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Transforming the transport sector for EVERYONE

How to achieve more socially just and environmentally friendly mobility

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Content

In a nutshell

The transport sector is the only sector in Germany where **greenhouse gas emissions** have remained virtually unchanged,[1] and it is one of those fields of everyday life in which **equal participation** for everyone is often not guaranteed. In other words, the German transport system is in urgent need of reform, both from an ecological and social point of view.

The current **equality gap** in transport is large and has many facets: people on low incomes tend to be more affected by transport-related air pollutants and noise than those who are socially better off. Women, children or elderly people for whom pedestrian travel plays an important role are disadvantaged in our car-dominated cities. The specific environmental costs of car transport are to a large extent not borne by the polluters but passed on to society. Prices for public transport have risen twice as much as the cost of buying and maintaining cars. Company car privileges, mileage allowance and energy tax rebate for diesel fuel have negative distributional effects and they cost German taxpayers billions every year.

Transport transition makes an essential contribution to closing the equality gap. However, care must be taken to ensure that transport transition does not create new social imbalances, for example through rising fuel prices. Policy makers must take this concern seriously and find targeted simultaneous solutions for a socially just and ecologically effective organisation of transport transition.

This UBA position paper sees several approaches to this:

- an ambitious **CO_2 pricing** for fuels, coupled with a reduction of the EEG levy and the introduction of a climate premium in such a way that low-income households are not burdened
- a policy for **increasing efficiency** to encourage the development and sale of fuel-efficient vehicles, e. g. through fleet limits
- **abolishing environmentally harmful subsidies** such as company cars and diesel privilege
- **strengthening public transport** coupled with a reform of public transport financing
- **development of pedestrian and cycle traffic networks** to give more space to active, healthy and virtually emission-free mobility

Who owns the town? And how do we want to be mobile in the future? These questions will be of great concern to urban planners, local authorities, business and road users in the future.

Answers to these questions are urgently needed because everyone wants to continue to be mobile according to their needs. At the same time, the majority of the population wants transport to become more environmentally and climate friendly. The shift towards socially fairer and at the same time climate friendly mobility requires a redistribution of scarce public space in favour of pedestrian traffic, cycling and public transport. Only concepts that fairly distribute costs and benefits and enable sustainable mobility for everyone will produce acceptance and open up paths to the urgently needed transport transition.

1 The paper was written before February 2020 – but remains valid despite the current decline in transport.

1. Introduction

The transport sector has not made sufficient contribution to climate protection so far. It is the only sector where greenhouse gas emissions have remained virtually unchanged in recent years.[2] In 2018, greenhouse gas emissions in Germany amounted to 162 million tonnes of CO_2 equivalents, which corresponds to around one fifth of total German greenhouse gas emissions [BMU 2019a]. According to the German government's latest projection report, emissions from the transport sector will only marginally decrease to around 159 million tonnes of CO_2 equivalents if no additional climate protection efforts are initiated [BMU 2019b]. **In order to achieve the climate protection targets for transport (95 to 98 million tonnes of CO_2 equivalents by 2030), there is therefore a gap of at least 60 million tonnes of CO_2 equivalents.**

The German Environment Agency (UBA), in its paper 'No reason for a gap', showed how greenhouse gas emissions from transport can be reduced [UBA 2019c]. The new climate protection package [BuReg 2019] aims to reduce or, in the best case, completely close this gap. The focus here is on road transport as it is responsible for the lion's share of greenhouse gas emissions. Therefore, **this position paper** primarily **addresses road transport**.

The planned introduction of CO_2 pricing in the climate protection package signals that economic instruments are essential for a change of direction in the transport sector. The UBA paper 'No reason for a gap' also makes it clear that economic instruments play a key role in transport transition. However, large parts of the population have reservations about measures which impose a burden on citizens in financial terms. The discussion on CO_2 pricing is a prominent example. The main concern is that households with lower incomes or particularly affected groups such as long-distance commuters could be disproportionately burdened. Politicians must take this concern seriously and plan the transport transition in a socially acceptable way.

On the way toward **socially just and environmentally compatible mobility**, the aim is to avoid conflicts between environmental or climate protection on the one hand and social objectives on the other as far as possible. There are concepts available for this that have been tested in practice. It is at least as important to examine and use synergies between the various objectives. There are numerous synergistic approaches for transitioning to sustainable mobility which combine **many advantages** such as better health protection, greater safety on the roads, a higher quality of life in traffic-stricken cities, greater gender equality and a better supply of public transport to rural regions. Last but not least, the transition to sustainable mobility is the prerequisite of ensuring **prosperity and high quality of life for future generations**.

This position paper initially addresses the question of how the existing transport system should be assessed from an environmental and social point of view. It makes clear why reform is urgently needed. It describes strategies and instruments that are suitable for combining the ecological and climate-friendly transport transition with social goals and avoiding conflicts of interest. The deliberations show that social hardships can be largely avoided and that low-income households can even benefit financially if the mix of instruments is cleverly designed.

2 The paper was written before February 2020 – but remains valid despite the current decline in transport. The current corona crisis must not lead to a situation where the transport transition gets out of focus in both (sub-)urban and rural areas.

2. Road transport today: not suitable for grandchildren nor socially acceptable

Climate protection must be affordable for everyone. This also applies to transport transition: only concepts that distribute costs and benefits equally and enable sustainable mobility for everyone can create the basis of broad acceptance and political feasibility.

The initial situation must first be clarified in order to develop suitable concepts, what are the impacts of the current transport system and how far away is it from ecological and social targets? It is usually assumed in current discussions about transport transition that existing framework conditions lead to socially fair results in road transport. As the following deliberations show, this is wrong – **the equality gap in mobility currently is rather large**. Therefore, there is a fundamental need for reform – due to environmental and social reasons.

The following analysis of the status quo also shows that the social impacts of transport are extremely complex. A reform debate that focuses only on short-term income effects and the costs of the necessary investments is therefore too narrow and prevents targeted solutions.

Status quo: **no intergenerational justice?**

'Why should we still go to school and learn for a future that for us, may not even exist anymore?' This is the question students all over the world ask themselves and are involved in Fridays for Future [FFF 2019].

Climate change is a gradual and self-accelerating process. Future generations will have to shoulder the burdens and impacts of current and past emissions – even if they themselves emit nothing or hardly any greenhouse gases. This is a serious violation of the intergenerational equality principle [UBA 2019a]. Negative consequences for prosperity and quality of life of future generations can only be limited and controlled if the quantity of greenhouse gas emissions is reduced as quickly as possible and as much as possible.

Climate change also leads to injustice on a global scale. People in many developing countries already suffer more from flooding, droughts or storms than industrialised countries (and will do so more frequently in the future), even though they emit significantly less greenhouse gases per capita. The Intergovernmental Panel on Climate Change (IPCC) writes: 'People with the highest exposure and vulnerability are often those having the smallest capacity to respond.' [IPCC 2019]. People with high incomes have more opportunities to protect themselves against or avoid the negative consequences of climate change. This is another reason why **failure to protect the climate is unsocial**.

Status quo: **lack of environmental justice**

Nationwide representative studies show that people with low incomes tend to be more affected by traffic-induced air pollutants and noise than those who are better off in society. Respondents with a low socioeconomic status stated much more frequently in UBA's 'German Environmental Survey' and the Robert Koch Institute's (RKI) 'German Health Interview and Examination Survey for Adults' that they live on a more heavily or extremely busy road than respondents with a high socioeconomic status [Bunge, Katzschner 2009], [Laußmann et al. 2013]. In addition, people at risk of poverty more often state that they feel stressed by traffic noise and that they are affected by traffic-induced environmental pollution [Destatis 2019a]. The RKI report on the health of adults in Germany also confirms the connection between low income and higher subjective exposure to road traffic noise in the residential environment [Laußmann et al. 2013].

Regional studies from Berlin, Dortmund and Frankfurt/Main support these surveys: the Berlin 'Environmental Justice Monitoring', for example, shows that a large proportion of urban areas with a high density of social problems is also affected by high health-influencing environmental pollution (noise, air, bioclimatic pollution, scarce provision of green spaces) [SenUVK 2019]. A study from Dortmund points to higher levels of nitrogen oxide and particulate matter

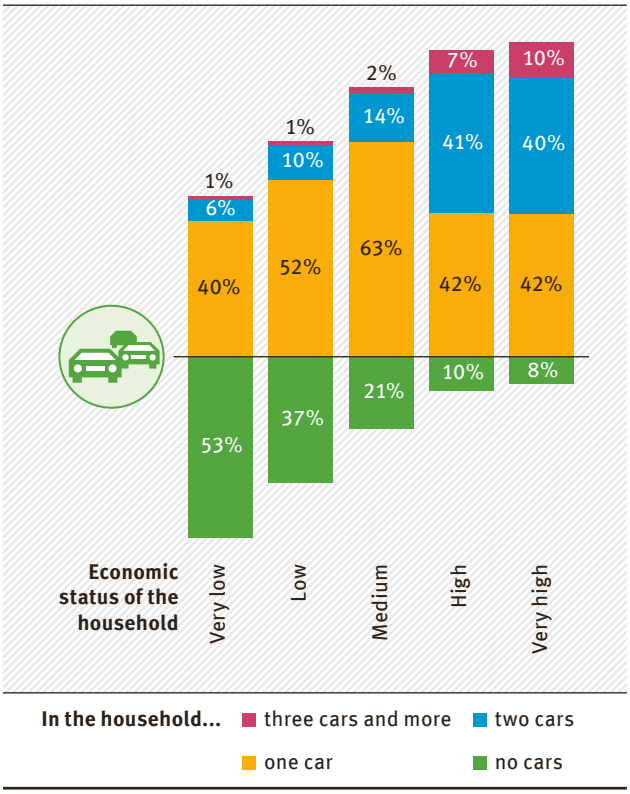
(PM10) pollution in urban areas of Dortmund where a particularly large number of socially disadvantaged population groups live [Flacke et al. 2016]. In a survey in Frankfurt, families with a low social status rated air quality of their living environment as poorer and felt more exposed to noise than families with a higher social status [Schade 2014].

Although data on the links between transport-related environmental pollution, social factors and health still need to be improved. The available empirical evidence suggests that socially disadvantaged population groups are indeed, on average, more exposed and therefore have a higher health risk.

Children are among the most vulnerable population groups. They absorb more pollutants in relation to their body weight through breathing than adults. A large number of negative health effects due to traffic-induced air pollutant exposures have been observed both in children and in epidemiological studies in adults. The consequences include respiratory and cardiovascular diseases [Schulz et al. 2018]. Continuous exposure to environmental noise can also have particularly far-reaching consequences in children. For example, the acquisition of reading skills may be delayed by up to one month if the continuous noise level increases by 10 dB(A) if the school is located in a region exposed to aircraft noise for example [WHO 2018b], [Klatte et al. 2014].

Figure 1

Car ownership by economic status of households in Germany 2018 (status increasing from left to right)



Source: German Environment Agency, based on BMVI data (2019a), p. 11

Status quo: **violation of the polluter-pays principle**

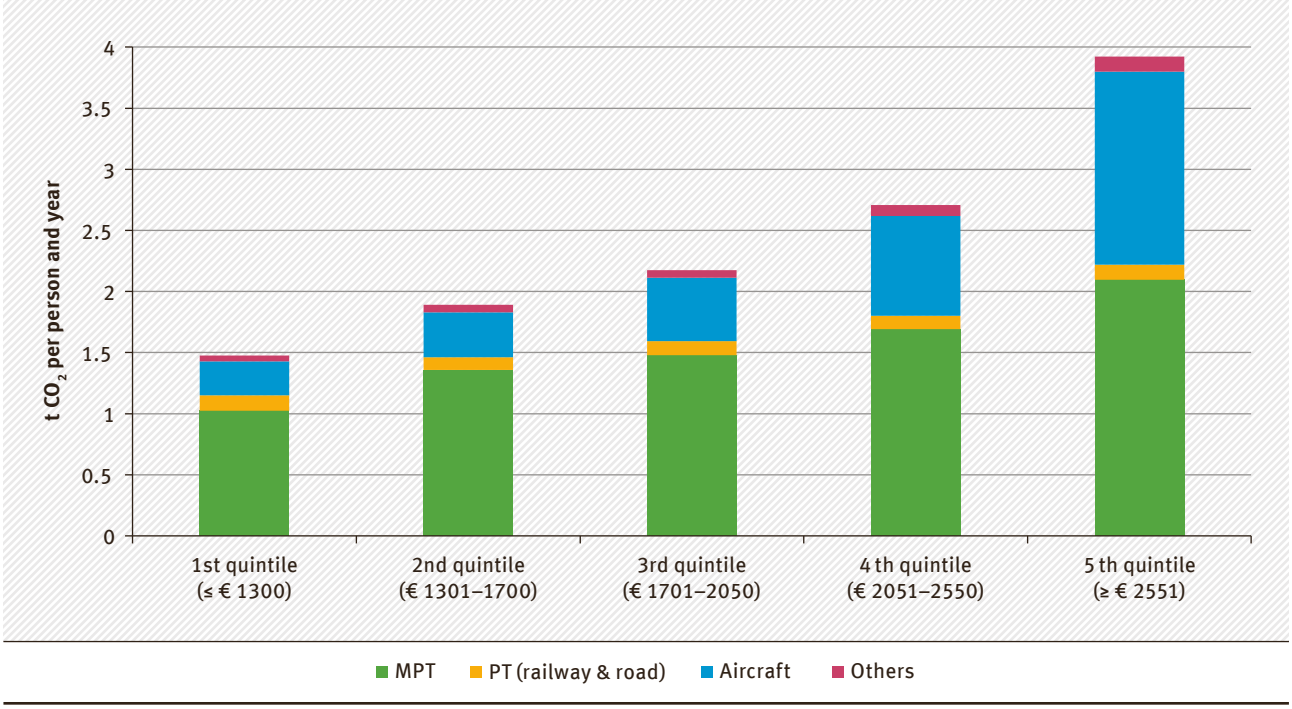
On the path to socially equal mobility it is essential to answer the question as to who benefits primarily from motorised private transport (MPT) and who causes how much environmental pollution. The figures for car ownership among the various social groups in Germany (cf. Figure 1) provide information on this. While 53 % of very low-income households do not own a car, this is only true for 8 % of households with a very high economic status. Just under half of households with high and very high economic status can even have two or more cars, while this proportion is much lower in the other status categories [BMVI 2019a].

Also, the extent of car use increases with income. Baden Württemberg figures show that the MPT transport performance (driver and passenger) is 61 % of the total transport performance in very low-income households, while this proportion is between 70 % and 76 % in higher income households. The reverse holds true for public transport: households with very low incomes use more buses and trains (the public transport share is 29 %) than higher income households (the public transport share is 18 % to 24 %) [MV Ba-Wü 2019].

The MPT specific environmental costs are much higher than those of public transport and a significant part of theirs are not borne by the polluters but are passed on to society. High-income households benefit well above average from this violation of the polluter-pays principle, while low-income households and some particularly vulnerable groups of society (e. g. children) suffer more than average from the negative consequences of MPT.

Figure 2

CO_2 emissions per person per year, differentiated by mode of transport and equivalised household income



DLR (2019) based on UBA data

Well-off households produce more greenhouse gases per-capita than the average. This is confirmed not least by German Aerospace Center figures [DLR 2019]. DLR calculations show that transport-related per-capita CO_2 emissions also rise when household incomes increase (cf. Figure 2).

Status quo: **no participation for everyone**

Transport does not only include car traffic. A transport system must ensure equal and accessible participation for everyone. However, both children and older people are currently often disadvantaged. For example, pedestrian traffic plays an important role for these two groups. Therefore, footpaths should be attractive, free of detours, safe and accessible [UBA 2018]. The general need for accessibility in public spaces and in local and long-distance transport is also urgently needed against the background of the demographic change [Altenburg et al. 2009]. Not only do children and people with health impairments benefit from accessibility but everyone does [Dt. Städtetag 2018].

Minimum walking widths are usually adhered to in municipalities, but pedestrian traffic is often prevented by parking violators. A standard width of 1.5 m has become established, but experts believe that unhindered pedestrian travel is only possible on pavements that are at least 2.5 m wide [UBA 2018]. Questions of transport safety are closely related to accessibility [VCD 2019a]. 458 pedestrians were killed in traffic in Germany in 2018, often in accidents involving cars or lorries. This corresponds to over 15 % of the total of 3024 road deaths [Destatis 2019b]. More than half of 2018 fatalities were over 65 years old [VCD 2019b].

Status quo: **lack of gender equality**

Traffic behaviour varies according to gender. Men travel an average of 46 kilometres per day, 13 kilometres more than women. Men drive significantly more frequently while women are more likely to walk. If differentiated according to age, the differences in traffic behaviour begin to emerge from the age of 20, become more pronounced in the middle age groups and become clear in senior citizens with a decreasing mobility level and seen in both genders (see Figure 3). The gender-specific differences are largely due to the

different life contexts of men and women. Women living in households with children usually bear more responsibility for the family. Part-time employment is still a predominantly female phenomenon. Gender-specific differences in traffic behaviour noticeably prevail even after the family phase [BMVI 2019b].

Women and men also behave differently when it comes to transport purposes. The main reason for this is that the ratio of business trips is three to four times higher for men, and there is a slightly higher ratio of commuting. For women, other transport activities take up a larger proportion of their time. For example, depending on age group, they travel three times as many accompanying trips as men, go shopping more often, or are more often on the road for leisure activities [BMVI 2019b]. On average, women therefore cover significantly shorter distances than men completing a similar number of trips. Women walk more often and are therefore especially subjected to unattractive conditions of pedestrian travel.

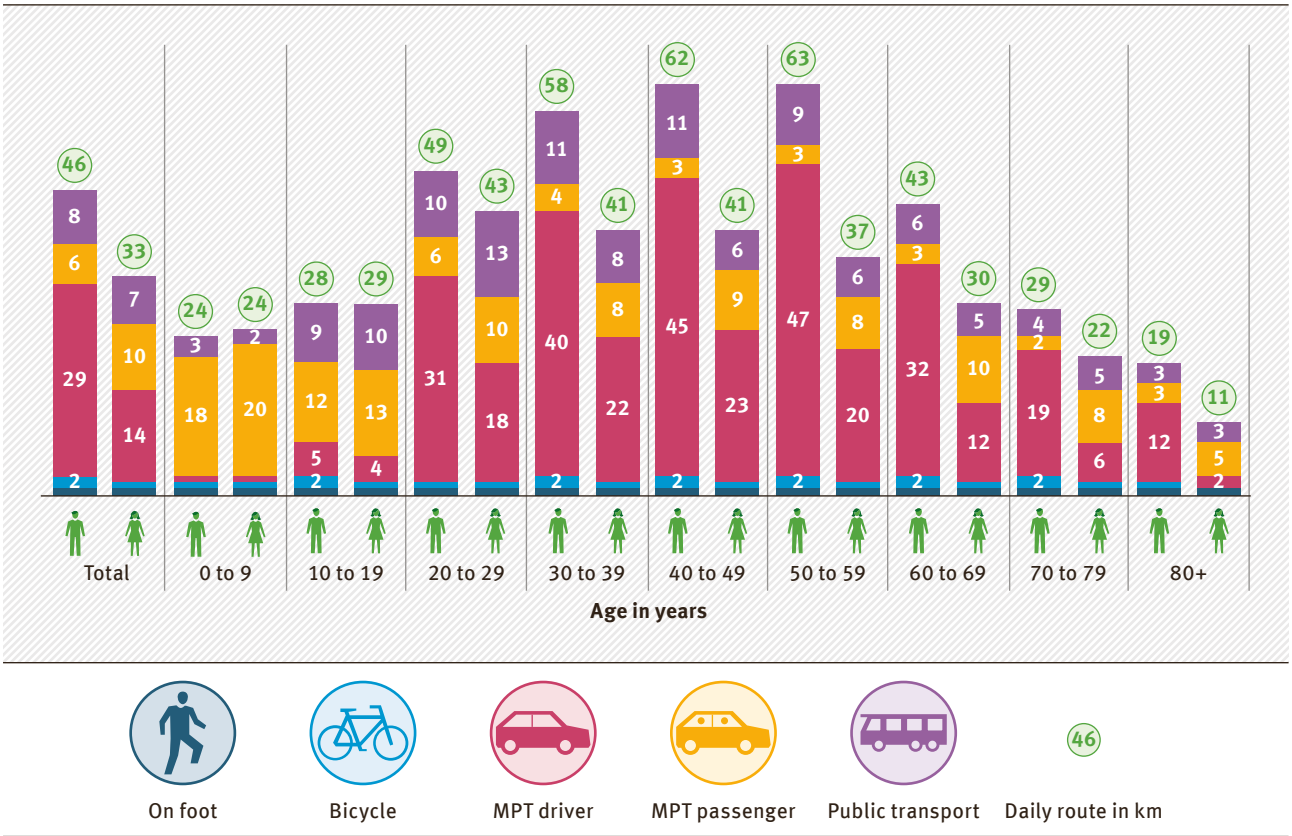
In order to create more gender equality in mobility design, more funds should be invested to ensure the local supply in the 'city and region of short distances' model while also improving the feeling of security in public spaces. Potential options can be shorter bus frequencies, well-lit bus stops and closer to the place of residence, safe footpaths and the development of safe cycling infrastructure. A gender-balanced and safe transport infrastructure improves mobility not only for women, but especially for older people and children.

Status quo: **increasingly poor mobility**

The car-centred transport system means that many everyday destinations cannot be reached without a car particularly in rural areas. The lack of alternative means of transport can subsequently lead to 'forced car ownership'. Those who cannot drive a car or do not have one available are threatened by poor mobility. For example, those affected cannot accept job offers, do their shopping or take advantage of leisure

Figure 3

Daily distance by means of transport, age and gender



Source: German Environment Agency based on BMVI data (2019b)

activities. If facilities can only be reached by car, children, young people and the elderly depend on carpooling [VCÖ 2018].

Dividing the population into five income groups illustrates that, on average, people with the lowest income only cover about half of the daily distance as those with very high incomes (see Figure 4).

When it comes to the question of who is mobile and who is not, the example of Baden-Württemberg paints a similar picture. On an average day, 13 % of all people in Baden-Württemberg are immobile and do not leave their homes at all, whereas in poorer households the figure is 21 % [MV Ba-Wü 2019].

The transport transition should therefore take into account people's individual mobility needs aiming for an equal, social access to an environmentally friendly transport system. This is currently not the case for households with the lowest income [Daubitz 2016], [Daubitz 2017] where a **double equality gap** currently reveals itself: low-income households are more often affected by poor mobility and at the same time suffer more from traffic-related environmental pollution than higher-income households [Rammler, Sweden 2018].

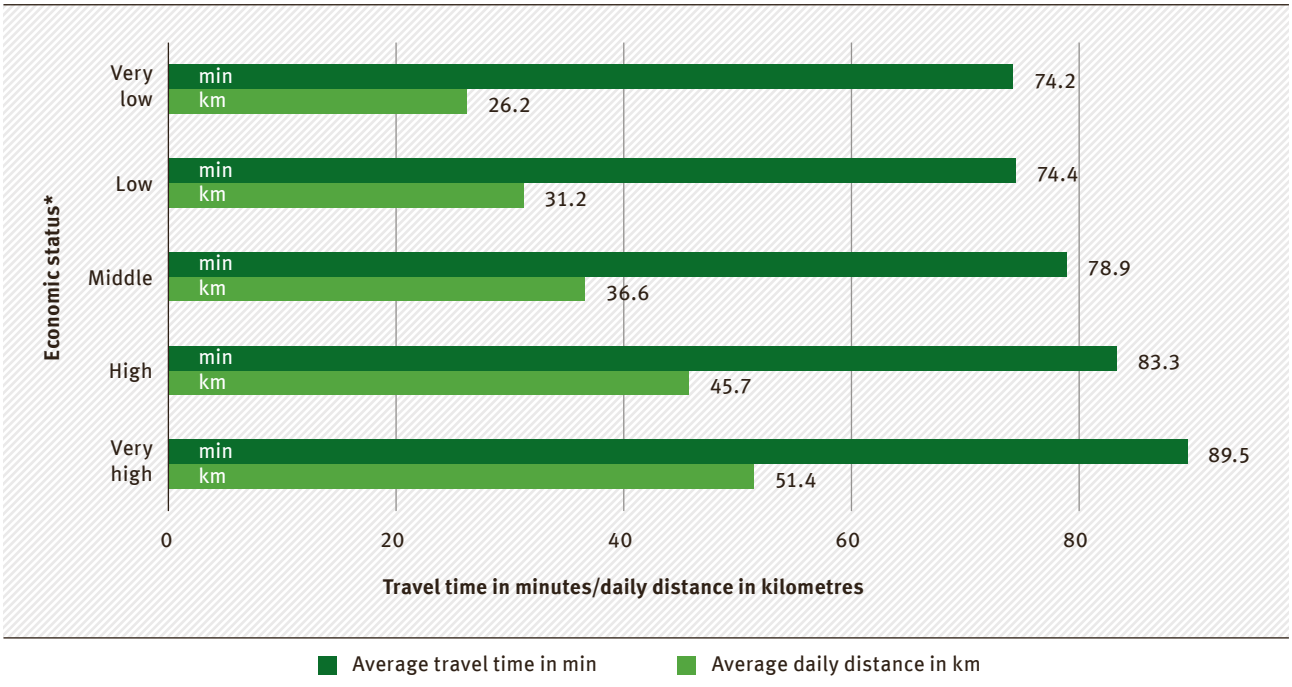
Status quo: **unjust distribution of space – who owns the city?**

Motorised private transport (MPT) takes up a very large share of road space. This is unfair and affects the quality of life, especially in cities. Mobility, based primarily on motorised private transport, also thwarts Germany's climate protection goals since car traffic is currently by far the largest emitter of greenhouse gases in the transport sector.

And the problem is getting worse: the number of vehicles continues to rise, and the size of individual vehicles is also growing rapidly. At the beginning of 2019, the number of cars in Germany reached a record of 47 million. The market share of space-consuming SUVs is also growing rapidly, from 12.7 % to 18.3 % between 2016 and 2018 alone [Statista 2019] [KBA 2019b].

Figure 4

Key mobility figures by economic status in Germany in 2017

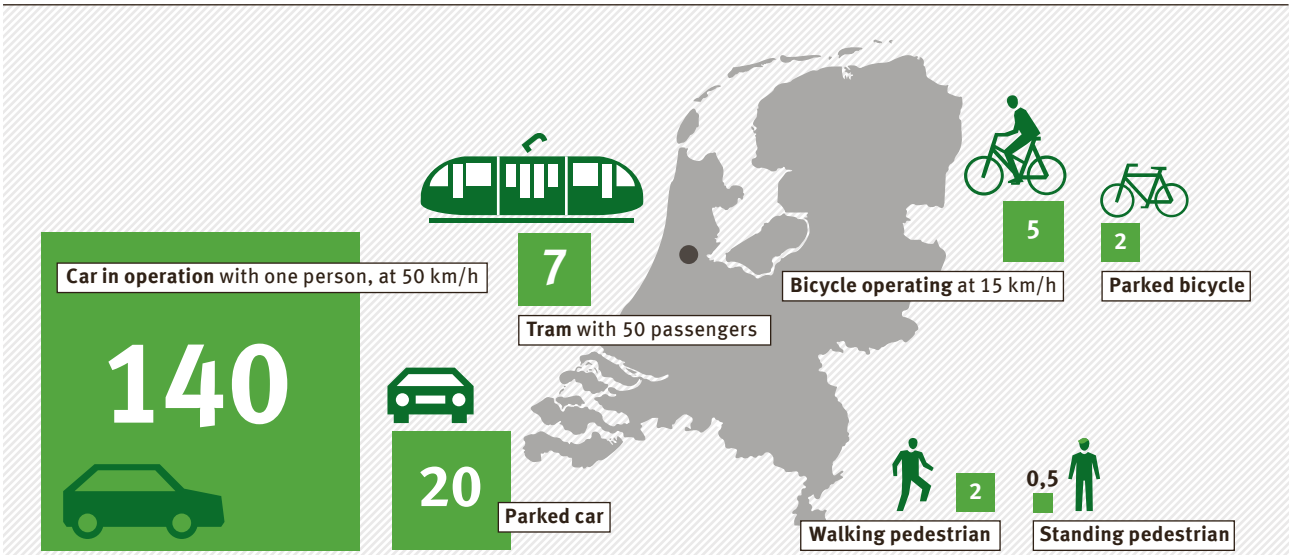


* Determined by household net income and weighted household size

Source: Illustration by the German Environment Agency based on BMVI data [ed.] (2018b): Mobility in Germany. Basic evaluation in tabular form. Germany, 2018 December edition

Figure 5

Example Amsterdam: Space requirements of means of transport



Source: German Environment Agency based on Mobility Atlas 2019/City of Amsterdam

The desired transition to a socially just and sustainable mobility behaviour requires a redistribution of scarce public space in favour of pedestrian traffic, cycling and public transport. In its publications "Tomorrow's cities" [UBA 2017] and "Let's go!" [UBA 2018], the German Environment Agency made concrete proposals for reducing the land-take of MPT in large cities.

Public transport, but especially cycling and pedestrian traffic, requires considerably less space per person than car traffic (see Figure 5). A rededication of space would benefit everyone by increasing the quality of life in cities, especially for those who voluntarily or compulsorily walk or cycle.

A major obstacle to a transport transition in cities is the low pricing of residents' parking spaces and car parks. It favours car drivers and hinders the transition to alternative means of transport. Figure 6 shows how low the charges in Germany are in international comparison.

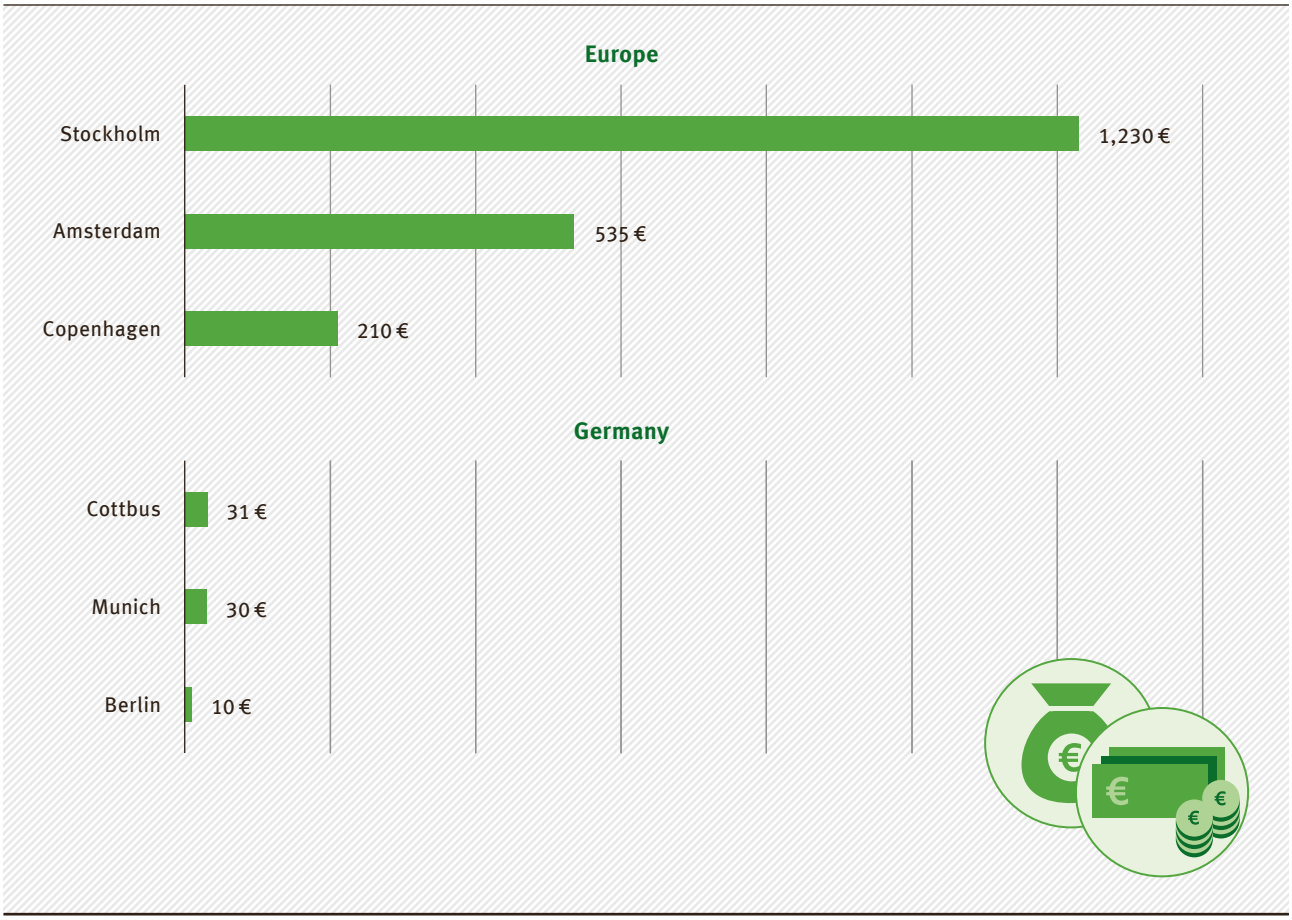
The comparison with other uses of the public space shows that owners of private cars are clearly advantaged. Parking is significantly cheaper than other uses of public space. In Munich, for example, parking a car (residents' parking) costs eight cents (per day), whereas an open bar the size of a parking space in front of a restaurant costs 1.50 euros and a comparably large vegetable stand at the weekly market costs as much as 18 euros [Agora Verkehrswende 2018b].

Status quo: **insufficient economic incentives for climate protection**

Despite increasing transport performance and a growing number of cars, the revenue from transport-related taxes and charges is stagnating. At around 50 billion euros, the sum of nominal annual revenues from energy tax, vehicle tax and lorry tolls has remained largely unchanged since 2003. Adjusted for inflation, the revenue has actually been declining for many years. In addition, the economic incentives for climate protection have also declined, aptly illustrated by the example of energy tax [FÖS 2015, 2017].

Figure 6

Comparison of urban annual fees for resident parking



Source: UBA illustration based on data from the cities' websites (as of October 2019)

The energy tax on fuels is a central lever for achieving climate protection targets in transport. If the energy tax rises, the incentive to save fuel increases, e. g. by avoiding or shortening distances, buying more fuel-efficient vehicles or switching to alternative means of transport [Agora Verkehrswende 2018a], [UBA 2010], [UBA 2019a].

However, this steering effect of energy tax has eroded over the years: since 2003 the tax has remained unchanged at 47.04 cents per litre of diesel and 65.45 cents per litre of petrol. Since the real, inflation-adjusted tax rate has been decreasing since then (see Figure 7), the economic incentives for climate protection are diminishing and are currently roughly at the level of the turn of the millennium. Energy taxation should therefore be regularly adjusted to the general price increase [UBA 2019b].

If we compare the taxes on the purchase (VAT, registration tax, registration fees), ownership (vehicle tax, insurance tax) and use (energy tax and VAT) of cars with other countries in Europe, Germany is in the bottom third [DIW 2018]. This also shows that owning and driving a car in Germany is too cheap. Countries such as Norway, Denmark and the Netherlands show that cleverly designed tools can make car traffic much more climate friendly.

In these countries, motor vehicle tax and company car taxes have a stronger environmental steering effect. In addition, there is also the occasional first-time registration tax spread according to environmental criteria and/or a bonus-malus system for the purchase of new vehicles.

More economic incentives are needed to make progress in climate protection. If these incentives are not in place and the binding climate protection targets under European law are not met, the state, and ultimately all citizens, will pay dearly (see info box 1).

Status quo: **wrong price signals**

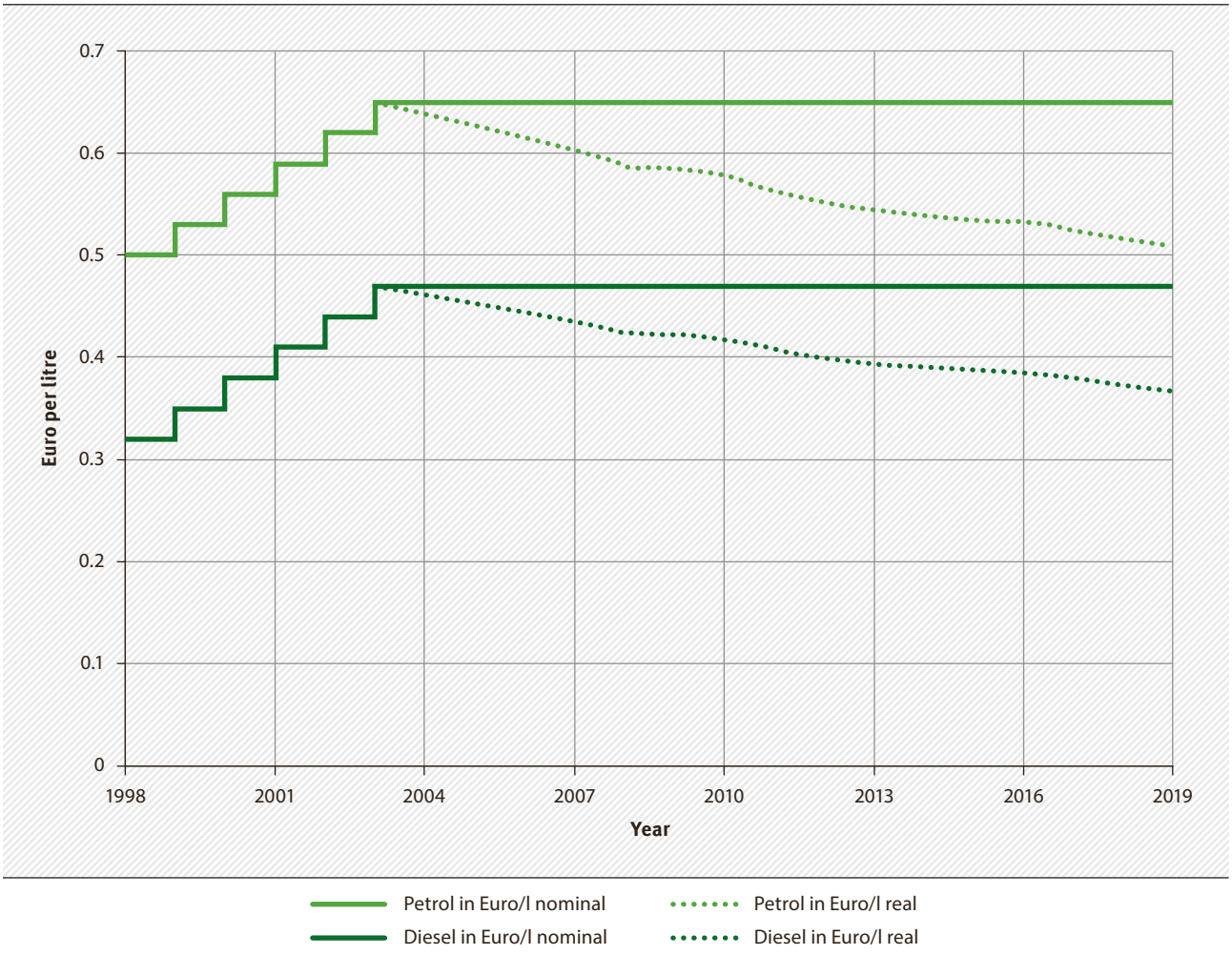
According to the Federal Statistical Office, the costs of buying and maintaining motor vehicles in 2018 were a good 36 % higher than the annual average in 2000. This sounds like a lot, but in comparison it is very little: with an increase of almost 79 %, the prices for local public transport increased more than twice as much. Rail ticket prices have also increased much more significantly – by almost 57 % since 2000 [Destatis 2018] (see Figure 8). The price index for the standard of living of all private households in Germany also shows that the cost of transport services has risen far more sharply than the cost of a car since 2010. Prices for petrol and diesel have even decreased in absolute terms between 2010 and 2017 [BMVI 2018a].

The trend in prices for public transport tickets and parking fees in Munich shows, for example, that local public transport is becoming less attractive in terms of price compared to motorised private transport: the cost of a monthly ticket rose by around 75 % between 2003 and 2018, and that for a single ticket by over 40 %, while the parking fees remained the same.

These developments are fatal for climate and environmental protection in the transport sector, as they contribute significantly to the fact that the move to public transport is not making progress. The developments of the past two decades must be seen

Figure 7

Nominal and real* tax rate on petrol and diesel, in Euro/litre



* Inflation-adjusted to the 2003 price level, HICP to the 2015 base for Germany (Eurostat), 2003=100

Source: UBA based on BMF 2001 and Eurostat

INFOBOX 1

Failure to protect the climate is expensive

Climate protection goals can be of a non-binding character or alternatively, legally binding. Alongside the national climate protection targets (e. g. for 2030), which are binding in the Climate Protection Act, Germany also has legally binding climate protection obligations for the years 2020 and 2030. Under EU law, Germany is obliged to reduce its greenhouse gas emissions by 38 % by 2030 compared to 2005, in sectors outside the European emissions trading system. This applies primarily to the transport, building and agricultural sectors. If Germany does not achieve this target, certificates from other Member States will have to be purchased.

For the period 2021 to 2030, there are indications that the target will be missed by a considerable margin unless countermeasures are taken with very decisive climate protection results. According to estimates by Agora Energiewende and Öko-Institut, with prices of up to 100 EUR/certificate this could result in costs of EUR 30–60 billion for the period 2021–2030 [Agora Energiewende, Agora Verkehrswende 2018]. Hesitant action will therefore cost German taxpayers dearly.

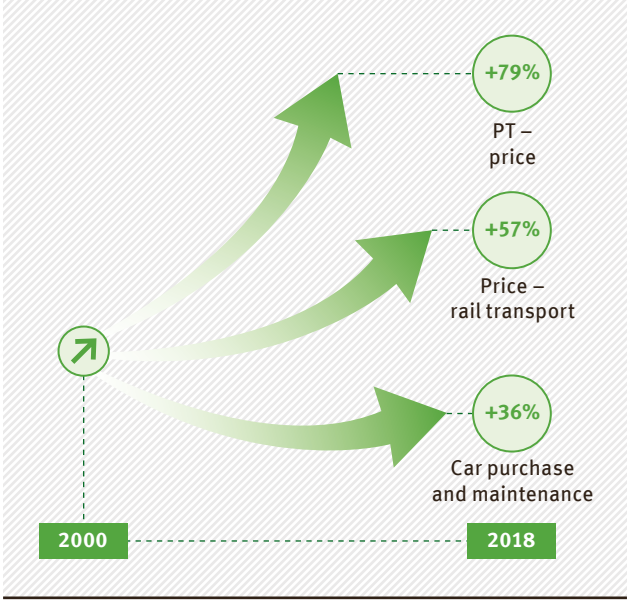
in a negative light from a social point of view also, as low-income households have been disproportionately affected by the sharp rise in the price of public transport.

Status quo: social imbalance caused by environmentally harmful subsidies

There are numerous environmentally harmful subsidies in the transport sector [UBA 2016]. Company car privilege, mileage allowance and energy tax rebate on diesel fuel alone cost German taxpayers more than 15 billion euros every year (see Figure 9). Not only do they damage the environment, they are also negative in social terms because households with high incomes benefit from them most.

Figure 8

Price increases between 2000 and 2018



PT = Public Transport

Source: UBA illustration, Destatis figures (2018)

In addition, the more the state subsidises fossil fuel for motorised private transport, the more it has to grant subsidies in return so that a switch to more environmentally friendly means of transport becomes attractive. This places a double burden on taxpayers.

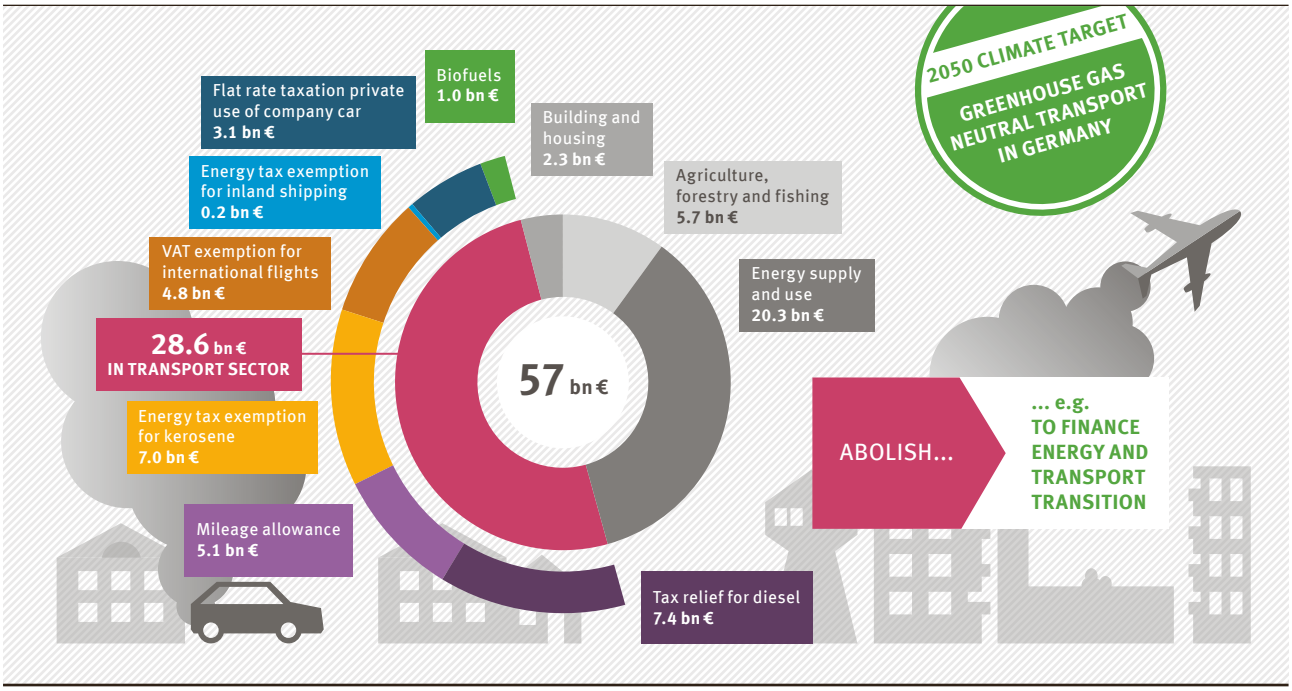
Diesel privilege. So far, diesel has been subject to a lower energy tax than petrol (47.04 ct/l vs. 65.45 ct/l). From an ecological point of view, this sends the wrong price signal, especially since diesel emits more CO_2 per litre than petrol. Since people from richer households drive more cars, they benefit disproportionately from the diesel privilege.

Mileage allowance. The mileage allowance favours long-distance commuting and promotes a growth in the volume of traffic. On average, households with higher incomes commute farther and are subject to a higher income tax rate. For these reasons, they benefit significantly more from the mileage allowance than low-income households.

Company car privilege. The company car privilege also promotes the car as a means of transport and contributes to the environmental impact of road traffic.

Figure 9

Environmentally harmful subsidies in Germany



Source: UBA illustration & figures – UBA (2016b)

For private use of a company car, 1 % of the vehicle list price is taxed monthly as a non-cash benefit within the income tax framework. This flat-rate taxation is an incentive to use the company car frequently for private trips. It is also a particularly obvious case of social injustice, since only a small, privileged section of the population benefits from this. Since company cars are provided by companies primarily for employees in higher income brackets, the regulation violates the principle of vertical tax justice: higher earners take advantage of tax privileges that are much less accessible to those on normal incomes. A further problem is that women scarcely benefit at all from the company car privilege – around 80 % of company cars are provided for men [FiFo et al. 2011], [Jacob et al. 2016].

3. Strategies and instruments for more sustainable mobility

The German transport system is in urgent need of reform, both from an environmental and social point of view. But how could a reform be implemented that meets both environmental and social demands? How can synergies be used and conflicts of objectives avoided? What strategies are available for this? This chapter presents the essential building blocks that are indispensable for steering the transport system towards a sustainable future.

Making the tax and levy system climate-friendly and socially acceptable

Raising fuel prices, for example by increasing energy tax or pricing CO_2 emissions, is a delicate and politically controversial measure. It is often argued that rising energy prices have a negative distribution effect: if diesel and petrol become appreciably more expensive, this will lead to losses, especially for low-income households.

INFOBOX 2

Eco-bonus in Switzerland

Since 2008, Switzerland has levied a CO_2 tax to promote the economical use of fossil fuels, then from 2018, the tax rate amounted to the equivalent of around 87 euros per tonne of CO_2 and totals around 1.1 billion euros per year. One third of the tax revenue goes into a support programme for the energy-efficient refurbishment of buildings, two thirds are returned via an eco-bonus. Each person receives the same amount regardless of their energy consumption. This favours low-income households as they consume less energy on average than high-income households. The share of the levy from industry and commerce is redistributed in line with the companies' wage bills [BAFU 2018].

This objection is justified, but it overlooks the fact that the state can return the additional revenues in a targeted form and thus prevent negative distribution effects or even compensate for social inequalities. Relief can be provided, for example, by reducing other taxes or by direct payment in the form of a climate bonus. This strategy is already being successfully implemented in Sweden and Switzerland (see Infobox 2).

A redistribution of the revenue from an increase in energy tax or a CO_2 price via a climate bonus could be combined with a reduction in electricity prices, for example by lowering the EEG (Renewable Energy Act) levy. This would result in a shift of government-determined electricity price mechanisms for fossil fuels [Fiedler et al. 2018]. The reduction of the EEG levy uses electricity-based technologies such as electromobility (including rail and electricity-based local public transport), thus providing further benefits for climate protection.

The German Institute for Economic Research (DIW) calculated the distribution effects of a CO_2 tax of 80 euro/tonne CO_2 for 2023 and this showed that the tax revenue would finance a climate bonus of 80 euros per inhabitant and a reduction in the electricity tax and EEG levy [DIW 2019].

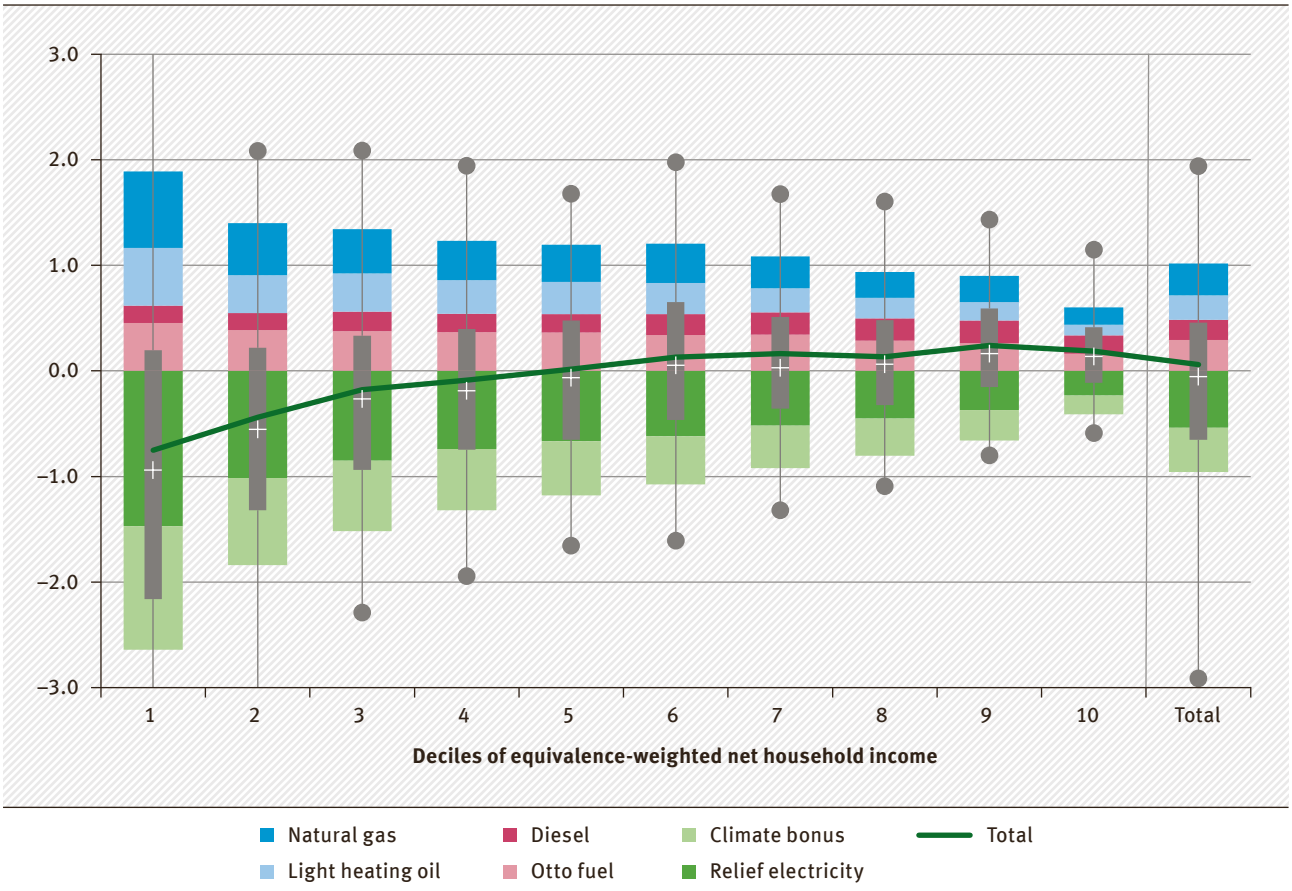
The bottom line is that low-income households would experience a noticeable reduction in their burden. The financial situation would remain largely unchanged for middle-income households while households with higher incomes would be burdened to a justifiable extent somewhat more than before (see Figure 10). **There is therefore no reason to abandon an ambitious CO_2 price for social reasons.**

From a social point of view, it also makes sense to gradually increase the CO_2 price and give citizens the highest possible degree of planning security. If this is guaranteed, everyone could prepare themselves early for rising CO_2 prices. Misinvestments, e. g. the purchase of vehicles with high fuel consumption would be avoided and adaptation processes such as switching to electric mobility would be encouraged.

Figure 10

Burden and relief for private households through an energy tax increase of 80 euros per tonne of CO_2, introduction of a climate bonus and reduction of the electricity tax and EEG levy in 2023

All households in percentage of net household income



Deciles of equivalence-weighted net household income

Source: German Environment Agency based on DIW (2019)

Promoting efficiency and innovation

Efficient vehicles relieve the environment and conserve natural resources simultaneously reducing fuel consumption and thus mobility costs. A policy of **increasing efficiency**, which promotes the development and sale of fuel-efficient vehicles, for example through fleet limits, thus contributes both to climate protection and social objectives.

Resource conservation and efficiency improvement have, however, been given low priority in the automobile market so far. Instead, manufacturers have been developing ever larger, heavier and more powerful cars.

The increasing number of SUVs and minivans among newly registered vehicles is fuelling this trend, which, from an environmental point of view, points in an entirely wrong direction. Resource consumption, CO_2 emissions and land use increases proportionally with the vehicles' size, weight and fuel consumption. According to the International Energy Agency, the trend towards SUVs has been the second largest driver of greenhouse gas emissions at a global level [IEA 2019]. This development is worrying for environmental and climate protection reasons.

Another strategy for linking environmental and social objectives is to promote **technical and social innovations** that specifically strengthen less environmentally damaging forms of mobility. Car sharing is not a new concept, but it is still an effective one. It can act as an "enabler" and facilitate more environmentally friendly transport behaviour [BCS 2018], [BMU 2018]. In addition, the number of digital mobility services in transport has increased in recent years. Many innovations make use of the Internet and are easy and convenient to use thanks

to apps. These include integrated mobility services of ecomobility (transport associations etc.), ride sharing, ride hailing, digital ticketing, e-bikes and cargo bikes. Such innovations have great potential to facilitate multi-modal mobility and reduce dependence on one's own car. Work forms such as videoconferencing and cloud-based working also make journeys unnecessary and avoid traffic. Automated and networked driving can, in conjunction with the right framework conditions, also make transport more environmentally friendly in the future [Fraunhofer ISI 2019], [KCW 2019b].

Creating adaptation aids and avoiding hardship cases

Commuters from rural areas with inadequate public transport connections are considered to be the losers in CO_2 pricing. The new climate package includes an increase in the mileage allowance as a compensation. According to this, the mileage allowance is to be increased by five cents to 35 cents from 2021 from the 21st kilometre and by a further three cents to a total of 38 cents from 2024. The increase in mileage allowance is limited until the end of 2026, but from an environmental point of view it makes no sense to increase the mileage allowance when a CO_2 price is introduced. This thwarts the steering effect of the CO_2 price, since the increased flat rate compensates or even overcompensates for additional burdens. Environmentally harmful transport behaviour would be no more expensive than today or would even be rewarded. From a social point of view, too, the increase in the mileage allowance is problematic, as it favours households with high incomes more than households with low incomes.

Instead, it would make sense to provide adaptation assistance that sensibly links climate protection and social goals. These include premiums and interest-free loans for the purchase of electric vehicles, especially for commuters with low incomes who are dependent on their own cars. It is equally important and necessary that the expansion of public transport, especially in rural areas, creates more climate-friendly alternatives to motorised private transport.

However, the expansion of public transport can only be implemented gradually and a switch to electric cars is not immediately possible for all households. Therefore, it makes sense to create a hardship clause to supplement the abolition of the mileage allowance. It should provide targeted and exclusive support to households that are particularly affected by rising fuel costs [UBA 2016].

Abolishing environmentally harmful subsidies

The abolition of environmentally harmful subsidies creates a financial margin worth billions which the state can use to relieve the burden on citizens and to promote sustainable mobility for everyone. The bottom line is that low-income households will benefit. Households that switch to more environmentally friendly forms of mobility will also benefit.

Mileage allowance. As already mentioned, the mileage allowance encourages the growth of transport services and the trend towards long commuting distances and urban sprawl [UBA 2016]. If the mileage allowance is abolished in this legislative period, emissions could be reduced by around 4 million tonnes of CO_2eq by 2030. The results of the research project 'Distribution effects of environmental policy measures and instruments' [Jacob et al. 2016] show that those on high incomes benefit more than average from the flat rate. Abolition places the greatest burden on the upper middle class with an average of 0.75 % of their income. By contrast, the income of low-income households will only fall by 0.33 % on average, as they commute relatively little and receive only a small tax relief from the mileage allowance.

A hardship clause which would continue to allow tax recognition of travel costs in exceptional cases could significantly reduce the burden on low-income households. If the additional tax revenues were used to increase the basic personal tax allowance and to subsidise public transport, low- and middle-income households would actually receive a net relief on average (see Figure 11). The distribution effects are particularly positive if the additional tax revenues are used to subsidise public transport.

Company car privilege. There are numerous examples of less environmentally harmful company car taxation abroad. In other European countries, a higher percentage is usually used to calculate the monetary advantage than in Germany (see Table 1). In other countries, the spread of the tax burden depending on environmentally relevant vehicle characteristics (e. g. CO_2 emissions, fuel consumption, incentives for electric vehicles) is also widespread

[FÖS 2018]. In the Netherlands, a change in the company car scheme has succeeded in significantly increasing the proportion of fuel-efficient vehicles within a short period of time [Kok 2015].

In Germany, the Federal Climate Change Act gives higher support to battery electric vehicles. It was decided in the climate protection package to reduce the monetary benefit to 0.5 % of the list price for a subsidy for plug-in hybrid vehicles.

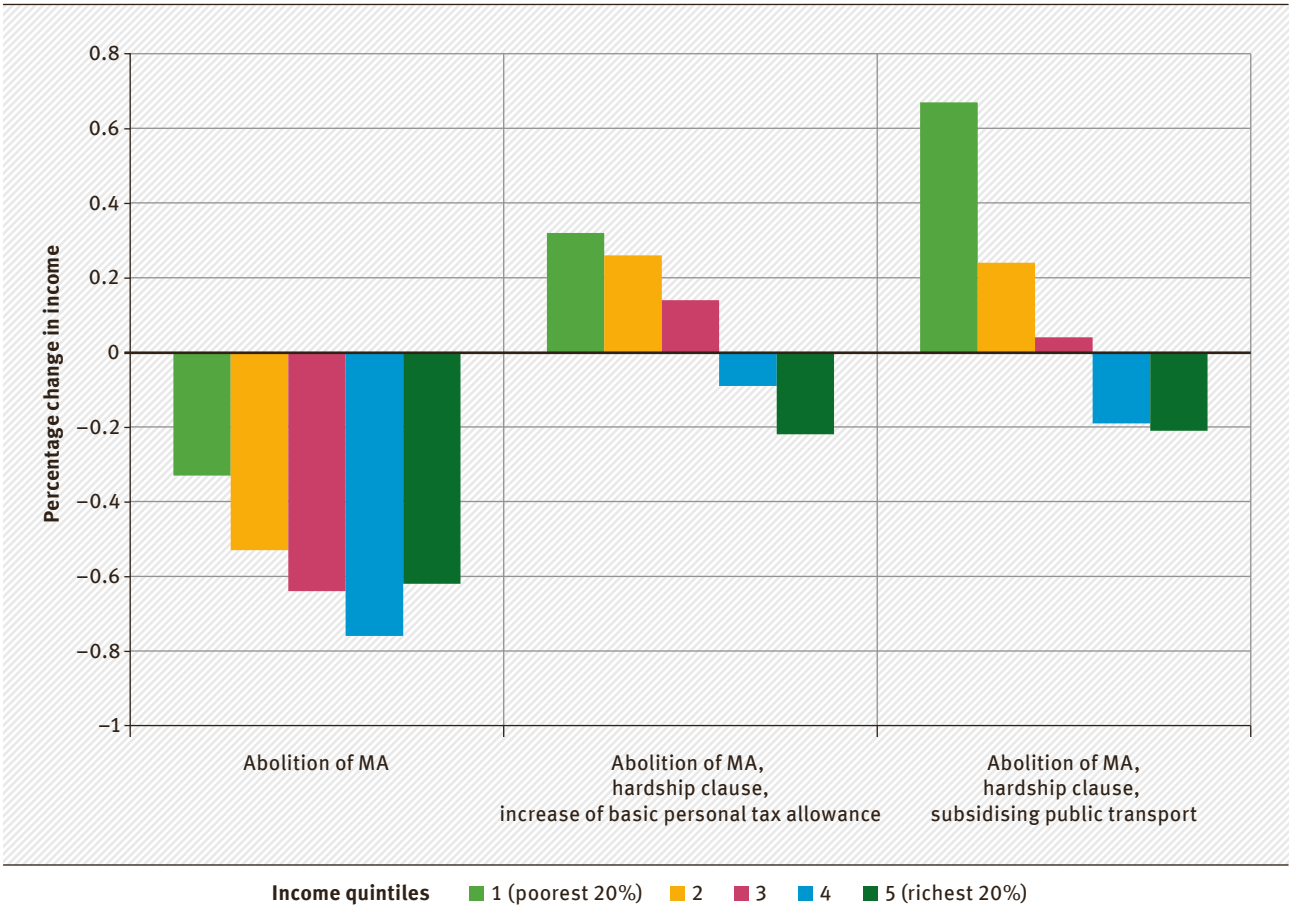
It is important to note that plug-in hybrid vehicles only receive a subsidy if they have very low overall emissions, which is by no means the case for all hybrid models. For purely electric vehicles, only 0.25 % of the list price (if this does not exceed 60,000 euros) is taxable each month.

Any reform of the company car privilege should be guided by the objective of tax neutrality, i. e. the monetary benefit from the private use of company cars should be fully taken into account. The company car privilege would thus be abolished because a company car would then no longer be more attractive in tax terms than a correspondingly higher salary from the employer. The taxation of the monetary advantage should be raised overall and spread much more widely at the same time depending on the vehicle's CO_2 emissions. Plus, private mileage should also be taken into account: anyone who uses a company car more often for private purposes, should also pay tax for a higher monetary advantage.

Diesel privilege. So far, diesel has been subject to a lower energy tax than petrol (47.04 ct/l vs. 65.45 ct/l). It would be important to gradually align the energy tax on diesel with that of petrol, as the subsidy for diesel is not justified from an environmental point of view. Diesel fuel produces about 13 % more CO_2 emissions per litre when burnt than petrol. Alignment at the same level of taxation would correspond to an

Figure 11

Distribution effects from a reform of the mileage allowance (MA)



Source: UBA illustration based on figures from Jacob et al. (2016)

Table 1

Taxable monetary advantage of company cars in Germany and other countries

Country	Calculation of the annual monetary advantage (BEV)	Battery electric vehicle	Middle class car	Luxury car
Denmark	25 % of the purchase price up to 40,000 € (min. 21,500 €) 20 % on the rest of the car price + Green tax (CO_2-dependent; kW-dependent for BEV)	5,500 € + green tax	6,160 €	16,500 €
Germany	12 % of the gross list price (equivalent to 1 % per month) 0.25 % monthly for electric cars Alternative: individual calculation using a logbook	700 €	2,520 €	5,670 €
The Nether-lands	22 % of the list price 4 % for zero-emission vehicles Only if more than 500 km are driven privately	880 €	4,400 €	9,900 €
UK	16–37 % of the list price, depending on CO_2 emissions, annual adjustment of rates and CO_2 steps	3,520 €	5,000 €	16,650 €

Source: Öko-Institut/FÖS/Klinski (i. E.) based on ACEA data (2019)
Figures are based on Renault Zoe (battery electric vehicle), Golf Trendline 1.0 TSI OPF (middle class car), Mercedes E 400 d 4MATIC (luxury car)

increase in the energy tax on diesel by 18.41 cents/l. At the same time the car tax on diesel would be reduced accordingly.

Expand public transport and make it more attractive

Public transport is a key component of transport transition. It is an essential part of public services and an important prerequisite for equal living conditions [BMI 2019] in town and country. It is therefore urgently necessary to reduce deficits in this area for economic, social and environmental reasons.

Public transport must be affordable for everyone. It is necessary to put an end to the long-standing trend that the prices of public transport rise much more than the cost of car use. The aim should be to reverse this trend. A first step is the reduction of VAT on rail tickets agreed upon in the new climate package. In addition, the shift from car journeys to less environmentally and climate-damaging means of transport of **ecomobility** (public transport, cycling and walking) is indispensable to achieve the climate protection goals. Public transport, walking and cycling are the more climate-friendly choices for short and medium distances, and railway and bus for long distances. As Table 2 shows, the various means of transport have very different specific emissions. Cars and aircraft score particularly poorly in terms of climate damage. The picture is similar for air pollutants: on average, buses and trains do less damage to the environment than cars and aircraft.

The success of public transport increases and falls with its attractiveness. Diversity and quality of the offer, solid infrastructure, short intervals, high speed and low costs are decisive in this respect. A modern and sound ecomobility also increases the acceptance and effectiveness of other instruments such as CO_2 pricing or the abolition of the mileage allowance.

The Federal Climate Change Act plans to give more support to public transport, for example by increasing regionalisation funds, which may only be used for public transport. These funds are made available by the Federal Government to the states (Länder) to finance public transport. This is an important first step.

Since public transport in Germany makes an important contribution to public services, participation and environmental protection, it must be co-financed by public funds. The cost recovery ratio, i. e. the proportion of costs that can be covered by ticket prices,

is generally much higher in conurbations than in rural areas. On average, approximately 40 % of the total public transport budget is generated by ticket revenues [KCW 2019a].

An UBA research project illustrates the extent to which networked mobility concepts can contribute to reducing CO_2 emissions in particular in small and medium-sized towns and in rural areas [Herget et al. 2019]. Modern app-based services and transport offers can support and accelerate development. In any case, a reform of public transport funding is necessary to ensure the provision of public transport in the area [Herget et al. 2019]. Public transport is a state responsibility and will continue to need to be publicly funded to a large extent. To this end, in the future the state could make greater use of levies and taxes on car and air traffic and use additional tax revenues by abolishing environmentally harmful subsidies.

The challenges for public transport are particularly great in very sparsely populated areas. Private transport will continue to play a role in these regions. Electromobility can help make MPT more environmentally friendly in rural areas.

Promoting active forms of mobility

Cycling and walking are healthy, environmentally friendly, climate-friendly, cheap, fast over short distances and therefore a mainstay of transport transition.

The current study 'Mobility in Germany' [BMVI 2019b] found that around 40 % of car journeys are shorter than five kilometres. This puts them in a distance range where bicycles are often the fastest means of transport (see Figure 12). Many car journeys are so short that they could easily be made by walking. In conurbations, up to 30 % of car journeys can be shifted to cycling.

Table 2

Comparison of average emissions from various means of passenger transport (2018)

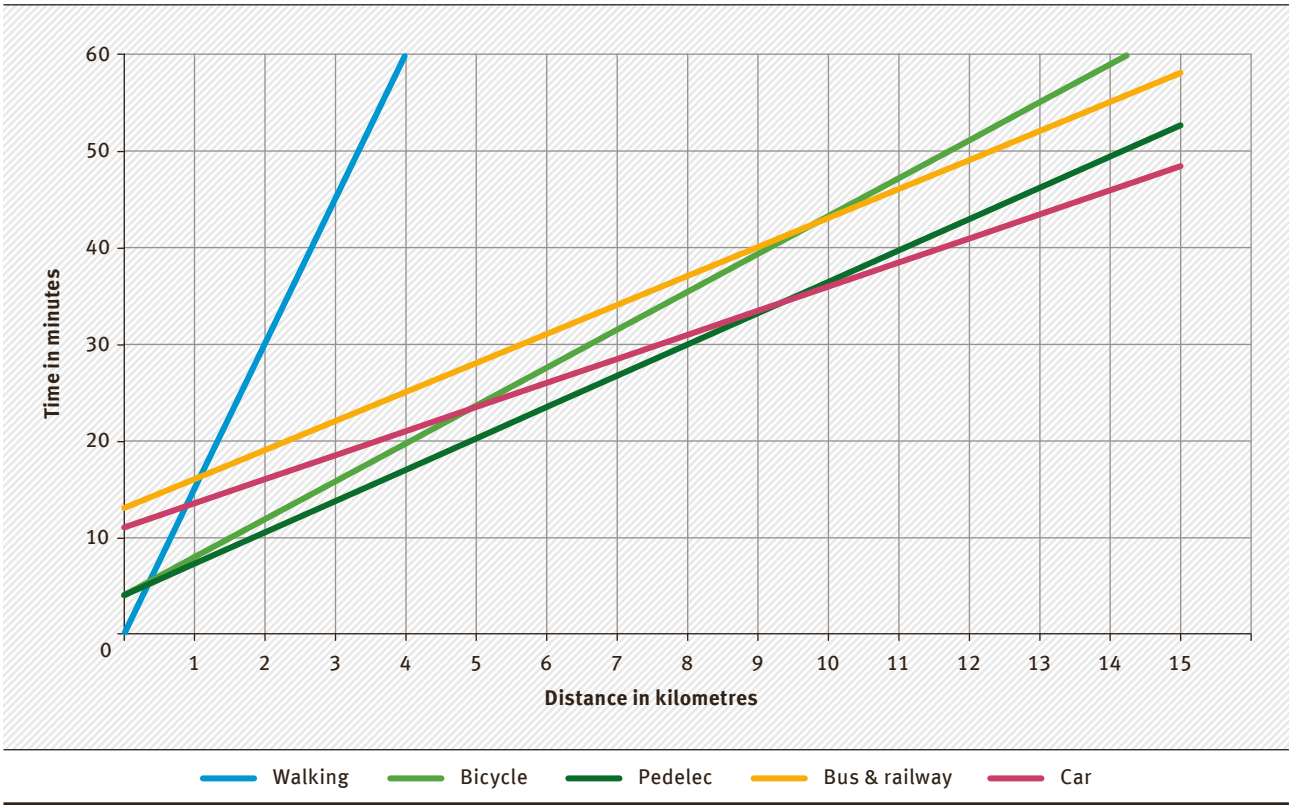
		Car	Aircraft, Germany	Railway, long-distance transport	Long-distance bus	Other coaches[6]	Railway, local transport	Bus	Tram, S-bahn and underground
Greenhouse gases[1]	g/pkm	147	230[3]	32[2]	29	31	57	80	58
Carbon monoxide	g/pkm	1.00	0.48	0.02	0.02	0.04	0.04	0.06	0.04
Volatile hydrocarbons[4]	g/pkm	0.14	0.13	0.00	0.01	0.01	0.01	0.03	0.00
Nitrogen oxides	g/pkm	0.43	1.01	0.04	0.06	0.11	0.20	0.32	0.05
Particles[5]	g/pkm	0.007	0.014	0.001	0.001	0.002	0.004	0.005	0.002
Workload	1.5 persons/car	71 %	56 %	55 %	64 %	28 %	19 %	19 %	

g/pkm = grams per passenger kilometre, including emissions from the provision and conversion of energy sources into electricity, petrol, diesel and paraffin
[1]CO2, CH4, and N2O given in CO2 equivalents
[2]The emission factors for railways shown in the table are based on data on the average electricity mix in Germany. Emission factors based on company- or sector-related electricity consumption (see, for example, the 'Umweltmobilcheck' of Deutsche Bahn AG – German Railways) therefore differ from the values shown in the table.
[3]including non-CO2 effects
[4]without methane
[5]without abrasion of tyres, road surface, brakes, overhead lines
[6]Group trips, day trips (e. g. bus tours, school trips, "coffee trips")

Source: TREMOD 6.03
German Environment Agency, 01/2020

Figure 12

Route comparison: from door to door in urban traffic*



*Average speeds were used for each mode of transport: pedestrian Øv = 4 km/h, bicycle Øv = 15.3 km/h, pedelec Øv = 18.5 km/h, bus/rail Øv = 20 km/h, car Øv = 24.1 km/h.
In addition, access time and walking time to home for the respective means of transport were defined = point of intersection with the y-axis

Source: German Environment Agency, expert estimate, July 2014

This is the best way to unlock the potential for relieving the burden on the environment and on the people in the city, which is important and can be implemented quickly at comparatively little cost. Cities such as Copenhagen, Amsterdam or other particularly bicycle-friendly German cities such as Münster, where the share of bicycle traffic has already surpassed the share of private motorised transport, demonstrate that this goal is achievable.

The promotion of cycling benefits everyone, including those who mainly take the car, use public transport or walk. As environmentally friendly transport, cycling is not associated with noise or harmful emissions and its space demand is low. Together with short-distance public transport and pedestrian traffic, it especially relieves the inner cities of traffic jams, pollutants and noise. This is another reason why cities, municipalities and regions with a lot of pedestrian and bicycle traffic are rated as particularly lively and worth living in – this applies, for example, to Vienna with its high share of pedestrian traffic, and to the cycling city of Copenhagen. In addition, the expansion of cycle superhighways in combination with the use of e-bikes also offers the opportunity to shift commuter routes from cars towards bicycles in rural areas. Bicycle traffic is also an economic factor that is becoming more and more important [BMVI 2019c].

Bicycle and pedestrian traffic are therefore essential building blocks for a transport transition. The UBA publications 'Tomorrow's Cities' [UBA 2017] and the UBA draft for a national pedestrian strategy 'Let's go' (Geht doch!) [UBA 2018] are dedicated extensively to the potential of active mobility. Cycling and walking not only benefit the environment, but also improve the quality of life, reduce medical expenses and relieve the social security systems.

However, decision makers still often lack awareness of and attentiveness to the great potential of active mobility and for synergies in interaction with urban planning and health care [UBA/ECF 2018]. It is therefore important to quantify the advantages of

cycling and walking. The World Health Organisation has developed a special tool for this purpose, which calculates the monetised health benefits from increasing the cycling and walking shares based on the actual measure [WHO 2018], [UBA 2014].

At least the promotion of bicycle traffic has picked up speed recently in Germany. The Federal Ministry of Transport and Digital Infrastructure is promoting bicycle traffic with the National Cycling Plan 2020 and its updates. The German government also wants to further strengthen cycling as part of the climate-change package. The potential of pedestrian traffic is still largely untapped.

4. Conclusion: socially just transport transition is feasible

Traffic is the problem child in climate protection. Greenhouse gas emissions from this sector have persisted at a high level for years.[3] In order to meet the climate protection targets in Germany in 2030, an immediate and drastic reduction of greenhouse gas emissions in traffic is required.

This is no simple task and requires prompt, deliberate action. This is because in the future, each person will want to be mobile according to his or her needs. At the same time, surveys reveal that a majority of the population wants transport to become environmentally and climate friendlier and that environmental targets take priority [BMU/UBA 2019]. Many people in Germany are bothered by or even have their health impaired by exhaust fumes and noise, primarily from motor traffic. It is therefore high time for modern mobility needs to be brought into conformity with environmental and climate protection targets.

The shift from private car to less environmental und climate-damaging means of transport in ecomobility (public transport as well as bicycle and pedestrian traffic) is indispensable for achieving climate protection targets. Many car trips are so short that they can also be done without any problems by foot or by bicycle. Bicycle and pedestrian traffic are healthy, environmentally and climate-friendly, inexpensive, and fast over short distances – so everyone profits from active mobility because it relieves city centres of traffic jams, pollutants and noise. Admittedly, decision-makers still often lack awareness of and attentiveness to the great potential of active mobility and for synergies in interaction with urban planning and health care.

Today's transport system exhibits social and environmental imbalance in different ways. A major problem is wrong price signals: the prices for public transport have increased in the past much more than the costs for a private car. This is disastrous for climate and environmental protection in traffic, as it puts a brake on switching to public transport. Even from a social perspective, it represents an undesirable development. It is necessary to intensify the promotion of public transport in order to create attractive alternatives to driving a car, in urban as well as in rural areas, and to improve poor mobility.

At present: high income households own and drive more private cars and cause overall higher-than-average greenhouse gases and other transport-related environmental impacts. In addition, they profit disproportionately from environmentally harmful subsidies – for example through company car privileges and commuting allowances. An elimination of these privileges would provide for more social justice. Moreover, households with lower income are affected more than average from environmental and health burdens because they often live on streets with higher volumes of traffic. A major conclusion of the paper is therefore: **More incentives for climate and environmental protection as well as elimination of social imbalance often go hand in hand.**

But don't new social problems arise from transport transition? Rising fuel prices, following a common argument, lead to budget cuts especially in low-income households. It is overlooked that the state can give back the additional revenue and thereby even remove or avoid negative distributional effects. If the state for example lowers electricity costs when implementing CO_2 pricing or the additional revenue is directly paid out to citizens in the form of a climate bonus, low-income households on average fare better rather than worse. It will then become more expensive, primarily for high-income households and for those who do not want to do without their fossil-fuel-powered, heavy and inefficient cars in the future. This example shows a clever structuring of instruments can achieve the climate protection target in traffic without leading to social imbalance or to reduced mobility.

3 The paper was written before February 2020, but maintains its validity in spite of currently fallen transport performance.

We certainly don't yet have satisfactory answers today to all questions. In rural, sparsely populated areas for example, an environmentally friendly "mobility for everyone" is particularly challenging. To be able to overcome them, it is necessary that the public sector assumes the majority of additional costs for strengthening ecomobility. All levels of government have this obligation, the Federal Government as well as the states and local authorities.

Last but not least, transport transition cannot succeed overnight. The conversion can only succeed gradually and over a long period of time, whereby predictability is a key success factor for all parties. However, the strategies for a socially just, environmentally and climate-friendly mobility are on the table. They should now be put into practice by all relevant players in federal, state and local government. The decade of transport transition must begin immediately.

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