2035 und klimaneutrale Stadtverwaltung 2030", RatsInformationsSystem, No. 20-26 / V 05040, accessed April 6, 2023, https://risi.muenchen.de/risi/sitzungsvorlage/detail/6895803, (Draft resolution, December 16, 2021) and https://risi.muenchen.de/risi/sitzungsvorlage/detail/6895803?dokument=v6996782 (Final resolution, January 12, 2022).

[34] München unterwegs, "Mobilitätsstrategie 2035: Münchens Fahrplan für die Verkehrswende", accessed April 6 2023, https://muenchenunterwegs.de/2035.

Department for Mobility, "Beschluss: Mobilitätsstrategie 2035, Entwurf einer neuen Gesamtstrategie für Mobilität und Verkehr in München", RatsInformationsSystem, No. 20-26 / V 03507, June 2021, accessed April 6, 2023, https://risi.muenchen.de/risi/sitzungsvorlage/detail/6619227?dokument=v6625968. Further goals result from the 19 sub-strategies, of which the city council has already decided on the strategies for pedestrian traffic, commercial traffic and shared mobility. As of April 2023, Munich's final Mobility Strategy 2035 has not been published yet.

Car traffic reduction policy

[35] Bavarian State Government, "Klimaland Bayern", p. 19.

[36] German Environment Agency, "Mobilität neu steuern. Ein Steuer- und Abgabenkonzept für klimaschonenden und sozial gerechten Verkehr bis 2050", June, 2021, accessed April 20, 2023, https://www.umweltbundesamt.de/sites/default/files/medien/479/publikationen/2022_fb_mobilitaet_neu_steuern_bf.pdf.

[37] Federal Government, "Fragen und Antworten zum Tankrabatt" accessed April 20, 2023, https://www.bundesregierung.de/breg-de/suche/faq-energiesteuersenkung-2049702.

[38] Juliane Kipper, "Entlastung für Gutverdiener. Ökonomen fällen vernichtendes Urteil über Tankrabatt", *n-tv*, accessed April 20, 2023, https://www.n-tv.de/wirtschaft/Oekonomen-faellen-vernichtendes-Urteil-ueber-Tankrabatt-article23369462.html.

[39] Federal Government, "Ermäßigter Steuersatz für Gas, weniger Stromkosten" accessed April 20, 2023, https://www.bundesregierung.de/breg-de/themen/entlastung-fuer-deutschland/entlastung-energieabgaben-2125006.

[40] Munich Statistical Office, "Pkw-Erstzulassungen und Pkw-Bestände in München von 2010 bis März 2022", Münchner Statistik, 2. Quartalsheft, 2022, accessed April 13, 2023, https://stadt.muenchen.de/dam/jcr:d9d44b8e-b100-4b63-a241-b1df6fbd5661/mb220202.pdf.

[41] The dataset on "New car registrations per segment" is obtained from Munich Statistical Office, "Monatszahlen-Monitoring München", downloaded on February 2, 2023, https://www.mstatistik-muenchen.de/monatszahlenmonitoring/atlas.html.

[42] Huber Felix and Oliver Schwedes, "Autos und Stadtraum", in: *Handbuch der kommunalen Verkehrsplanung, Loseblattsammlung*, ed. Thilo Becker et al. (Berlin and Offenbach: Germany, 2021), chapter no. 2.3.3.2, accessed April 12, 2023, https://www.static.tu.berlin/fileadmin/www/10002265/Mitarbeiter/Veroeffentlichungen/Schwedes/HKV_Huber_Schwedes_2.3.3.2.pdf.

[43] Forschungsgesellschaft für Straßen- und Verkehrswesen e.V. (FGSV), "Neue Entwurfsregelwerke bevorzugen Fuß- und Radverkehr", December 2022, accessed April 12, 2023, https://www.fgsv.de/aktuelles/news-details/neue-entwurfsregelwerke-bevorzugen-fuss-und-radverkehr.

[44] Kira Pieper, "Neue Regeln in Deutschland – Der Parkplatz der Zukunft soll größer werden", *rbb24*, January 2023, accessed April 12, 2023, https://www.rbb24.de/panorama/beitrag/2023/01/parkplatz-auto-verkehr-berlin-verkehrswende.html.

[45] Janina Belz et al., "Mobilität in Deutschland – MiD Regionalbericht Stadt München, Münchner Umland und MVV-Verbundraum", Studie von infas, DLR, IVT and infas 360 on behalf of Federal Ministry for Transportation and digital infrastrucutre, Bonn, Berlin: Germany, December 2020, https://muenchenunterwegs.de/content/657/download/infas-grossraummuenchen-regionalbericht-mid5431-20201204.pdf.

[46] Alexander Czeh, "Zusammenhang von Verkehrswende und sozio-ökonomischer Lage in Berlin – Autobesitz und sozio-ökonomische Lage", Experi, September 15, 2021, accessed April 12, 2023, https://www.experi-forschung.de/zusammenhang-von-verkehrswende-und-sozio-okonomischer-lage-in-berlin-autobesitz-und-sozio-okonomische-lage/.

[47] Belz et. al., "Mobilität in Deutschland – MiD Regionalbericht Stadt München, Münchner Umland und MVV-Verbundraum".

[48] Ruth Blank, Konstantin Kreye, and Wiebke Zimmer, "Impulse für mehr Klimaschutz und soziale Gerechtigkeit in der Verkehrspolitik. Kurzstudie zu monetären Verteilungswirkungen ausgewählter verkehrspolitischer Instrumente und Vorschläge für eine sozial gerechtere Ausgestaltung", ed. Öko-Institut, Freiburg: Germany, November 2020, accessed April 12, 2023, https://www.nabu.de/imperia/md/content/nabude/verkehr/20-11-27-_studie_impulse_f__r_mehr_klimaschutz_und_sozialvertr__glichkeit_in_der_verkehrspolitik.pdf.

Detlef Laußmann et al., "Soziale Ungleichheit von Lärmbelästigung und Straßenverkehrsbelastung", *Bundesgesundheitsblatt – Gesundheitsforschung – Gesundheitsschutz* 56, (2013): 822 – 831, accessed April 12, 2023, https://doi.org/10.1007/s00103-013-1668-7.

REDUCING CAR TRAFFIC AND REPURPOSING PUBLIC STREETS

[49] Department for Urban Planning and Building Regulations, "Grundsatzbeschluss „Autofreie Altstadt" und „Altstadt-Radlring", RatsInformationsSystem, No. 14-20 / V 14478 , accessed April 11, 2023, https://risi.muenchen.de/risi/sitzungsvorlage/detail/5383981?dokument=v5472337 (Draft resolution, May 22, 2019) and https://risi.muenchen.de/risi/sitzungsvorlage/detail/5383981?dokument=v5539098 (Final resolution, June 26, 2019).

[50] Muenchen.de, "Autoreduzierte Altstadt", accessed April 12, 2023, https://stadt.muenchen.de/infos/autoreduzierte-altstadt.html.

[51] ADAC, "Spielstraße und verkehrsberuhigter Bereich: Das sind die Unterschiede", May 11, 2022, accessed April 20, 2023, https://www.adac.de/verkehr/recht/verkehrsvorschriften-deutschland/spielstrasse/.

[52] For example, the pedestrian zones in Dienerstraße and Löwengrube were extended.

[53] The Mobility Department examines the streets depending on the preferred spatial concepts, their importance for traffic and the potential for upgrading. Spaces for which the Mobility Department has received specific investigation orders (as of March 2023): Tal (20-26 / V 06570), pedestrian zone Westenriederstraße between Radlsteg and Frauenstraße (20-26 / A 02134), pedestrian zone Westenriederstraße (20-26 / V 06570), surface design as part of the restoration of the Hildegardstraße construction project (20-26 / B 03959), Max-Joseph-Platz (20-26 / V 03016), Herzog-Wilhelm-Straße, Prannerstraße (20-26 / B 03931), and Maximilianstraße (20-26 / A 01017).

[54] Scientific Advisory Board to the Federal Minister of Transportation and Digital Infrastructure, "Perspektiven für den Stadtverkehr der Zukunft", Gutachten 01/2021, https://bmdv.bund.de/SharedDocs/DE/Anlage/G/perspektiven-stadtverkehr-zukunft.pdf?__blob=publicationFile.

[55] Catherine Hoffmann, "Verkehr in München. Es muss nicht immer eine Fußgängerzone sein", *Süddeutsche Zeitung*, June 30, 2022, accessed April 12, 2023, https://www.sueddeutsche.de/muenchen/muenchen-fussgaengerzone-altstadt-1.5611602.

[56] Department for Urban Planning and Building Regulations, "Saisonale Stadträume", RatsInformationsSystem, No. 20-26 / V 00438 (Draft Resolution), December 1, 2020, accessed April 14, 2023, https://risi.muenchen.de/risi/sitzungsvorlage/detail/6009679.

[57] The two variants of the summer streets are play streets (Spielstraßen) and temporarily traffic-calm areas (temporäre verkehrsberuhigte Bereiche), see München unterwegs, "Neue Nutzung von Flächen in der Stadt. Sommerstraßen", accessed April 12, 2023, https://muenchenunterwegs.de/sommerstrassen.

[58] Patrick Stäbler, "Fußgänger und Radler statt Autos: Für immer Sommerstraße - Anwohner in Haidhausen uneinig", *Süddeutsche Zeitung*, October 8, 2022, accessed April 12, 2023, https://www.sueddeutsche.de/muenchen/muenchen-sommerstrassen-haidhausen-1.5670536.

Muenchen.de, "Münchens Sommerstraßen 2022: Platz zum Spielen und Flanieren", accessed April 12, 2023, https://www.muenchen.de/freizeit/aktuell/sommerstrassen.

[59] München unterwegs, "Parkflächen neu genutzt. Parklets in München", accessed April 20, 2023, https://muenchenunterwegs.de/parklets.

PARKING MANAGEMENT

[60] Department for Urban Planning and Building Regulations, "Autofreie Altstadt. Parkraumkonzept Innenstadt", RatsInformationsSystem, No. 20-26 / V 01977, accessed April 12, 2023, https://risi.muenchen.de/risi/sitzungsvorlage/detail/6295679?dokument=v6303326 (Draft resolution, November 11, 2020) and https://risi.muenchen.de/risi/sitzungsvorlage/detail/6295679?dokument=v6422586 (Final resolution, November 19, 2022).

[61] Deutsche Umwelthilfe, "Gebührenordnung für Anwohnerparkausweis".

[62] Berthold Neff, "Stellplätze: Parken wird in München doppelt so teuer", *Süddeutsche Zeitung*, June 1, 2022, accessed April 12, 2023, https://www.sueddeutsche.de/muenchen/muenchen-parkgebuehren-erhoehung-1.5595609.

Department for Mobility, "Verordnung zur Änderung der Verordnung über Parkgebühren in Bereichen mit Parkuhren und Parkscheinautomaten in der Landeshauptstadt München (Parkgebührenordnung), RatsInformationsSystem, No. 20-26 / V 06146, (Final Resolution), June 29, 2022, accessed April 20, 2023, https://risi.muenchen.de/risi/sitzungsvorlage/detail/7104656?dokument=v7230568.

[63] Federal Enviornment Agency, "Parkraummanagement für eine nachhaltige urbane Mobilität in der Stadt für Morgen", October 2021, accessed April 12, 2023, https://www.umweltbundesamt.de/sites/default/files/medien/479/publikationen/uba_broschuere_parkraummanagement_0.pdf.

[64] Federal Ministry for Transportation and Digital Infrastructure, "Erste Verordnung zur Änderung der Bußgeldkatalog-Verordnung", Bundesgesetzblatt, No. 74, October 13, 2021, accessed April 12, 2023, https://bmdv.bund.de/SharedDocs/DE/Anlage/StV/BGBl-bussgeld-vo.pdf?__blob=publicationFile.

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[65] For requirements for the establishment of a parking licence area see München unterwegs, "Parken", accessed April 20, 2023, https://muenchenunterwegs.de/faqs/parken.

[66] Deutscher Städte- und Gemeindebund, "Länder können Gebührenrahmen für Bewohnerparkausweise anpassen", June 8, 2020, accessed April 12, 2023, https://www.dstgb.de/aktuelles/archiv/archiv-2020/laender-koennen-gebuehrenrahmen-fuer-bewohnerparkausweise-anpassen/.

[67] Deutsche Umwelthilfe e.V., "Update vom 19. Mai 2022. Gebührenordnung für Anwohnerparkausweise in den Bundesländern", May 2022, accessed April 12,2023, https://www.duh.de/fileadmin/user_upload/download/Pressemitteilungen/Verkehr/Anwohnerparkgebühren_Länderbriefings_Update_final.pdf.

[68] It is important to note that in Munich, Hamburg and Zurich there is a uniform price for parking tickets for the entire city area. Stockholm and Amsterdam, on the other hand, are divided into different tariff zones. The different tariff zones result in different prices, whereby the more central, the more expensive. The values shown in the chart are the maximum values for Stockholm and Amsterdam. The prices for parking licenses are obtained from the respective websites of the municipalities and are those currently valid for 2023:

For Munich: Muenchen.de, "Parkausweis für Anwohner*innen – Neuantrag oder Verlängerung", accessed April 6, 2023, https://stadt.muenchen.de/service/info/hauptabteilung-i-sicherheit-und-ordnung-praevention/1072045/.

For Hamburg: Hamburg.de, "Bewohnerparken Gebühren", accessed April 6, 2023, https://www.hamburg.de/lbv-parken/14731476/bewohnerparkausweis-gebuehren/.

For Zurich: Stadt Zürich, "Anwohnerparkkarte", accessed April 6, 2023, https://www.stadt-zuerich.ch/pd/de/index/dav/parkkarten_bewilligungen/parkkarten_beziehen/parkkarte_anwohner/anwohnerparkkarte.html.

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For Stockholm: Stockholms stad, "Taxeområden och avgifter", accessed April 6, 2023, https://parkering.stockholm/betala-parkering/taxeomraden-avgifter/.

[69] Deutscher Städtetag, "Lebenswerte Städte durch angemessene Geschwindigkeiten – eine neue kommunale Initiative für stadtverträglicheren Verkehr", July 08, 2023, accessed April 12, 2023, https://www.staedtetag.de/files/dst/docs/Dezernat-5/2022/2022-01-31-Positionspapier-Staedteinitiative-Tempo-30-Unterstuetzer-rein.pdf.

[70] As of September 2023, over 900 cities, municipalities and districts have already joined the initiative. See Städteinitiative Lebenswerte Städte durch angemessene Geschwindigkeiten, "Die Initiative", accessed April 20, 2023, https://www.lebenswerte-staedte.de/.

[71] Christina Hertel, "Tempo 30 in ganz München? Debatte nimmt Fahrt auf", *Abendzeitung*, January 3, 2023, accessed April 12, 2023, https://www.abendzeitung-muenchen.de/muenchen/tempo-30-in-ganz-muenchen-debatte-nimmt-fahrt-auf-art-869302.

Low Emission Zone and Diesel Driving Ban

[72] Official Journal of the European Union, "Directive 2008/50/EC of the European Parliament and of the council of 21 May 2008 on ambient air quality and cleaner air for Europe", accessed April 26, 2023, https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32008L0050.

[73] Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, "39. Verordnung zur Durchführung des Bundes-Immissionsschutzgesetzes. Verordnung über Luftqualitätsstandards und Emissionshöchstmengen", first published August 2, 2010, amended June 19, 2020, accessed April 20, 2023, https://www.gesetze-im-internet.de/bimschv_39/index.html.

[74] European Environment Agency, "Air quality in Europe 2021. Health impacts of air pollution in Europe, 2021", accessed April 20, 2023, https://www.eea.europa.eu/publications/air-quality-in-europe-2021/health-impacts-of-air-pollution.

World Health Organization, Review of evidence on health aspects of air pollution. REVIHAAP project. Technical report, Copenhagen: Denmark, 2021, accessed April 20, 2023, https://apps.who.int/iris/handle/10665/341712.

Erich Wichmann, Expertise zu gesundheitlichen Risiken von Stickstoffdioxid im Vergleich zu Feinstaub und anderen verkehrsabhängigen Luftschadstoffen", February 5, 2018, accessed April 12, 2023, https://vm.baden-wuerttemberg.de/fileadmin/redaktion/m-mvi/intern/Dateien/PDF/PM_Anhang/Luftreinhaltung_Wichmann_2018_Risiken_Stickstoffdioxid_Expertise.pdf.

[75] Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, "39. Verordnung zur Durchführung des Bundes-Immissionsschutzgesetzes".

[76] Muenchen.de, "Immissionsmessungen in München", accessed April 20, 2023, https://stadt.muenchen.de/infos/immissionsmessungen-muenchen; and Bayerisches Landesamt für Bayern, " Lufthygienische Berichte", accessed April 20, 2023, https://www.lfu.bayern.de/luft/immissionsmessungen/lufthygienische_berichte/index.htm.

[77] The measurement points are located along the following streets: Landshuter Allee (two different measuring points), Tegernseer Landstraße and Trappentreustraße.

[78] Department for Environment and Climate Protection, "Luftreinhalteplan Landeshauptstadt München: 8. Fortschreibung", December 21, 2022, accessed April 12, 2023, https://stadt.muenchen.de/dam/jcr:bb41c9c1-6d96-476d-98bd70b81b731e29/230124_8.Fortschreibung_Luftreinhalteplan-FINAL.pdf.

[79] Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, "Umweltplakette / Umweltzone", accessed April 20, 2023, https://www.bmuv.de/themen/luft-laerm-mobilitaet/luft/umweltplakette-umweltzone.

[80] Muenchen.de, "Diesel Fahrverbot. Kontrolle des Verbots", accessed April 20, 2023, https://stadt.muenchen.de/infos/umweltzone-muenchen.html.

[81] Verwaltungsgericht München, "Urteil vom 09.10.2012 - M 1 K 12.1046", OpenJur, October 9, 2012, accessed April 12, 2023, https://openjur.de/u/587081.html.

[82] Info Curia Rechtssprechung, "Urteil des Gerichtshofs (Siebte Kammer) vom 3. Juni 2021", accessed April 20, 2023, https://curia.europa.eu/juris/liste.jsf?language=DE&num=C-635/18.

Markus Sehl, "Welche Folgen hat das Urteil gegen Deutschland?" *Legal Tribune Online*, June 3, 2021, accessed April 12, 2023, https://www.lto.de/recht/nachrichten/n/eugh-c63518-deutschland-luftverschmutzung-eu-kommission-diesel-stickstoffdioxid/.

[83] Bavarian State Chancellery, "Bayerisches Immissionsschutzgesetz (BayImSchG), Teil 1: Ausführung des Bundes-Immissionsschutzgesetzes, Art. 2. Besondere Zuständigkeiten", December 10, 2019, accessed April 12, 2023, https://www.gesetze-bayern.de/Content/Document/BayImSchG-2.

[84] Department for Environment and Climate Protection, "Inkraftsetzung der 8. Fortschreibung des Luftreinhalteplans München", RatsInformationsSystem, No. 20-26 / V 0848, December 21, 2022, accessed April 12, 2023, https://risi.muenchen.de/risi/sitzung/detail/6866941/tagesordnung/oeffentlich?topid=7503066.

[85] Bayerisches Landesamt für Umwelt, "Langzeitverläufe der Schadstoffbelastung", accessed April 26, 2023, https://www.lfu.bayern.de/luft/immissionsmessungen/auswertungen/langzeitverlaeufe/doc/no2_langzeit.pdf.

[86] See Table 9 in Chapter 4 of Department for Environment and Climate Protection, "Inkraftsetzung der 8. Fortschreibung des Luftreinhalteplans München".

[87] World Health Organization, WHO global air quality guidelines. Particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide, Geneva: Switzerland, 2021, accessed April 12, 2023, https://www.who.int/publications/i/item/9789240034228.

[88] For London, air quality improved significantly since the introduction of the Ultra Low Emission Zone (ULEZ). Cumulatively since 2019, nitrogen oxides (NOx) emissions from road traffic were reduced by 23% compared with what they would have been without the ULEZ. For more details see the evaluation report by Mayor of London, "Inner London Ultra Low Emission Zone – One Year Report", February 10, 2023, accessed April 12, 2023, https://www.london.gov.uk/sites/default/files/2023-02/Inner%20London%20ULEZ%20One%20Year%20Report%20-%20final.pdf.

For Gent, a shift towards more sustainable modes of transport and improved accessibility of the city were reached after the introduction of the Traffic Circulation Plan in 2017. For more information on Gent's Traffic Circulation Plan see City of Ghent, "Principles of the Circulation Plan", accessed April 20, 2023, https://stad.gent/en/mobility-ghent/circulation-plan/principles-circulation-plan.

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[89] Ruth Blanck and Michael Jakob, "Städte für Menschen, nicht für Autos. Autoreduzierte Quartiere erfolgreich umsetzen", June 6, 2021, accessed April 13, 2023, https://www.oeko.de/fileadmin/oekodoc/PolicyBrief-Akzeptanz-Autofrei.pdf.

[90] Scientific Advisory Board to the Federal Minister for Transport and Digital Infrastructure, Perspektiven für den Stadtverkehr der Zukunft, Gutachten 01/2021, May 25, 2021, accessed April 18, https://bmdv.bund.de/SharedDocs/DE/Anlage/G/perspektiven-stadtverkehr-zukunft.pdf?__blob=publicationFile.

For a summary and analysis of reform proposals see Agora Verkehrswende, "StVO-Reform im Überblick. Zusammenfassung der Vorschläge zur Reform der Straßenverkehrsordnung für mehr Sicherheit, Gesundheit, Umwelt- und Klimaschutz sowie für bessere städtebauliche Entwicklung", Politikpapier, August 2022, accessed April 19, 2023, https://www.agora-verkehrswende.de/veroeffentlichungen/stvo-reform-im-ueberblick/.

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[91] Marie Rajon Bernard, Dale Hall, and Nic Lutsey, "Update on electric vehicle uptake in European cities", ed. International Council on Clean Transportation (ICCT), Working Paper, No. 37, October 2021, accessed April 12, 2023, https://theicct.org/wp-content/uploads/2021/12/ev-uptake-eu-cities-oct21.pdf.

PURCHASE AND USE OF ELECTRIC PASSENGER VEHICLES

[92] Sozialdemokratische Partei Deutschlands (SPD), BÜNDNIS 90 / DIE GRÜNEN and Die Freien Demokraten (FDP). "Mehr Fortschritt Wagen. Bündnis Für Freiheit, Gerechtigkeit Und Nachhaltigkeit", Koalitionsvertrag, 2021, accessed April 13, 2023, https://www.bundesregierung.de/resource/blob/974430/1990812/1f422c60505b6a88f8f3b3b5b8720bd4/2021-12-10-koav2021-data.pdf?download=1.

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[94] European Commission, "Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Sustainable and Smart Mobility Strategy – putting European transport on track for the future", December 9, 2020, accessed April 26, 2023, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0789.

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[131] Radentscheid München, "Wo ist unser Alstadt-Radlring?", accessed April 12, 2023, https://www.radentscheidmuenchen.de/woistunseraltstadtradlring/.

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[133] München unterwegs, "Verkehrsversuch: Protected Bike Lanes", accessed April 12, 2028, https://muenchenunterwegs.de/angebote/protected-bike-lanes.

[134] Department for Urban Planning and Building Regulations, "Einhaltung der Abstandsregelungen für den Radverkehr während der Corona-Pandemie / Pop-up-Bike Lanes für München in der Corona-Zeit?", RatsInformationsSystem, No. 20-26 / V 00491, accessed April 11, 2023, https://risi.muenchen.de/risi/sitzungsvorlage/detail/6019312 (Draft resolution, May 5, 2020) and https://risi.muenchen.de/risi/sitzung/detail/5653113/tagesordnung/oeffentlich?topid=6019314 (Final resolution, May 27, 2020).

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Creating a bicycle priority network

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[137] München unterwegs, "Ohne Umwege schneller ans Ziel: Fahrradstraßen und geöffnete Einbahnstraßen", accessed April 12, 2023, https://muenchenunterwegs.de/information/fahrradstrassen-und-geoeffnete-einbahnstrassen.

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[142] For Bavaria: Bavarian State Ministry of the Interior, for Sport and Integration, "Verkehrssicherheitsprogramm 2030 - Bayern mobil - sicher ans Ziel", March 2021, accessed April 12, 2023, https://www.bestellen.bayern.de/shoplink/03100093.htm.

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[143] Federal Ministry for Digital and Transport, "Fahrradland Deutschland 2030: Nationaler Radverkehrsplan 2030", January 2022, accessed April 12, 2023, https://bmdv.bund.de/SharedDocs/DE/Anlage/StV/nationaler-radverkehrsplan-3-0.pdf?__blob=publicationFile.

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[145] Department for Urban Planning and Building Regulations, "Gesamtkonzeption Fahrradparken in München", RatsInformationsSystem, No. 14-20 / V 08684, December 19, 2018, accessed April 12, 2023, https://risi.muenchen.de/risi/sitzungsvorlage/detail/4441786.

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[147] Tagesschau, "110 Millionen Euro für Fahrradparkhäuser", March 6, 2023, accessed April 12, 2023, https://www.tagesschau.de/inland/innenpolitik/wissing-fahrradparkhaeuser-foerderung-101.html.

[148] Department for Urban Planning and Building Regulations, "Die Fahrradabstellplatzsatzung (FBS)", October 2020, accessed April 12, 2023, https://stadt.muenchen.de/dam/jcr:2f41eea4-6022-4971-b6d2-ae59a2e77ef4/Fabs_2020_webS.pdf.

[149] Department for Climate and Environmental Protection, "Förderrichtlinie Klimaneutrale Antriebe".

Public transport policy

[150] For Amsterdam, the modal split share of cycling amounts to 38% (2019) for residents and 28% (2019) for both residents and visitors. See Gemeente Amsterdam, "Amsterdamse Thermometer van de Bereikbaarheid 2021", accessed April 13, 2023, www.amsterdam.nl/publish/pages/905215/amsterdamse_thermometer_van_de_bereikbaarheid_2021.pdf.

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[151] Till Koglin, Marco te Brömmelstroet, and Bert van Wee, "Cycling in Copenhagen and Amsterdam", in: *The MIT Press eBooks*, eds.: Ralph Buehler and John Pucher, 2021, 347:370, accessed April 12, 2023, https://doi.org/10.7551/mitpress/11963.003.0022.

[152] For numbers of passengers from 2019 to 2021 see Münchner Verkehrsgesellschaft GmbH (MVG), "Der MVV in Zahlen und Fakten 2021", accessed March 10, 2023, https://www.mvv-muenchen.de/fileadmin/mediapool/05-Service/02-Dokumente/MVV-Statistikbroschuere_2021_SCREEN.pdf.

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For numbers of passengers from 2011 to 2015 see Münchner Verkehrs- und Tarifverbund GmbH (MVV), "Verbundbericht 2015 Münchner Verkehrs- und Tarifverbund", accessed March 10, 2023 https://www.mvv-muenchen.de/fileadmin/Servicedownloads/MVV_Verbundbericht_2015.pdf.

[153] All transport ministers of Germany's 16 federal states (Länder) are represented in the Conference of the Ministers of Transport. The meetings, which take place twice a year, are intended for the exchange of experience and to clarify issues between the Länder or between the federal government and the Länder.

[154] Bavarian State Ministry for Housing, Construction and Transport, "ÖPNV-Strategie 2030", accessed April 12, 2023, https://www.stmb.bayern.de/med/aktuell/archiv/2022/221208oepnvstrategie/.

[155] The position paper advocates for an increase in regionalisation funds between 2022 and 2030 by at least EUR 1.5 billion compared to the respective previous year. The so-called regionalisation funds are made available annually by the federal government to the federal states in accordance with the Federal Regionalisation Act to finance local rail passenger transport. See München unterwegs, "Verdoppelung des ÖPNV bis 2030: Positionspapier unterzeichnet", September 17, 2021, accessed April 3, 2023, https://muenchenunterwegs.de/news/verdoppelung-des-oepnv-bis-2030-positionspapier-unterzeichnet.

Improving public transport

[156] Department for Urban Planning and Building Regulations, "Weitere U-Bahn-Planung der Landeshauptstadt München", RatsInformationsSystem, No. 14-20 / V 12213, January 23, 2019, accessed March 23, 2023, https://risi.muenchen.de/risi/sitzungsvorlage/detail/5027942.

[157] Martin Mühlfenzl, "Bruch mit einem Dogma", *Süddeutsche Zeitung*, February 23, 2017, accessed April 12, 2023, https://www.sueddeutsche.de/muenchen/landkreismuenchen/tangentialverbindungen-bruch-mit-einem-dogma-1.3392374.

München unterwegs, "Der Stadtrat beschließt: Priorität für Planung von acht U-Bahn- und Tramlinien", accessed April 12, 2023, https://muenchenunterwegs.de/news/prioritaet-fuer-planung-von-acht-u-bahn-und-tramlinien.

[158] Muenchen.de, "Ausbau des ÖPNV: Zusätzliche Mittel für Tram-Neubaustrecken Archiv", accessed April 12, 2023, https://ru.muenchen.de/2022/239/Ausbau-des-OePNV-Zusaetzliche-Mittel-fuer-Tram-Neubaustrecken-104943.

[159] Muenchen.de, "Schnelle Maßnahmen zur Bus- und Trambeschleunigung", accessed April 12, 2023, https://ru.muenchen.de/2022/225/Schnelle-Massnahmen-zur-Bus-und-Trambeschleunigung-104613.

[160] Münchner Verkehrsgesellschaft (MVG), "Unsere Fahrzeuge", accessed April 12, 2023, https://www.mvg.de/dam/mvg/ueber/unternehmensprofil/mvg_in_zahlen_s.

[161] Ministry for Digital and Transport, "Gesetz über die Beschaffung sauberer Straßenfahrzeuge", accessed April 12, 2023, https://bmdv.bund.de/SharedDocs/DE/Artikel/G/clean-vehicles-directive.html.

For the definition of clean vehicles see European Comission, "Clean Vehicles Directive", accessed April 12, 2023, https://transport.ec.europa.eu/transport-themes/clean-transport-urban-transport/clean-and-energy-efficient-vehicles/clean-vehicles-directive_en.

Introduction of a nationwide public transport ticket by the federal government

[162] The amount of EUR 2.5 billion is based on projections of lost ticket revenues for the Länder.

[163] VDV: Die Verkehrsunternehmen, "Bilanz zum 9 – Euro – Ticket", accessed April 12, 2023, https://www.vdv.de/bilanz-9-euro-ticket.aspx.

[164] Allister Loder et al., "The 9 Euro Ticket: A Nation-Wide Experiment: Almost Fare-Free Public Transport for 3 Months in Germany: First Findings", Conference: TRB 102nd Annual Meeting, January 8-12, 2023, Washington, DC, DOI:10.13140/RG.2.2.30900.12164. In this study, only the responses from the first wave of the survey are evaluated. It started on May 25 (iOS App Store) and May 30 (Android App Store) 2022 with the release of the app and ended on June 16, 2022.

[165] Michael Weidemann, "Das 49-Euro-Ticket kommt - der Streit bleibt", Tagesschau, March 16, 2023, accessed April 12, 2023, https://www.tagesschau.de/inland/innenpolitik/49-euro-ticket-119.html.

[166] Öko-Institut e.V., "Abschlussbericht zum Fachgutachten Klimaneutralität München 2035".

[167] Deutscher Städte- und Gemeindebund, "Zusätzliche ÖPNV-Mittel reichen nicht für ÖPNV-Ausbau", December 8, 2022, accessed April 5, 2023, https://www.dstgb.de/themen/mobilitaet/oepnv/zusaetzliche-oepnv-mittel-reichen-nicht-fuer-oepnv-ausbau/.

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About ReMGo

The Responsible Mobility Governance & Innovation (ReMGo) project anticipates, assesses, and addresses potential impacts, societal expectations, and ethical issues related to research and technology together with partners, especially with regard to recommendations for action and governance issues in and outside the MCube cluster.

https://www.mcube-cluster.de/en/projekt/remgo/

About MCUBE

The Munich Cluster for the Future of Mobility in Metropolitan Regions (MCube) pursues the vision of establishing Munich as a pioneer for sustainable and transformative mobility innovations. MCube uses the unique geographical concentration of innovation actors in the mobility sector as a "learning region" to develop scalable solutions with model character for metropolitan regions in Germany and worldwide.

www.mcube-cluster.de

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